New

PINNACLE

1st edition

RAILWAY SCIENCE

5300+ TCS - MCQ

All TCS Questions asked in Railway Exams

Chapter- Wise Coverage

With detailed explanation

English Medium

ALP Technician tier 1, tier 2, NTPC CBT 1, NTPC CBT 2, Group D, RPF SI, RPF Constable, RRB JE and other railway exams

piracy check

each book has multipurpose unique ID

PINNACLE Publications

INDEX

PHYSICS

11.	Discoveries	MCQ	149 - 150	1471 - 1489	19
12.	Units and measurements	MCQ	150 - 156	1490 - 1562	73
		Numerical MCQ	156 - 157	1563 - 1570	08
13.	Miscellaneous	MCQ	157 - 163	1571 - 1628	58
		Numerical MCQ	163 - 164	1629 - 1640	12

CHEMISTRY

S. No.	Chapter Name	MCQ	Page no.	Question no.	No. of questions
1.	Structure of Atom	MCQ	165 - 172	01 - 86	86
		Numerical MCQ	172 - 176	87 - 141	55
2.	Metals, Non-metals and alloys	MCQ	176 - 189	142 - 274	133
3.	Acid, Bases and Salt	MCQ	189 - 206	275 - 447	173
4.	Carbon and its Compound	MCQ	206 - 212	448 - 518	71
5.	Metallurgy	MCQ	212 - 214	519 - 531	13
6.	Organic Chemistry	MCQ	214 - 224	532 - 643	112
		Numerical MCQ	224	644 - 646	03
7.	Periodic table	MCQ	225 - 257	647 - 993	347
		Numerical MCQ	257	994 - 995	02
8.	Chemical Reactions	MCQ	257 - 292	996 - 1334	339
9.	Ideal Gas Law	MCQ	292 - 293	1335 - 1348	14
		Numerical MCQ	293	1349	01
10.	Chemical properties	MCQ	293 - 298	1350 - 1401	52
11.	Solutions	MCQ	298 - 302	1402 - 1437	36
		Numerical MCQ	302 - 303	1438 - 1443	06
12.	Chemistry in Everyday life	MCQ	303 - 309	1444 - 1506	63
13.	Discoveries	MCQ	309 - 311	1507 - 1526	20
14.	Common Name	MCQ	311 - 314	1527 - 1560	34
15.	Miscellaneous	MCQ	314 - 327	1561 - 1687	127

BIOLOGY

S. No.	Chapter Name	Page no.	Question no.	No. of questions
1.	Scientific name	328	01 - 08	08
2.	Nutrition in Animal	328 - 331	09 - 38	30
3.	Nutrition in plant	331 - 338	39 - 106	68
4.	Deficiency and Diseases	338 - 344	107 - 172	66
5.	Reproduction in animals	344 - 360	173 - 322	150
6.	Reproduction in Plant	360 - 370	323 - 414	92
7.	Cell : Basic unit of life	370 - 380	415 - 509	95
8.	Sensory Organs	380 - 382	510 - 531	22
9.	Circulatory System	382 - 389	532 - 600	69
10.	Excretory System	389 - 395	601 - 654	54
11.	Endocrine/Exocrine system	395 - 397	655 - 671	17
12.	Respiratory system	397 - 402	672 - 727	56
13.	Digestive system	402 - 408	728 - 784	57
14.	Nervous system	409 - 412	785 - 820	36
15.	Skeleton system	412 - 416	821 - 865	45
16.	Plant kingdom	416 - 430	866 -1007	142
17.	Animal Kingdom	430 - 437	1008 - 1079	72
18.	Microorganism	437 - 439	1080 - 1097	18
19.	Enzymes and Hormones	439 - 443	1098 - 1138	41
20.	Discoveries and Vaccines	443 - 445	1139 - 1163	25
21.	Scientific Study	445 - 447	1164 - 1184	21
22.	Miscellaneous	447 - 460	1185 - 1311	127

ENVIRONMENT

S. No.	Chapter Name	Page no.	Question no.	No. of questions
1.	Ecosystem & Ecology	461 - 463	01 - 23	23
2.	Environmental Resources	463 - 465	24 - 46	23
3.	Environmental Conservation	465 - 471	47 - 99	53
4.	Environmental Wastes	471 - 475	100 - 136	37
5.	Ozone	475 - 476	137 - 152	16

SCIENCE And TECHNOLOGY

COMPUTER

16.	Programming Languages	517 - 518	142 - 149	08
17.	Database	518	150 - 155	06
18.	Computer Abbreviations	518 - 520	156 - 183	28
19.	Inventions and Discoveries	520 - 521	184 - 207	24
20.	Number System	522	208 - 212	05
21.	Miscellaneous	522	213 - 220	08

Physics

Light and Optics

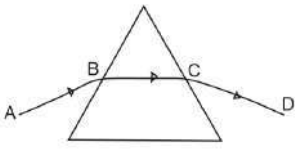
Q.1. Which of the following types of images can be obtained on a screen?
(a) Real and enlarged
(b) Real and diminished
(c) Virtual and enlarged
(d) Virtual and diminished
RRC Group D 17/08/2022 (Morning)
(a) Both (c) and (d) (b) Both (a) and (d)
(c) Both (a) and (b) (d) Both (b) and (c)

Sol.1.(c) Both (a) and (b). Real and enlarged image is obtained when Object placed between the centre of curvature (c) and focus (F) (Concave Mirror) and when Object placed between the focus (F_1) and centre of curvature ($2F_1$) (Convex Lens). Real and diminished - When an object is placed beyond the center of curvature (C) in a concave mirror and beyond ($2F_1$) in a convex lens. Virtual and enlarged - convex lens. Virtual and diminished - A convex mirror always forms a virtual, erect, and diminished image, irrespective of the position of the object.

Q.2. If a ray of light is incident passing through the centre of curvature of a concave mirror, then the angle between the incident ray and the reflected ray will be equal to:
RRC Group D 17/08/2022 (Morning)
(a) 0° (b) 150° (c) 90° (d) 180°

Sol.2.(a) 0°. As the ray of light passes through the Center of Curvature of a Concave mirror, it strikes the mirror along the normal (i.e. it incidences onto the mirror at 90 degrees and 0 degrees with normal). Hence the Incident ray coincides with the normal. Therefore the Angle of Incidence is 0 degrees.

Q.3. In the figure shown below, the incident ray and the emergent ray in the respective order are given by:



RRC Group D 17/08/2022 (Afternoon)
(a) BC and CD (b) AB and CD
(c) AB and BC (d) CD and AB

Sol.3.(b) AB and CD. Incident Ray = AB and Emergent Ray = CD. Refracted ray = BC. An Incident ray is a rectilinear ray of light that strikes a surface. Emergent Ray is a ray emerging after reflection or refraction or dispersion.

Q.4. The distance between the pole and the center of curvature of a spherical mirror, in terms of its focal length, is equal to _____.
RRC Group D 17/08/2022 (Afternoon)
(a) $\frac{f}{4}$ (b) $\frac{f}{2}$ (c) f (d) 2f

Sol.4.(d) 2F. F = $\frac{R}{2}$, so R = 2F. The Radius of Curvature (R) (of a Spherical mirror) - radius of the circle of which the Spherical mirror is a part. The Center of Curvature (of a Spherical mirror) - It is defined as the Center of the Sphere of which the Spherical Mirror is a part. The Focal Length (F) (of a Spherical mirror) - It is the distance between the pole and the principal focus of the mirror.

Q.5. A student focusses a sharp image of sun using a spherical mirror on a sheet of paper, which starts to burn after some time. Which of the following statements / statements about the mirror is/are correct?
(A) It is concave spherical mirror
(B) It has positive focal length
(C) It is a converging mirror
RRC Group D 17/08/2022 (Evening)
(a) Both (A) and (C) (b) Both (A) and (B)
(c) (A), (B) and (C) (d) Both (B) and (C)

Sol.5.(a) Both (A) and (C). A Concave mirror is a Converging mirror on which when parallel rays fall then all the rays get converged at a point which is known as the focus of the Concave mirror and as all the rays coincide at one point and therefore the intensity at that point will increase and that is why when a paper is kept at the focal point of the Concave mirror exposed to sunlight for some time the paper catches fire. The concave mirror forms a virtual and magnified image. The focal length of a Concave mirror is negative because the Focus of a Concave mirror is in front of the mirror.

Q.6. A ray of light is incident on an interface separating two media along the normal to the interface. The angle between the incident ray and refracted ray is equal to:
RRC Group D 17/08/2022 (Evening)
(a) 90° (b) 0° (c) 45° (d) 30°

Sol.6.(b) 0°. Incident angle - The angle between the incident ray and the normal to the surface. Incident ray - The ray of light that hits the surface. Reflected ray - The ray that gets reflected away. Reflection - phenomenon of returning light from the surface of an object when the light is incident on it. Refraction - change in the direction of a wave passing from one medium to another.

Q.7. Which of the following statements are correct?
(A) For a lens the first principal focus is the position of the object whose image is at infinity
(B) For a lens the first principal focus is the position of the object whose image is formed at twice the focal length.
(C) For a lens the second principal focus is the position of the real image whose object is at infinity
(D) For a lens the second principal focus is the position of the object whose image is formed at twice the focal length
RRC Group D 18/08/2022 (Morning)
(a) Both (B) and (C) (b) Both (B) and (D)
(c) Both (A) and (C) (d) Both (A) and (B)

Sol.7.(c) Both (a) and (c) . Image formation by Convex Lens - Object Position (Image position, Image feature) - At Infinity (at focus F_2 , highly diminished, real and inverted), At $2F_1$ (At $2F_2$, same size, real and inverted), between F_1 and $2F_1$ (beyond $2F_2$, enlarged, real and inverted), at focus F_1 (At infinity, highly enlarged, real and inverted), between focus F_1 and optical centre O (on the same side of lens as the object, enlarged, virtual and erect), beyond $2F_1$ (Between F_2 and $2F_2$, diminished, real and inverted).

Q.8. A boy focusses a sharp image of a distant object on a screen using a lens. The distance between the lens and screen is approximately equal to:
RRC Group D 18/08/2022 (Morning)
(a) 2f (b) $\frac{f}{2}$ (c) $\frac{f}{3}$ (d) f

Sol.8.(d) f (Focal Length). A convex lens converges all the rays coming from a distant object on its focus to form a real image. If the image is obtained on a screen placed at the focal point of the lens, then the distance between the lens and the screen would be the focal length (f) of the lens.

Q.9. An object is placed at the principal focus of a concave lens. Which of the following options represents the characteristics of the image formed?
RRC Group D 18/08/2022 (Morning)
(a) Virtual and enlarged

(b) Virtual and highly diminished
(c) Real and enlarged
(d) Real and diminished

Sol.9.(b) Virtual and highly diminished. Formation of image by concave lens : Object Position (Image position, Image feature) - At infinity (At focus, virtual and highly diminished), Between lens and infinity (At lens and focus on the same side, Virtual and diminished).

Q.10. An optical device Y has positive focal length. Y is:
RRC Group D 18/08/2022 (Afternoon)
(a) either a convex lens or a concave mirror
(b) either concave lens or a convex mirror
(c) either a convex lens or a convex mirror
(d) either a concave lens or a concave mirror

Sol.10.(c) The Focal length of the convex lens is positive because a light ray parallel to the principal axis passes through a focus on the other side of the lens. Uses: to correct Hypermetropia, as a magnifying glass. The focal length of a convex mirror is at the right-hand side of the optical centers. So, it is taken as positive. Uses: Used in sunglasses, as a rear-view mirror in automobiles and as a reflector for street lights.

Q.11. The apparent position of a star keeps on changing slightly because:
RRC Group D 18/08/2022 (Afternoon)
(a) the atmosphere scatters star light
(b) the physical conditions of the atmosphere keep changing
(c) the atmosphere consists of a mixture of gases
(d) the physical conditions of the atmosphere are stationary

Sol.11.(b) The twinkling of a star is due to atmospheric refraction of starlight. The temperature and density of the different layers of the atmosphere keep varying. Since the atmosphere bends the starlight towards normal, the apparent position of the star appears to be slightly different from its actual position. Stellar parallax is the apparent shift of position of any nearby star against the background of distant stars.

Q.12. The magnification produced by a spherical mirror is -0.5. The image formed by the mirror is:
RRC Group D 18/08/2022 (Evening)
(a) virtual, erect and enlarged
(b) real, inverted and diminished
(c) real, inverted and enlarged
(d) virtual, erect and diminished

Sol.12.(b) Real, inverted and diminished. If the magnification produced by the spherical mirror is -0.5, then the image will be real, inverted, and diminished and the mirror is a converging mirror or Concave mirror. The Object's Position is beyond the Centre of Curvature, and the Image's location is between the Center of Curvature and the Focal point. The

Magnification = $\frac{Height\ of\ the\ Image}{Height\ of\ the\ Object}$.

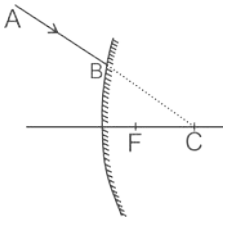
Q.13. Which of the following line(s) act as a normal to a spherical mirror?
(i) Line joining the pole and center of curvature
(ii) Line joining the center of curvature and point of incidence
(iii) Line joining focus and point of incidence
RRC Group D 18/08/2022 (Evening)
(a) Both (i) and (ii) (b) Both (i) and (iii)
(c) (i), (ii) and (iii) (d) Both (ii) and (iii)

Sol.13.(a) Both (i) and (ii). In a spherical mirror, normal drawn on any point on the spherical mirror passes through the center of curvature. So, the line passing joining the center of curvature from any point either pole or point of incidence is normal to the spherical mirror. Two types of spherical mirror - concave mirror (converging mirrors because light converges at a certain point) and convex mirror (diverging mirror because diverging the light).

Q.14. Planets do not twinkle because
RRC Group D 18/08/2022 (Evening)
(a) they scatter more light
(b) they scatter less light
(c) they act as extended source of light
(d) they act as a point source of light

Sol.14.(c) Planets do not twinkle because they are nearer to earth and hence earth receives a greater amount of light and, therefore minor variations in the intensity are not noticeable. Twinkling of stars is due to atmospheric refraction.

Q.15. A ray of light AB is incident on a convex mirror as shown in figure. What will be its reflection angle?



RRC Group D 22/08/2022 (Afternoon)
(a) 90° (b) 0° (c) 30° (d) 45°

Sol.15.(b) 0^0. As the ray of light passes through the centre of curvature of a convex mirror it strikes the mirror along the normal (i.e. it incidences on to the mirror at 90 degree and 0 degree with normal). Hence the incident ray coincides with the normal. Therefore, the angle of reflection is 0 degree.

Q.16. For a ray of light undergoing refraction through a triangular glass prism, the angle of deviation is the angle between
RRC Group D 22/08/2022 (Afternoon)
(a) the incident ray and the normal at the point of incidence
(b) the incident ray and the emergent ray
(c) the incident ray and the refracted ray
(d) the refracted ray and the emergent ray

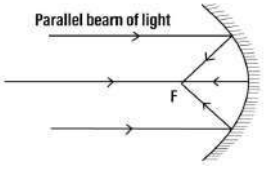
Sol.16.(b) Incident ray and the emergent ray. It is produced by a light ray depending on 4 factors: incident angle, the material of the prism, the wavelength of light used, the angle of the prism. Angle of refraction - the angle between the refracted ray and normal at the point of incidence.

Q.17. The component of white light that deviates the most on passing through a glass prism is:
RRC Group D 22/08/2022 (Evening)
(a) blue (b) red (c) violet (d) green

Sol.17.(c) Violet. Dispersion of light: When a white light is passed through a prism it splits into its seven constituent colors (VIBGYOR). The Red color (wavelength-700 nm) deviates least and Violet color (wavelength-400nm) deviates most because its wavelength is shortest among other colors.

Q.18. A spherical mirror converges a beam of light, at a given point on the principal axis. Which of the following statement(s) about the mirror is/are true?
(A) The mirror used is concave
(B) The mirror has positive focal length
(C) The point of convergence is the principal focus of the mirror
RRC Group D 22/08/2022 (Evening)
(a) Both (A) and (B) (b) Only (A)
(c) Only (B) (d) Both (A) and (C)

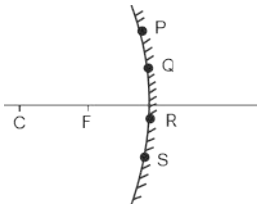
Sol.18.(d) Both (a) and (c).



If a parallel beam of light is incident on a concave mirror, it converges the beam to a point called focus. The focal length of the mirror is equal to half of the radius of curvature of the spherical mirror and is given by the relation: $f = \frac{R}{2}$

where, f is the focal length of the spherical mirror and, R is the Radius of Curvature of the spherical mirror.

Q.19. P, Q, R and S are four points on the surface of a concave mirror as shown in the figure. If r_1, r_2, r_3 and r_4 are the distance of centre of curvature from points P, Q, R and S respectively, then the correct relation between r_1, r_2, r_3 and r_4 is:



RRC Group D 23/08/2022 (Morning)
(a) $r_1 = r_2$, $r_3 = r_4$, $r_2 \neq r_3$ (b) $r_1 = r_2 = r_3 = r_4$
(c) $r_1 > r_2 < r_3 > r_4$ (d) $r_1 < r_2 < r_3 < r_4$

Sol.19.(b) $r_1 = r_2 = r_3 = r_4$.
Spherical mirror - Has a consistent curve and a constant radius of curvature, images formed by can either be real or virtual. Types - Concave Mirror (inner side of the spherical mirror is reflecting) and Convex Mirror (outer side of the spherical mirror is reflecting).

Q.20. Lemons placed inside a beaker filled with water appear relatively larger in size due to:
RRC Group D 23/08/2022 (Morning)
(a) scattering of light
(b) refraction of light
(c) reflection of light
(d) dispersion of light

Sol.20.(b) Refraction of Light: The bending of the ray of light passing from one medium to the other medium. Refraction is used in telescopes, microscopes, peepholes of house doors, cameras, movie projectors, magnifying glasses, etc. Reflection of light : Returning light from the surface of an object when the light is incident on it. Examples: Reflection by a plane mirror or spherical mirror. Scattering of light: Bouncing off of the light in a random direction by the atoms or molecules of the medium through which it is traveling. Examples : Red color of sun at sunrise and sunset, Blue color of sky, Red color used as danger signal. Dispersion of light : Spreading of white light into its constituent colors. Example - Rainbow.

Q.21. At which position on principal axis does a concave mirror forms a highly diminished, real an inverted image of an object?
RRC Group D 23/08/2022 (Morning)
(a) 2F (b) beyond 2F
(c) between F and 2F (d) F

Sol.21.(d) Focus (F). Other positions of image in Concave mirror explained in the following syntax - Placement of the object (Image obtained): At infinity (Highly diminished, real and inverted). Beyond the center of curvature (Diminished, real and inverted). At the center of curvature (Same size as that of the object, real and inverted). Between the center of curvature and principal of focus (Enlarged, real and inverted). Between the principal focus and the pole (Image is obtained behind the mirror, highly enlarged, virtual and erect).

Q.22. A convex lens forms a real and inverted image twice the size of the object. The magnification produced by the lens is equal to:
RRC Group D 23/08/2022 (Afternoon)
(a) 2 (b) $-\frac{1}{2}$ (c) $-\frac{1}{2}$ (d) - 2

Sol.22.(d) -2 . Magnification: Ratio between the image height and object height. A magnification of 2 indicates the image is twice the size of the object. If the magnification is positive, then the image is upright compared to the object (virtual image). If magnification is negative then the image is inverted as compared to the object (real image). A convex lens is a lens that is thick at the middle and thin at the edges. It is used in eyeglasses for correcting farsightedness.

Q.23. What is the distance between the pole and focus of a spherical mirror?
RRC Group D 23/08/2022 (Afternoon)
(a) 2R (b) $\frac{R}{4}$ (c) $\frac{R}{2}$ (d) R

Sol.23.(c) $\frac{R}{2}$. The surface of a curved mirror may be either convex or concave. The distance from the pole to the focal point is called the focal length (f). The focal length of a spherical mirror is then approximately half its radius of curvature (R). Radius of curvature = 2f.

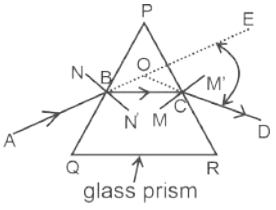
Q.24. The magnification produced by a lens is $\frac{1}{2}$. The nature and the relative size of the image formed by the lens in the respective order is:
RRC Group D 23/08/2022 (Afternoon)
(a) virtual, erect and enlarged
(b) real, inverted and enlarged
(c) real, inverted and diminished
(d) virtual, erect and diminished

Sol.24.(d) virtual, erect and diminished. Magnification is a measure of the size of an image compared to the size of the object. Lenses and curved mirrors can produce magnified images. When the magnification is less than one, it signifies that the image formed by the lens is smaller than the original size of the object.The positive sign of magnification indicates that the image is virtual and erect.

Q.25. A boy standing in front of a magical mirror combination finds in the mirror his head larger, body the same size, and legs smaller. The mirrors used at the top, middle and bottom of the magic mirror configuration are, respectively.
RRC Group D 23/08/2022 (Evening)
(a) convex, plane, concave
(b) convex, concave, plane
(c) concave, plane, convex
(d) concave, convex, plane

Sol.25.(c) concave, plane, convex. If the image of the child's head is bigger in the mirror because the concave mirror enlarges the image of an object. His middle portion of body is the same as a plane mirror forms the same size of image. his legs look smaller in the mirror as convex mirrors make the image smaller in size.

Q.26. The following figure shows the refraction of a light ray AB through a triangular glass prism. Here ∠EOD represents _____.



RRC Group D 23/08/2022 (Evening)
(a) deviation angle
(b) angle of incidence
(c) angle of refraction
(d) output angle

Sol.26.(a) deviation angle. The angle of deviation is angle between the incident ray and the emerging ray. In the figure, PQR is a prism with base QR. AB is incident ray on surface PQ . It makes ∠ABN with the normal NB. This angle is angle of incidence. After entering the

prism, the light ray bends towards normal. BC is refracted ray, ∠N'BC is angle of refraction. Once the refracted ray emerges from the prism into air, it bends away from normal. CD is emergent ray, ∠DCM is angle of emergence, Therefore ∠EOD is angle of deviation. Angle of incidence - angle between the normal and the ray of light. Angle of refraction - the angle between a refracted ray and the normal drawn at the point of incidence to the interface at which refraction occurs.

Q.27. The component of white light, which has maximum refractive index, is of _____ colour.
RRC Group D 23/08/2022 (Evening)
(a) red (b) violet (c) yellow (d) green

Sol.27.(b) Violet. A refractive index is a property of the material through which the ray is passing through. The refractive index changes inversely with the wavelength. The colours in the order of the increasing wavelength are violet, indigo, blue, green, yellow, orange, and red. The violet ray has the shortest wavelength. So, it has the highest refractive index.

Q.28. What will be the angle of incidence for a ray of light incident along the principal axis of a convex mirror?
RRC Group D 24/08/2022 (Morning)
(a) 0° (b) 30° (c) 60° (d) 90°

Sol.28.(a) 0°. Third rule of image formation by a convex mirror - When a ray of light going towards the focus becomes parallel to the principal axis after reflection on the mirror. This is just the reverse case of the first rule (A ray of light which is parallel to the principal axis of a convex mirror, appears to be coming from its focus after getting reflected from the mirror).

Q.29. A ray of light traveling in air enters a glass slab. Which of the following statements is/are correct?
(i) Angle of incidence is greater than the angle of refraction.
(ii) Angle of incidence is equal to angle of emergence.
(iii) The emergent ray is parallel to the incident ray.
RRC Group D 24/08/2022 (Morning)
(a) Both (i) and (ii) (b) (i), (ii) and (iii)
(c) Both (i) and (iii) (d) Both (ii) and (iii)

Sol.29.(b) (i), (ii) and (iii). When the light ray enters the glass slab, the light ray bends towards the normal as the glass is denser than air. Therefore, angle of incidence is greater than angle of refraction. As the ray emerges out of the glass slab, it bends away from the normal. The angle of emergence is equal to the angle of incidence. As the light ray undergoes refraction two times in opposite directions, the emergent ray is parallel to the incident ray.

Q.30. A convex lens forms a real, inverted and diminished image. The position of the object is:
RRC Group D 24/08/2022 (Morning)
(a) at infinity (b) between O and F
(c) between F and 2F (d) beyond 2F

Sol.30 (d) Beyond 2F. Other Positions of Convex Lens: Placement of Object (Image Obtained) - At infinity (At F_2, real, Inverted and highly diminished). Object at 2F (At $2F_2$, real, inverted and Same size). Object between Focus and 2F (Beyond $2F_2$, real, inverted and magnified), Object at Focus (At infinity, real, inverted and magnified). Object is between Centre and Focus (Behind the lens, Virtual, erect and magnified).

Q.31. The value of absolute refractive index of a medium is always _____.
RRC Group D 24/08/2022 (Afternoon)
(a) equal to 0 (b) more than 1
(c) equal to 1 (d) less than 1

Sol.31.(b) More than 1. Refractive index of a medium is always greater than or equal to 1 because the definition of refractive index, n of a medium is the ratio of the speed of light in a vacuum, c, to the speed of light in the medium, v. i.e. n = c/v. Refractive index below 1 means a speed above the speed of light in vacuum, which is not possible in real life. The refractive index of an optical medium is a dimensionless number that gives the indication of the light bending ability of that medium described by Snell's law of refraction.

Q.32. A ray of light is incident on the pole of a concave mirror. What is the acute angle formed between the incident ray and the principal axis called?
RRC Group D 24/08/2022 (Afternoon)
(a) angle of emersion
(b) angle of reflection
(c) deviation angle
(d) angle of incidence

Sol.32.(d) angle of incidence. Terminologies : Centre of curvature (C) - Centre of the sphere of which the mirror is a part. Radius of curvature (R) - Radius of the sphere of which the mirror is a part. Pole - Geometric centre of the spherical surface of the mirror. Principal axis - Straight line joining the pole of the mirror to its centre of curvature.

Q.33. Virtual and erect images are always formed by which of the following mirrors?
(A) convex mirror (B) plane mirror
(C) concave mirror
RRC Group D 24/08/2022 (Afternoon)
(a) B only (b) A only
(c) Both A and B (d) Both B and C

Sol.33.(c) Both A and B. A spherical mirror is a mirror that has the shape of a piece cut out of a spherical surface.

Q.34. A beam of white light is refracted through a triangular glass prism to produce a palette of seven colours. Which of these statements is correct?
(i) The red color component has a minimum refractive index.
(ii) The deviation of violet color component is minimum.
(iii) All components of white light have the same speed in glass.
RRC Group D 24/08/2022 (Afternoon)
(a) only (i) (b) both (ii) and (iii)
(c) both (i) and (ii) (d) only (ii)

Sol.34.(a) only (i). The phenomenon due to which white light splits into seven colours on passing through a prism is called dispersion. White light is made up of seven bands of colours each having different wavelengths. Upon passing through a medium, each of the colors travels at different speeds and hence has different angles of refraction leading to the splitting of the light. The violet light is deviated more than the red light because the refractive index of the prism for violet rays of light is more.

Q.35. The laws of reflection hold true for which of the following mirror(s)?
(A) Concave mirror (B) Convex mirror
(C) Plane mirror
RRC Group D 24/08/2022 (Evening)
(a) Only A and B (b) A, B and C
(c) Only B and C (d) Only A and C

Sol.35.(b) A, B and C. According to the laws of reflection, The angle of incidence is equal to the angle of reflection, and The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.

Q.36. A concave mirror forms a real, inverted and diminished image of an object. Where is the object placed?
RRC Group D 25/08/2022 (Morning)
(a) Between pole and focus

(b) Beyond centre of curvature
(c) Between focus and centre of curvature
(d) At focus

Sol.36.(b) Beyond the centre of curvature. Concave mirrors form both real and virtual images.

Q.37. A ray of light bends towards the normal while traveling from medium A to medium B. Which of the following statements is/are correct?
(A) Medium A is optically denser than medium B.
(B) Speed of light is more in medium A than medium B.
(C) Refractive index of medium B is more than the refractive index of medium A.
RRC Group D 25/08/2022 (Afternoon)
(a) Both A and C (b) A, B and C
(c) Both A and B (d) Both B and C

Sol.37.(d) Both B and C. It is a phenomenon of refraction. It happens with sound, water and other waves. Because the rarer the medium, the faster the speed of light, when light enters from rarer to denser medium, the speed decreases and hence the light takes a short path by bending towards the normal to reach the boundary in the same time.

Q.38. Which of the following optical devices can be used to produce a parallel beam of rays from a point source of light?
(A) Convex lens (B) Concave lens
(C) Concave mirror (D) Convex mirror
RRC Group D 25/08/2022 (Evening)
(a) Both (B) and (C) (b) Both (A) and (C)
(c) Both (A) and (B) (d) Both (A) and (D)

Sol.38.(b) Both (A) and (C). Concave mirrors and convex lenses act similarly. From a point source when the light ray hits a concave mirror or a convex lens, the beams of light that emerge are always parallel and the image is formed at infinity.

Q.39. An object is placed in front of a convex mirror at a point between infinity and the pole of the mirror. The image formed is:
RRC Group D 25/08/2022 (Evening)
(a) virtual and inverted
(b) real and inverted
(c) virtual and erect
(d) real and erect

Sol.39.(c) Virtual and erect. Convex mirror (diverging mirror) diverges the rays of light, which fall on its reflecting surface. It is a curved mirror where the reflective surface bulges out toward the light source. The image formed in a convex mirror is always virtual and erect, whatever be the position of the object.

Q.40. A ray of light, passing through the centre of curvature, is incident on a concave mirror. It is reflected by an angle of _____.
RRC Group D 26/08/2022 (Morning)
(a) 1.20° (b) 0° (c) 3.10° (d) 4.30°

Sol.40.(b) 0°. It is because the angle of incidence is 0°. The ray passing through the centre of curvature is incident normally to the mirror. Angle of Incidence - The angle between the normal and the ray of light is called the angle of incidence. Angle of reflection - The angle between a reflected ray and the perpendicular to a reflecting surface drawn at the point of contact.

Q.41. Which of the following optical phenomena can explain the flattening of the disk of the Sun at sunrise and sunset?
RRC Group D 26/08/2022 (Afternoon)
(a) Dispersion of light
(b) total internal reflection
(c) scattering of light
(d) atmospheric refraction

Sol.41.(d) Atmospheric refraction. The deviation of light or other electromagnetic waves from a straight line as it passes through the atmosphere. Dispersion of light - Splitting of white light through a glass prism into its spectrum of colours (in order Violet, Indigo, Blue, Green, Yellow, Orange and Red). Total internal reflection - Complete reflection of a ray of light within a medium. Scattering of light - Change in the direction of propagation of light caused by the large number of particles present in the atmosphere.

Q.42. It is found that the more a color component bends during dispersion of white light by a glass prism, the higher the refractive index of the glass for that color component. If μ_y , μ_v, and μ_G are the refractive indices for yellow, violet, and green light, respectively, then which of the following relations is correct between them?
RRC Group D 26/08/2022 (Evening)
(a) $\mu_y = \mu_v = \mu_G$ (b) $\mu_G > \mu_y > \mu_v$
(c) $\mu_v > \mu_G > \mu_y$ (d) $\mu_y \mu_v > \mu_G$

Sol.42.(c) $\mu_V > \mu_G > \mu_Y$**.** When a ray of light passes through a glass prism the white light splits to form a band of seven colors on a white screen. The seven colors of the spectrum are Red, Orange, Yellow, Green, Blue, Indigo, and Violet i.e. VIBGYOR.

Q.43. Consider the following statements:
(a) The particles in clouds are larger than the wavelength of different colors in white light coming from the sun.
(b) All colors of white light are scattered by approximately the same amount.
Which of the above statements help(s) us to understand the white color of clouds during sunshine?
RRC Group D 29/08/2022 (Evening)
(a) Only (b) (b) Only (a)
(c) Both (a) and (b) (d) Neither (a) nor (b)

Sol.43.(c) Both (a) and (b). The colour of scattered light depends on the size of the scattering particles. Fine particles scatter mainly light of shorter wavelength like blue light, particles of larger size scatter light of longer wavelengths like red color, and particles of very large, the scattered light may appear white. Some examples of scattering - blue color of the sky, White color of clouds, etc.

Q.44. The color of scattered light depends on the size of the scattering particles. Very fine particles scatter mainly the_____light.
RRC Group D 29/08/2022 (Evening)
(a) yellow (b) red (c) green (d) blue

Sol.44.(d) Blue. Light is scattered when it falls on various objects. The colour of scattered light depends on the size of the scattering particles.

Q.45. The refractive indices of mediums 1, 2 and 3 are 1.46, 1.65 and 1.31, respectively. If the speed of light in the mediums are V_1, V_2 and V_3, respectively, which of the following relations between them is correct?
RRC Group D 30/08/2022 (Morning)
(a) $V_3 > V_1 > V_2$ (b) $V_2 > V_3 > V_1$
(c) $V_1 > V_2 > V_3$ (d) $V_1 = V_2 = V_3$

Sol.45.(a) $V_3 > V_1 > V_2$. The ratio between the speed of light in vacuum to speed in a medium is the **refractive index**. The speed of light in a medium depends on the properties of the medium. In electromagnetic waves, the speed of light is dependent on the optical density of the medium. The more optically dense material is, the slower the speed of light. One such indicator of the optical density of a medium is the refractive index. So,

the more the refraction index, the less is the velocity. So, $V_3 > V_1 > V_2$ is the correct order.

Q.46. The stars are visible_____at night.
RRC Group D 30/08/2022 (Afternoon)
(a) below their original position
(b) above their actual position
(c) less bright
(d) more colorful

Sol.46.(b) Above their actual position. At night, the stars seem to be higher in the sky than they actually are. This is due to atmospheric refraction. When the light from a star reaches the earth's surface, it passes through the different layers of the atmosphere. But our eye will see the star at that position from where light enters it in the straight line direction.

Q.47. An object is placed in front of a concave mirror at a distance thrice its focal length (3f). The image is formed at:
RRC Group D 30/08/2022 (Afternoon)
(a) C
(b) a point between F and C
(c) a point behind the mirror
(d) a point beyond C

Sol.47.(b) a point between F and C. The center of curvature (C) is located at 2f. Here the object is placed at a distance 3f. It means that the object is placed beyond C (center of curvature). In this situation, an image is formed between the center of curvature (C) the focus (F). The image thus formed is diminished, real and inverted.

Q.48. An object is placed in front of a concave mirror at a distance twice its focal length (2f). The image is formed at a distance of
RRC Group D 30/08/2022 (Evening)
(a) 4f (b) 1.5f (c) 2f (d) f

Sol.48.(c) 2f. In a Concave mirror if the object is placed at the center of curvature of the mirror Then the image is also formed at the Centre of Curvature and at the same distance. The image formed has the same size as that of the object and it is real and inverted.

Q.49. Red color is scattered the _____ by fog or smoke because its wavelength is _____ than the wavelength of other color components of white light.
RRC Group D 01/09/2022 (Morning)
(a) least, less (b) most, less
(c) least, more (d) most, more

Sol.49.(c) least, more. Scattering of light- The phenomenon in which light rays deviate from their original path upon striking an obstacle like dust, gas molecules, or water vapors. Rayleigh scattering- The longer the wavelength of radiation, the less it is dispersed.

Q.50. An optical device X has a focal length of - 30 cm. X can be:
RRC Group D 01/09/2022 (Morning)
(a) either a convex lens or a convex mirror
(b) either a concave lens or a concave mirror
(c) either a convex lens or a concave mirror
(d) either concave lens or a convex mirror

Sol.50.(b) either a concave lens or a concave mirror. According to the sign convention, the focal length of a concave lens as well as of a concave mirror is always negative. So the given optical device can be either a concave lens or a concave mirror. And focal length of the convex mirror and the convex lens is taken as + (positive).

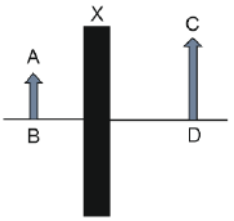
Q.51. In the absence of atmosphere, the color of the sky would be:
RRC Group D 01/09/2022 (Afternoon)
(a) blue (b) white (c) black (d) red

Sol.51.(c) black. Sky appears blue due to scattering. In absence of atmosphere no scattering will occur. Therefore the sky will be seen black. Our eyes are more sensitive to the blue light thus we see the sky as blue. phenomenon of scattering of light - Tyndall effect.

Q.52. In which of the following cases does a concave mirror form a real image?
(i) Object placed between focus and pole
(ii) Object placed at infinity
(iii) Object placed at focus
RRC Group D 01/09/2022 (Afternoon)
(a) Both (ii) and (iii) (b) (i), (ii) and (iii)
(c) Both (i) and (iii) (d) Both (i) and (ii)

Sol.52.(a) Both (ii) and (iii). Concave mirrors can produce both real and virtual images. When the concave mirror is placed very close to the object, a virtual and magnified image is obtained and if we increase the distance between the object and the mirror, the size of the image reduces and real images are formed. So, the images formed are real (except when the object is between pole and focus).

Q.53. An optical device X forms an image CD for an object AB as shown in the figure. The device X is a:



RRC Group D 01/09/2022 (Evening)
(a) concave mirror (b) convex lens
(c) convex mirror (d) concave lens

Sol.53.(a) A **concave mirror** forms an erect, virtual and enlarged image as shown in the question figure when the object is between focus and the pole of the mirror. A concave mirror has a reflective surface that is curved inward and away from the light source. Concave mirrors reflect light inward to one focal point. Unlike convex mirrors, the image formed by a concave mirror shows different image types depending on the distance between the object and the mirror.

Q.54. Rays coming from the sun are refracted by the atmosphere. Due to this, the apparent sunset is about _____ the actual sunset.
RRC Group D 01/09/2022 (Evening)
(a) 1 minute after (b) 1 minute before
(c) 2 minutes before (d) 2 minutes after

Sol.54.(d) 2 minutes after. We are able to see the sun 2 minutes before the actual sunrise and 2 minutes after the actual sunset due to refraction of light by the atmosphere. The refraction of light caused due to different layers of the atmosphere at different temperatures (different refractive indices) is called the atmospheric refraction. Some Examples:- Twinkling of stars, Apparent higher position of a star, Early sunrise and delayed sunset, Flattened appearance of sun during sunrise and sunset.

Q.55. A ray of light is incident on a refracting surface AB of a glass prism, kept in air, and emerges out of the other refracting surface AC. Consider the following statements :
(a) The angle of refraction at surface AB is less than the angle of incidence.
(b) The angle of refraction at the surface AC is more than the angle of incidence,
Which of the above statements is/are correct?
RRC Group D 02/09/2022 (Morning)
(a) Neither (a) nor (b) (b) Both (a) and (b)
(c) Only (a) (d) Only (b)

Sol.55.(b) Both (a) and (b). When a light ray falls on one side of the prism, it gets

refracted (bent towards the normal). It is because it has moved from an optically rarer medium (air) towards optically denser medium (prism). When this ray reaches the other side of the prism, it gets refracted again (bent away from normal). It is because now it has moved from an optically denser medium (prism) towards optically rarer medium (air).

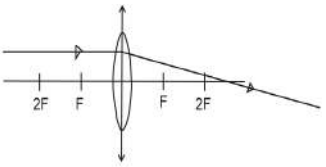
Q.56. Which of the following point(s) always lie(s) on the principal axis of a lens?
(i) Point of refraction (ii) Optical Centre
(iii) Point of incidence
RRC Group D 02/09/2022 (Morning)
(a) Both (i) and (iii) (b) Both (i) and (ii)
(c) Only (ii) (d) Only (i)

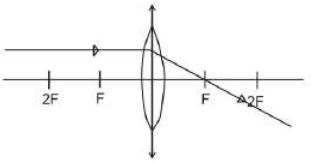
Sol.56.(c) Only (ii). The point on the principle axis inside the lens, through which a light ray passes without any deviation is called the optical center (O) of the lens. A lens is a transmissive optical device that focuses a light beam by following the phenomenon called refraction. A lens consists of an imaginary line called the principal axis on which the optical center is present. The point of incidence is the point at which light strikes the surface of the lens.

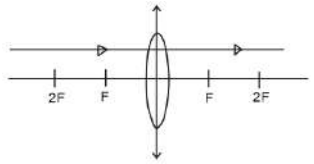
Q.57. It is found that during dispersion of white light by a glass prism, the more a colour component is bent, the more is the refractive index of the glass for that colour component. If μ_B μ_Y and μ_G are refractive indices for blue, yellow and green lights, respectively, then which of the following relations between them is correct?
RRC Group D 02/09/2022 (Morning)
(a) $\mu_Y = \mu_G = \mu_B$ (b) $\mu_G > \mu_B > \mu_Y$
(c) $\mu_B > \mu_G > \mu_Y$ (d) $\mu_Y > \mu_G > \mu_B$

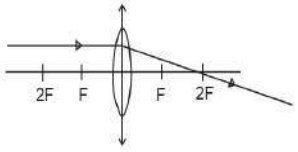
Sol.57.(c) $\mu_B > \mu_G > \mu_Y$**.** Dispersion of light - When white light is passed through a glass prism it splits into its spectrum of colors (in order violet, indigo, blue, green, yellow, orange and red). Violet having the minimum speed gets deviated by maximum angle and red having the maximum speed gets deviated by minimum angle.

Q.58. Which of the following diagrams correctly represents the path of a light ray incident parallel to the principal axis after refraction through the lens?
RRC Group D 02/09/2022 (Evening)

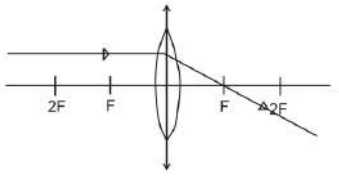
(a)


(b)


(c)


(d)


Sol.58.(b) In the figure, Object location is at Infinity, so image is formed at Focus (F), image nature is Real and Inverted and Image size is Diminished.



Q.59. A ray of light is incident on a concave mirror at point M. The ray makes an angle of 10° with a line joining M to the center of curvature. The ray is reflected at an angle of _____.
RRC Group D 02/09/2022 (Evening)
(a) 10° (b) 40° (c) 30° (d) 20°

Sol.59.(a) 10°. When a ray of light incident on a concave mirror from its centre of curvature it retraces the path of the incident ray i.e., it goes along the same path. So if a ray of light is incident on a concave mirror at point M and the ray makes an angle of 10° with a line joining M to the centre of curvature. Then the ray is reflected at an angle of 10°.

Q.60. Due to atmospheric refraction, the apparent position of a star is slightly _____ than its actual position, when viewed from near the horizon, and this apparent position_____ This results in twinkling of stars.
RRC Group D 05/09/2022 (Morning)
(a) higher, is stationary
(b) higher, keeps on changing
(c) lower, is stationary
(d) lower, keeps on changing

Sol.60.(b) Higher, Keeps on changing. Actual position of the star is different from apparent position because - star acts as a point source of light, starlight undergo refraction while entering the atmosphere. Twinkling of a star is due to atmospheric refraction of starlight.

Q.61. The angle of incidence for a ray of light incident on a glass slab along its normal, is:
RRC Group D 05/09/2022 (Afternoon)
(a) 0° (b) 90° (c) 30° (d) 45°

Sol.61.(a) 0°. Angle of incidence - is equal to the reflected angle through the law of reflection. When a light ray hits a surface normally, the angle between the incident ray and the normal is zero. when the wave is parallel to the surface it's incident angle of incident will be 90°.

Q.62. For a ray of light undergoing refraction through a triangular glass prism, which of the following statements is/are always correct?
(A) Angle of incidence is the angle between the incident ray and normal at the point of incidence.
(B) Angle of incidence is equal to angle of emergence.
(C) Angle of deviation is the angle between incident ray and emergent ray.
RRC Group D 05/09/2022 (Evening)
(a) Only (A) (b) Both (A) and (C)
(c) Both (B) and (C) (d) Only (B)

Sol.62.(b) Both (A) and (C). Refraction is the bending of light when it goes from one medium to another. When a ray of light passes through a glass prism, refraction of light occurs both when it enters the prism as well as when it leaves the prism. Since the refracting surfaces are not parallel, therefore, the emergent ray and incident ray are not parallel to one another and the ray of light is deviated on passing through the prism.

Q.63. The refractive index of mediums 1, 2 and 3 are 1.31, 1.36 and 1.44 respectively. If the speed of light in the medium is V_1, V_2 and V_3, then which of the following relation is correct between them?
RRC Group D 06/09/2022 (Morning)
(a) $V_1 = V_2 = V_3$ (b) $V_3 > V_1 > V_2$
(c) $V_2 > V_3 > V_1$ (d) $V_1 > V_2 > V_3$

Sol.63.(d) $V_1 > V_2 > V_3$**.** The refractive index of a medium is inversely proportional to the speed of light in that medium i.e. $n \propto 1/v$. The more the refractive index of a medium, the less is the speed.

Q.64. A ray of light is incident on one refracting surface AB of a glass prism and emerges out on the other refracting surface AC. Consider the following statements:
(A) The angle of refraction at surface AB is the same for different colors of white light.
(B) The angle of refraction at surface AC is different for different colors.
Which of the above statements are correct?
RRC Group D 06/09/2022 (Morning)
(a) neither (A) nor (B) (b) only (B)
(c) both (A) and (B) (d) only (A)

Sol.64.(b) Only (B). When light enters into a prism, it gets refracted because it enters from one medium (air) to another (glass). When white light is passed through a prism, it splits into seven colors of VIBGYOR (violet, indigo, blue, green, yellow, orange, red).

Q.65. A beam of white light passes through a glass prism and a spectrum is obtained. Which of the following colour components bends the most?
Green, Red, Indigo, Blue
RRC Group D 06/09/2022 (Afternoon)
(a) Red (b) Green (c) Indigo (d) Blue

Sol.65.(c) Indigo. This is because Indigo has the lowest velocity in glass and least wavelength among the given options. So, it bends the most.

Q.66. An object is placed in front of a concave mirror at a point lying between its focus F and the center of curvature C. The image will be formed at a point located at _____, and will be _____.
RRC Group D 06/09/2022 (Afternoon)
(a) Between F and C, the bigger
(b) beyond C, small
(c) beyond C, Large
(d) between F and C, Smaller

Sol.66.(c) Beyond C, Large. Image Formation by Concave Mirror - Object placed at Infinity - Image is real and inverted and formed at the focus, At the centre of curvature - real image is formed at the centre of curvature, Between the centre of curvature and principal focus - real image is formed beyond the centre of curvature, At the principal focus - real image is formed at infinity, between focus and pole - virtual and erect image is formed behind the mirror.

Q.67. Milk appears white when surrounded by white light because the particles in the milk are _____ compared to the wavelengths of different colors of white light that fall on it, and all colors of white light are scattered by ____.
RRC Group D 06/09/2022 (Evening)
(a) large, almost equal
(b) small, almost identical
(c) small, different
(d) large, different

Sol.67.(a) Large, almost equal. When light hits these casein micelles it causes the light to refract and scatter resulting in milk appearing white. Caseins are one of the main types of protein in milk which cluster together with calcium and phosphate to form tiny particles called micelles.

Q.68. A ray of light in glass is incident at an angle of 30° on the surface separating glass from air. The ray is refracted in the air at an angle of_____ and the refracted ray_____in the plane of the incident ray.
RRC Group D 08/09/2022 (Afternoon)
(a) more than 30 °, does not lie
(b) more than 30°, lies
(c) less than 30°, does not lie
(d) less than 30°, lies

Sol.68.(b) More than 30°, lies. Refraction of light - Refraction is the change in the direction of a wave passing from one medium to another. Examples - Twinkling of stars in a clear sky, Pool of water appears to be less deep than it actually is, Rainbow formation in the sky.

Q.69. An object is placed in front of a concave mirror at a point beyond its centre of curvature C. The image is formed at a point_____ and_____ is:
RRC Group D 08/09/2022 (Evening)
(a) between F and C, diminished
(b) beyond C, diminished
(c) beyond C, enlarged
(d) between F and C, enlarged

Sol.69.(a) between F and C, diminished. Concave mirrors can produce real as well as virtual images. Position of object and formation of images is as follows: when object is at infinity - diminished, real, point size, and inverted image will form at focus (F). If the Object is placed exactly at C - a real and inverted Image of the same size will form at C. If the Object is at F - real, inverted and magnified image will form at infinity. object is placed between F and the pole (P) of the mirror - Virtual, erect and magnified image will form appearing behind the mirror.

Q.70. An object is placed on the principal axis of a concave lens, at a point between infinity and its optical centre O. Its image formed is_____.
RRC Group D 08/09/2022 (Evening)
(a) real and diminished
(b) virtual and diminished
(c) virtual and enlarged
(d) real and enlarged

Sol.70.(b) Virtual and diminished. Concave lens - diverges a straight light beam from the source to a diminished, upright, virtual image, irrespective of the position of the object; Uses - Telescopes and binoculars to magnify objects, In short-sightedness (myopia). Focal length of a concave lens is negative.

Q.71. A ray of light is incident on a refracting surface AB of a glass prism and emerges out of the other refracting surface AC.
Consider the following statements:
(A) The angle of refraction at surface AB is more than the angle of incidence.
(B) The angle of refraction at the surface AC is less than the angle of incidence.
Which of the above statements is/are correct?
RRC Group D 09/09/2022 (Morning)
(a) Both (A) and (B) (b) Only (A)
(c) Neither (A) nor (B) (d) Only (B)

Sol.71.(c) Neither (a) nor (B). If a ray of light is incident on a refracting surface AB of a glass prism and emerges out of the other refracting surface AC.Then the angle of refraction at surface AB is not more than the angle of incidence and the angle of refraction at the surface AC is not less than the angle of incidence. So, both the given statements are incorrect.

Q.72. The focal length of a convex mirror is:
RRC Group D 09/09/2022 (Afternoon)
(a) infinite (b) zero
(c) negative (d) positive

Sol.72.(d) Positive. The focal length - Defined as the distance from the primary focus to its pole. For a converging or concave mirror, the focal length is always negative. The focal length of a convex mirror is half of its radius of curvature.

Q.73. When blue and orange lights, which are parallel to each other, are passed through prism then:
RRC Group D 09/09/2022 (Evening)
(a) blue ray will bend more
(b) both emergent rays will be parallel
(c) blue ray will bend towards the top
(d) orange ray will bend more

Sol.73.(a) blue ray will bend more.

When yellow, orange and blue color light is passed through the prism, the blue color light will bend the most as its wavelength is least in comparison to other colors. Refraction of Light Through Prism: When light travels from one medium to another, the speed of its propagation changes, as a result, it 'bends' or is 'refracted'. It is refracted towards the base of the triangle.

Q.74. A ray of light is incident on a refracting surface AB of glass prism, kept in air, and emerges out of the other refracting surface AC. Consider the following statements:
(A) The angle of refraction at surface AB is less than the angle of incidence.
(B) The angle of refraction at the surface AC is less than the angle of incidence.
Which of the above statements is/are correct?
RRC Group D 12/09/2022 (Morning)
(a) Neither (A) nor (B) (b) Both (A) and (B)
(c) Only (A) (d) Only (B)

Sol.74.(c) Only (A). Refraction is the bending of light when it goes from one medium to another so, when a ray of light passes through a glass prism, refraction of light occurs both, when it enters the prism as well as when it leaves the prism. Since the refracting surfaces are not parallel, therefore, the emergent ray and incident ray are not parallel to one another. In this case the ray of light is deviated on passing through the prism. Examples of atmospheric refraction of light : Twinkling of stars, Stars appear higher than they are, early sunrise and delayed sunset.

Q.75. The random wavering of objects seen through a turbulent stream of hot air rising above a fire can be explained using:
RRC Group D 12/09/2022 (Morning)
(a) scattering of light
(b) Total internal reflection
(c) dispersion of light
(d) atmospheric refraction

Sol.75.(d) Atmospheric refraction. Examples : Twinkling of stars, Apparent higher position of a star, Early sunrise and delayed sunset. Flattened appearance of sun during sunrise and sunset .

Q.76. The focal length of a concave mirror is:
RRC Group D 12/09/2022 (Morning)
(a) positive or negative
(b) zero
(c) always negative
(d) always positive

Sol.76.(c) Always negative. A concave mirror is a type of spherical mirror in which the reflecting surface is the inner curved surface of the sphere. Concave mirrors form both real and virtual images. Eg- the mirrors used in automobile headlights, reflecting telescopes, torch lights, etc. The focal length of an optical system is a measure of how strongly the system converges or diverges light.

Q.77. Which of the following points always lie(s) on the principal axis of a spherical mirror?
(i) Centre of curvature
(ii) Point of incidence
(iii) Pole
RRC Group D 12/09/2022 (Afternoon)
(a) Both (i) and (ii) (b) Only (i)
(c) Only (ii) (d) Both (i) and (iii)

Sol.77.(d) Both (i) and (iii). Spherical mirror - A mirror that has the shape of a piece cut out of a spherical surface. Types - concave mirror and convex mirror.

Q.78. During dispersion of light through a triangular prism white light will split into_____ bands of colour.
RRC Group D 12/09/2022 (Afternoon)
(a) eight (b) five (c) seven (d) three

Sol.78.(c) Seven. Prism - A transparent solid body that has three rectangular lateral surfaces and two triangular faces that are inclined at an angle. Dispersion - Separation of white light into different colors when the light is passed through the prism depending on the wavelength of the light.

Q.79. An object is placed at a distance of 30 cm in front of a convex mirror of focal length 10 cm, on its principal axis. Its image is formed at:
RRC Group D 12/09/2022 (Evening)
(a) 20 cm
(b) a point between 0 cm and 10 cm
(c) a point between 10 cm and 20 cm
(d) a point between 20 cm and infinity (∞)

Sol.79.(b) A point between 0 cm and 10 cm. In the case of a convex mirror no matter where the object is placed (except for infinity) the image is always formed between the pole and the focal length of the mirror.

Q.80. When light travels from one medium to another medium then:
RRC Group D 12/09/2022 (Evening)
(a) incident ray, normal at the point of incidence and refracted ray all are in the same plane
(b) incident ray, normal at the point of incidence and reflected ray are in the same plane
(c) incident ray, normal at the point of incidence and emerged ray, all are in the separate plane.
(d) incident ray, normal at the point of incidence and reflected ray are in two planes

Sol.80.(a) Second Law of refraction : The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant. This is also known as Snell's law of refraction. Refraction - Bending of light as it passes from one transparent substance into another. This bending by refraction makes it possible for us to have lenses, magnifying glasses, prisms and rainbows.

Q.81. The Outer space looks black because of:
RRC Group D 12/09/2022 (Evening)
(a) no scattering of light takes place
(b) no refraction of light takes place
(c) scattering of light by large particles
(d) scattering of light by smaller particle

Sol.81.(a) No scattering of light takes place. Scattering depends upon particle or molecule size and the wavelength of the incident light. In space or on the Moon there is no atmosphere to scatter light. Since there is virtually nothing in space to scatter or re-radiate the light to our eyes, we see no part of the light and the sky appears to be black.

Q.82. When a ray of light is incident obliquely at the pole of a concave mirror then the reflected ray will:
RRC Group D 12/09/2022 (Evening)
(a) return with Angle i = Angle r
(b) return without deviation
(c) pass straight
(d) become perpendicular to incident ray

Sol.82.(a) Return with Angle i = Angle r. The mirror is a reflective surface that reflects the incident light to form the image. The images can be either real or virtual. The convex mirror is a curved mirror in which the reflective surface will be pointing out towards the light source. If the ray of light is incident obliquely towards the pole of the convex mirror the ray will be reflected at an angle equal to the angle of incidence.

Q.83. A concave mirror has a _____ towards the centre of the sphere with polish _____ the centre of curvature.
RRC Group D 13/09/2022 (Morning)
(a) bulge, towards
(b) depression, towards
(c) bulge, opposite
(d) depression, opposite to

Sol.83.(d) Depression, opposite to. Concave mirror and convex mirror can be formed from a single spherical glass by slicing it but polishing both the slices in the opposite manner. Concave mirror - Silver surface is away from the centre of curvature and reflecting surface is towards the centre of curvature. Convex mirror - Silver surface is towards the centre of curvature and reflecting surface is away from the centre of curvature.

Q.84. The reddish appearance of the sun at the time of sunrise is due to:
RRC Group D 13/09/2022 (Morning)
(a) reflection of light (b) dispersion of light
(c) scattering of light (d) refraction of light

Sol.84.(c) Scattering of light. During sunrise and sunset, the rays travel a larger part of the atmosphere because they are close to the horizon. Therefore, light other than red is mostly scattered away. Most of the red light (longest wavelength), which is the least scattered, enters our eyes. This process occurs due to Rayleigh scattering. The phenomenon of scattering of light by dust, particles, smoke and water droplets suspended in air in colloidal form is known as "Tyndall effect" or "Tyndall Scattering". It was first explained by John Tyndall in 1859.

Q.85. The light from a point source is rendered parallel by a concave mirror. What is the position of the light source?
RRC Group D 13/09/2022 (Morning)
(a) Between focus and centre of curvature
(b) At centre of curvature
(c) At Focus
(d) At infinity

Sol.85.(c) At Focus. All the light rays which are parallel to the principal axis of a concave mirror, converge at the principal focus (F) after reflection from the mirror. Since a concave mirror converges to a parallel beam of light rays, it is also called a converging mirror.

Q.86. A ray of light undergoes refraction through a triangular glass prism. The angle between the incident ray and emergent ray is called:
RRC Group D 13/09/2022 (Afternoon)
(a) angle of deviation
(b) angle of refraction
(c) angle of emergence
(d) angle of incidence

Sol.86.(a) Angle of deviation. The expression of the angle of deviation is ⇒ δ = (i + e) - A , Angle of refraction, The angle between the refracted ray and normal at the point of refraction. Angle of emergence: The angle of the light ray coming out of a medium perpendicular to the surface at the point of emergence.

Q.87. To obtain sharp signals from a dish antenna, the receiver of the dish antenna should be placed_____.
RRC Group D 13/09/2022 (Evening)
(a) in front of the dish at C
(b) in front of the dish at F
(c) in front of the dish between C and F
(d) behind the dish

Sol.87.(b) In front of the dish at F. In TV antenna dish concave mirror is used to concentrate the parallel beam of signals coming to the receiver situated at its focus.

Q.88. When a ray of light travels from a denser to a rarer medium, it will:
RRC Group D 13/09/2022 (Evening)
(a) bend away from the normal
(b) not hold the phenomenon of refraction
(c) bend towards the normal
(d) have similar angles of incidence and refraction

Sol.88.(a) Bend away from the normal. Refractive Index (n) is the velocity of light in vacuum divided by the velocity of light in a medium, Refractive Index Formula n=c/v. Refractive Index Examples - Air (1.0003), Water (1.333), Diamond (2.42), Ice (1.31), Alcohol (1.36) and Fused quartz (1.46).

Q.89. If the magnification of an image is -0.65, then the nature of the image is:
RRC Group D 14/09/2022 (Morning)
(a) real, inverted and enlarged
(b) real, inverted and smaller
(c) real, erect and smaller
(d) virtual,erect and enlarged

Sol.89.(b) Real, inverted and smaller. Magnification = $\frac{Image\ size\ (v)}{object\ size\ (u)}$.
The size or height of real and inverted images is considered negative and that of virtual and erect images is considered positive. According to question, magnification is - 0.65 which means the value of $\frac{v}{u}$ is less than 1, which means the size of the image is smaller than the size of the object. The negative sign implies that the image is real and inverted.

Q.90. A beam of white light passes through a glass prism and a spectrum is obtained. Which of the following colour components bends the least?
Yellow, Orange, Blue, Violet
RRC Group D 14/09/2022 (Morning)
(a) Yellow (b) Blue (c) Orange (d) Violet

Sol.90.(c) Orange. After passing through a prism, bending of light depends on the wavelength, light of shorter wavelength bends the most. Decreasing order of wavelength of light: Red > Orange >Yellow > Green > Blue > Indigo > Violet. Red light having maximum wavelength bends the least and violet light having least wavelength bends the most.

Q.91. What happens when a pencil is immersed in water?
RRC Group D 14/09/2022 (Afternoon)
(a) Colour of pencil changes
(b) Pencil appears bright
(c) Pencil appears bent
(d) Pencil looks curved

Sol.91.(c) Pencil appears bent. Refraction is the bending of a wave when it enters a medium where its speed is different.The optical density of water is higher than that of the air. The light from the part of the pencil which is immersed in water, travels from water to air i.e, denser medium to rarer medium. Therefore, the light bends away from the normal and the pencil appears to be bent or broken.

Q.92. For a spherical mirror, the distance between the pole and the centre of the curvature is :
RRC Group D 15/09/2022 (Morning)
(a) twice the distance between pole and F
(b) equal to the focal length
(c) half of the radius of curvature
(d) equal to the distance between c and F

Sol.92.(a) Twice the distance between pole and F. Spherical mirror is formed by cutting out a piece of a sphere and silvering either the inside or outside surface. Two types: Concave Mirror and Convex Mirror. For spherical mirrors of small apertures, the radius of curvature is found to be twice the focal length.

Q.93. The height of the image of an object below the principal axis of a

spherical mirror_____.
RRC Group D 15/09/2022 (Morning)
(a) depends on position of object
(b) depends on position of image
(c) is positive
(d) is negative

Sol.93.(d) Is negative (for real images). The height of the image of an object above the principal axis of a spherical mirror is positive (virtual images). Spherical mirror: The shape of a piece cut out of a spherical surface and silvering either the inside or outside surface. Two types: Concave Mirror (Converging mirror): Reflects light inwards to one focal point. Uses: Satellite Dishes, Headlights in a car, Shaving mirror, Dentist's mirror. Convex Mirror (Diverging mirror): Reflects light outwards. Uses: Rearview mirror in vehicles, Security mirrors in ATMs.

Q.94. When white light is passed through a prism it undergoes dispersion. The angle of deviation is :
RRC Group D 15/09/2022 (Evening)
(a) Directly proportional to the wavelength
(b) Inversely proportional to the wavelength
(c) Independent of the wavelength
(d) Maximum for red colour

Sol.94.(b) Angle of deviation is the angle between the incident ray and the emergent ray of light after it passes through the prism. When white light is passed through a prism, it undergoes dispersion and splits into its constituent colors called spectrum. The angle of deviation is inversely proportional to the wavelength of light. Light with longer wavelength i.e. red deviates less and light with shorter wavelength i.e. violet deviates more.

Q.95. An incident ray passes through the focus of a concave mirror. The reflected ray:
RRC Group D 15/09/2022 (Evening)
(a) Is parallel to the principal axis
(b) Passes through the centre of curvature
(c) Passes through the focus of the mirror
(d) Is normal to the mirror

Sol.95.(a) Is parallel to the principal axis. Concave mirror (converging mirrors) is a spherical mirror whose reflecting surface is on the inner curved surface of the sphere. An incident ray starting or passing through the focus of a concave mirror travels parallel to its principal axis after reflection. Uses - Shaving mirrors, Headlights, Astronomical telescopes, Solar furnaces, Projectors, Makeup mirrors.

Q.96. When parallel beam of light rays are incident on the convex mirror of focal length 1 m, reflected rays:
RRC Group D 15/09/2022 (Evening)
(a) Converge to a point at a distance 0.5 m from the convex surface
(b) Appear to diverge from a point at a distance 1 m behind the mirror
(c) Appear to diverge from a point at a distance 0.5 m behind the mirror
(d) Converge to a point at a distance 1 m from the convex surface

Sol.96.(b) When parallel beam of light rays are incident on a convex mirror, the reflected rays appear to diverge from a point behind the mirror known as the virtual focus or focal point. In the case of a convex mirror, the virtual focus is located behind the mirror surface. The distance between the mirror surface and the virtual focus is equal to the focal length of the mirror, which in this case is 1 m. Hence, the reflected rays appear to diverge from a point at a distance of 1 m behind the mirror.

Q.97. Out of indigo, green, orange and yellow colours, which colour has the least refractive index?
RRC Group D 15/09/2022 (Evening)
(a) Orange (b) Yellow (c) Green (d) Indigo

Sol.97.(a) Orange. The refractive index of a particular colour is the reciprocal of its wavelength. The refractive index will be Red < Orange < Yellow < Green < Blue < Indigo < Violet . Wavelengths - Red > Orange > Yellow > Green > Blue > Indigo > Violet .

Q.98. When a beam of light of wavelengths 4500Å, 5400Å, and 6000Å respectively are passed through a prism then the angle of deviation is
RRC Group D 16/09/2022 (Morning)
(a) more in light of 4500 Å
(b) more in light of 6000 Å
(c) equal in all
(d) more in light of 5400 Å

Sol.98.(a) More in light of 4500 Å. The angle between the direction of incident ray and the emergent ray, is called the angle of deviation. Factors on which angle of deviation depends: angle of incidence, The wavelength of light used, the material of the prism, the angle of prism. Wavelength is the distance between identical points in the adjacent cycles of a waveform signal propagated in space or along a wire. SI unit is meter. Angle of deviation increases with decreases in wavelength. So, the angle of deviation is more in light of 4500 Å.

Q.99. Reflected ray passes through principal focus when incident ray:
RRC Group D 16/09/2022 (Morning)
(a) is passing through C of convex mirror
(b) is incident at the pole of plane mirror
(c) is parallel to principal axis of convex mirror
(d) is parallel to principal axis of concave mirror

Sol.99.(d) Image Formation by Concave Mirror- Object placed at- Infinity- Image is real and inverted and formed at the focus, Beyond the centre of curvature- real image is formed between the centre of curvature and focus, At the centre of curvature- real image is formed at the centre of curvature, Between the centre of curvature and principal focus- real image is formed behind the centre of curvature, At the principal focus- real image is formed at infinity, between focus and pole- virtual and erect and image is formed behind the mirror.

Q.100. The refractive index of fluid A is 1.47. This means:
RRC Group D 16/09/2022 (Morning)
(a) the speed of light in fluid A is 1.47 times greater than the speed of light in air
(b) the speed of light in fluid A is 1.47 times greater than the speed of light in water
(c) the speed of light in fluid A is reduced by 1.47 times than the speed of light in vacuum
(d) the speed of light in fluid A is increased 1.47 times than the speed of light in water

Sol.100.(c) Refractive index(n) is the measure of the bending of a light ray when passing from one medium to another. Formula:- n=c/v. c = speed of light in vacuum , v = phase velocity of light. Refractive index of a medium depends upon- the wavelength of light, Density of the medium and Temperature.

Q.101. Which of the following materials CANNOT be used to make a spherical lens?
RRC Group D 16/09/2022 (Afternoon)
(a) Water (b) Cellophane
(c) Wood (d) Clear glass

Sol.101.(c) Wood. Spherical Lens - Transmissive optical device that focuses or disperses a light beam by means of refraction. Convex lens - Lens that converge rays of light that are traveling parallel to its principal axis. Use - Corrective lenses, Magnifying glasses, Cameras, Projectors, Telescopes etc. Concave lens - Diverge a single beam of light when it passes through leading to the formation of upright, diminished and virtual images. Use - Correcting long-sightedness (hypermetropia), Correcting astigmatism.

Q.102. Most ordinary gases do not show dispersion with visible light. This is because the velocities of propagation of waves of different wavelengths of visible light are_____.(Velocity of light in vacuum is c)
RRC Group D 16/09/2022 (Evening)
(a) very much different
(b) always much less than c
(c) always much greater than c
(d) almost the same as c

Sol.102.(d) Almost the same as C. Since, the velocity of propagation of waves of various wavelengths of visible light are almost same in most of the ordinary gases therefore, they do not show dispersion on visible light.

Q.103. A reflected ray will follow the same path but in reverse direction when it passes through the pole and_____.
RRC Group D 16/09/2022 (Evening)
(a) surface of mirror
(b) focal plane
(c) is perpendicular to the focal plane
(d) is parallel to the focal plane

Sol.103.(c) Is perpendicular to the focal plane. Law of reflection: The angle of incidence = Angle of reflection. The incident ray, reflected ray, and the normal of the system lie in the same plane.

Q.104. Smaller particles scatter the light of _____and _____ colour the most; on the other hand, larger particles scatter the light of _____and _____ colour the most.
RRC Group D 17/09/2022 (Morning)
(a) violet, blue; red, orange
(b) violet, blue; green, yellow
(c) red, orange; violet, blue
(d) red, orange; green, yellow

Sol.104.(a) Violet, blue; red, orange . Scattering of light is the phenomenon in which light rays get deviated from its straight path on striking an obstacle like dust or gas molecules, water vapors and other minute particles. Factors affecting Scattering of light - Size of particle and Wavelength of light.

Q.105. When light is passed through a prism, refraction of light occurs:
RRC Group D 17/09/2022 (Afternoon)
(a) two times (b) three times
(c) one time (d) zero times

Sol.105.(a) Two times. As light passes through the prism, it slows and bends, but different wavelengths bend at different angles. This separates light into different wavelengths, forming a rainbow of colors. In this whole process refraction of light occurs two times because when light travels through a glass prism, it is refracted both inside and outside the prism.

Q.106. When we observe the floor of a swimming pool filled with water we notice that the pool looks:
RRC Group D 17/09/2022 (Evening)
(a) More wider than it actually is
(b) less wide than it actually is
(c) deeper than it actually is
(d) less deep than it actually is

Sol.106.(d) Less deep than it actually is. The rays of light coming from the bottom of the swimming pool are refracted by the water and form a virtual image of the swimming pool. This phenomenon is called the refraction of light. Eyes do not take refraction in account so the swimming pool appears less deep than actual when it is filled with water.

Q.107. If the magnification of an image from a spherical mirror is -1.38, then the nature of the image will be:
RRC Group D 17/09/2022 (Evening)
(a) real, inverted and enlarged
(b) virtual, erect and enlarged
(c) real, inverted and smaller
(d) virtual, erect and smaller

Sol.107.(a) Real, inverted and enlarged.

Magnification of mirror (m) = $\frac{h_i}{h_o}$

(where h_i = height of image, h_o = height of object.) Since the magnification of a spherical mirror is -1.38, which is greater than 1, which implies that the image size is larger than object size. Negative sign implies that the image is real and inverted in nature.

Q.108. A ray of white light is incident on a refracting surface AB of a glass prism and emerges out of the other refracting surface AC. Consider the following statements:
RRC Group D 18/09/2022 (Morning)
(A) The angle of refraction at surface AB is different for different colours of white light.
(B) The angle of refraction at the surface AC is different for different colours.
Which of the above statements is/are correct?
(a) Both (A) and (B) (b) Only (B)
(c) Neither (A) nor (B) (d) Only (A)

Sol.108.(a) Both (A) and (B). Refraction is the bending of light as it passes from one transparent substance into another. The angle of refraction is different for different colors Because different colors have different wavelengths, the speed with which they all bend varies depending on their wavelength. The violet deviates the most, having the shortest wavelength and red deviates the least, having the longest wavelength.

Q.109. If the value of the refractive index increases then:
RRC Group D 18/09/2022 (Evening)
(a) deviation decreases
(b) deviation in direction of light increases
(c) there is no deviation in direction of light
(d) light will follow curved path

Sol.109.(b) Deviation in direction of light increases. The deviation of light occurs when a beam of light changes route as it travels from one medium to another. The phenomenon of deviation of light rays from their original path,when they pass from one medium to another, is called refraction. As the refractive index of a medium increases, the speed of light in that medium decreases because the speed of light in a medium is inversely proportional to the refractive index of the medium, i.e., $n \propto 1/v$.

Q.110. The radius of curvature of a spherical mirror is the distance between:
RRC Group D 19/09/2022 (Morning)
(a) Principal focus and center of curvature
(b) Centre of curvature and pole
(c) Pole and principal focus
(d) Centre of curvature and infinity

Sol.110.(b) Centre of curvature and pole. The focal length of a spherical mirror is the distance between the pole of the mirror and the focus of the mirror on the principal axis. Rays parallel to the principal axis converge on the focus (for a concave mirror) or appear to diverge

from the focus (for a convex mirror). Centre of curvature = 2 × focal lengths.

Q.111. A student measured the magnification of a spherical lens and a spherical mirror. He found that both are +3.0. He would conclude that:
RRC Group D 19/09/2022 (Afternoon)
(a) the lens and the mirror both are convex
(b) the lens and the mirror both are concave
(c) the lens is concave but the mirror is convex
(d) the lens is convex but the mirror is concave

Sol.111.(d) The magnitude of magnification is greater than 1, it signifies that the image is enlarged. Since magnitude is 3, the image is 3 times bigger than the object. The mirror must be a concave mirror and the lens is convex.

Q.112. The correct relation between v, u , and f for a spherical mirror is:
RRC Group D 19/09/2022 (Afternoon)
(a) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ (b) v = u + f
(c) $\frac{1}{f} + \frac{1}{u} = \frac{1}{v}$ (d) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

Sol.112.(d) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$. Spherical mirror is a mirror which has the shape of a piece cut out of a spherical surface. Types - Concave and Convex mirror. Convex mirrors Use - Sunglasses, rear view mirrors, shaving mirror and concave mirrors Use - Reflectors, converging of light, solar cooker etc.

Q.113. A light ray enters from medium A to medium B, and as a result, it bends away from the normal in the medium B. The refractive index of medium B relative to medium A is:
RRC Group D 20/09/2022 (Morning)
(a) greater than unity (b) equal to unity
(c) less than unity (d) equal to 2

Sol.113.(c) Less than unity. Refraction - When light travels from one medium to another, it bends towards or away from the normal. When light moves from rarer to denser mediums, the rays bend towards the normal. In medium B, light rays bend away from the normal that indicates medium B is optically rarer than medium A.
Now, refractive index
$_{A}\mu_{B} = \frac{V_b}{V_a}$; $V_a > V_b \Rightarrow \therefore {}_{A}\mu_{B} < 1$.

Q.114. When light is incident along the normal and passes from air to water, then the direction of light will_____
RRC Group D 20/09/2022 (Evening)
(a) not be changed
(b) change at the boundary
(c) change before entering water
(d) change after entering water

Sol.114.(a) Not be changed. Refraction of light - When the light rays either bend or change their direction while passing from one medium to another.

Q.115. Suppose a point source is incident on a system and it produces a parallel beam of light with respect to the principal of the system. The system is:
RRC Group D 22/09/2022 (Morning)
(a) either a concave mirror or a concave lens
(b) either a convex mirror or a convex lens
(c) either a concave mirror or a convex lens
(d) Two plane mirrors perpendicular to each other

Sol.115.(c) Concave Mirror (converging mirror) - A mirror whose reflecting surface is toward the centre of the curvature. Convex Mirror (diverging mirror) - A mirror whose reflecting surface is away from the centre of the curvature. Concave lens - A lens that diverges the beam of light and is used to minimize the size of the object. Examples - Binoculars, Cameras, Lasers etc. Convex lens - A lens that converges the beam of light and is used to maximize the size of the object. Examples - Magnifying glasses, Microscopes etc.

Q.116. Which of the following instruments use the principle of refraction?
RRC Group D 22/09/2022 (Morning)
(a) Radio (b) Spectacles
(c) Mobile (d) Clock

Sol.116.(b) Spectacles. Refraction is the bending of light, when light passes from one transparent medium to another, causing a change in speed, which results in a change in the direction of light. Example - Twinkling of stars in a clear sky, a Pool of water that appears to be less deep than it actually is, Rainbow formation in the sky, etc.

Q.117. Suppose Raghu has kept an object in front of a concave mirror of focal length (f) at various distances (u) and he has measured the corresponding image distances (v). From the values of u and v, Raghu is able to plot a graph of magnification m against v. Which of the following options is true?
RRC Group D 22/09/2022 (Morning)
(a) It is a straight line with slope -1/f, and x intercept-1 and y intercept +f
(b) It is a straight line with slope +f, and x intercept-1 and y intercept 1/f
(c) It is a straight line with slope -f, and x intercept -1 and y intercept -f
(d) It is a straight line with slope +1/f, and x intercept +f and y intercept -1

Sol.117.(d) Magnification v/s image distance - A straight line used to find magnification as a function of image distance. The formula of magnification (m) = $\frac{-v}{u}$.

Q.118. When a ray is incident parallel to the principal axis of a convex lens then the refracted ray will pass through:
RRC Group D 22/09/2022 (Afternoon)
(a) principal axis (b) centre of curvature
(c) optical centre (d) principal focus

Sol.118.(d) Principal focus. Convex Lens- A lens that converges rays of light that convey parallel to its principal axis. Concave Lens - A lens that diverges a straight light beam from the source to a diminished, upright, virtual image. Ray Diagram- When a ray strikes concave or convex lenses obliquely at its optical center, it continues to follow its path. When a ray, passing through focus strikes concave or convex lenses, the reflected ray will pass parallel to the principal axis.

Q.119. A point on the principal axis which is equidistant from the curved surface of a spherical mirror is:
RRC Group D 22/09/2022 (Afternoon)
(a) centre of curvature (b) principal focus
(c) infinity (d) pole

Sol.119.(b) Principal focus. Centre of curvature is the center of the sphere of which the spherical mirror is a part. The center of the reflecting surface of a spherical mirror is a point called the Pole.
Mirror Formula → $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$.
Where, f = Focal length of the mirror,
v = Distance of image from the mirror,
u = Distance of the object from the mirror

Q.120. A rainbow is formed by water droplets suspended in the atmosphere after the rain shower. The phenomenon responsible for occurring of rainbow consists of

RRC Group D 22/09/2022 (Afternoon)
(a) A combination of refraction, dispersion and total internal reflection
(b) Reflection only
(c) Refraction only
(d) All combination of refraction, scattering and dispersion

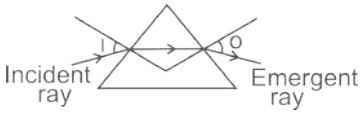
Sol.120.(d) Rainbow is caused by the dispersion of sunlight by tiny water droplets, present in the atmosphere. Due to the dispersion of light and internal reflection, different colors are observed in the sky. The sequence of colors in the spectrum , VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange, Red).

Q.121. The correct relation between the radius of curvature R and focal length f for a spherical mirror is
RRC Group D 22/09/2022 (Afternoon)
(a) $\frac{R}{2} = f$ (b) $R = \frac{f}{2}$
(c) $R = f$ (d) $\frac{1}{R} = \frac{2}{f}$

Sol.121.(a) $\frac{R}{2} = f$**.** A spherical mirror is a mirror that has the shape of a piece cut out of a spherical surface.

Q.122. Consider an equilateral glass prism on which a ray of light incident at an angle θ and passes through the prism in such a way that the refracted ray inside the prism is parallel to its base and emerges at an angle of emergence β . Which of the following is true?
RRC Group D 22/09/2022 (Evening)
(a) θ = − β (b) θ = 2β
(c) θ = β (d) θ = − 2β

Sol.122.(c) θ = β**.** In an equilateral triangle the refracted ray inside the prism is parallel to the base. In an equilateral prism the angle made by the emergent ray with the normal at the surface is equal to the angle made by the ray with the normal at the refracting surface. This is because the prism is equilateral and therefore the ray will make the same angle with both the faces. θ = angle of incidence, β = angle of emergence.



Q.123 The wavelength of visible light is blue in _____ size. Clear sky color for light by _____ of particles.
RRC Group D 26/09/2022 (Afternoon)
(a) Large, refraction (b) Small, refraction
(c) Short, distraction (d) Large, distraction

Sol.123.(c) Short, distraction. Blue light has shorter waves, with wavelengths between about 450 and 495 nanometers. Red light has longer waves, with wavelengths around 620 to 750 nm. Scattering of light is the phenomenon that makes the path of light visible. When a beam of light strikes fine particles present in the atmosphere, scattering happens.

Q.124. Select the correct property/properties from among the following, with respect to the reflection of light by a concave mirror.
(A) Light does not obey the laws of reflection as the concave surface is a curved surface.
(B) A light ray directed on to the pole of a concave mirror retraces the path of incidence in the opposite direction.
RRC Group D 26/09/2022 (Evening)
(a) Both (A) and (B) are correct
(b) Only (B) is correct
(c) Both (A) and (B) are incorrect
(d) Only (A) is correct

Sol.124.(c) The laws of reflection of light are applicable to both plane and curved surfaces. For both, plane and curved surfaces, the incident ray, the reflected ray and the point of incidence, all lie on the same plane. So, statement A is incorrect. When a ray of light is incident obliquely towards the pole of a concave mirror or a convex mirror, it is reflected obliquely in such a way the incident and reflected rays make equal angles with the principal axis. So, statement B is incorrect. Hence, Both statements A and B are incorrect.

Q.125. If an image formed after reflection from a mirror is virtual and highly diminished, then the position of the object and type of mirror is:
RRC Group D 27/09/2022 (Morning)
(a) Between C and F and concave mirror
(b) Centre of curvature and concave mirror
(c) infinity and concave mirror
(d) infinity and convex mirror

Sol.125.(d) Infinity and convex mirror. Convex mirrors form virtual, diminished and erect images. Position of object - At infinity, Position of image - Highly diminished, point size image at the focus F, Behind the mirror. Position of object - Between infinity and pole, Position of image - Diminished image between pole and focus.

Q.126. The appearance of a stick at the interface when immersed in water is an example of_____
RRC Group D 27/09/2022 (Morning)
(a) displacement of light
(b) reflection of light
(c) refraction of light
(d) transmission of light

Sol.126.(c) Refraction of light is the change in the direction of a light wave passing from one medium to another. The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant.

Q.127. Which of the following statements is correct with regard to the reflection of light by a spherical mirror?
(A) A convex mirror converges the light rays incident parallel to its principal axis.
(B) A concave mirror converges the light rays incident parallel to its principal axis.
(C) Convex mirrors can form both, real and virtual images.
(D) Concave mirrors can form both real and virtual images.
RRC Group D 27/09/2022 (Afternoon)
(a) Only (A) and (D) (b) Only (A) and (C)
(c) Only (B) and (C) (d) Only (B) and (D)

Sol.127.(d) Only (B) and (D). Concave Mirror: Curved inward and away from the light source, forms both real and virtual images. Convex Mirror: Diverging mirror, forms virtual and erect images. Ray diagram of the spherical mirror - When a ray strikes a spherical mirror obliquely at its pole, it is reflected obliquely making the same angle with the principal axis. When a ray, parallel to the principal axis strikes a spherical mirror, the reflected ray passes through the focus on the principal axis.

Q.128. When light passes from water to air then_____changes.
RRC Group D 27/09/2022 (Afternoon)
(a) Wave length (b) its frequency
(c) its colour (d) its speed

Sol.128.(d) Its Speed. The speed of light decreases when it enters from a rarer medium to a denser medium and increases when it enters from a denser medium to a rarer medium. The speed of light increases when a light ray passes from water to air and the speed of light decreases when a light ray passes from water to glass. It is known as the phenomenon of refraction. The refractive index of water with respect to air is 1.33.

Q.129. Stars twinkle at night due to:
RRC Group D 27/09/2022 (Evening)
(a) atmospheric reflection of starlight

(b) atmospheric dispersion
(c) atmospheric scattering of starlight
(d) atmospheric refraction of starlight

Sol.129.(d) Atmospheric refraction of starlight. When the light coming from a star enters the earth's atmosphere, it undergoes refraction due to the varying optical densities of air at various altitudes. The atmosphere is continuously changing (because optical densities of air at different levels in the atmosphere keep on changing). The star-light reaching our eyes increases and decreases continuously due to atmospheric refraction and the star appears to twinkle at night.

Q.130. Which of the following is/are correct with respect to the reflection by spherical mirrors?
(A) A concave mirror will diverge the rays of light if the object is placed between the pole and the focus.
(B) A convex mirror can converge a beam of rays.
RRC Group D 28/09/2022 (Morning)
(a) (A) is only correct
(b) (B) is only correct
(c) Both (A) and (B) are incorrect
(d) (A) and (B) both are correct

Sol.130.(a) (A) is only correct. Reflection of Light by Spherical Mirrors - A spherical mirror is that mirror whose reflecting surface is the part of a hollow sphere of glass.

Q.131. Light travels from air into water with an index of refraction of 1.33. The light ray will :
RRC Group D 28/09/2022 (Afternoon)
(a) Go perpendicular to the normal
(b) Bend away from the normal
(c) Bend towards the normal
(d) Go parallel to the normal

Sol.131.(c) Bend towards the normal. Refractive index is the ratio of the velocity of light in a vacuum to its velocity in a specified medium. When the ray of light travels from an optically rarer medium to an optically denser medium its speed slows down and the refracted ray gets bends towards the normal but if it moves from an optically denser medium to an optically rarer medium it bends away from the normal.

Q.132. A concave mirror of focal length f produces a real image at a distance v from the pole, when an object is kept at the distance u from the pole. Here, focal length of the given mirror is :
RRC Group D 28/09/2022 (Afternoon)
(a) (u + v) / (u v) (b) (1/u) - (1/v)
(c) (u v) / (u + v) (d) (1/v) - (1/u)

Sol.132.(c) (u v) / (u + v). Concave Mirror (Converging mirror) - If a hollow sphere is cut into parts and the outer surface of the cut part is painted, then it becomes a mirror with its inner surface as the reflecting surface. The image formed by the concave mirror can be small or large and can be real or virtual. Example - Headlights, Shaving mirrors, Solar furnaces, Searchlights, Torches, Flashlights, Dental Mirror etc. Mirror formula ($\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$).

Q.133. When white light is incident on a prism, its dispersion takes place. In this context, select the correct option.
(A) Red light gets bent the most in a prism.
(B) Violet color of light has the least speed in the prism.
(C) The refractive index of violet colored light is highest.
(D) When the prism is held upright, the violet color is at the top and the red color is at the bottom.
(E) The formation of a rainbow is also due to dispersion.
RRC Group D 28/09/2022 (Afternoon)
(a) (B), (D) and (E) (b) (B), (C) and (D)
(c) (B), (C) and (E) (d) (A), (C) and (D)

Sol.133.(c) (B), (C) and (E). When white light passes through a glass prism, it splits into its spectrum of colours (in order violet, indigo, blue, green, yellow, orange, and red) and this process of splitting white light into its constituent colours is known as dispersion.

Q.134. Which of the following statements with regard to the principal axis of a spherical mirror is/are correct?
(a) The pole on the principal axis is similar to the origin of a Cartesian coordinate axis plane.
(b) Distances measured from the pole, along the principal axis opposite to the direction of the incident light are negative.
(c) Heights of the objects or image above the principal axis and perpendicular to it are considered negative.
RRC Group D 28/09/2022 (Afternoon)
(a) Only (a) and (b) (b) Only (b) and (c)
(c) (a), (b) and (c) (d) Only (a) and (c)

Sol.134.(a) Only (a) and (b). Terms associated with the spherical mirrors- Pole(P) - The geometrical center of the spherical mirror is called its pole. Centre of curvature(C) - The center of the imaginary sphere of which the mirror is a part is called the center of the curvature. Principal focus(F) - A point on that spherical mirror's principal axis where parallel light rays intersect (meet) or emerge to deviate after reflection. Focal Length - The distance between the pole and the focus is called the focal length. The focal length is half the radius of curvature. Aperture - The portion of a mirror from which the reflection of light actually takes place is called the aperture of the mirror.

Q.135. Identify the correct statement(s) with respect to the reflection of light by a spherical mirror from among the following.
(A) A convex mirror can only form real and inverted images.
(B) A concave mirror can form real, inverted and virtual, erect images.
(C) Images formed by convex mirrors are either diminished, same size or enlarged depending on the position of the object.
(D) Images formed by concave mirrors are either diminished, same size or enlarged depending on the position of the object.
RRC Group D 28/09/2022 (Evening)
(a) (B) and (D) are only correct
(b) (A) and (C) are only correct
(c) (B) and (C) are only correct
(d) (A) and (D) are only correct

Sol.135.(a) (B) and (D) are only correct. Image formation by Concave mirror - If an object is close to the mirror a magnified, erect and virtual image is obtained. If we increase the distance between object and mirror, the size of the image reduces and a real and inverted image is formed. Image formation by Convex mirror : Always form virtual, erect and diminished images.

Q.136. The refractive index of a material can be linked with relative _____ of propagation of light in different media.
RRC Group D 28/09/2022 (Evening)
(a) displacement (b) acceleration
(c) force (d) speed

Sol.136.(d) Speed. Refractive index - The measure of bending of a light ray when passing from one medium to another. It can also be defined as the ratio of the velocity of a light ray in an empty space to the velocity of light in a substance. n = c/v. Where c is the velocity of light in a vacuum (3×10^8 m/s). Refractive index of different mediums - Air (1.0003), Water (1.333). The vacuum has a

refractive index of 1.

Q.137. When a thin beam of white light is passed through a prism, the light _____.
RRC Group D 29/09/2022 (Morning)
(a) will reflect (b) will converge
(c) will flicker (d) will be anagrammed

Sol.137.(d) Will be anagrammed. Dispersion of light - When white light is passed through a glass prism it splits from the sun into 7 colours - Violet, Indigo, Blue, Green, Yellow, Orange and Red (VIBGYOR).

Q.138. Which of the following statements is/are true regarding the centre of curvature of a spherical mirror?
(S-I) Rays of light passing in any direction through the centre of curvature are normal to the mirror.
(S-II) A ray of light passing through the centre of curvature, and the principal focus is also normal to the mirror.
(S-III) The angle of incidence of the ray of light passing through the centre of curvature onto the mirror is 90°.
RRC Group D 29/09/2022 (Morning)
(a) (S-I), (S-II) and (S-III)
(b) (S-I) and (S-III) only
(c) (S-I) only
(d) (S-I) and (S-II) only

Sol.138.(c) (S-I) only. Center of Curvature (C) - It is the centre of the hollow sphere which the mirror forms a part. In the case of the Concave mirror, it lies in front of the mirror, while in the case of the Convex mirror it lies behind the mirror. The distance between the Pole and the Principal Focus of the spherical mirror is termed as the focal length. Focal Length = $\frac{Radius\ of\ curvature}{2}$.

Q.139. The correct relation between the focal length of a lens and its power is:
RRC Group D 29/09/2022 (Afternoon)
(a) $p = \frac{1}{f}$ (b) $p = \frac{-1}{f}$
(c) $p \propto f$ (d) $p = f$

Sol.139.(a) $p = \frac{1}{f}$. Power of a lens (P) is the reciprocal of its focal length. SI unit - dioptre (D). One dioptre is the power of a lens whose focal length is 1 meter (1D = $1m^{-1}$). The power of a convex lens - positive, concave lens - negative.

Q.140. In the following table, mirror, its application and the justification for the application are given. Identify the rows in which the information is completely correct, with regard to given spherical mirrors in column 2.

	Mirror	Application	Justification
1	Concave	Dentist Mirror	Virtual, Erect and Magnified Image
2	Convex	Street Lights	Diverges the light rays hence wider field of view is possible
3	Concave	Solar Furnace	Converges light rays from a distant source like sun
4	Convex	Rearview Mirrors	Virtual erect and enlarged images are formed

RRC Group D 29/09/2022 (Afternoon)
(a) 1, 2, 3 and 4 (b) Only 1
(c) Only 1 and 2 (d) Only 1, 2 and 3

Sol.140.(d) Only 1, 2 and 3. Uses of Convex mirror: sunglasses, rear-view mirror in Automobiles, utilized in ATMs and other places for security reasons, reflector for street lights. Uses of concave mirror: Shaving mirrors, Head mirrors, Ophthalmoscope, Astronomical telescopes, Headlights, Solar furnaces. The image formed by a convex mirror is located behind the mirror, always a virtual and erect image and reduced in size.

Q.141. If a parallel beam of light is not parallel to the principal axis of a concave mirror, then such rays will converge at the _____.
RRC Group D 29/09/2022 (Evening)
(a) Principal focal plane
(b) Infinity
(c) Centre of curvature
(d) Pole

Sol.141.(a) Principal focal plane. Any ray of light that passes through the mirror is always parallel to the principal axis. A ray of light that passes through the focus of the mirror becomes parallel to the principal axis of the mirror after reflection. A ray of light passing through the centre of curvature of any mirror is reflected back along the same path. Any incident ray which isn't parallel to the principal axis is also reflected diagonally and the incident ray and the reflected ray always follow the laws of reflection i.e. the angles formed by these rays are equal to each other.

Q.142. The emergent ray from the optical centre of the lens will be_____.
RRC Group D 30/09/2022 (Morning)
(a) un-deviated (b) reflected
(c) bent (d) deviated

Sol.142.(a) Un-Deviated. The ray passing through the optical centre does not deviate because the curvature of the lens at the incident and exit points are exactly opposite so the deviation at the first point is cancelled at the other point. For a thin lens the ray appears to be passing straight but for a thick Lens there will be a lateral shift i.e incident ray will be parallel to emergent ray but displaced.

Q.143. Which of the following statements is/are correct with regard to the principal axis of a spherical mirror?
(a) A principal axis is an imaginary line extended on both sides of the mirror.
(b) A principal axis passes through the center of curvature, principal focus and pole.
(c) The principal axis for a curved mirror is curved.
RRC Group D 30/09/2022 (Afternoon)
(a) Only (b) is correct
(b) (a), (b) and (c) are correct
(c) Only (a) is correct
(d) Only (a) and (b) are correct

Sol.143.(d) Only (a) and (b) are correct. Pole: The geometric center of the spherical surface of the mirror is called the pole of the mirror. Principal axis: It is the straight line joining the pole of the mirror to its centre of curvature. It is straight for all kinds of mirrors. Centre of curvature of a mirror is the centre of the sphere of which the mirror is a part.

Q.144. The correct sign conventions for focal length (f) and radius of curvature (R) for the formation of images by spherical mirrors is:
RRC Group D 30/09/2022 (Evening)
(a) for convex mirror f is negative, R is positive
(b) for convex mirror f is negative, R is negative
(c) for concave mirror f is positive, R is negative
(d) for concave mirror f is negative, R is negative

Sol.144.(d) Rules for sign convention: The distances which are measured along the direction of the incident ray are taken as positive. The distances which are measured opposite to the direction of the incident ray are taken as negative. The region above the principal axis is considered positive. The region below the principal axis is considered negative. All measurements should be taken from the Pole of the mirror.

Q.145. Which of the following statements is/are true regarding the centre of curvature of spherical mirror?

(I) The centre of curvature (C) of a spherical mirror is the centre of the sphere of which the mirror is a cut part.
(II) The aperture (D) of a spherical mirror is the mirror is the diameter of the sphere of which the mirror is a cut part.
(III)The principal focus (F) is strictly the mid-point between the pole (P) and the centre of curvature (C) of a spherical mirror.
RRC Group D 06/10/2022 (Morning)
(a) (S - I) and (S -II) only
(b) (S - I) and (S - III) only
(c) (S - I) only
(d) (S - I), (S - II) and (S - III)

Sol.145.(b) (S - I) and (S - III) only. Any ray of light that passes through the mirror is always parallel to the principal axis. Any ray of light that passes through the mirror always passes through the principal focus (f) of the mirror after reflection. A ray of light passing through the centre of curvature of any mirror is reflected back along the same path. Any incident ray which isn't parallel to the principal axis is also reflected diagonally and the incident ray and the reflected ray always follow the laws of reflection i.e. the angles formed by these rays are equal to each other.

Q.146. The correct relation between refractive index(μ), speed of light in air (c) and speed of light in the medium (v) is :
RRC Group D 07/10/2022 (Morning)
(a) $c = \frac{\mu}{v}$ (b) $v = \frac{\mu}{c}$
(c) $\frac{1}{\mu} = \frac{c}{v}$ (d) $\mu = \frac{c}{v}$

Sol.146.(d) $\mu = \frac{c}{v}$. Refractive index refers to the measure of the bending of a ray of light when it passes from one medium to another medium. It is defined as the ratio of the speed of light in a vacuum to the speed of the light in the medium. Some refractive indices - air (1.0003); water (1.333); and diamond (2.417).

Q.147. If one sees some marbles that are immersed in water, he/she will observe them as enlarged. This is because water acts as a:
RRC Group D 07/10/2022 (Afternoon)
(a) plane mirror (b) plano-concave lens
(c) convex lens (d) concave lens

Sol.147.(c) Convex lens. Water acts as a convex lens and magnifying glass. Whenever light travels from one medium to another, the rays bend towards or away from the normal. This is called the refraction of light. When light moves from rarer to denser mediums, the rays are bent towards the normal.

Q.148. Suppose a magic mirror is placed in front of a boy. As a result, the boy observes that the image of his head is of the same size, the middle portion of his body is smaller and that of his legs is bigger. Hence, from top to bottom, the magic mirror displays which of the following images?
RRC Group D 07/10/2022 (Afternoon)
(a) Plane, convex and concave
(b) Convex, concave and plane
(c) Plane, concave and convex
(d) Concave, plane and convex

Sol.148.(a) Plane, convex and concave. If in the magic mirror the child looks at her head of the same size then in the top part the plane mirror is used. His middle portion of the body is looking smaller, then in the middle part a convex mirror is used. The convex mirror produced the erect and diminished image. The bottom part of the mirror produces a bigger image of the legs. The image is bigger since it is produced by a concave mirror. A concave mirror produces an enlarged and erect image.

Q.149. The line joining the two foci of a lens is called_____.
RRC Group D 07/10/2022 (Afternoon)
(a) paraxial ray (b) principal axis
(c) Focal length (d) radius of curvature

Sol.149.(b) Principal axis. Paraxial rays are nothing but a set of incident rays on the mirrors which lie very close to the principal axis. The focal length (f) is defined as the distance between the focus and the pole of the mirror. The radius of curvature (R) is defined as the radius of the mirror that forms a complete sphere.

Q.150. For a spherical mirror, when a ray is passed through the centre of curvature C, the angle formed between the reflected ray and incident ray will be:
RRC Group D 11/10/2022 (Morning)
(a) 0° (b) 270° (c) 90° (d) 180°

Sol.150.(a) 0°. As the ray of light passes through the centre of curvature of a concave mirror it strikes the mirror along the normal (i.e. it incidences on to the mirror at 90 degree and 0 degree with normal). Hence the incident ray coincides with the normal. Therefore the angle of incidence is 0 degree.

Q.151. Ratio of Sin i and Sin r is known as:
RRC Group D 11/10/2022 (Morning)
(a) dispersion (b) magnification
(c) refractive index (d) refraction

Sol.151.(c) Refractive index. It can be equated to the ratio of speed of light in the two mediums.

Q.152. Excessive curvature of eye lens leads to _____
RRB NTPC CBT - I (29/12/2020) Morning
(a) Hypermetropia (b) cataract
(c) colour blindness (d) myopia

Sol.152.(d) Myopia (Nearsightedness) - Image forms right in front of the retina rather than on its surface. It can be corrected by using a concave lens (Diverging lens). Hypermetropia (Farsightedness) - Nearby objects appear blurred, It can be corrected using a convex lens (Converging lens). Cataract - Cloudy area in the lens of our eye. Color blindness - The condition is often inherited (trouble in identifying colors like blue, green and red).

Q.153. Which of the two colours of spectrum forms the extremes?
RRB NTPC CBT - I (07/01/2021) Evening
(a) Violet and Red (b) Yellow and Orange
(c) Blue and Green (d) Red and Orange

Sol.153.(a) Violet and Red. The spectrum of colours (VIBGYOR) Violet, Indigo, Blue, Green, Yellow, Orange, Red. The wavelength of light defines the colour of the light and in VIBGYOR, wavelength increases from left to right. Violet colour has minimum wavelength while Red colour has a maximum wavelength.

Q.154. Which type of mirror is used by dentists to see large images of patients' teeth?
RRB NTPC CBT - I (09/01/2021) Morning
(a) Concave mirror
(b) Convex mirror
(c) Spherical mirror
(d) Spherical and Convex mirror

Sol.154.(a) Concave mirror: Used as Vehicle headlights, Shaving mirrors, Solar furnaces, Searchlights, Microscopes, flashlights, torches, etc. Uses of Convex Mirror - In the rear-view mirrors of all the vehicles, Inside buildings, Magnifying glass, Security purposes etc.

Q.155. The ability of the eyes to focus on both, near and distant objects, by adjusting its focal length, is called the

_____ of the eye.
RRB NTPC CBT - I (11/01/2021) Morning
(a) accommodation (b) suitability
(c) adjustment (d) refractiveness

Sol.155.(a) Accommodation - This process is achieved by the ciliary muscles in the eye, which change the shape of the lens to alter its focal length. The least distinct vision is 25 cm for normal healthy eyes. Focal length - The distance between the pole and the principal focus of a spherical mirror.

Q.156. Travellers in deserts often tend to have an optical illusion of a sheet of water where none actually exists. What is this called?
RRB NTPC CBT - I (11/01/2021) Evening
(a) Scattering (b) Reflection
(c) Mirage (d) Diversion

Sol.156.(c) Mirage - An optical phenomenon caused by the total internal reflection of light from distant objects. When light passes from cold air (denser) to hot air (rarer), it bends away from the normal and undergoes total internal reflection, thus causing an illusion to the observer that light is coming from the ground.

Q.157. The ability of a medium to refract light is also expressed in terms of its:
RRB NTPC CBT - I (12/01/2021) Evening
(a) optical volume (b) optical density
(c) optical mass (d) optical illusion

Sol.157.(b) Optical density. Optical illusion is basically a difference between reality and what our brain thinks it's observing. Mass density is the mass per unit volume of a substance. Refraction is the change in the direction of a wave passing from one medium to another.

Q.158. The center of the reflecting surface of a spherical mirror is a point called:
RRB NTPC CBT - I (12/01/2021) Evening
(a) principal axis (b) pole
(c) center of curvature (d) focus

Sol.158.(b) Pole. It is the midpoint of the aperture of the spherical mirror and usually represented by the letter P. Principal axis is the line passing through the optical center and centers of curvature of the faces of a lens or a curved mirror. The centre of curvature is the centre of the sphere of which the spherical mirror is a part. It is denoted by 'C'. When rays from infinity come in parallel to the optical axis of a spherical mirror, they are bent so that they either converge and intersect at a point, or they seem to diverge from a point. The point of convergence or divergence is called the focus.

Q.159. Which of the following principles is related to solar power systems?
RRB NTPC CBT - I (13/01/2021) Morning
(a) Photovoltaic effect
(b) Photoelectric effect
(c) Photokinetic effect
(d) Photosynthesis effect

Sol.159.(a) Photovoltaic effect. The photoelectric effect is the emission of electrons when electromagnetic radiation, such as light, hits a material. The theory of photokinetic effects expresses the forces and torques exerted by a beam of light.

Q.160. Which of the following is NOT an example of refraction of light?
RRB NTPC CBT - I (19/01/2021) Morning
(a) Twinkling of stars
(b) Image formation by human eye
(c) Red colour of setting sun
(d) Formation of rainbow

Sol.160.(c) The red color of the setting sun is an example of the scattering of light. Other Examples of scattering of light - The blue color of the sky, The twinkling of stars, The appearance of a diamond as sparkling, The use of lasers in surgery. Examples of refraction - Pool of water appears to be less deep than it actually is, Camera lenses, Glasses.

Q.161. The lens which is thin in the middle and thick at its periphery is called a.
RRB NTPC CBT - I (30/01/2021) Morning
(a) Concave Lens (b) Cylindrical lens
(c) Convex lens (d) Parallel lens

Sol.161.(a) Concave Lens. Cylindrical lens - A type of lens that has differing radii in the X and Y axes. Convex lens - a lens that converges rays of light that convey parallel to its principal axis.

Q.162. The blue colour of the sky is due to the:
RRB NTPC CBT - I (03/02/2021) Evening
(a) Dispersion of light
(b) Scattering of light
(c) Refraction of light
(d) Diffraction of light

Sol.162.(b) Scattering of light. Other Examples of Scattering - Reddish color of the sun during sunrise and sunset, Danger signals in red color. Examples of refraction of light - Twinkling of stars in a clear sky, Camera lenses, Pool of water appears to be less deep than it actually is. Examples of Dispersion of light - Rainbow formation, Petrol poured in water will show different colours. Examples of Diffraction of light - CD reflecting rainbow colours, Holograms, Bending of light at the corners of the door.

Q.163. The phenomenon of 'dispersion of light' into its seven constituent colors was discovered by _____ in 1666.
RRB NTPC CBT - I (09/02/2021) Morning
(a) Archimedes (b) Isaac Newton
(c) Henry Moseley (d) Mendeleev

Sol.163.(b) Isaac Newton. The dispersion of light - The phenomenon of splitting a beam of white light into its seven constituent colours when passed through a transparent medium.

Q.164. Shadows are formed when ____ objects come in the path of light.
RRB NTPC CBT - I (15/02/2021) Evening
(a) translucent (b) transparent
(c) luminous (d) opaque

Sol.164.(d) Opaque: An object which does not allow any light to pass through it. Example - Wood, stone, metal. Translucent: An object which allows only some light to pass through it. Example - Butter paper, sunglasses, various types of plastics. Transparent - An object which allows all light to pass through it. Example - Air, water, clear glass. Luminous - An object which emits light or energy of their own. Example - Sun, stars, candles.

Q.165. What is the full form of LASER?
RRB NTPC CBT - I (22/02/2021) Evening
(a) Lower Application of System Emission of Radioactivity
(b) Learning to Amplify and Stimulate Emission of Radiation
(c) Light Addition to Systematic Electromagnetic Radiation
(d) Light Amplification by Stimulated Emission of Radiation

Sol.165.(d) Light Amplification by Stimulated Emission of Radiation. It is a device that emits coherent and focused light through a process called stimulated emission**.** It produces a narrow and intense beam of light that is typically monochromatic (single wavelength) and highly directional. Examples of laser applications - Laser eye surgery, laser printers, barcode scanners, fiber optic communications.

Q.166. Which type of mirrors are commonly used in torches, searchlights and vehicle headlights to get powerful parallel beams of light?
RRB NTPC CBT - I (27/02/2021) Evening
(a) Convex (b) Cylindrical
(c) Concave (d) Bifocal

Sol.166.(c) Concave mirror (converging mirror). When light rays fall they are reflected inward and converge at a point called the focal point. Concave mirror uses: Shaving mirrors, Astronomical telescopes, Headlights, Solar furnaces.

Q.167. Which kind of mirror is used as rear view wing mirrors in vehicles?
RRB NTPC CBT - I (03/03/2021) Evening
(a) Concave (b) Concave and convex
(c) Plane (d) Convex

Sol.167.(d) Convex. Uses of Convex mirrors - Optical instruments, Calling bell, Magnifying glasses, in Sunglasses. Uses of Plane mirrors - Looking Glasses, Periscopes and kaleidoscopes.

Q.168. What is the time difference between the actual passing of the sun over the horizon and our being able to see the image of it on earth?
RRB NTPC CBT - I (03/03/2021) Evening
(a) 8 min (b) 10 min (c) 4 min (d) 2 min

Sol.168.(d) 2 min. We are able to see the sun 2 minutes before the actual sunrise and 2 minutes after the actual sunset due to Refraction of light by the atmosphere. Time taken by the sunlight to reach the earth's surface is 8 minutes 20 seconds. Time taken by moonlight to reach the earth's surface is about 1.3 seconds.

Q.169. Which of the following can produce a virtual image larger than the object?
RRB NTPC CBT - I (08/03/2021) Evening
(a) Convex mirror (b) Concave lens
(c) Plane mirror (d) Concave mirror

Sol.169.(d) Concave mirror - When the object is placed between the pole and focus of the mirror. Convex mirrors and concave lenses always produce virtual images that are smaller than the object. Plane mirrors produce virtual images that are the same size as the object.

Q.170. Light travels in a :
RRB NTPC CBT - I (12/03/2021) Morning
(a) vertical line (b) horizontal line
(c) straight line (d) curved line

Sol.170.(c) Straight Line. Light is electromagnetic radiation and is both wave-like and particle-like. Properties: It is demonstrated by phenomena such as the photoelectric effect and the double-slit experiment. Light exhibits interference and diffraction phenomena, demonstrating its wave nature. Light can be described as discrete packets of energy called photons. Inventor of the Light bulb - Thomas Edison.

Q.171. Rainbow is a natural phenomenon that shows:
RRB NTPC CBT - I (19/03/2021) Morning
(a) refraction (b) diffraction
(c) reflection (d) dispersion

Sol.171.(d) Dispersion :- The splitting of light into its component colors. Example: Rainbow - Colors of rainbow (Red, orange, yellow, green, blue, indigo, violet).

Q.172. Which mirror is used for shaving purposes ?
RRB NTPC CBT - I (27/03/2021) Morning
(a) Convex (b) Opaque
(c) Concave (d) Transparent

Sol.172.(c) Concave mirror. Other Uses Of Concave Mirror - Head mirrors, Ophthalmoscope, Headlights, Solar furnaces, Astronomical telescope.

Q.173. Which among the following represents the Lens formula?
RRB NTPC CBT - I (27/03/2021) Evening
(a) $\frac{1}{h}+\frac{1}{v}=\frac{1}{f}$ (b) $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$
(c) $\frac{1}{v}+\frac{1}{f}=\frac{1}{u}$ (d) $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

Sol.173.(b) Lens formula : $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

Other related Formulas: Radius of curvature = 2 × focal length, Snell's formula n = sin i / sin r (Where i is the angle of incidence and r is the angle of refraction),

Mirror Formula → $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

(Where f is the focal length, v is the image distance and u is the object distance), Power of a lens P = 1/focal length , Magnification (mirror) = height of image/ height of object.

Q.174. Which of the following types of light carries a signal from a television remote to the device it controls ?
RRB NTPC CBT - I (31/07/2021) Morning
(a) Ultraviolet (b) X- ray
(c) Polarised (d) Infrared

Sol.174.(d) Infrared. Infrared (IR) light is used by electrical heaters, cookers for cooking food, optical fibers, security systems and thermal imaging cameras which detect people in the dark. Ultraviolet radiation is widely used in industrial processes and in medical and dental practice. X- ray used to scan bone fractures.

Q.175. If the object is placed between infinity and optical centre O of the concave lens, how will the image be formed after refraction?
RRB JE 22/05/2019 (Afternoon)
(a) Diminished (b) Point size
(c) Of same size (d) Enlarged

Sol.175.(a) Diminished. Concave lens: A lens that diverges the beam of light. The light from the source is refracted as a diminished, virtual or real, and vertically inward image. Examples**:** Binoculars, Telescope, Eyeglass, Flashlight, Spyholes indoors. Image Formation: Object at Infinity: A virtual, erect, highly diminished in size, and of point size. Object between Infinity and Optical Centre: A virtual, erect, and diminished-sized picture of the object is formed between the concave lens's focus and optical center.

Q.176. To obtain an enlarged real inverted image beyond $2F_2$ after refraction by convex lens, where should the object be placed?
RRB JE 22/05/2019 (Evening)
(a) Between F_1 and $2F_1$
(b) Between focus F_1 and optic center O
(c) At infinity
(d) At $2F_1$

Sol.176.(a) Between F_1 and $2F_1$. Convex lens: That converging rays of light that convey parallel to its principal axis (i.e. converges the incident rays towards the principal axis) which is relatively thick across the middle and thin at the lower and upper edges. The edges are curved outward rather than inward. Images formed are real and inverted when the position of the object is: At infinity {Image (Highly diminished) - At focus F_2}, At $2F_1$ {Image (Same size) - At $2F_2$}, Beyond $2F_1$ {Image (diminished) - Between F_2 and $2F_2$}, At focus F_1 {Image (highly enlarged) - At Infinity}.

Q.177. A ray of light appearing to meet at the principal focus of a concave lens emerge after refraction will be-
RRB JE 23/05/2019 (Morning)
(a) Parallel to the principal axis
(b) Without any deviation
(c) Through the centre of curvature
(d) Through the principal focus

Sol.177.(a) Parallel to the principal axis.

Refraction Through a Concave Lens: When an object is placed at infinity, a point-sized (highly diminished), virtual and erect image is formed at the focus. When an object is placed at a finite distance from the lens (or between infinity and optical centre O of the lens), a diminished, virtual and erect image is formed between the optical center and focus of the concave lens.

Q.178. How will the light rays passing from air into a glass prism bend ?
RRB JE 23/05/2019 (Morning)
(a) Away from the normal
(b) Almost at 90 degrees with normal
(c) As the normal
(d) Towards the normal

Sol.178.(d) Towards the normal. Refraction is the bending of light as it passes from one transparent substance into another. In a rarer to a denser medium, the ray of light bends towards normal and in a denser to a rarer medium, the ray of light bends away from normal.

Q.179. Dentists use which of these types of mirrors to view enlarged images of teeth ?
RRB JE 23/05/2019 (Evening)
(a) Plane mirror
(b) Both Convex and Plane mirror
(c) Convex mirror
(d) Concave mirror

Sol.179.(d) Concave mirror: A spherical mirror, whose reflecting surface is curved inwards, that is, faces towards the centre of the sphere. It is commonly used in torches, search-lights and vehicle headlights to get powerful parallel beams of light. It is used as shaving mirrors to see a larger image of the face.

Q.180. A ray of light from the object parallel to the principal axis of a concave lens, after refraction, appears to diverge from which point on the same side of the lens?
RRB JE 24/05/2019 (Morning)
(a) Principal focus
(b) Centre of curvature
(c) Point between optic centre and focus
(d) Point between the centre of curvature and focus

Sol.180.(a) Principal focus. The Centre of curvature (C) is the center of a sphere of which a lens is formed. Focal length is the distance between the optical center and the principal focus of a lens. Optical center is the center point of a lens. A concave lens is a lens that diverges a straight light beam from the source to a diminished, upright, virtual image.

Q.181. Why is red colour preferred for danger signal lights?
RRB JE 24/05/2019 (Afternoon)
(a) Because red colour is preferred by many
(b) Because red colour light has shorter wavelength
(c) Because red colour is bright to eyes
(d) Because red colour light has longest wavelength and least scattered by fog and smoke

Sol.181.(d) Wavelength - The distance between the two successive crests or troughs of the light wave. The frequency and wavelength are indirectly proportional to each other.

Q.182. On what factor does the colour of scattered light depend upon?
RRB JE 25/05/2019 (Afternoon)
(a) The amount of impurity
(b) The colour of the scattering particles
(c) The refractive index of the particles
(d) The size of the scattering particles

Sol.182.(d) Scattering of Light - When light rays get deviated from its straight path on striking an obstacle like dust or gas molecules, water vapors etc. Examples - Red colour of sun at sunrise and sunset, Blue colour of sky, White color of sky at noon. It depends on Wavelength of Light, Nature of Particles, Angle of Incident Light, Polarization of Light.

Q.183. What is the distance of the principal focus F from the pole P of the spherical mirror called?
RRB JE 26/05/2019 (Morning)
(a) Object distance (u)
(b) Image distance (v)
(c) Virtual distance
(d) Focal length (f)

Sol.183.(d) Focal length (f). The focal length is taken as positive (+) for a convex lens and convex mirror. It is taken as negative (-) for a concave lens and a concave mirror. Object distance (u) - The distance between the object and the pole of the mirror. Image distance (v) - The distance between the image and the pole of the mirror.

Q.184. Which set of sign conventions is followed while dealing with reflection of light by spherical mirrors?
RRB JE 26/05/2019 (Afternoon)
(a) Sign convention
(b) New Cartesian sign convention
(c) System convention
(d) Mirror convention

Sol.184.(b) New Cartesian sign convention. In this convention, the pole (P) of the mirror is taken as the origin. The principal axis of the mirror is taken as the x-axis of the coordinate system. The sign conventions are: The object is always placed to the left of the mirror. All distances parallel to the principal axis are measured from the pole of the mirror. All the distances measured to the right of the origin (along + x-axis) are taken as positive while those measured to the left of the origin (along – x-axis) are taken as negative. Distances measured perpendicular to and above the principal axis (along + y-axis) are taken as positive and below the principal axis (along –y-axis) are taken as negative.

Q.185. Why does dispersion occur when white light which is a mixture of seven colours passes through a glass prism?
RRB JE 26/05/2019 (Evening)
(a) The white light scatters the 7 colours throughout the prism.
(b) 7 colours are refracted at same speed.
(c) 7 colours of white light travel at different speeds through a glass prism.
(d) 7 colours are reflected by prism.

Sol.185.(c) Dispersion of light - The phenomenon of splitting a beam of white light into its seven constituent colours when passed through a transparent medium. It was discovered by Sir Issac Newton. Examples of Dispersion of light in daily life: Formation of a Rainbow, Compact disks, Petroleum spilled on water, Soap bubbles, Prism, Plastic rulers.

Q.186. How is the refractive index of a material related to the speed of light in air?
RRB JE 27/05/2019 (Morning)
(a) Refractive index = Speed of light in air × Speed of light in material
(b) Refractive index = Speed of light in air + Speed of light in material
(c) Refractive index = Speed of light in material/ Speed of light in air
(d) Refractive index = Speed of light in air / Speed of light in material

Sol.186.(d) Refractive index (index of refraction) is measure of the bending of a ray of light when passing from one medium into another. Refractive index of some substance - Water (1.33) Kerosene (1.44), Crown glass (1.52), Canada

Balsam (1.53), Rock salt (1.54), Diamond (2.42).

Q.187. Sort the following materials in ascending order of their respective refractive indices - Water, Glass, Air.
RRB JE 27/05/2019 (Afternoon)
(a) Glass, Water, Air (b) Water, Air, Glass
(c) Air, Water, Glass (d) Glass, Air, Water

Sol.187.(c) Air, Water, Glass. When a ray of light that travels obliquely from one transparent medium into another will change its direction in the second medium. The extent of the change in direction that takes place in a given pair of media is expressed in terms of the refractive index, the "constant". It turns out that light propagates with different speeds in different media. The refractive index of medium 2 with respect to medium 1 is given by μ_{21} = $\frac{Speed\ of\ light\ in\ medium\ 1}{Speed\ of\ light\ in\ medium\ 2} = \frac{v_1}{v_2}$,

v_1= Speed of light in medium 1,
v_2 = Speed of light in medium 2.

Q.188. The structure of the eye which serves to refract and focus light rays upon retina is called-
RRB JE 27/05/2019 (Afternoon)
(a) Cornea (b) Lens (c) Pupil (d) Iris

Sol.188.(b) Lens. Cornea - It is the clear, transparent, anterior portion of the external coat of the eyeball. The rays of light enter this layer. Cornea accounts for two-thirds of the total optical power of the eye. Pupil - It is an aperture of variable size in the center of Iris, which regulates the amount of light entering the eyeball. Iris - It is the coloured membrane behind the cornea and in point of lens with an aperture of variable size called pupil. It has a circular and long muscle fibre. Iris is attached to the ciliary body. Retina - It is an essential part of the eye that enables vision.

Q.189. A ray of light passing through the optical centre of a concave lens emerge after refraction will be
RRB JE 27/05/2019 (Evening)
(a) Without any deviation
(b) Through the principal focus
(c) Through the centre of curvature
(d) Parallel to the principal axis

Sol.189.(a) Without any deviation. Convex lens - In which the rays reflected through the surface are dispersed in a parallel path using reflection of light. It has a positive focal length. The image formed is real and inverted. In hypermetropia a convex lens is used. Concave lens - Diverges a straight light beam from the source to a diminished, upright, virtual image. The image formed in a concave lens is virtual, upright and small in size. It has a negative focal length. A concave lens's magnification is less than one. In myopia concave lens is used.

Q.190. To obtain the same size image at $2F_2$ after refraction by a convex lens where should the object be placed?
RRB JE 28/05/2019 (Afternoon)
(a) At $2F_1$
(b) Beyond $2F_1$
(c) At infinity
(d) Between focus F_1 and optic centre O

Sol.190.(a) At $2F_1$. Convex lens (Converging lens): A lens having two spherical surfaces, bulging outwards is called a double convex lens (or simply convex lens). It is thicker in the middle as compared to the edges.

Q.191. Which mirror is used in a solar furnace?
RRB JE 29/05/2019 (Morning)
(a) Concave mirror (b) Spherical mirror
(c) Plane mirror (d) Convex mirror

Sol.191.(a) Concave (converging) **mirror -** It is the only type of mirror that reflects light toward a single focal point which will help in effective heating. Spherical mirror - That has a consistent curve and a constant radius of curvature. The images formed by a spherical mirror can either be real or virtual. Plane mirror - A mirror with a flat reflective surface.

Q.192. An incident ray makes an angle of 30° with the surface of a plane mirror. What is the angle of reflection?
RRB JE 29/05/2019 (Evening)
(a) 30° (b) 45° (c) 60° (d) 15°

Sol.192.(a) 30°. The first Law of reflection states that the incident ray, the reflected ray, and the normal to the surface of the mirror, all lie in the same plane. The second law of reflection states that when a ray of light reflects off a surface, the angle of incidence (θ_i) is equal to the angle of reflection (θ_r).

Q.193. How will the emergent ray be after refraction of light through a glass slab?
RRB JE 30/05/2019 (Morning)
(a) The emergent ray is at 90 degrees to the incident rays.
(b) The emergent ray and incident rays are random.
(c) The incident ray goes without deflection and emergent ray is same as incident ray
(d) The emergent ray is parallel to the incident ray

Sol.193.(a) The bending of the ray of light on the air - glass interface is equal and opposite to the bending of the ray of light on the air - glass interface. Thus, Angle of incidence = Angle of Emergence. Laws of Refraction of light - **Law 1** : The incident ray, refracted ray and normal ray all lie on the same plane. **Law 2** (Snell's Law) : $\frac{sin\ i}{sin\ r}$ = Refractive index (constant) of medium 2 with respect to medium 1. Incident ray (i) - The light ray which travels into a medium. Refracted ray (r) - The light ray which bends after refracting. Normal ray - The light ray which is perpendicular to the surface at Point of Intersection.

Q.194. A spherical mirror and a thin spherical lens both have a focal length of -10 cm. The mirror and the lens are likely to be-
RRB JE 30/05/2019 (Morning)
(a) The mirror is concave and the lens is convex
(b) Both concave
(c) The mirror is convex and the lens is concave
(d) Both convex

Sol.194.(b) Both concave. Focal length:- It is the distance from the lens to the focal point. It is always positive for concave lenses (diverging) or convex mirrors (converging) and always negative for converging or concave mirrors.

Q.195. To get a virtual, erect and enlarged image behind a concave mirror, where should the object be placed?
RRB JE 30/05/2019 (Afternoon)
(a) Between pole P and focus F
(b) At the centre of curvature C
(c) At focus F
(d) Between centre of curvature C and focus F

Sol.195.(a) Between pole P and focus F. Image formation by a concave mirror for different positions of the object: At infinity {Image (small) - At the focus F, Real and inverted}. Beyond C {Image (small) - Between F and C, Real and inverted}. At C {Image (same) - At C, Real and inverted}. Between C and F {Image (large) - Beyond C, Real and inverted}. At F {Image (large) - At infinity, Real and

inverted}. C - Centre of curvature, F - Focus, P - Pole.

Q.196. Which of the following statements is FALSE?
1. The object is always placed to the left of the spherical mirror.
2. All distances parallel to principal axis are measured from pole of the mirror.
3. All distances measured to the right of the origin are taken as negative.
4. Distances measured perpendicular to and above the principal axis are taken as positive.
RRB JE 31/05/2019 (Morning)
(a) 3 (b) 2 (c) 4 (d) 1

Sol.196.(a) 3. Spherical mirrors are of two types : concave mirror and convex mirror. Focal length of concave mirror is always negative, focal length of convex mirror is always positive. If a real image is formed, then it will form in front of the mirror, hence it will be negative. If a virtual image is formed, then it will be formed behind the mirror, hence it will be taken as positive.

Q.197. To obtain a virtual enlarged erect image on the same side of a convex lens after refraction, where should the object be placed?
RRB JE 31/05/2019 (Afternoon)
(a) Between F_1 and $2F_1$
(b) Between focus F_1 and optic centre O
(c) At $2F_1$
(d) At infinity

Sol.197.(b) Between focus F_1 and optic centre O. Image Formation by convex lens - When Object is at infinity (At focus F_2, Highly diminished, point-sized, Real and inverted), object beyond $2F_1$ (Between F_2 and $2F_2$, Diminished, Real and inverted), Object is at $2F_1$ (At $2F_2$, Same size, Real and inverted), Object is placed between F_1 and $2F_1$ (Beyond $2F_2$, enlarged, Real and inverted), Object is at F_1(At infinity, highly enlarged, Real and Inverted), Object is between F_1 and optical centre (On the same side of the lens as the object, enlarged, Virtual and erect) Lens Formula: $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$.

Q.198. If the object is placed between infinity and optical centre O of the concave lens, how will the image be formed after refraction?
RRB JE 31/05/2019 (Evening)
(a) Real and inverted
(b) Virtual and erect
(c) Real and same size
(d) Real and enlarged

Sol.198.(b) Virtual and erect. Image formed by a concave lens for various positions of the object: Object at infinity - Image form at the focus, highly diminished, Virtual and erect. Object between Infinity and optical centre - Image form between focus and optical centre, Diminished, virtual and erect. When an object is at the center of curvature, the real image is formed at the other center of curvature; Size of the image is the same as compared to that of the object. When an object is placed at the focus, a real image is formed at infinity; Size of the image is much larger than that of the object.

Q.199. Which colour among the seven colours of white light gets least deviated after dispersion of light through a glass prism?
RRB JE 01/06/2019 (Morning)
(a) Orange (b) Violet (c) Indigo (d) Red

Sol.199.(d) Red. Dispersion of light is the phenomenon of splitting a beam of white light into its constituent 7 colours on passing through a prism (Violet, indigo, blue, green, yellow, orange and red). The wavelength of red colour is the longest and the violet colour is the shortest. The speed of light depends on the refractive index of the medium.

Q.200. If the image formed by a spherical mirror is virtual, then the magnification value is-
RRB JE 01/06/2019 (Morning)
(a) Infinity (b) Zero
(c) Positive (d) Negative

Sol.200.(c) Positive. The concave lens and the convex mirror give a virtual image. Their magnification is positive. The convex lens and the concave mirror can produce real and virtual images based on the object position, therefore, their magnification can be positive or negative. Formula of magnification of mirror

$(m) = \frac{-v}{u} = \frac{h_i}{h_o}$

Where, v = image distance, u = object distance, h_i = height of image, h_o = height of object.

Q.201. When a light ray enters from a denser medium to a rarer medium, say from glass to air, how does the light ray bend?
RRB JE 01/06/2019 (Afternoon)
(a) Bends and merges with the normal
(b) Away from the normal
(c) Bends at 90 degree from normal
(d) Towards normal

Sol.201.(b) Away from the normal. Refraction of light: When a ray of light passes from one medium to another, its velocity and direction change on entering the second medium, that is, the ray of light deviates from its path. Rarer medium is a medium in which the speed of light is more. Example: Air is optically rarer medium as compared to glass and water. Denser medium is a medium in which the speed of light is less. Example: Glass is optically denser medium as compared to air.

Q.202. The measurements from _____ are taken for the spherical lenses according to sign conventions.
RRB JE 02/06/2019 (Morning)
(a) Pole
(b) Optical centre
(c) Both principal focus and pole
(d) Principal focus

Sol.202.(b) Optical Centre. Sign Convention for Spherical lens - The axis along which the distances are measured is called the principal axis. These distances are measured from the optical center of the lens. The distance measured above the principal axis is taken positive, distance below the principal axis is considered as Negative. Focal length of convex lens is taken positive and that of concave lens is negative.

Q.203. What is the formula for the refractive index of the medium, n_m?
RRB JE 02/06/2019 (Evening)
(a) The sum of the speed of light in air and the speed of light in medium
(b) The ratio of speed of light in air to the speed of light in medium
(c) The product of speed of light in air and speed of light in medium
(d) The ratio of speed of light in medium to speed of light in air

Sol.203.(b) Refractive index (n):- Measures the bending of a ray of light when passing from one medium into another. It is calculated as n = c / v, where c = speed of light in air and v = phase velocity of light. Refractive index of some material - Air (1.0003), Water (1.33), Diamond (2.42).

Q.204. Through which point will a ray parallel to the principal axis of a concave mirror after reflection pass?

RRB JE 26/06/2019 (Morning)
(a) Centre of curvature C
(b) Pole P
(c) Any point between focus F and center of curvature
(d) Focus F

Sol.204.(d) Focus F. Pole (P) - Center of the reflecting surface of a spherical mirror. Center of curvature (C) - Center of the sphere formed by the reflecting part of a spherical mirror. Radius of curvature (R) - Radius of the sphere of which the mirror forms the part. Principal axis - A straight line joining the pole (P) and the center of curvature. It is normal for the mirror at its pole. Principal focus - The incident rays coming parallel to the principal axis after reflection appear to converge to a common point on the principal axis. Focal length (f) - Distance between the pole and the principal focus of a spherical mirror.

Q.205. An imaginary straight line passing through the two centers of curvature and the optic center of the lens is called-
RRB JE 26/06/2019 (Evening)
(a) Principal axis (b) Radius of curvature
(c) Focal length f (d) Aperture of the lens

Sol.205.(a) Principal axis. Radius of Curvature - Distance between Centre of curvature and surface of lens. Focal Length -The distance of the principal focus from the optical centre of a lens. Aperture - The effective diameter of the circular outline of a spherical lens is called its aperture. Relation between Focal length and Radius of Curvature for Lens: $\frac{1}{f}$ = (n - 1) ($\frac{1}{R1} - \frac{1}{R2}$)**.** Where f - focal length, (R1, R2) - radius of curvature , n - refractive index of the material of the lens. It is also known as the lens maker's formula.

Q.206. Photolysis is a decomposition reaction caused by-
RRB JE 27/06/2019 (Morning)
(a) Electricity (b) Mechanical energy
(c) Light (d) Heat

Sol.206.(c) Light. Photolysis - Chemical process by which molecules are broken down into smaller units through the absorption of light. Example - photolysis of water during photosynthesis in plants. Other reactions affected by light: The photosynthetic production of starch by plants from carbon dioxide and water. photochemical reaction, a chemical reaction initiated by the absorption of energy in the form of light.

Q.207. If an incident ray is reflected back along the same path in a concave mirror, then through which point does that ray pass?
RRB JE 28/06/2019 (Evening)
(a) Any point between focus F and center of curvature
(b) Pole P
(c) Centre of curvature C
(d) Focus F

Sol.207.(c) Centre of curvature C. In case of curved mirrors the normal passes through the center of curvature, and here the angle of incidence is 0°. That is, the ray passing through the center of curvature is incident normally to the mirror. The angle of reflection should also be 0°.

Q.208. During the dispersion of white light, the light of _____ color bends the most.
RRB ALP Tier - II (21/01/2019) Afternoon
(a) blue (b) Red (c) violet (d) Green

Sol.208.(c) Violet (having the shortest wavelength and the highest frequency)**.** The red light bends the least, with the longest wavelength (lowest frequency).

Q.209. _____ was the first person to prove that white light is a combination of several component colours.
RRB ALP Tier - II (21/01/2019) Afternoon
(a) Henry Cavendish (b) Isaac Newton
(c) C V Raman (d) John Dalton

Sol.209.(b) Isaac Newton. Dispersion of light - The process of the separation of white light into different colors when the light is passed through the prism. Other discoveries: Newton - Reflecting telescope, discovered calculus, three laws of motion, law of universal gravitation. Henry Cavendish - Discoverer of hydrogen. C V Raman - Discovered 'The Raman Effect'. John Dalton - Proposed the 'Modern Atomic Theory'.

Q.210. The increasing order of the refractive index of certain materials is (left to right)_____.
RRB Group D 17/09/2018 (Afternoon)
(a) Rocksalt, Benzene, Kerosene, Ice
(b) Rock Salt, Ice, Benzene, Kerosene
(c) Ice, Kerosene, Benzene, Rock Salt
(d) Kerosene, Ice, Benzene, Rock Salt

Sol.210.(c) Ice, Kerosene, Benzene, Rock salt. Refractive index - It is the ratio of the speed of light in a vacuum to that in a second medium of greater density. It depends on the Density of the medium and is dimensionless.

Q.211. Which of the following cannot be used for making lenses?
RRB Group D 17/09/2018 (Afternoon)
(a) Plastic (b) Soil (c) Glass (d) Water

Sol.211.(b) Soil - It is an opaque material and light cannot pass through it. Lenses are made of transparent material (Optical Glass, Plastics, Water, Crystal) that concentrates or disperses light rays when passed through them by refraction.

Q.212. A ray of light passes from water to glass. It bends:
RRB Group D 18/09/2018 (Morning)
(a) away from the normal and speeds up
(b) away from the normal and slows down.
(c) towards the normal and slows down
(d) towards the normal and speeds up

Sol.212.(c) towards the normal and slows down. A ray of light traveling from a rarer medium to a denser medium slows down and bends towards the normal. When it travels from a denser medium to a rarer medium, it speeds up and bends away from the normal.

Q.213. Bifocal lenses are used by people suffering from _____ .
RRB Group D 18/09/2018 (Afternoon)
(a) Myopia and Hypermetropia
(b) Hypermetropia but not Myopia
(c) Myopia but not Hypermetropia
(d) Myopia or Hypermetropia

Sol.213.(a) Myopia and Hypermetropia. Bifocal lenses feature two lens powers to help see objects at all distances. Myopia (Nearsightedness) - A condition in which close objects appear clearly, but far ones don't. The image of a distant object is formed in front of the retina and not at the retina itself. Concave lens is used to correct it. Hypermetropia (Farsightedness) - A vision condition in which nearby objects look blurry. The image of a nearby object is formed behind the retina. Convex lens is used to correct it.

Q.214. Clouds looking white in colour are due to the phenomenon of _____ .
RRB Group D 18/09/2018 (Afternoon)
(a) Reflection of light
(b) Scattering of light
(c) Refraction of light
(d) Radiation

Sol.214.(b) Scattering of light - The phenomenon in which light rays deviate

from their original path upon striking atmospheric particles. When air molecules scatter sunlight, the cloud's water droplets reflect all colors, resulting in white appearance.

Q.215. Dentists use a concave mirror because the reflection created on it is _____ .
RRB Group D 18/09/2018 (Evening)
(a) real and large
(b) virtual but blurred
(c) Real but upside down
(d) Virtual and large

Sol.215.(d) Virtual and large. Concave mirrors are used by dentists to see a magnified image of a tooth.

Q.216. An object is placed in front of a concave mirror at a point lying between its focal point and center of curvature. The image created will be :
RRB Group D 19/09/2018 (Morning)
(a) virtual and direct (b) real and inverted
(c) virtual and inverted (d) real and direct

Sol.216.(b) Real and inverted. If an object is placed between focus (F) and center of curvature (C) then the image will form beyond center of curvature and the size of image will be diminished.

Q.217. When a ray of light travels from a denser medium to a rarer medium, the ray will:
RRB Group D 19/09/2018 (Afternoon)
(a) Slow down and bend away from the normal
(b) Speed up and bend towards the normal
(c) Slow down and bend towards the normal
(d) Speed up and bend away from the normal

Sol.217.(d) Speed up and bend away from the normal. Snell's laws of refraction of light: The incident ray, the refracted ray and the normal at the point of incidence, all lie in the same plane.

Q.218. The magnification of the mirror for virtual and erect image should be:
RRB Group D 19/09/2018 (Evening)
(a) Zero (b) Infinite
(c) Negative (d) positive

Sol.218.(d) Positive. In both concave and convex mirrors, the magnification of a mirror in case of a simulated and erect image is positive.

Q.219. What is the position of the image formed by a concave mirror when the object is placed at the centre of curvature of that spherical mirror?
RRB Group D 20/09/2018 (Afternoon)
(a) At Infinity
(b) Between Infinity and the centre of curvature
(c) At focus
(d) At the centre of curvature

Sol.219.(d) At the center of curvature. Image Formation in Concave Mirror - Between Pole and Focus (Behind the mirror), At the Focus (At Infinity), Between Focus and Centre of Curvature (Beyond the Centre of Curvature), Beyond the Centre of curvature (between center of curvature and focus), At Infinity (At focus).

Q.220. The size of the image formed by a converging mirror when the object is placed at principal focus is _____.
RRB Group D 22/09/2018 (Morning)
(a) of the same size (b) point image
(c) highly magnified (d) diminished

Sol.220.(c) highly magnified. In this case, the reflected rays will become parallel to each other so these rays cannot intersect each other and the image will be formed at infinity. The image formed in this case will be highly magnified, real and inverted.

Q.221. An object is placed in front of a convex mirror at a point between infinity and the pole of the mirror. The image formed is
RRB Group D 22/09/2018 (Afternoon)
(a) real and enlarged.
(b) real and diminished
(c) virtual and enlarged
(d) virtual and diminished

Sol.221.(d) Virtual and diminished image will be formed at Between P and F, behind the mirror.

Q.222. When light is incident on a shiny surface, the phenomenon of _____ reflection occurs.
RRB Group D 23/09/2018 (Morning)
(a) Irregular (b) Normal
(c) Regular (d) Diffused

Sol.222.(c) Regular. Reflection of light may be classified as regular reflection and diffused reflection. When the reflecting surface is very smooth and the rays of light falling on it are reflected straight off it, then it is called regular reflection. When the reflection of light takes place from a rough surface the light is reflected off in all directions, called diffused reflection.

Q.223. What controls the amount of light entering the eye ?
RRB Group D 24/09/2018 (Morning)
(a) Iris (b) Cornea (c) Retina (d) Sclera

Sol.223.(a) Iris is the colored part of the eye that surrounds the pupil. It adjusts the size of the pupil to control the amount of light that enters the eye. The pupil is the opening at the center of the iris through which light passes.

Q.224. The characteristics of the image formed by a plane mirror are:
RRB Group D 24/09/2018 (Afternoon)
(a) equal size, erect, inverted, real, magnified
(b) different shapes, straight, inverted, virtual
(c) different size, magnified, inverted, virtual
(d) Same shape, straight, laterally inverted, virtual

Sol.224.(d) Same shape, straight, laterally inverted, virtual. A plane mirror is a flat mirror that reflects light and produces a virtual image without the interference of an inward or outward curve. Image formation by plane mirror: The size of the image is equal to that of the object. The image formed is as far behind the mirror as the object is in front of it. Uses - Solar cookers, and Periscope.

Q.225. The focal length of a spherical mirror is _____.
RRB Group D 24/09/2018 (Evening)
(a) twice its radius of curvature
(b) Same as its radius of curvature
(c) Half of its radius of curvature
(d) Three times its radius of curvature

Sol.225.(c) Half of its radius of curvature (f=R/2). Focal Length of a Spherical Mirror: The distance between the mirror and the point where incident light rays parallel to the axis converge. It influences the behavior of a mirror, affecting the type of image it forms and the size of that image.

Q.226. The objects that produce their own light are called as:
RRB Group D 26/09/2018 (Morning)
(a) Transparent objects
(b) Luminous objects
(c) Translucent objects
(d) Nonluminous objects

Sol.226.(b) Luminous objects. For example, the Sun, stars, electric bulbs, torches, tube lights. Transparent objects: These objects allow light to pass through

them completely. Examples - glass and water. Translucent objects: These objects allow some light to pass through them. Examples- frosted glass and wax paper.

Q.227. The absolute refractive index of diamond is _____.
RRB Group D 26/09/2018 (Afternoon)
(a) 2.24 (b) 2.42 (c) 2.32 (d) 2.23

Sol.227.(b) 2.42. The ratio of the speed of light in air or vacuum to the speed of light in the medium is called the refractive index of that medium. It is generally denoted by 'μ' or 'n'. It is a dimensionless quantity. The absolute refractive index can never be less than 1.

Q.228. The image for a plane mirror is:
RRB Group D 26/09/2018 (Evening)
(a) Virtual and lateral inverted
(b) Real and lateral vertical
(c) real and vertical
(d) Virtual and lateral vertical

Sol.228.(a) Virtual and lateral inverted. Image formed by a plane mirror is always virtual and erect. The size of the image is equal to that of the object. The image formed is as far behind the mirror as the object is in front of it. Further, the image is laterally inverted.

Q.229. _____ helps the eye to adjust the focal length of the lens.
RRB Group D 27/09/2018 (Morning)
(a) Lens (b) Ciliary body
(c) Retina (d) Entire eyeball

Sol.229.(b) Ciliary body: A circular structure that is an extension of the iris (the colored part of the eye) Ciliary body produces the fluid in the eye called aqueous humour. It also contains the ciliary muscle, which changes the shape of the lens when the eyes focus on a near object.

Q.230. The point at which all rays converge is termed as___.
RRB Group D 28/09/2018 (Morning)
(a) principle axis (b) pole
(c) aperture (d) focus

Sol.230.(d) Focus. Aperture - A point in a mirror or lens from which light rays actually come. **Principal Axis -** The central line in an optical system, along which light travels, connecting the center of the lens/mirror to the focal point. **Pole -** The geometrical center of the spherical surface of the mirror or lens.

Q.231. A simple magnifying glass consists of:
RRB Group D 28/09/2018 (Evening)
(a) Concave lens of short focal length
(b) Convex lens of high focal length
(c) Concave lens of high focal length
(d) Convex lens of short focal length

Sol.231.(d) Convex lens of short focal length. A simple magnifier is a converging lens and produces a magnified virtual image of an object located within the lens's focal length. The simple magnifier is a convex lens used to produce an enlarged image of an object on the retina.

Q.232. In what does light travel at the highest speed?
RRB Group D 01/10/2018 (Morning)
(a) vacuum (b) glass (c) water (d) air

Sol.232.(a) Vacuum is the least dense medium with no obstruction to the path of light. Its refractive index is equal to unity, hence, the speed of light is maximum in a vacuum. The higher the refractive index of the medium, the lower is the speed of light.

Q.233. When light travels from a denser medium to a rarer medium, what is the effect on its speed ?
RRB Group D 01/10/2018 (Evening)
(a) Increases
(b) No change
(c) Decreases
(d) Decreases and then increases

Sol.233.(a) Increases. The refraction of light is the phenomenon of bending or changing the direction of light rays when it passes from one medium to another.

Q.234. The absolute refractive index of any medium is always:
RRB Group D 03/10/2018 (Morning)
(a) more than one (b) 0
(c) 1 (d) less than one

Sol.234.(a) more than one. Refractive index (n): Measure of the bending of a ray of light when passing from one medium into another (n = speed of light in vacuum / speed of light in medium). It has no dimension or units. Optical Materials and their Refractive index (n): Vacuum (1), Air (1.0003), Water (1.33), Glass (1.5), Diamond (2.42).

Q.235. When light travels from a rarer medium to a denser medium, it_____.
RRB Group D 03/10/2018 (Afternoon)
(a) speed remains the same
(b) speeds down then up
(c) speeds down
(d) speeds up

Sol.235.(c) Speeds down. When light passes through any medium, it interacts with the atoms and molecules present. This interaction causes the light to slow down due to the energy transfer between the light and the medium.

Q.236. _____ Lenses are used by people suffering from nearsightedness (myopia).
RRB Group D 04/10/2018 (Afternoon)
(a) cylindrical (b) convex-concave
(c) concave (d) convex

Sol.236.(c) Concave lens: Deviates light beams, creating a diminished, upright, virtual image. Cylindrical lens: Used for astigmatism correction. Convex lens: Use for treating hypermetropia (farsightedness). Bifocal lens: Used for treating presbyopia (combination of myopia and hypermetropia).

Q.237. _____ mirror produces an image that is always virtual, erect and the same size as that of the object.
RRB Group D 05/10/2018 (Morning)
(a) Convex (b) Concave
(c) Plane (d) Plano-convex

Sol.237.(c) Plane. Uses - looking glass, solar cookers, Torch Lights. A convex mirror always produces a virtual, erect, and diminished image of an object. A concave mirror can produce either a real or virtual image, depending on the distance of the object from the mirror. A plano-convex mirror is a type of mirror that has one side that is flat and the other side that is convex. The image produced by a plano-convex mirror is similar to the image produced by a convex mirror.

Q.238. A ray of light passing through the _____ of a lens will emerge without any deviation.
RRB Group D 09/10/2018 (Afternoon)
(a) main focus (b) center of curvature
(c) main axis (d) optical center

Sol.238.(d) optical center. Principal focus: It is a point (on the principal axis) where parallel incident rays meet after reflecting (in mirrors) or refracting (in lenses). Principal axis : It is a straight line that passes through the pole and centre of curvature of a spherical mirror or lens. Focal length is the distance between the optical center of lens and Principal focus.

Q.239. _____ is also called a

converging mirror.
RRB Group D 10/10/2018 (Morning)
(a) Convex mirror (b) Concave mirror
(c) Plane mirror (d) Plane convex mirror

Sol.239.(b) Concave mirror. It is a mirror with a reflecting surface that curves inward like the interior of a sphere. When light rays parallel to the principal axis strike a concave mirror, they converge at a point in front of the mirror after reflection. This point is called the focal point, and the distance from the mirror to the focal point is called the focal length.

Q.240. _____ is also called a diverging mirror.
RRB Group D 10/10/2018 (Evening)
(a) Concave mirror (b) convex mirror
(c) Plane-convex mirror (d) plane mirror

Sol.240.(b) Convex mirror. It is a spherical mirror whose reflecting surface is curved outwards. Nature of Image - Virtual, Erect and Diminished. Uses of convex mirrors - Side-view mirrors on vehicles like buses, trucks, and vans; they are installed in stores, warehouses, and parking lots to provide a wide-angle view of areas.

Q.241 In case of hypermetropia, where is the image formed?
RRB Group D 11/10/2018 (Morning)
(a) In front of the retina (b) On the retina
(c) Behind the retina (d) On the cornea

Sol.241.(c) Behind the retina. Hypermetropia (Long-Sightedness) - Lens used - Convex. Other eye diseases : Myopia (Near-Sightedness) - Image Location - Front of Retina. Lens Used - Concave Lens. Presbyopia - The gradual loss of your eyes' ability to focus on nearby objects. Lens - Bifocal Lens. Image Location - behind the Retina.

Q.242. The image formed on the retina of the human eye is-
RRB Group D 11/10/2018 (Afternoon)
(a) real and inverted
(b) Virtual and inverted
(c) real and direct
(d) Virtual and direct

Sol.242.(a) real and inverted. The retina is like the camera film of the eye. It's a layer at the back of your eye that's sensitive to light. When light hits it, it sends signals to your brain, which turns them into the images you see.

Q.243. The sky appears _____ to the astronaut from the spacecraft.
RRB Group D 11/10/2018 (Evening)
(a) Black (b) Blue (c) Orange (d) Red

Sol.243.(a) Black. In space, due to the absence of the atmosphere the light rays do not refract and reach the astronomer's eyes therefore it appears black. On Earth, the sky appears blue due to the presence of the atmosphere. Atmosphere refracts light rays coming from the sun and we see the color of the sky.

Q.244. Which of the following statements is true ?
RRB Group D 15/10/2018 (Morning)
(a) Radius of curvature is equal to focal length
(b) Radius of curvature is half of the focal length
(c) Radius of curvature is equal to three times the focal length
(d) Radius of curvature is equal to twice the focal length

Sol.244.(d) Radius of curvature is equal to twice the focal length. The equation R = 2f, represents the relationship between the radius of curvature (R) and the focal length (f) of a spherical mirror. This equation applies to both concave and convex spherical mirrors. For concave mirrors, the focal length is negative, and for convex mirrors, the focal length is positive.

Q.245. When an object is placed at the infinity of a concave mirror, its image is formed -
RRB Group D 15/10/2018 (Evening)
(a) at focus
(b) Between focus (F) and center (C)
(c) at center (C)
(d) away from the center (C)

Sol.245.(a) At focus. Image Formation by Concave Mirror: Object at center of curvature - Image also at center of curvature. Object beyond center of curvature: Image between center of curvature and focal point. Object between C and F : position of image will be beyond C.

Q.246. The focal length of a convex mirror is _____.
RRB Group D 16/10/2018 (Afternoon)
(a) zero (b) negative (c) positive (d) infinite

Sol.246.(c) Positive. Convex mirrors: These are also known as diverging mirrors because they reflect light rays away from each other, creating a wider field of view than flat mirrors. Focal length : This is the distance between the mirror's surface and its focal point, where parallel rays of light seem to converge after reflection.

Q.247. In what situation does a normal ray, incident ray and reflected ray all lie on the same surface ?
RRB Group D 16/10/2018 (Afternoon)
(a) In case of angle of incidence
(b) In both refraction and reflection
(c) In electrical potential energy
(d) In amplification of refractive index

Sol.247.(b) Both laws of refraction and reflection state that: The incident ray refracted ray, and the normal to the interface of two media at the point of incidence all lie on the same plane.

Q.248. Which of the following has minimum optically denser medium ?
RRB Group D 23/10/2018 (Evening)
(a) Water (b) Air (c) Benzene (d) Turpentine

Sol.248.(b) Air. Optical Density - A property of a transparent material that measures the speed of the light through the material. Highest optical Density - Diamond.

Q.249. Which of the following mediums has the lowest refractive index ?
RRB Group D 24/10/2018 (Afternoon)
(a) Petrol (b) Oil (c) Air (d) Diamond

Sol.249.(c) Air. The Refractive Index of a medium is defined as the ratio of the speed of light in a vacuum to the speed of light in the medium. It is also called an absolute refractive index. Absolute refractive index of some material media: Air (1.0003), Ice (1.31), Water (1.33), Alcohol (1.36), Diamond (2.42), Turpentine oil (1.47), Kerosene (1.44), Crown glass (1.52), Rock salt (1.54), Sapphire (1.77), Dense flint glass (1.65), Benzene (1.5).

Q.250. A spherical mirror and thin spherical lens each have a focal length of -20 cm. Which of the following is likely to be true in such a scenario?
RRB Group D 30/10/2018 (Evening)
(a) Both are convex.
(b) There is a concave mirror and a convex lens.
(c) There is a convex mirror and a concave lens.
(d) Both are concave.

Sol.250.(d) Both are concave. According to the sign convention, the focal length of concave lens is always negative. The focal length of a convex lens is always positive. The focal length of a concave mirror is negative while that of a convex mirror is positive.

Q.251. In a Concave mirror, where should the Object be placed to get a real, inverted and diminished image between C and F ?
RRB Group D 31/10/2018 (Afternoon)
(a) At C (b) Between F and C
(c) Beyond C (d) Between F and P

Sol.251.(c) Beyond C. Image formation by concave mirror for different positions of the object: Position of the object (position, size of the image): At infinity (At focus, highly diminished and point sized), At C (At C, same size), Between C and F (beyond C, enlarged), At F (At infinity, highly enlarged), Between P and F (behind the mirror, enlarged).

Q.252. _____ color has the smallest angle of deviation.
RRB Group D 1/11/2018 (Afternoon)
(a) purple (b) yellow (c) blue (d) red

Sol.252.(d) Red. Wavelength is inversely proportional to the deviation in the path of the light. The color red, therefore, deviates the least since it has a maximum wavelength and the color violet deviates the most since it has the least wavelength.

Q.253. The image (which we see on the screen) formed by the actual intersection of reflected rays is _____.
RRB Group D 05/12/2018 (Evening)
(a) virtual (b) imaginary
(c) probable (d) real

Sol.253.(d) Real images can be obtained on the screen. Examples - The images formed on a cinema screen are real images. The virtual image is formed due to the apparent intersection of reflected or refracted light rays. Virtual images can't be obtained on the screen. Example - The image of our face in a plane mirror is a virtual image.

Q.254. What is the distance between the polar point or focus point and the center of vision or optic center in the lens called ?
RRB Group D 07/12/2018 (Evening)
(a) radius of curvature
(b) main line or principal line
(c) focal length or polar distance
(d) pole or focus

Sol.254.(c) Focal length or polar distance. Principal focus is a point (on the principal axis) where parallel incident rays meet after reflecting (in mirrors) or refracting (in lenses). Focus is just a random point where some rays meet, it might be at the principal focus or otherwise. It also need not be placed on the principal axis of the lens/mirror.

Q.255. If an object is placed at infinity, what will be the position of its image formed by a convex lens ?
RRB Group D 11/12/2018 (Evening)
(a) At the focus or center of F_2
(b) On $2F_2$
(c) beyond $2F_2$
(d) in infinity

Sol.255.(a) If an object is at infinity, the position of an image formed due to the convex lens is at the focal point. Convex lenses converge parallel rays coming from objects at infinity and a highly diminished - point sized, real and inverted image is formed at principal focus.

Q.256. Which of the following mirrors always forms virtual and erect images and shows the size of the image equal to the size of the object ?
RRB Group D 14/12/2018 (Evening)
(a) Concave mirror (b) convex mirror
(c) plane concave mirror (d) plane mirror

Sol.256.(d) Plane mirror - A plane mirror is a mirror with a flat (planar) reflective surface. Characteristics of an image formed in a plane mirror - Image formed by a plane mirror is always virtual and erect; The size of the image is equal to that of the object; The image formed is as far behind the mirror as the object is in front of it; The image is laterally inverted.

Q.257. The reflector of a searchlight is a:
RRB ALP Tier - I (09/08/2018) Morning
(a) cylindrical mirror (b) convex mirror
(c) concave mirror (d) plane mirror

Sol.257.(c) Concave Mirror: Reflecting surface is toward the center of the curvature. It is also known as a converging mirror. Image formed - Real, Virtual, Erect and Inverted. Uses: Shaving mirrors, Headlights and Solar furnaces.

Q.258. A convex mirror of focal length f (in air) is immersed in a liquid ((μ = 4/3) The focal length of the mirror in liquid will be:
RRB ALP Tier - I (09/08/2018) Morning
(a) $(\frac{7}{3})$f (b) f (c) $(\frac{4}{3})$f (d) $(\frac{3}{4})$f

Sol.258.(b) f. The focal length of a mirror does not depend on the refractive index of the medium. On immersing a mirror in water, the focal length of the mirror remains unchanged because the focal length of the mirror depends on radius of curvature which is unchanged. So the focal length of the mirror is "f".

Q.259. If you look into a mirror and find that the image (your reflexion) is smaller than you, then the type of the mirror is:
RRB ALP Tier - I (09/08/2018) Afternoon
(a) concave mirror
(b) convex mirror
(c) plano-concave mirror
(d) plane mirror

Sol.259.(b) Convex mirror (Fish eye mirror or diverging mirror): It is that mirror whose reflecting surface is away from the center of the curvature. Image formed - Virtual and erect. Uses - Rear-view mirrors in vehicles, Security purposes in buildings and ATMs.

Q.260. A person holding a pen in his left hand sees his reflection in the mirror holding the pen in his right hand. This is due to which of the following phenomena?
RRB ALP Tier - I (09/08/2018) Evening
(a) Total internal reflection
(b) Refraction
(c) Diffused reflection
(d) Lateral inversion

Sol.260.(d) Lateral inversion - It means the apparent reversal of the mirror image's left and right when compared with the object. Total internal reflection is the complete reflection of a light ray within the medium (Air, Water Glass). Refraction is the bending of a wave when it enters a medium where its speed is different.

Q.261. When a ray of light travels from a denser medium to a rarer medium, it bends:
RRB ALP Tier - I (10/08/2018) Morning
(a) away from the normal and speeds up
(b) towards the normal and speeds up
(c) away from the normal and slows down
(d) towards the normal and slows down

Sol.261.(a) Refraction - The bending of light rays after entering a medium where its speed is different. Natural Phenomenon: Bending of Object in a Glass, Shallower Swimming Pool, Atmospheric Refraction and Setting sun, Twinkling Star.

Q.262. The velocity of light in vacuum is:
RRB ALP Tier - I (10/08/2018) Afternoon
(a) 3×10^6 ms^{-1} (b) 3×10^7 ms^{-1}
(c) 3×10^8 ms^{-1} (d) 2×10^8 ms^{-1}

Sol.262.(c) 3×10^8 ms^{-1}. Speed of light - The speed at which light propagates

through the medium. The speed of light in free space has the same value in all inertial frames of reference. Speed of light (c) = $f \times \lambda$, where f = frequency of light, λ = wavelength of light.

Q.263. The centre of the reflecting surface of a spherical mirror is called the:
RRB ALP Tier - I (10/08/2018) Afternoon
(a) focus (b) pole
(c) radius (d) centre of curvature

Sol.263.(b) Pole. Aperture - The diameter of the reflecting surface of a spherical mirror. Focus (F) - The point at which the light rays concentrate or appear to concentrate after reflecting from the spherical mirror. Centre of Curvature (C) - The centre of curvature is the centre of the sphere of which the spherical mirror is a part. Radius of curvature (R) - Distance of center of curvature from pole.

Q.264. Name the type of mirror used in the headlight of vehicles:
RRB ALP Tier - I (10/08/2018) Evening
(a) Concave mirror
(b) Plane mirror
(c) Convex mirror
(d) Plano-convex mirror

Sol.264.(a) Concave Mirror (Converging mirror)- It is that mirror whose reflecting surface is toward the center of the curvature. Image formed - Real, virtual, erect or inverted. Uses - Shaving mirrors, Headlights and Solar furnaces.

Q.265. Which of the following is a Non-Luminous body?
RRB ALP Tier - I (10/08/2018) Evening
(a) Glowing bulb (b) Moon
(c) Firefly (d) Burning candle

Sol.265.(b) Moon. Non-luminous objects are which can not emit light on their own. These objects reflect light from luminous bodies. Examples - Moon, Earth. Luminous objects are those objects which emit light on their own. Examples - Sun, flame of a burning candle, Firefly and Glowing bulb.

Q.266. If the power of a corrective lens is +2.0D, then it is a:
RRB ALP Tier - I (13/08/2018) Morning
(a) convex mirror (b) concave mirror
(c) convex lens (d) concave lens

Sol.266.(c) Convex lenses (converging lenses) have positive power because their focal lengths (distance between the center of the lens to the focus) are positive; It converges the beam of light coming from outside and focus it to a point on the other side; It is thicker at the center and thinner at edges.

Q.267. A curved mirror where the reflecting surface is curved inwards is called a:
RRB ALP Tier - I (13/08/2018) Morning
(a) plane mirror
(b) concave mirror
(c) plano-convex mirror
(d) convex mirror

Sol.367.(b) Concave mirror (converging mirrors) reflects and focuses incoming light rays (parallel) at a point called Focus point; Depending on the distance of an object from the reflecting surface, different types of images are formed. A plane mirror is a mirror with a flat (planar) reflective surface. Plano-convex lenses/Mirrors are positive focal length elements that have one spherical surface and one flat surface.

Q.268. A lemon kept in water in a glass tumbler appears to be bigger than its actual size when viewed from the sides. This is because of:
RRB ALP Tier - I (14/08/2018) Morning
(a) diffraction of light
(b) refraction of light
(c) internal reflection of light
(d) reflection of light

Sol.268.(b) Refraction of light. As the light waves travel from water/glass medium (denser) to air medium (rarer), it bends away from the normal, hence projecting an image larger than the object.

Q.269. If the angle of incidence formed on a concave mirror at a point is 30° then the angle of reflection will be:
RRB ALP Tier - I (17/08/2018) Afternoon
(a) 15° (b) 30° (c) 90° (d) 60°

Sol.269.(b) 30°. According to laws of reflection, for an incident ray and its corresponding reflected ray, the angle of incidence is always equal to the angle of reflection. Thus, if the angle of incidence is 30° then the angle of reflection will also be equal to 30°.

Q.270. What is the Centre of Curvature of a spherical mirror?
RRB ALP Tier - I (17/08/2018) Evening
(a) It is the point on the principal axis through which rays of light parallel to the principal axis pass after reflection.
(b) It is the centre of a hollow sphere of which the spherical mirror is a part.
(c) It is a point from which the rays of light appear to be coming from on the principal axis of a convex mirror.
(d) It is the midpoint of a spherical mirror.

Sol.270.(b) The distance between the Pole and the Principal Focus of the spherical mirror is termed as the focal length 'f' of the mirror. The Pole of a spherical mirror 'P' (convex or concave) is the center of the reflecting surface of the spherical mirror. It lies on the surface of the spherical mirror. Pole: The center of a spherical mirror.

Q.271. The diameter of the reflecting surface of a spherical mirror is called a/an:
RRB ALP Tier - I (20/08/2018) Morning
(a) focus (b) pole
(c) principal axis (d) aperture

Sol.271.(d) Aperture. Principal focus - Meeting point of parallel rays after reflection from a concave mirror. Pole - The central point of the spherical mirror. Principal axis - Straight line that passes through the pole and centre of curvature of a spherical mirror.

Q.272. What is the principal focus of a spherical mirror?
RRB ALP Tier - I (20/08/2018) Evening
(a) It is the midpoint of a spherical mirror.
(b) It is the point on the principal axis through which rays of light parallel to the principal axis pass after reflection or appear to be arising from this point on the principal axis.
(c) It is a point from which the rays of light appear to be coming from on the principal axis of a convex mirror.
(d) It is the centre of a hollow sphere of which the spherical mirror is a part.

Sol.272.(b) The principal focus of a concave mirror - A number of rays which drop parallel to the principal axis on a concave mirror converge at a point on the principal axis after getting reflected. The principal focus of a convex mirror - A number of rays which drop parallel to the principal axis after getting reflected, the rays appear to diverge from a point (principal focus).

Q.273. In a concave mirror when the object is placed at infinity which of the following applies to the image?
RRB ALP Tier - I (21/08/2018) Morning
(a) Real, inverted image of the same size at centre of curvature (C)
(b) Real, inverted, highly diminished image at focus

(c) Real, inverted, diminished image between centre of curvature (C) and principal focus (F)
(d) Real, inverted, highly enlarged image at centre of curvature (C)

Sol.273.(b) Concave mirror (converging mirrors) - A type of spherical mirror in which the reflecting surface is the inner-curved surface of the sphere. Object Position (Image position, Features of image): When object is placed at beyond C (Between F and C, Real and Inverted), At C (At C, Real and Inverted), Between C and F (Beyond C, Real and Inverted), At F (At Infinity, Real and Inverted) and Between P and F (Behind the mirror, Virtual and erect). Uses - Shaving mirrors, Headlights and Solar furnaces.

Numericals :-

Q.274. An object is placed at a distance of 25 cm from the converging lens. The real and inverted image of the object is formed at a distance of 30 cm from the lens. What is the magnification produced by the lens equal to?
RRC Group D 17/08/2022 (Afternoon)
(a) $\frac{5}{6}$ (b) $\frac{-6}{5}$ (c) $\frac{6}{5}$ (d) $\frac{-5}{6}$

Sol.274.(b) $\frac{-6}{5}$**.** The object distance (u) in a convex lens is always negative, u = -25 cm. Since, Real and inverted image (v) of the object is formed, v = 30 cm.

Magnification of the lens (m) = $\frac{v}{u}$

= $\frac{30}{-25} = \frac{-6}{5}$.

Q.275. A convex mirror used as a rear-view mirror of a car has a focal length of 2 m. If a bus is located at a distance of 3 m from the mirror, where will its image be formed?
RRC Group D 17/08/2022 (Evening)
(a) 1.2 m behind the mirror
(b) 0.83 m in front of the mirror
(c) 1.2 m in front of the mirror
(d) 0.83 m behind the mirror

Sol.275.(a) 1.2 m behind the mirror. Position of Object (u) = - 3 m, Focal Length = 2 m,

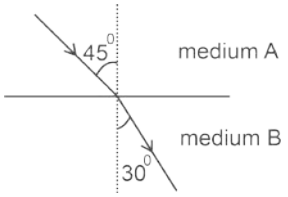
$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \Rightarrow \frac{1}{2} = \frac{1}{(-3)} + \frac{1}{v}$

$\Rightarrow \frac{1}{v} = \frac{1}{2} + \frac{1}{3} \Rightarrow \frac{1}{v} = \frac{3+2}{6}$

$\Rightarrow \frac{1}{v} = \frac{5}{6} \Rightarrow v = \frac{6}{5} \Rightarrow v$ = 1.2 m

The image (v) will be formed 1.2 m behind the mirror (because the principal focus of a convex mirror is behind the mirror). The image is virtual and erect.

Q.276. The path of a ray of light incident on an interface separating two media is shown in the figure below. The refractive index of medium A with respect to medium B is equal to:



RRC Group D 18/08/2022 (Morning)
(a) $2\sqrt{2}$ (b) $\sqrt{2}$ (c) $\frac{1}{\sqrt{2}}$ (d) $\frac{1}{2\sqrt{2}}$

Sol.276.(b) $\sqrt{2}$ **.**

Refractive Index = $\frac{\sin i}{\sin r}$

= $\frac{\sin 45°}{\sin 30°} = \frac{1/\sqrt{2}}{1/2} = \sqrt{2}$

Q.277. The focal length of a diverging lens is 50 cm. The power of the lens is:
RRC Group D 18/08/2022 (Evening)
(a) 2 D (b) - 2 D (c) - 5 D (d) 5 D

Sol.277.(b) - 2 D. The power of a lens is $\frac{1}{focal\ length}$ (measured in meters). So, 50 cm is $\frac{1}{2}$ meter, so the power is -2 D (Concave lens have negative focal length); D stands for diopters, the unit of power for lenses.

Q.278. The speed of light in two transparent media A and B are 2 × 10^8 m/sec and 2.25 × 10^8 m/sec. The refractive index of medium A with respect to medium B is equal to:
RRC Group D 22/08/2022 (Morning)
(a) 4.50 (b) 1.125 (c) 0.89 (d) 4.25

Sol.278.(b) 1.125. Given, Speed of light media in A = 2 × 10^8 m/sec, Speed of light in media B = 2.25 × 10^8 m/sec.
Refractive Index =

$\frac{speed\ of\ light\ in\ medium\ B}{speed\ of\ light\ in\ medium\ A}$

= $\frac{2.25 \times 10^8\ m/sec}{2 \times 10^8 m/sec}$ = 1.125.

Q.279. The refractive index of a given transparent medium is 1.5. The speed of light in the medium is equal to:
RRC Group D 22/08/2022 (Morning)
(a) 4.5 × 10^8 m/sec (b) 2 × 10^8 m/sec
(c) 3 × 10^8 m/sec (d) 0.5 × 10^8 m/sec

Sol.279.(b) 2 × 10^8 **m/sec**. Refractive Index- The ratio of the speed of light in a vacuum to its speed in a specific medium. Formula- n = $\frac{c}{v}$. Where, C = speed of light,V = velocity of light in a substance and n= the refractive index.

n = $\frac{3 \times 10^8}{v} \Rightarrow$ v = $\frac{3 \times 10^8}{n}$

v = $\frac{3 \times 10^8}{1.5} \Rightarrow 2 \times 10^8$ m/sec.

Refractive index of light in different media- Air(1.0003), Water(1.333), Diamond(2.417), Ice(1.31),etc.

Q.280. The magnification 'm' produced by a convex lens when the object is placed at a distance 2f from the lens is given by:
RRC Group D 22/08/2022 (Morning)
(a) m = - 2 (b) m = +2 (c) m = -1 (d) m = +1

Sol.280.(c) m = -1. Given, object distance = -2f, magnification= m. According to lens formula,

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{2f} = \frac{1}{2f}$.

So, magnification (m) = $\frac{v}{u} = \frac{2f}{-2f}$ = - 1.

Hence magnification m = -1.
Magnification m produced by a convex mirror - 0 < m < 1.

Q.281. A convex lens having power 5 D is placed in contact with a concave lens having power - 3 D. The focal length of the combination will be:
RRC Group D 22/08/2022 (Afternoon)
(a) 50 cm (b) -0.5 cm (c) 0.5 cm (d) -50 cm

Sol.281.(a) 50 cm. Power of Convex Lens, P_1 = 5 D. Power of a Concave lens, P_2 = -3 D . The Combined Power, P = P_1 + P_2 ,

P = 5 +(-3) , P = 2 D . Since

P = $\frac{1}{focal\ length}$, f = $\frac{1}{P}$, f = $\frac{1}{2}$

f = 0.5m = 50cm. Hence, the focal length of the combination is 50 cm.

Q.282. A concave mirror having focal length of magnitude 20 cm forms a real image at a distance of 60 cm from it. The object distance (in cm) is
RRC Group D 22/08/2022 (Evening)
(a) +15 (b) +30 (c) -30 (d) -15

Sol.282.(c) - 30. The focal length of the concave mirror is always negative, Given f = -20 cm. The image distance of the concave mirror is negative (image is formed in front of the mirror (real image)), Given v = -60 cm.

Mirror formula :- $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$= \frac{1}{-60} + \frac{1}{u} = \frac{1}{-20}$

$= \frac{1}{u} = \frac{1}{60} - \frac{1}{20} \Rightarrow \frac{1}{u} = \frac{1-3}{60}$

$= \frac{1}{u} = \frac{-2}{60} \Rightarrow$ u = - 30 cm.

Q.283. A convex lens produces a magnification of -3 for an object placed at 1.5 m from the lens. Find the image distance (with correct sign)
RRC Group D 22/08/2022 (Evening)
(a) - 4.5 m (b) 4.5 m (c) 0.5 m (d) - 0.5 m

Sol.283.(b) 4.5 m.
Object Distance, u = - 1.5m
(for convex lens), Magnification, m = - 3, Image distance, v = ?.

Since, m = $\frac{v}{u}$.

So, (-3) = $\frac{v}{(-1.5)} \Rightarrow$ (-3) × (-1.5) = v ⇒ 4.5.
Hence, Image distance (v)= 4.5 m.

Q.284. A light ray is traveling from air medium to water medium (refractive index = 1.3) such that angle of incidence is x degree and angle of refraction is y degree. The value of ratio (sin y)/(sin x) is:
RRC Group D 24/08/2022 (Evening)
(a) 1.3 (b) $\frac{1}{1.3}$ (c) 1 (d) 0.3

Sol.284.(b) $\frac{1}{1.3}$ According to Law of Refraction (Snell's law), The ratio of the sine of the angle of incidence 'i' to the sine of the angle of refraction 'r' is constant for the pair of given media. This constant is called the refractive index of the second medium w.r.t. the first medium and can be expressed as: (sin i) / (sin r) = refractive index of 2nd medium / refractive index of first medium So,
(sin x) / (sin y) = 1.3/1
⇒ (siny) / (sinx) = 1/1.3.

Q.285. Identify the correct relation between radius of curvature 'R", object distance "u" and image distance "v" for a spherical
RRC Group D 24/08/2022 (Evening)
(a) R = $\frac{uv}{2(u+v)}$ (b) R = $\frac{2uv}{u+v}$
(c) R = $\frac{(u+v)}{2uv}$ (d) R = $\frac{2(u+v)}{uv}$

Sol.285.(b) It can be derived by using the mirror formula,
$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ & R = 2f
Here, u = object distance from the mirror
v = image distance from the mirror
R = radius of curvature
f = focal length
Solving the equation and substituting f by R, we get R = $\frac{2uv}{u+v}$.

m = $\frac{Height\ of\ the\ image}{Height\ of\ the\ object} = -\frac{v}{u}$

Q.286. An object, 1.0 cm in height, is placed at a distance of 18.0 cm in front of a concave mirror of focal length 10.0 cm, on its principal axis. Its image has a height of_____and is_____.
RRC Group D 25/08/2022 (Morning)
(a) more than 1.0 cm, inverted
(b) more than 1.0 cm, erect
(c) less than 1.0 cm, erect
(d) less than 1.0 cm, inverted

Sol.286.(a) more than 1.0 cm, inverted.
Given, object height, h_1 = 1.0 cm, object distance, u = - 18.0 cm, & Focal length = - 10.0 cm.

Using mirror formula, $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{-1}{10} - (\frac{-1}{18})$

$\Rightarrow$ v = $\frac{-45}{2}$

Now, magnification, m = $\frac{h_2}{h_1} = -\frac{v}{u}$

$\Rightarrow h_2 = -h_1 (\frac{\frac{-45}{2}}{-18})$

= - (1.0) ($\frac{5}{4}$) = - 1.25 cm.

So, the image formed will be more than 1.0 cm, inverted (because h_2 has a negative sign).

Q.287. The refractive indices of turpentine oil and glass are 1.47 and 1.52, respectively. A ray of light passes from turpentine oil to glass. The refractive index of glass with respect to turpentine oil is _____ and the ray bends _____ the normal in glass.
RRC Group D 25/08/2022 (Morning)
(a) 0.97, towards (b) 1.03, away from
(c) 1.03, towards (d) 0.97, away from

Sol.287.(c) 1.03, towards. The refractive index of glass with respect to turpentine oil = refractive index of glass / refractive index of turpentine oil = 1.52/1.47 = 1.03. Now, since the ray of light passes from turpentine oil to glass i.e. from a rare medium to a denser medium, it will bend towards the normal.

Q.288. An object is placed on the principal axis of a concave lens of focal length 20 cm, at a distance of 10 cm. The magnification produced by the lens is and the image is:
RRC Group D 25/08/2022 (Morning)
(a) less than 1, erect
(b) more than 1, inverted
(c) more than 1, erect
(d) less than 1, inverted

Sol.288.(a) less than 1, erect.
Given, Distance of the object, u = - 10 cm & Focal length, f = - 20 cm

Using the Lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u}$ = 1/(-20) + 1/(-10)
⇒ v = - 20/3
Now, the magnification for a lense, m = v/u = - (20/3)/(-10) = 2/3 = Less than 1.
Since the value of the magnification is positive, the image formed is erect.

Q.289. An object, 3.0 cm in height, is placed at a distance of 20.0 cm in front of a convex mirror of focal length 6.0 cm on its principal axis. Its image has a height of _____ and is _____.
RRC Group D 25/08/2022 (Afternoon)
(a) more than 3.0 cm, inverted
(b) less than 3.0 cm, inverted
(c) more than 3.0 cm, erect
(d) less than 3.0 cm, erect

Sol.289.(d) less than 3.0 cm, erect.
according to sign conventions, when the magnification is positive then the image has to be erect and virtual. if it is negative then the image is real and inverted.
Given, Object height, h_o = 3.0 cm,
object distance (u) = - 20.0 cm,
Focal length (f) = + 6.0 cm.

Using Mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{6} - (-\frac{1}{20}) = \frac{1}{6} + \frac{1}{20}$

$\Rightarrow$ v = $\frac{60}{13}$ cm = 4.6 cm

Now, magnification (m)

= $\frac{image\ height\ (hi)}{object\ height\ (ho)} = -\frac{v}{u}$

$\Rightarrow h_i = (-\frac{3 \times 4.6}{-20}) \cong \frac{14}{20}$ = 0.7

Hence, the image height is less than 3.0 cm, erect.

Q.290. A ray of light is incident at a point M on a convex mirror (pole P) of radius of curvature 20 cm. It is reflected back along the same path, and appears to come from its center of curvature C. Following the new Cartesian sign convention, PC = _____.
RRC Group D 26/08/2022 (Afternoon)
(a) 10 cm (b) -20 cm (c) 20 cm (d) -10 cm

Sol.290.(c) 20 cm. Signs of the radius of curvature and focal length in convex mirrors are taken as; Radius of curvature = +ve, Focal length = +ve. And on

reflecting back light ray will pass through the centre of curvature. So, PC = +20 cm.

Q.291. A 1.0-cm long object is placed at a distance of 12 cm on the principal axis of a convex lens of focal length 8 cm. The height of the image formed will be _____.
RRC Group D 26/08/2022 (Afternoon)
(a) 2.0 cm (b) 3.0 cm (c) 3.1 cm (d) 1.5 cm

Sol.291.(a) 2.0 cm. Here, u = - 12 cm , f = 8 cm, height of object = 1 cm. According to lens formula
$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{8} = \frac{1}{v} + \frac{1}{12} \Rightarrow$
v = 24 cm.

According to Magnification formula $\Rightarrow \frac{v}{u}$
$= \frac{height\ of\ image}{height\ of\ object}$
$\Rightarrow \frac{24}{12} = \frac{height\ of\ image}{1}$
⇒ height of image = 2 cm.

Q.292. The radius of curvature of a convex mirror is 15 cm. Following the New Cartesian sign Convention, the principal focus is located at x = ?
RRC Group D 29/08/2022 (Morning)
(a) 7.5 cm (b) 15 cm
(c) -15 cm (d) -7.5 cm

Sol.292.(a) 7.5 cm. The sign is taken as negative in front of a spherical mirror. Sign is taken as positive behind the spherical mirror. Since, the center of curvature and focus lies behind the convex mirror, so radius of curvature and focal length are taken as positive in the case of convex mirror.
Hence, R = 15 cm
Now, f = R / 2 = 15 / 2 = 7.5 cm

Q.293. An object is placed in front of a concave mirror of focal length 15 cm and its image is formed on the same side as the object, at a distance of 45 cm. The distance of the object from the mirror is:
RRC Group D 29/08/2022 (Evening)
(a) 33.75 cm (b) 45 cm
(c) 22.5 cm (d) 11.25 cm

Sol.293.(c) 22.5 cm**.** Since, the object is always placed in front of the mirror hence the sign of the object is taken as negative. Since, the center of curvature and focus lie in front of the concave mirror, signs of the radius of curvature and focal length are taken as negative in the case of the concave mirror.
Given, f = -15 cm and v = - 45 cm.
then u = distance of the object from the mirror.
Using mirror formula, $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$
$\Rightarrow -\frac{1}{15} = \frac{1}{u} - \frac{1}{45} \Rightarrow$ u = - 22.5 cm

Q.294. The refractive indices of ice and glass are 1.31 and 1.52, respectively. A ray of light passes from ice to glass. The refractive index of glass with respect to ice is _____ and the ray bends _____ the normal in glass.
RRC Group D 30/08/2022 (Morning)
(a) 0.86, towards (b) 0.86, away from
(c) 1.16, towards (d) 1.16, away from

Sol.294.(c) 1.16, towards. $n_{21} = n_2 / n_1$ = refractive index of material 2 w.r.t. Material 1. So, the refractive index of glass with respect to ice is = 1.52/1.31 = 1.16. When a light ray travels from a rarer medium to a denser medium, the speed of light reduces, and it bends towards the normal. Here, ice is rare medium and glass is denser. So, the ray will bend towards the normal.

Q.295. The radius of curvature of a concave mirror is 12 cm. Following the New Cartesian Sign Convention, the principal focus is located at x = _____.
RRC Group D 30/08/2022 (Morning)
(a) 6 cm (b) -12 cm (c) -6 cm (d) 12 cm

Sol.295.(c) -6 cm. Since, the center of curvature and focus lie in front of the concave mirror, signs of the radius of curvature and focal length are taken as negative in the case of the concave mirror. Here, R = -12 cm. So, f = R / 2 = -12/2 = -6 cm.

Q.296. The focal length of a concave mirror is 24 cm. Following New Cartesian Sign Convention, its center of curvature is located at:
RRC Group D 30/08/2022 (Afternoon)
(a) -48 cm (b) -24 cm (c) 24 cm (d) 48 cm

Sol.296.(a) - 48 cm. The sign is always taken as negative in front of a concave mirror. Since, the center of curvature and focus lie in front of the concave mirror, signs of the radius of curvature and focal length are taken as negative. Here, f = - 24 cm. So, R = 2f = - 48 cm.

Q.297. An object is placed on the principal axis of a lens of power -10 D, at a distance of 15 cm. The image formed is _____.
RRC Group D 30/08/2022 (Evening)
(a) real and erect (b) real and inverted
(c) virtual and erect
(d) virtual and inverted

Sol.297.(c) Virtual and erect.
Given, Power = -10 D,
Distance of object (u) = - 15 cm.
Now,
Focal length, f = $\frac{1}{P}$
= $\frac{1}{10}$ = - 0.1 m = -10 cm.
Because the focal length is negative, the given lens is concave lens and in the case of concave lens no matter where the object is placed other than infinity, the virtual and Erect image will be formed between the optical center and the focus of the concave lens.

Q.298. The focal length of a convex mirror is 15 cm. Following New Cartesian Sign Convention, its center of curvature is located at:
RRC Group D 30/08/2022 (Evening)
(a) 30 cm (b) - 15 cm
(c) 15 cm (d) - 30 cm

Sol.298.(a) 30 cm. Center of curvature is situated at 2f. Hence, C = 2f = 2(15) = 30 cm. According to the new cartesian sign Convention the center of curvature and focus lies behind in the convex mirror, so signs of the radius of curvature and focal length are taken as + (positive) in this case.

Q.299. According to mirror formula, the focal length of a spherical mirror is equal to:
RRC Group D 01/09/2022 (Morning)
(a) $\frac{u-v}{uv}$ (b) $\frac{uv}{u-v}$ (c) $\frac{u+v}{uv}$ (d) $\frac{uv}{u+v}$

Sol.299.(d) $\frac{uv}{u+v}$**.** The mirror formula is
$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{f} = \frac{(u+v)}{uv}$
$\Rightarrow$ f = $\frac{(u+v)}{uv}$, Where u and v are object distance and image distance respectively.

Q.300. A converging lens having focal length 50 cm is kept in contact with a diverging lens having focal length 20 cm. The power of combination of the two lenses is:
RRC Group D 01/09/2022 (Morning)
(a) 8 D (b) - 8 D (c) + 3 D (d) - 3 D

Sol.300.(d) - 3 D. For converging lenses, the focal length is always positive, while diverging lenses always have negative focal lengths. Therefore, f_1 = 50 cm and f_2 = - 20 cm.
Now, the focal length of the combination is $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} \Rightarrow \frac{1}{f} = \frac{1}{50} - \frac{1}{20}$

Hence, f = - $\frac{100}{3}$ cm = - $\frac{1}{3}$ m

Now, using P = $\frac{1}{f}$ = $\frac{1}{(-\frac{1}{3})}$ ⇒ P = - 3 D

Q.301. An object is placed at a distance of 40 cm from a convex lens having focal length 20 cm. Which option given below, correctly describes the nature and the relative size of the image formed in the respective order?
RRC Group D 02/09/2022 (Evening)
(a) Virtual, erect and diminished
(b) Real, inverted and diminished
(c) Virtual, erect and enlarged
(d) Real, inverted and same sized

Sol.301.(d) Real, inverted and same sized. Given,
Object distance (u) = - 40 cm,
Focal length (f) = 20 cm
So, Using lens formula $\frac{1}{f}$ = $\frac{1}{v}$ - $\frac{1}{u}$
⇒ $\frac{1}{v}$ = $\frac{1}{40}$ ⇒ v = 40cm. In Convex Lens when v is positive then the image formed is real and inverted while the v is negative then the image formed is virtual and erect. Also, the image formed at center of curvature(C) because C = 2f ⇒ C = 40cm. So, Image is same size as object. Hence, Image formed is Real, inverted and same sized.

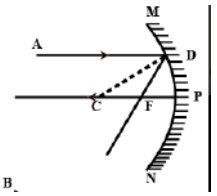
Q.302. An object is placed in front of a concave mirror of focal length 6 cm, at a distance of 24 cm. The magnification produced by the mirror is_____.
RRC Group D 05/09/2022 (Morning)
(a) - $\frac{1}{3}$ (b) - 3 (c) $\frac{1}{3}$ (d) 3

Sol.302.(a) - $\frac{1}{3}$.

According to Mirror Formula $\frac{1}{f}$ = $\frac{1}{u}$ + $\frac{1}{v}$. Given f = - 6 cm, u = - 24.
$\frac{1}{v}$ = $\frac{1}{f}$ - $\frac{1}{u}$ ⇒ $\frac{1}{v}$ = $\frac{1}{-6}$ + $\frac{1}{24}$ = $\frac{1}{-8}$
Mirror Magnification Formula = $\frac{-v}{u}$
⇒ $\frac{-(-8)}{-24}$ ⇒ $\frac{1}{-3}$.
An object is placed in front of a concave mirror of focal length 6 cm, at a distance of 24 cm. The magnification produced by the mirror is - $\frac{1}{3}$.

Q.303. If P, F and C represent the pole, principal focus and centre of curvature, respectively, of a concave mirror, then PC is equal to:
RRC Group D 05/09/2022 (Afternoon)
(a) ($\frac{1}{4}$) PF (b) ($\frac{1}{2}$) PF (c) 2PF (d) 4PF

Sol.303.(c) 2PF.



In this figure.
MPN = Concave spherical mirror
P = Pole
F = Principle focus
C = Centre of curvature
PF = Focal length of mirror
PC = Radius of curvature of mirror
The rays that are near the principal axis (paraxial rays) and parallel to it converge to a single point on the axis after emerging from the spherical mirror. And this is half of the radius of the curvature in a spherical mirror. So the PC is equal to 2PF.

Q.304. An object of size 4.0 cm is placed at a distance of 24 cm in front of a convex mirror of focal length 8 cm. The image formed will be _____, and its height will be _____.
RRC Group D 06/09/2022 (Morning)
(a) erect, 1.0 cm (b) erect, 2.0 cm
(c) reverse, 1.0 cm (d) reverse, 2.0 cm

Sol.304.(a) Erect, 1.0 cm. Object distance, u = - 24 cm, focal length, f = 8 cm, object height, m_o = 4.0 cm. Using Mirror formula, $\frac{1}{f}$ = $\frac{1}{u}$ + $\frac{1}{v}$ ⇒ $\frac{1}{8}$ = $\frac{1}{-24}$ + $\frac{1}{v}$
⇒ $\frac{1}{v}$ = $\frac{1}{8}$ + $\frac{1}{24}$ = $\frac{1}{6}$ ⇒ v = 6 cm.
Now, magnification, m = $\frac{m_i}{m_o}$ = $\frac{-v}{u}$
⇒ $\frac{m_i}{4}$ = $\frac{-6}{-24}$ ⇒ m_i = 1 cm.
Hence, the image is 1 cm in height and is erect.

Q.305. The focus of a convex mirror is at a distance of 30 cm from its pole. Its centre of curvature will be at a distance of _____from the focus.
RRC Group D 08/09/2022 (Morning)
(a) 30 cm (b) 45 cm (c) 15 cm (d) 60 cm

Sol.305.(a) 30 cm. For a convex mirror, the radius of curvature (R), is twice its focal length (f).
Here, f = 30cm, R = 2f = 2 × 30 = 60 cm.
Relation Between Focal Length and Radius of Curvature PC = PF + FC. PF = focal length f , PC = radius of curvature R, FC = Distance between focus and R . Given PF = 30cm, PC = 60 cm. Then FC = PC − PF = 60 − 30 = 30 cm. Its centre of curvature will be at a distance of 30 cm from the focus.

Q.306. A ray of light in air is incident at an angle of 30° on the surface of water in a jar. The ray is refracted in the water at an angle of _____and_____ in the plane of the incident ray.
RRC Group D 08/09/2022 (Morning)
(a) more than 30°, lies
(b) less than 30°, does not lie
(c) more than 30°, does not lie
(d) less than 30°, lies

Sol.306.(d) Less than 30°, lies. According to Snell's law, the ratio of sine of the angle of incidence to the sine of angle of refraction is a constant for a given pair of mediums.
$\frac{Sin\, i}{Sin\, r}$ = Constant. This constant is known as the refractive index of the medium.
Refractive index of water - 1.333.
Sin r = $\frac{Sin\, i}{Constant}$ ⇒ $\frac{Sin\, 30°}{1.33}$
⇒ $\frac{0.5}{1.33}$ = 0.375 (approx sin 22°).
According to the laws of reflection, the incident ray, the reflected ray and the normal, all lie in the same plane.

Q.307. A diverging mirror of focal length 20 cm forms an image one-third the size of the object. At what distance from the mirror is the object located?
RRC Group D 08/09/2022 (Afternoon)
(a) -40 cm (b) -20 cm (c) -10 cm (d) -5 cm

Sol.307.(a) - 40 cm.
Focal length (f) = 20 cm,
Height of image = $\frac{1}{3}$ of height of object.
Magnification (m) = $\frac{-v}{u}$
= $\frac{Height\ of\ image}{Height\ of\ object}$
⇒ $\frac{1}{3}$ = $\frac{-v}{u}$ ⇒ $\frac{1}{v}$ = $\frac{-3}{u}$
By Mirror formula, $\frac{1}{f}$ = $\frac{1}{v}$ + $\frac{1}{u}$
⇒ $\frac{1}{20}$ = $\frac{-3}{u}$ + $\frac{1}{u}$
⇒ $\frac{1}{20}$ = $\frac{-2}{u}$ ⇒ u = - 40 cm.

Q.308. A ray of light in air is incident at an angle of 60° on the surface separating air from a medium of refractive index √3. The ray is refracted in the medium at an angle of_____.
RRC Group D 09/09/2022 (Morning)

(a) 45° (b) 60° (c) 30° (d) 15°

Sol.308.(c) 30°. Given, angle of incidence= 60°, Medium of refractive index= √3

Refractive index(n)=sin i/sin r, where i = angle of incidence and r = angle of refraction.

$\Rightarrow \sqrt{3} = \frac{\sin 60°}{\sin r} \Rightarrow \sin r = \frac{1}{2}$

$\Rightarrow$ r = 30° (value of sin 30° = $\frac{1}{2}$)

Hence, the angle of refraction is 30°.

Q.309. If the power of a convex lens is 3 dioptre, then its focal length will be:

RRC Group D 09/09/2022 (Afternoon)

(a) +0.33 m (b) -0.33 m (c) -3 m (d) +3 m

Sol.309.(a) +0.33 m.

Power of convex lens (P) = 3 D (Dioptre)

Focal length (f) = $\frac{1}{P} \Rightarrow f = \frac{1}{3}$ = 0.33 m.

Q.310. The refractive indices of two transparent media A and B are 3/2 and 4/3, respectively. The refractive index of medium A with respect to medium B is equal to

RRC Group D 13/09/2022 (Morning)

(a) $\frac{1}{2}$ (b) $\frac{8}{9}$ (c) $\frac{9}{8}$ (d) $\frac{3}{4}$

Sol.310.(c) $\frac{9}{8}$. **Refractive index** of medium A with respect to medium B

$= \frac{Refractive\ index\ of\ A}{Refractive\ index\ of\ B}$

$= \frac{\frac{3}{2}}{\frac{4}{3}} = \frac{3}{2} \times \frac{3}{4} = \frac{9}{8}$

Q.311. If the size of a spherical mirror increases in such a way that its radius of curvature gets doubled, then its focal length will _____.

RRC Group D 14/09/2022 (Morning)

(a) increase to double

(b) remain same

(c) decrease by its half

(d) become infinite

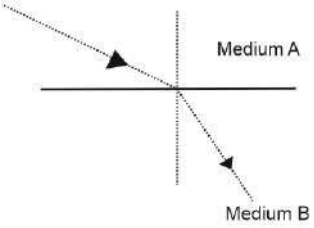
Sol.311.(a) Increase to double.

As we know, f = $\frac{R}{2}$; where, f = focal length, R = radius of curvature.

Given $R_2 = 2R_1$.

$\Rightarrow f_1 = \frac{R_1}{2}$, $R_1 = 2f_1$. $f_2 = \frac{R_2}{2} \Rightarrow f_2 = \frac{2R_1}{2} \Rightarrow f_2 = R_1 \Rightarrow f_2 = 2f_1$. It clearly shows focal length increases to double.

Q.312. The path of a ray of light incident on an interface separating two transparent media is shown in the figure. The refractive index (n) of medium B with respect to medium A is given by:



RRC Group D 14/09/2022 (Afternoon)

(a) n > 1 (b) 0 < n < 1 (c) n = 1 (d) n = 0

Sol.312.(a) n > 1. Refractive index - Ratio of Speed of light in a vacuum to the speed of light in medium. n = $\frac{\sin i}{\sin r}$, where i = angle of incidence, r = angle of reflection. When light rays travel from optically rarer medium (Speed of light is more) to denser medium (Speed of light is less) then n > 1. When light rays travel from optically denser medium to rarer medium then n < 1.

Q.313. If m, v and u, respectively, represent magnification, image distance and object distance, then the correct relation between m, v and u for a lens will be:

RRC Group D 15/09/2022 (Morning)

(a) m = $\frac{u}{v}$ (b) m = u + v

(c) m = $\frac{v}{u}$ (d) m = v × u

Sol.313.(c) m = $\frac{v}{u}$.

For lens : $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$; f : focal length of lens; u: object distance from lens; v: image distance from lens. m = $\frac{hi}{ho}$, where h_i = height of image and h_o = height of object or m= $\frac{image\ size}{actual\ size}$.

Q.314. A 12 cm long object is placed at a distance of 15 cm from a concave lens. Its virtual image of 8 cm is obtained at a distance of_____.

RRC Group D 15/09/2022 (Afternoon)

(a) +22.5 cm (b) -10 cm

(c) -22.5 cm (d) +10 cm

Sol.314.(b) -10 cm. Given, height of the image (h') = 8 cm, height of the object (h) = 12 cm, distance of the object (u) = -15 cm and distance of image (v) = ?.

Magnification (m)

$= \frac{height\ of\ the\ Image}{Height\ of\ the\ object} = \frac{h'}{h} = \frac{v}{u}$

So, $\frac{8}{12} = \frac{v}{-15} \Rightarrow$ v = -10 cm

Q.315. An object of diameter 6 cm is placed at a distance of 10 cm in front of a lens with a power of +5.0 D. The diameter of the image of the object will be:

RRC Group D 17/09/2022 (Evening)

(a)14 cm (b) 8 cm (c)10 cm (d)12 cm

Sol.315.(d) 12 cm.

power of lens, P = $\frac{1}{f}$

f = $\frac{1}{p} = \frac{1}{5}$ = 0.2m = 20cm

lens Formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

(where f = focal length, v = image distance, u = object distance).

$\frac{1}{20} = \frac{1}{v} - \frac{1}{-10} \Rightarrow \frac{1}{20} - \frac{1}{10} = \frac{1}{v}$

$\Rightarrow \frac{1}{v} = \frac{1-2}{20} \Rightarrow$ v = - 20 cm

Magnification of lens

M = $\frac{di}{do} = \frac{v}{u}$ (where di = diameter of the image , do =diameter of the object)

$\frac{di}{6} = \frac{-20}{-10} = 2 \Rightarrow$ di = 6 × 2 = 12cm.

Q.316. A child is looking at a reflecting surface of a Christmas tree ball which has a diameter of 10.0 cm, and the child observes an image of his face that is half the real size. How far is the child's face from the ball?

RRC Group D 18/09/2022 (Afternoon)

(a) +5.0cm (b) −5.0cm

(c) +2.5cm (d) −2.5cm

Sol.316.(d) −2.5cm. Given, D = 10 cm,

R = $\frac{10}{2}$ = 5 cm. So, f = $\frac{R}{2}$ = 2.5 cm

m (magnification) = - $\frac{d_{image}}{d_{object}}$

$\Rightarrow 0.5 = -\frac{d_{image}}{d_{object}} \Rightarrow d_i = -0.5 d_o$

$\frac{1}{2.5} = -\frac{1}{0.5 d_o} + \frac{1}{d_o}$

d_o = - 2.5 cm. Hence, the child's face from the ball is -2.5 cm.

Q.317. Consider the dispersion of a medium as D for a wavelength λ. The dispersion of the same medium for wavelength 3λ will be:

RRC Group D 18/09/2022 (Afternoon)

(a) $\frac{D}{16}$ (b) $\frac{D}{4}$ (c) $\frac{D}{81}$ (d) $\frac{D}{27}$

Sol.317.(d) $\frac{D}{27}$. As we know, Cauchy's

Dispersion formula is: $\mu = A + \frac{B}{\lambda^2}$

And the dispersion is given as : $D = -\frac{d\mu}{d\lambda}$

Therefore, from the above 2 equations we can say that:

$D = -(-2\lambda^{-3})B = \frac{2B}{\lambda^3} \Rightarrow D \propto \frac{1}{\lambda^3}$

Hence, we can say that:

$\frac{D'}{D} = (\frac{\lambda}{\lambda'})^3$

As the $\lambda' = 3\lambda$

Therefore, the value of $D' = \frac{D}{27}$

Q.318. When parallel beam of light rays are incident on the concave minor of radius of curvature 0.8 m, reflected rays:
RRC Group D 18/09/2022 (Evening)
(a) appear to diverge from a point at a distance 0.8 m behind the mirror
(b) converge to a point at a distance 0.4 m from the concave surface
(c) appear to diverge from a point at a distance 0.4 m behind the mirror
(d) converge to a point at a distance 0.8 m from the concave surface

Sol.318.(b) $f = \frac{R}{2} = \frac{0.8}{2} = 0.4m$

Where f = focal length, R = radius of curvature

Q.319. The refractive indices of mediums 1, 2 and 3 are 1.50, 1.36 and 1.54, respectively. If the speed of light in the mediums are v_1, v_2 and v_3 respectively, which of the following relations between them is correct?
RRC Group D 18/09/2022 (Evening)
(a) $v_2 > v_1 > v_3$ (b) $v_1 = v_2 = v_3$
(c) $v_1 > v_3 > v_2$ (d) $v_3 > v_2 > v_1$

Sol.319.(a) $v_2 > v_1 > v_3$. Refractive Index (n) = $\frac{c}{v}$ (The speed of light is 3×10^8 ms^{-1} in vacuum).

$n_1 = 1.50$, $n_2 = 1.36$. $n_3 = 1.54$.

$n_1 = \frac{3\times10^8}{v_1} = v_1 = \frac{3\times10^8}{1.50}$

$= 2 \times 10^8$ ms^{-1}

$n_2 = \frac{3\times10^8}{v_2} = v_2 = \frac{3\times10^8}{1.36}$

$= 2.20 \times 10^8$ ms^{-1}

$n_3 = \frac{3\times10^8}{v_3} = v_3 = \frac{3\times10^8}{1.54}$

$= 1.94 \times 10^8$ ms^{-1}

From the above solution we can state that, $v_2 > v_1 > v_3$.

Q.320. Suppose Sita has kept a needle in front of a concave mirror of focal length f at a distance (f + x) and a real image of the needle is seen on a screen at a distance (f + y). Then the focal length f can be exposed as:
RRC Group D 19/09/2022 (Morning)
(a) $f = 2\sqrt{xy}$ (b) $f = \sqrt{xy}$
(c) $f = -2\sqrt{xy}$ (d) $f = -\sqrt{xy}$

Sol.320.(b) $f = \sqrt{xy}$. By mirror formula,

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{f+x} + \frac{1}{f+y} = \frac{1}{f}$

$\Rightarrow \frac{f+x+f+y}{(f+x)(f+y)} = \frac{1}{f}$

$\Rightarrow f^2 + fx + f^2 + fy = f^2 + fy + fx + xy$,

$\Rightarrow f^2 = xy \Rightarrow f = \sqrt{xy}$

Q.321. Suppose a ball is placed in front of a concave mirror and a real image that is twice the size of the ball is formed on a screen. The ball and the screen are then moved until the image is five times the size of the object. If the shift of the screen is d, then the shift in the object is:
RRC Group D 19/09/2022 (Afternoon)
(a) $\frac{d}{18}$ (b) $\frac{d}{10}$ (c) $\frac{d}{15}$ (d) $\frac{d}{12}$

Sol.321.(b) $\frac{d}{10}$. Magnification, $m = \frac{v}{u}$

Given magnification (m) = 2

Mirror formula: $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

Multiplying with v in both the sides of the above equation:

$\Rightarrow \frac{v}{f} = \frac{v}{v} + \frac{v}{u}$

$\Rightarrow \frac{v}{f} = 1 + \frac{v}{u} \Rightarrow \frac{v}{u} = \frac{v}{f} - 1$

$\Rightarrow 2 = \frac{v}{f} - 1 \Rightarrow \frac{v}{f} = 3 \Rightarrow v = 3f$

When the screen is shifted by d cm then v' = v + d and m' = 5

$\frac{v'}{u'} = \frac{v'}{f} - 1$

$\Rightarrow 5 = \frac{v+d}{f} - 1 \Rightarrow 6f = v + d$, $v = 3f$

$\Rightarrow 6f = 3f + d \Rightarrow 3f = d \Rightarrow f = d/3$

$\Rightarrow v = 3f = 3 \times \frac{d}{3} = d$, $v = d$

Before Shift (object distance = u, image distance = v, focal length = f)

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\Rightarrow \frac{1}{u} = \frac{1}{f} - \frac{1}{v} \Rightarrow \frac{1}{u} = \frac{3}{d} - \frac{1}{d}$

$\Rightarrow \frac{1}{u} = \frac{2}{d} \Rightarrow u = \frac{d}{2}$

After Shift (object distance = u', image distance = v', focal length = f)

$\frac{1}{f} = \frac{1}{v'} + \frac{1}{u'}$

$\Rightarrow \frac{3}{d} = \frac{1}{v+d} + \frac{1}{u'} \Rightarrow \frac{3}{d} = \frac{1}{d+d} + \frac{1}{u'}$

$\Rightarrow \frac{3}{d} = \frac{1}{2d} + \frac{1}{u'} \Rightarrow \frac{1}{u'} = \frac{3}{d} - \frac{1}{2d}$

$\Rightarrow \frac{1}{u'} = \frac{5}{2d} \Rightarrow u' = \frac{2d}{5}$

Shift of Object = u - u' = $\frac{d}{2} - \frac{2d}{5}$

$= \frac{5d-4d}{10} = \frac{d}{10}$

Q.322. A ball of diameter 10 cm is placed at a distance of 40 cm in front of a lens with a power of +5.0 D. The diameter of the image of the ball will be:
RRC Group D 19/09/2022 (Afternoon)
(a) 10 cm (b) 8 cm (c) 12 cm (d) 6 cm

Sol.322.(a) 10 cm. Power of the lens (P) = $\frac{1}{f} \Rightarrow f = \frac{1}{P} = \frac{1}{5} = 0.2m = 20cm$.

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ (where f = focal length, v = image distance, u = object distance)

$\frac{1}{20} = \frac{1}{v} - \frac{1}{-40}$

$\frac{1}{v} = \frac{1}{20} - \frac{1}{40}$

$\frac{1}{v} = \frac{2-1}{40}$

v = 40 cm.

Magnification of lens (m) = $\frac{d_i}{d_o} = \frac{v}{u}$ (where d_i = diameter of image, d_o = diameter of object)

$\frac{d_i}{d_o} = \frac{v}{u}$

$\frac{d_i}{10} = \frac{40}{-40}$

d_i = - 10 cm. (here negative sign shows that the image is inverted in nature)

Q.323. When an object is placed at a point 21 cm in front of a convex mirror, the image is formed at 7 cm behind the mirror. Now, someone moves the object to a distance of 14 cm in front of the mirror. The distance of the image from the mirror (in cm) now is:
RRC Group D 19/09/2022 (Evening)
(a) + 6 (b) + 3 (c) - 6 (d) - 3

Sol.323.(a) + 6.
Convex mirror : Given u = -21cm,
v = +7cm ;

Mirror formula $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\Rightarrow \frac{1}{f} = \frac{1}{7} + \frac{1}{-21}$

$\Rightarrow \frac{1}{7} - \frac{1}{21} \Rightarrow \frac{3-1}{21} \Rightarrow \frac{2}{21}$

New object distance (u) = -14cm

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{2}{21} = \frac{1}{v} + \frac{1}{-14}$

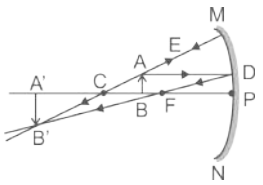
$\Rightarrow \frac{1}{v} = \frac{2}{21} + \frac{1}{14} \Rightarrow \frac{4+3}{42} = \frac{7}{42} = \frac{1}{6}$

$\Rightarrow \frac{1}{v} = \frac{1}{6}$

v = +6cm, now the image is formed at 6 cm behind the mirror.

Q.324. In order to obtain an inverted and magnified image of an object by a spherical mirror of radius of curvature 40 cm, the object should be placed:
RRC Group D 20/09/2022 (Morning)
(a) between 20 cm and 40 cm from a concave mirror
(b) at infinity from a Convex mirror
(c) between 20 cm and 40 cm from a convex mirror
(d) 20 cm from a convex mirror

Sol.324.(a)
Radius of curvature (R) = 40 cm.
$f = \frac{R}{2} = \frac{40}{2}$ = 20 cm
So, distance from the pole of the mirror = 20 cm
When an object is placed in between the center of curvature and focus, the real image is formed behind the center of curvature which is inverted and the size of the image is larger than that of the object.



From the above theorem it states, if the object is placed between the center of curvature and focus which is between 20 - 40 cm from the pole of the mirror and image is real and inverted.

Q.325. The magnification of an image is +1.5 and the object distance is 30 cm from a spherical mirror. The image is formed at_____.
RRC Group D 20/09/2022 (Afternoon)
(a) 45 cm in front of the mirror
(b) 20 cm in front of the mirror
(c) 45 cm behind the mirror
(d) 20 cm behind the mirror

Sol.325.(c) 45 cm behind the mirror.
Given, magnification of an image (m) = +1.5. Object distance (u) = - 30 cm.
magnification (m) = $\frac{-v}{u} \Rightarrow 1.5 = \frac{-v}{-30}$
$\Rightarrow 1.5 \times 30 = v \Rightarrow v = 45$cm.
Since, magnification is positive, hence the image will form 45 cm behind the mirror. Image is erect and virtual.

Q.326. A shaving mirror is constructed in such a way that a person at a distance of 30 cm from the mirror sees his image magnified 1.33 times. What will be the radius of curvature of the mirror?
RRC Group D 20/09/2022 (Afternoon)
(a) 27.5 cm (b) 28.6 cm
(c) 30.4 cm (d) 34.25cm

Sol.326.(d) 34.25 cm.
Object distance (u) = - 30 cm.
Magnification (m) = $-\frac{v}{u} \Rightarrow$ - 1.33
$= -\frac{v}{-30} \Rightarrow$ v = - 39.9cm $\backsim$ - 40 cm.
By Mirror formula,
$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \Rightarrow \frac{1}{f} = \frac{1}{-30} + \frac{1}{-40} \Rightarrow$
$\frac{1}{f} = -\frac{7}{120} \Rightarrow f = -\frac{120}{7}$ = - 17.14 cm
Radius of curvature R = 2 × f
= - 2 × 17.14 = - 34.28 $\backsim$ - 34.25 cm.

Q.327. Suppose a pin is placed in front of a concave mirror and a real image that is thrice the size of the pin is formed on a screen. The pin and the screen are then moved until the image is six times the size of the object. If the shift of the screen is 24 cm, then the shift in the object is:
RRC Group D 20/09/2022 (Evening)
(a) $\frac{7}{3}cm$ (b) $\frac{4}{3}cm$ (c) $\frac{2}{3}cm$ (d) $\frac{5}{3}cm$

Sol.327.(b) $\frac{4}{3}cm$.

Case I -
Initial magnification (m_1) = 3
$-\frac{v_1}{u_1} = 3, u_1 = -\frac{v_1}{3}$
$\frac{1}{f_1} = \frac{1}{v_1} + \frac{1}{u_1}$
$\frac{1}{f_1} = \frac{1}{v_1} - \frac{1}{\frac{v_1}{3}} \Rightarrow -\frac{2}{v_1} \Rightarrow f_1 = -\frac{v_1}{2}$

Case II -
Final magnification (m_2) = 6
$-\frac{v_2}{u_2} = 6, u_2 = -\frac{v_2}{6} \Rightarrow \frac{1}{f_2} = \frac{1}{v_2} + \frac{1}{u_2}$
$\frac{1}{f_2} = \frac{1}{v_2} - \frac{1}{\frac{v_2}{6}} \Rightarrow -\frac{5}{v_2} \Rightarrow f_2 = -\frac{v_2}{5}$
Since focal length is same, $f_1 = f_2$
$-\frac{v_1}{2} = -\frac{v_2}{5} \Rightarrow v_1 = \frac{2v_2}{5}$
shift of the screen is 24 cm
$v_2 - v_1 = 24$ cm
$v_2 - \frac{2v_2}{5} = 24 \Rightarrow \frac{3v_2}{5} = 24, v_2 = 40$ cm
$v_1 = \frac{2 \times 40}{5} \Rightarrow 16$ cm
Hence, $u_1 = \frac{-16}{3}$, $u_2 = \frac{-40}{6}$
shift in the object = $u_1 - u_2$
$= \frac{-16}{3} + \frac{40}{6} \Rightarrow \frac{4}{3}$ cm

Q.328. Suppose a dentist uses a spherical mirror which can result in an upright image that is magnified five times. Then the radius of curvature in terms of the object distance d_o is given by:
RRC Group D 20/09/2022 (Evening)
(a) $-\frac{5}{2}d_o$ (b) $+\frac{5}{4}d_o$
(c) $+\frac{5}{2}d_o$ (d) $-\frac{5}{4}d_o$

Sol.328.(a) $-\frac{5}{2}d_o$. Given, Magnification (m) = 5, object distance (u) = - d_0
$m = -\frac{v}{u} \Rightarrow 5 = -\frac{v}{-d_0} \Rightarrow v = 5d_0$
$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{5d_0} - \frac{1}{d_0} \Rightarrow -\frac{4}{5d_0}$,
$f = -\frac{5d_0}{4}$
Radius of curvature is observed to be equal to twice the focal length, for spherical mirrors ,with small apertures Hence,
$R = 2f = 2 \times (-\frac{5d_0}{4}) \Rightarrow -\frac{5d_0}{2}$

Q.329. A light ray travels from air into an optical fibre with an index of refraction of 1.45. If the angle of incidence on the end of the fibre is 22°, the angle of refraction inside the fibre is:
RRC Group D 22/09/2022 (Afternoon)
(a) 20.99° (b) 22.69° (c) 14.99° (d) 25.69°

Sol.329.(c) 14.99°. Given, index of refraction= 1.45, angle of incidence = 22°.
Refractive index = $\frac{\sin i}{\sin r}$
$\Rightarrow$ Sin r = $\frac{\sin i}{Refractive\ Index}$
(value of sin 22° = 0.3746).
$\Rightarrow$ Sin r = $\frac{0.3746}{1.45}$
$\Rightarrow$ Sin r = 0.2586 $\Rightarrow$ sin 14.99° approx.

Q.330. Suppose a beam of light of average wavelength 600 nm is incident on a glass prism from air, and on entering into the prism, it splits into different colours. One of the colours has a wavelength 380 nm. The refractive index of the medium for this particular wavelength is:
RRC Group D 22/09/2022 (Evening)
(a) 1.58 (b) 1.42 (c) 1.73 (d) 1.33

Sol.330.(a) 1.58. The refractive index of

the material of the prism is given by μ= c/v, where c is the speed of light in vacuum, and v is the speed of light in the medium (prism).
Since the velocity of a wave is a product of frequency and wavelength, we can write $c = v\lambda_a$ and $v = v\lambda_m$, where λ_a and λ_m are the wavelengths in air and medium respectively and v is the frequency of light waves.

Thus, $\mu = \frac{v\lambda a}{v\lambda m} = \lambda_a/\lambda_m$. For 380 nm wavelength, the refractive index is
μ = 600/380 = 1.578 ≈ 1.58.

Q.331. A stalactite of size 10.0 m is found in Brazil. If this stalactite is placed at a distance of 20.0 m from a concave mirror and a real image of size 30.0 m is formed, then the principal focus of the mirror is at:
RRC Group D 26/09/2022 (Morning)
(a) - 30.0 m (b) - 15.0 m
(c) + 30.0 m (d) + 15.0 m

Sol.331.(a) -30.0 m.

$m = \frac{h_i}{h_o} = \frac{-v}{u}$

$\Rightarrow \frac{30}{10} = \frac{-v}{-20} \Rightarrow v = 60$ m

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{f} = \frac{1}{60} + \frac{1}{-20}$

$\frac{1}{f} = \frac{1-3}{60} \Rightarrow f = -30$ m

Q.332. A needle of height 6 cm is placed at a distance of 20 cm in front of a lens with a power of -2.5 D. The height of the image of the needle will be:
RRC Group D 26/09/2022 (Morning)
(a) 4 cm (b) 6 cm (c) 7 cm (d) 5 cm

Sol.332.(a) 4 cm. (Concave lens).
Size of the object (h_1) = 6 cm,
Object distance (u) = – 20 cm.

Power of Lens $P = \frac{1}{f}$

$\Rightarrow -2.5 = \frac{1}{f} \Rightarrow f = -0.4$ m = - 40 cm.

By lens formula,

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$\Rightarrow \frac{1}{v} = \frac{-1}{40} + \frac{-1}{20} \Rightarrow v = -13.33$ cm.

Magnification of the image

$(m) = \frac{h_2}{h_1} = \frac{v}{u}$

Where f = focal length, u = object distance, v = image distance, h_1= object height, h_2= Image height.

$\Rightarrow h_2 = \frac{-13.33}{-20} \times 6 = 4$ cm.

Q.333. If light enters from air to some medium A having a refractive index of 1.33, then what is the speed of light in the medium A?
RRC Group D 26/09/2022 (Evening)
(a) $2.67 \times 10^8 \frac{m}{s}$ (b) $1.67 \times 10^8 \frac{m}{s}$
(c) $2.26 \times 10^8 \frac{m}{s}$ (d) $1.97 \times 10^8 \frac{m}{s}$

Sol.333.(c) $2.26 \times 10^8 \frac{m}{s}$.

$\mu = \frac{c}{v} = \frac{speed\ of\ light\ in\ air}{speed\ of\ light\ in\ medium}$

so μv = c

so $v = \frac{c}{\mu} = \frac{3 \times 10^8\ m/s}{1.33}$

$= 2.26 \times 10^8 \frac{m}{s}$.

Q.334. A light ray is travelling from air medium to water medium (refractive index = 1.3) such that angle of incidence is x degree and angle of refraction is y degree. The value of ratio (sin y)/(sin x) is:
RRC Group D 26/09/2022 (Evening)
(a) 0.3 (b) $\frac{1}{1.3}$ (c) 1.3 (d) 1

Sol.334.(b) $\frac{1}{1.3}$ Refractive index = $\frac{\sin i}{\sin r}$

$1.3 = \frac{\sin i}{\sin r} = \frac{\sin x}{\sin y}$

(because i = x and y = r)

$\Rightarrow \frac{\sin y}{\sin x} = \frac{1}{1.3}$

Q.335. A coin of diameter 10 cm is placed at a distance 3.5f from the pole of a concave mirror of focal length f. The linear magnification and the diameter of the image are:
RRC Group D 27/09/2022 (Morning)
(a) $\frac{2}{5}$ and 4cm, respectively
(b) $\frac{1}{5}$ and 2 cm, respectively
(c) $\frac{3}{5}$ and 5cm, respectively
(d) $\frac{4}{8}$ and 8cm, respectively

Sol.335.(a) $\frac{2}{5}$ and 4cm,respectively.

Given, height of the object (h) = 10 cm, height of the image (h') = ?, distance of the image (v) = ?, distance of the object (u) = -3.5f, focal length (f) = -f .

Magnification (m) = $-\frac{v}{u} = \frac{h'}{h}$ and mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$,

On applying mirror formula,

$= \frac{1}{-f} = \frac{1}{v} + \frac{1}{-3.5f}$,

$\Rightarrow \frac{1}{v} = \frac{1}{-f} + \frac{1}{3.5f}$, $\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{2}{7f}$

$\Rightarrow \frac{1}{v} = -\frac{5}{7f}$, $\Rightarrow v = -\frac{7f}{5}$,

$\Rightarrow -\frac{-7f/5}{-3.5f} = \frac{h'}{10}$

⇒ h' = - 4 cm (negative sign indicates image is inverted).

Magnification (m) = $\frac{h'}{h}$

$\Rightarrow m = \frac{-4}{10}$

$\Rightarrow m = \frac{-2}{5}$ (negative sign shows the mirror is concave).

Q.336 Refractive index of flint glass is 1.56. Then the critical angle(I_c) for glass air interface can also be expressed as Sin I_c equals:
RRC Group D 27/09/2022 (Afternoon)
(a) 0.64 (b) 0.94 (c) 0.74 (d) 0.84

Sol.336.(a) 0.64.

Critical angle = $\frac{1}{refractive\ index}$

$= \frac{1}{1.56} = 0.64$

The ratio between the speed of light in vacuum to speed of light in a medium is the refractive index (μ or n).

Q.337. An ice-ball of 6 cm diameter is placed 30 cm in front of a concave mirror and its principal focus is double the distance of the object. Following the new Cartesian sign convention, the diameter of the image is:
RRC Group D 27/09/2022 (Afternoon)
(a) 14 cm (b) 12 cm (c) 16 cm (d) 10 cm

Sol.337.(b) 12 cm. Given, f (Focal length)= - 60cm. , v (Image distance) = ? , u(Object distance) = - 30cm.

Mirror Formula → $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\Rightarrow \frac{1}{-60} = \frac{1}{v} + \frac{1}{-30}$ (Given, f = 2u)

$\Rightarrow \frac{1}{v} = \frac{1}{60} \Rightarrow v = 60$ cm,

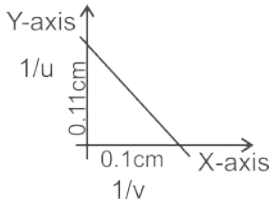
$\frac{h_i}{h_0} = \frac{-v}{u} \Rightarrow \frac{h_i}{6} = \frac{-60}{-30}$

$\Rightarrow h_i = 12$ cm, where h_i = height of image (diameter of image) and h_o = height of object (diameter of object).

Q.338. Suppose Ram has placed a ball in front of a concave mirror of focal length (f) at various distances (u) and he has measured the corresponding image distances (v). From the values of u and v. Ram is able to plot a graph of 1/v against I/u. From the graph, Ram has observed that x intercept and y intercept are 0.1

cm and 0.11 cm, respectively. Then the focal length of the mirror is:
RRC Group D 27/09/2022 (Evening)
(a) 12.65 cm (b) 8.5 cm
(c) 9.09 cm (d) 11.25 cm

Sol.338.(c) 9.09 cm. Based on Ram's observations, we can use the mirror formula to calculate the focal length of the concave mirror. The mirror formula is: $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ (where f = focal length of the mirror, u = object distance, and v =image distance)
We know that the graph Ram plotted is of $\frac{1}{v}$ against $\frac{1}{u}$,
Rearranging the above equation, we get $\frac{1}{v} = -\frac{1}{u} + \frac{1}{f}$,
comparing it with y = mx + c



m = - 1 and c = $\frac{1}{f}$ = 0.11 (given)
f = 9.09 cm.

Q.339. In the Leviathan telescope in Ireland, a concave mirror of focal length 3.0 m is used. If an image of height 80 cm is formed at a distance of 4.0 m, then the object height, object distance and magnification are (the object is placed in front of the mirror):
RRC Group D 27/09/2022 (Evening)
(a) 2.4 m, 12 m and $\frac{1}{3}$ respectively
(b) 2.4 m, 6 m and $\frac{1}{3}$ respectively
(c) 1.2 m, 12 m and $\frac{1}{3}$ respectively
(d) 2.4 m, 12 m and $\frac{1}{2}$ respectively

Sol.339.(a) 2.4 m, 12 m and $\frac{1}{3}$ respectively.
Given that, Focal length = - 3m, Image distance V_i = - 4m, let Object distance V_o = U
Mirror Formula, $\frac{1}{F} = \frac{1}{Vi} + \frac{1}{Vo}$
$\Rightarrow \frac{1}{-3} = \frac{1}{-4} + \frac{1}{U}$
$\Rightarrow \frac{1}{U} = -\frac{1}{12}$ = u = - 12m.
Magnification (m) = $\frac{-V}{U} = -\frac{-4}{-12} = \frac{-1}{3}$
Object Height = $\frac{hi}{ho} = -\frac{Vi}{Vo}$
$\Rightarrow -\frac{0.8}{ho} = -\frac{-4}{-12} \Rightarrow h_o$ = 2.4 m.

Q.340. A concave mirror forms a real image of three times the size of an object on a screen. The object and screen are then moved until the image is six times the size of the object. If the shift of the screen is 39 cm, then the focal length of the mirror is:
RRC Group D 28/09/2022 (Morning)
(a) 26 cm (b) 10 cm (c) 13 cm (d) 39 cm

Sol.340.(c) 13 cm. Given, magnification is 3 times the size of the object, m = $\frac{v}{u}$
Mirror formula $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$, multiplying both side with v,
$\frac{v}{f} = \frac{v}{u} + 1 = \frac{v}{u} = \frac{v}{f} - 1$
= m = $\frac{v}{f} - 1 \Rightarrow 3 = \frac{v}{f} - 1$
= 4f = v -----(1)
When the screen is shifted 39 cm ,
$v_1 = v + 39$, $m_1 = 6$
= $m_1 = \frac{v_1}{f} - 1 \Rightarrow 6 = \frac{v+39}{f} - 1$
7f = v + 39 -----(2)
Equating 1 and 2
7f = 4f + 39 $\Rightarrow$ 3f = 39 $\Rightarrow$ f = 13 cm

Q.341. A ray of light is traveling from medium A to medium B. The incident ray makes an angle 75° with respect to the normal, and the refracted ray makes an angle 40° with respect to the normal. The refractive index of the medium A relative to the medium B is:
RRC Group D 28/09/2022 (Morning)
(a) 0.67 (b) 1.34 (c) 1.50 (d) 0.87

Sol.341.(a) 0.67. Refractive Index
= $\frac{sin\, r}{sin\, i}$ (From medium A to B)
Refractive index = $\frac{sin\, 40}{sin\, 75}$ = 0.67.

Q.342. If a coin is placed at the bottom of a tumbler of height 30 cm filled with water of refractive index 1.33, then the apparent depth of the coin appears to be:
RRC Group D 28/09/2022 (Evening)
(a) 39.9 cm (b) 25.7 cm
(c) 36.7 cm (d) 22.6 cm

Sol.342.(d) 22.6 cm. Given, real depth = 30 cm, apparent depth = ? and n = 1.33 .
Refractive index (n) = $\frac{real\ depth}{apparent\ depth}$,
$\Rightarrow$ 1.33 = $\frac{30}{apparent\ depth}$,
$\Rightarrow$ apparent depth = $\frac{30}{1.33}$, $\Rightarrow$ 22.6 cm.

Q.343. A doublet is a combination of two lenses. One such doublet is made with a convex lens of focal length of 20 cm and a concave lens of focal length of 50 cm. The effective focal length and power of this doublet is _____and_____ respectively.
RRC Group D 29/09/2022 (Morning)
(a) 50 cm, 2D (b) 33.3 cm, 3D
(c) 14.28 cm, 7D (d) 20 cm, 5D

Sol.343.(b) 33.3 cm, 3D.
$\frac{1}{F} = \frac{1}{f1} + \frac{1}{f2} \Rightarrow \frac{1}{F} = \frac{1}{20} + (-\frac{1}{50})$
= $\frac{5-2}{100} = \frac{3}{100}$ cm = 0.03 cm.
So, $F_{effective} = \frac{1}{0.03} = \frac{100}{3}$ cm = 33.3cm
f_1 = 20cm = 0.2 m, f_2 = 50cm = 0.5 m
$P_1 = \frac{1}{f1} = \frac{1}{0.2}$ = 5,
$P_2 = \frac{1}{f2} = -\frac{1}{0.5}$ = -2
$P_1 + P_2$ = 5 + (-2) = 3D. Hence, the focal length and power are 33.3cm and 3D.

Q.344. A ray of light in air is incident at an angle of 60° on the surface separating air from a medium of refractive index $\sqrt{(3/2)}$ The ray is refracted in the medium at an angle of_____.
RRC Group D 29/09/2022 (Afternoon)
(a) 45° (b) 15° (c) 60° (d) 30°

Sol.344.(a) 45°. Given, the angle of incidence (i) = 60° , and angle of refraction (r) = ?, refractive index of the material (n) = $\sqrt{\frac{3}{2}}$
On applying snell's law,
$n = \frac{sin\, i}{sin\, r} \Rightarrow \sqrt{\frac{3}{2}} = \frac{sin\, 60°}{sin\, r}$
($\because$ sin 60° = $\frac{\sqrt{3}}{2}$)
$\Rightarrow \sqrt{\frac{3}{2}} = \frac{\sqrt{3}}{2\, .\, sin\, r}$
$\Rightarrow$ sin r = $\frac{1}{\sqrt{2}}$, ($\because$ sin 45° = $\frac{1}{\sqrt{2}}$)
So, sin r = sin 45°
on comparing both side, r = 45°

Q.345. A coin of diameter 4 cm is placed at a distance of 45 cm in front of a convex lens of focal length 30 cm. Then the diameter of the image of the coin will be:
RRC Group D 29/09/2022 (Evening)
(a) 10 cm (b) 8 cm (c) 6 cm (d) 12 cm

Sol.345.(b) 8 cm. Given, Height of object (h_o) = 4cm, Object distance (u) = - 45 cm, focal length (f) = 30 cm.
Formula used, Lens formula,

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \frac{1}{30} = \frac{1}{v} - \frac{1}{-45} \Rightarrow$ v = 90 cm

Magnification formula (m) = $\frac{v}{u} = \frac{h2}{h1}$

m = $\frac{90}{-45} = \frac{h_i}{h_o} = \frac{h_i}{4}$

Height of image (h_i) = - 8 cm (negative sign shows that the image is real and inverted)

Q.346. Suppose a satellite is 10^2 km above the ground and it is used to take high resolution images of objects. If a concave mirror is used to form a primary image of an object of size 1.0 m and if the image size is 5 μm and it is inverted, then the principal focus of the concave mirror should be:
RRC Group D 30/09/2022 (Afternoon)
(a) +1.0 m (b) +0.50 m
(c) −1.0 m (d) −0.5 m

Sol.346.(d) -0.5 m.
Given, u= -10^2 km or -10^5 m, h_i = 5 μm or 5 × 10^{-6} m, h_o = 1m

Magnification, m = $\frac{hi}{ho} = \frac{-v}{u}$

$\Rightarrow \frac{-v}{-10^5} = \frac{-5 \times 10^{-6}}{1}$

$\Rightarrow v = \frac{-5 \times 10^{-6} \times 10^5}{1} = \frac{-5 \times 10^{-1}}{1}$

$= -0.5\ m$

Here, Object distance > Image distance, we can say that the object was at infinity with respect to image. So, in such cases the image will form on focus. So, focal length = image distance = - 0.5 m.

Q.347. The refractive index of a diamond is 2.42. Then the speed of light in the diamond is:
RRC Group D 06/10/2022 (Evening)
(a) 2.48 × 10^8 m/s (b) 1.24 × 10^8 m/s
(c) 3 × 10^8 m/s (d) 1.72 × 10^8 m/s

Sol.347.(b) 1.24 × 10^8 m/s. We know that refractive index (n) = $\frac{c}{v}$ = (speed of light in vaccum)/(speed of light in diamond)

$\Rightarrow 2.42 = \frac{(3 \times 10^8)}{v}$

$\Rightarrow$ v = 1.24 × 10^8 m/s.

Q.348. Suppose Raghu has kept an object in front of a concave mirror of focal length (f) at various distances (u) and he has measured the corresponding image distances (v). From such an experiment, Raghu is able to plot a graph of u against 1/magnification, i.e. u vs. 1/m. Which of the following options is true?
RRC Group D 06/10/2022 (Evening)
(a) It is a straight line with slope +f, and x intercept +1 and y intercept −f
(b) It is a straight line with slope −1/f, and x intercept +1 and y intercept −f
(c) It is a straight line with slope 1/f, and x intercept −1 and y intercept +f
(d) It is a straight line with slope +f, and x intercept −1 and y intercept +f

Sol.348.(d) In a concave mirror, when the distance of the object is less than the focal length, the magnification will be greater than one. When we place the object on the centre of curvature, magnification will be 1. When we move away from the mirror, magnification will be less than 1.

Q.349. Ram has a corrective lens of power − 6.5 D. The focal length of the lens is:
RRC Group D 07/10/2022 (Evening)
(a) −13.76 cm (b) 15.38 cm
(c) +13.76 cm (d) −15.38 cm

Sol.349.(d) -15.38 cm. The power of a lens is defined as the reciprocal of its focal length in meters.

Since P = $\frac{1}{f} \Rightarrow$ f = $\frac{1}{D} = \frac{1}{-6.5}$

= - 0.1538 meters

= -0.1538 × 100 = - 15.38 cm.

Q.350. If a lens has a focal length of 25 cm, what will be the power of that lens?
RRB NTPC CBT - I (10/02/2021) Evening
(a) 4D (b) 2D (c) 1D (d) 6D

Sol.350.(a) 4D. Power of lens (Dioptre)

D = $\frac{1}{Focal\ length(f)}$

F = 25 cm = 0.25m

D = $\frac{1}{0.25m}$ = 4D

Q.351. A concave mirror produces 3 times magnified real image of an object placed at 5 cm in front of it. At what distance from the front of the mirror is the image located?
RRB JE 23/05/2019 (Afternoon)
(a) 5 cm (b) 20 cm (c) 15 cm (d) 10 cm

Sol.351.(c) 15 cm. According to mirror magnification formula, m = $\frac{-v}{u} = \frac{h_i}{h_o}$

Given u = - 5 (-ve sign = image produced is real) , h_i = 3 h_o

Now, $\frac{-v}{u} = \frac{3h_o}{h_o} \Rightarrow -v = 3u$

$\Rightarrow$ v = -3 × -5 = 15 cm.

Q.352. A concave lens has a focal length 15 cm. If the object is placed at 30 cm from the lens, what is the image distance?
RRB JE 24/05/2019 (Afternoon)
(a) -15 cm (b) -10 cm
(c) -18 cm (d) -20 cm

Sol.352.(b) - 10 cm. Given, focal length (f) = - 15 cm (focal length of concave lens always negative),
object distance (u) = - 30 cm
By lens formula,

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$-\frac{1}{15} = \frac{1}{v} - \frac{1}{-30}$

$-\frac{1}{15} - \frac{1}{30} = \frac{1}{v}$

$\frac{1}{v} = -\frac{3}{30}$

Hence, image distance (v) = - 10 cm.

Q.353. If the radius of curvature of a concave mirror is 6.2 cm, its focal length is _____ cm.
RRB Group D 18/09/2018 (Afternoon)
(a) 12.4 (b) 3.1 (c) 2.6 (d) 6

Sol.353.(b) 3.1 cm.
Given, R = 6.2 cm.

∵ Focal length, f = $\frac{R}{2}$ where, R is the radius of curvature.

∴ f = $\frac{6.2}{2}$ = 3.1 cm.

Q.354. If an object is placed 10 cm away from a convex mirror of radius of curvature 5 cm, what will be its magnification?
RRB Group D 18/09/2018 (Evening)
(a) 0.05 (b) 0.2 (c) 0.1 (d) 2

Sol.354.(b) 0.2.
Given, u = - 10 cm

We know that, f = $\frac{R}{2} = \frac{5}{2}$ = 2.5 cm.

Using mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{5}$

$= \frac{1}{v} + \frac{1}{(-10)} \Rightarrow$ v = 2 cm

Magnification, m = - $\frac{v}{u} = -\frac{2}{-10}$ = 0.2.

Q.355. The speed of light in a medium of refractive index 1.5 is _____ .
RRB Group D 20/09/2018 (Evening)
(a) 1.2 × 10^8 m / s (b) 1.5 × 10^8 m / s
(c) 3.0 × 10^8 m / s (d) 2.0 × 10^8 m / s

Sol.355.(d) 2.0 × 10^8 m/s.
Refractive Index (n)

$= \frac{Velocity\ of\ Light\ in\ a\ vacuum\ (C)}{Velocity\ of\ light\ in\ a\ Medium\ (v)}$

Velocity of Light in Vacuum, c
$= 3 \times 10^8$ m/s.
According to question, 1.5

$= \frac{3 \times 10^8\ m/s}{Speed\ of\ light\ in\ a\ medium}$

⇒ Speed of light in a medium

$= \frac{3 \times 10^8\ m/s}{1.5} = 2.0 \times 10^8$ m/s.

Q.356. The focal length of a concave mirror with a radius of curvature of 20.0 cm is:
RRB ALP Tier - I (09/08/2018) Afternoon
(a) 5cm (b) 15cm (c) 10cm (d) 20cm

Sol.356.(c) 10 cm. The radius of curvature is twice the focal length. In other words, focal length is half of the radius of curvature.
Focal length

(f) $= \frac{Radius\ of\ curvature\ (R)}{2}$.

Given that R = 20 cm so, f $= \frac{20}{2} = 10$ cm.

Q.357. An incident ray strikes a plane mirror at an angle of 20° with the mirror. The angle between the incident ray and reflected ray is _____.
RRB ALP Tier - I (13/08/2018) Afternoon
(a) 20° (b) 50° (c) 140° (d) 40°

Sol.357.(c) 140°. The law of reflection: The incident ray, reflected ray and normal ray to the mirror, all lie on the same plane. The angle of incidence and angle of reflection are equal. An incident ray strikes a plane mirror at an angle of 20° with the mirror. Therefore, it will make an angle (90° - 20° = 70° with the normal. Angle of incidence = Angle of reflection = 70°
Therefore, the angle between the incident ray and the reflected ray = 70°+ 70°
= 140°

Q.358. A lens has a power + 2.0D. The type of lens and its focal length will be_____.
RRB ALP Tier - I (14/08/2018) Evening
(a) concave, -0.5 m (b) convex, -0.5 m
(c) convex, 0.5 m (d) concave, 0.5 m

Sol.358.(c) Convex, 0.5 m. Given, lens of power P = (2.0) D.

Power (P) $= \frac{1}{f}$, f $= \frac{1}{P} = \frac{1}{2}$,

F = 0.5 m. (focal length is positive, it is a convex lens)
The SI unit of power of a lens is dioptre (D).

Q.359. An object is placed at a distance of 20 cm from a convex lens of focal length 10 cm. The image is formed at a distance of:
RRB ALP Tier - I (29/08/2018) Morning
(a) 5 cm (b) 20 cm (c) 10 cm (d) 15 cm

Sol.359.(b) 20 cm.

lens Formula ⇒ $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

where 'u' = object distance and
'v' = image distance and
focal length = 'f'.
Given,
f = 10cm , u = - 20cm

$\frac{1}{10} = \frac{1}{v} - \frac{1}{-20} \Rightarrow \frac{1}{10} - \frac{1}{20} = \frac{1}{v}$

$\Rightarrow \frac{2-1}{20} = \frac{1}{v}$ ⇒ v = 20 cm.

Q.360. A convex lens has a focal length of 50 cm. Calculate its power.
RRB ALP Tier - I (29/08/2018) Afternoon
(a) 4 D (b) 1 D (c) 2 D (d) 3 D

Sol.360.(c) 2D.
Given: Length = 50 Cm ⇒ 0.5 m

P $= \frac{1}{f\ (in\ m)}$ ⇒ P $= \frac{1}{0.5}$

⇒ P $= \frac{10}{5}$ ⇒ P = 2D

Q.361. An object is placed 30 cm before a concave mirror of focal length of 20 cm to get a real image. What will be the distance of the image from the mirror?
RRB ALP Tier - I (30/08/2018) Evening
(a) 60 cm (b) 30 cm (c) 20 cm (d) 40 cm

Sol.361.(a) 60 cm. Given,
focal length, f = −20 cm
image distance, u = −30 cm
object distance, v = ?
Using mirror formula :- $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\frac{1}{(-20)} = \frac{1}{v} + \frac{1}{(-30)}$

$\Rightarrow \frac{1}{-20} = \frac{1}{v} - \frac{1}{30} \Rightarrow \frac{1}{v} = \frac{1}{-20} + \frac{1}{30}$

$\Rightarrow \frac{1}{v} = \frac{-3+2}{60} \Rightarrow \frac{1}{v} = \frac{-1}{60} \Rightarrow$ v = - 60
So, the image is produced 60 cm in front of the mirror.

Q.362. An object of 1.2 cm height is placed 30 cm before a concave mirror of focal length of 20 cm to get a real image at a distance of 60 cm from the mirror. What is the height of the image formed?
RRB ALP Tier - I (31/08/2018) Morning
(a) − 3.6 cm (b) − 2.4 cm
(c) 1.2 cm (d) 2.4 cm

Sol.362.(b) − 2.4 cm. Given that, Height of Object (h_o) = 1.2 cm, Height of image (h_i) = ?,
Object distance (u)= - 30 cm, Image distance (v) = - 60 cm,
Focal length (f) = - 20cm.

We know that magnification = $\frac{-v}{u} = \frac{h_i}{h_o}$

By putting the value of the formula,

$\Rightarrow \frac{-(-60)}{-30} = \frac{h_i}{1.2}$

$\Rightarrow h_i$ = - 2.4 cm (inverted image).

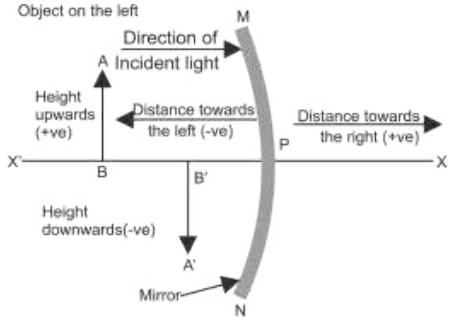
Image formation by a concave mirror for different positions of the object :-

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F	Highly diminished point-sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

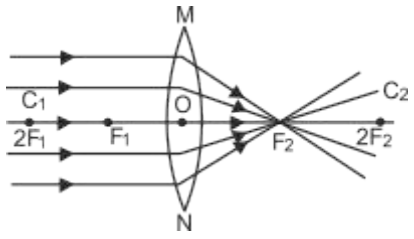
Nature, position and relative size of the image formed by a convex mirror :-

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At the focus F, behind the mirror	Highly diminished, point-sized	Virtual and erect
Between infinity and the pole P of the mirror	Between P and F, behind the mirror	Diminished	Virtual and erect

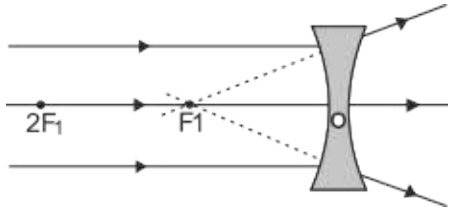
The New Cartesian Sign Convention for spherical mirrors :-



Converging action of a convex lens :-



Diverging action of a concave lens :-



Nature, position and relative size of the image formed by a convex lens for various positions of the object :-

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_2	Highly diminished, point-size	Real and inverted
Beyond 2 F_1	Between F_2 and $2F_2$	Diminished	Real and inverted
At $2F_1$	At $2F_2$	Same size	Real and inverted
Between F_1 and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted
At focus F_1	At infinity	Infinitely large or highly enlarged	Real and inverted
Between focus F_1 and optical centre O	On the same side of the lens as the object	Enlarged	Virtual and erect

Nature, position and relative size of the image formed by a concave lens for various positions of the object :-

Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_1	Highly diminished, point-sized	Virtual and erect
Between infinity and optical centre O of the lens	Between focus F_1 and optical centre O	Diminished	Virtual and erect

Heat and Thermodynamics

Q.363. An electrical device that works on the principle of Joule's Law of Heating is:
RRC Group D 13/09/2022 (Morning)
(a) Immersion rod (b) Speaker
(c) Electromagnet (d) Electrical bell

Sol.363.(a) Immersion rod. Joule's Law of Heating - The rate at which resistance in a circuit converts electrical energy into heat energy. The joule's first law shows the relationship between heat produced by flowing electric current through a conductor. $H = I^2RT$. Electromagnet is a device consisting of a core of magnetic material surrounded by a coil through which an electric current is passed to magnetize the core. The electric bell is a simple circuit that triggers a sound on the completion of the circuit by pressing the button.

Q.364. What is the melting point of the tungsten filament used in bulbs?
RRB NTPC CBT - I (01/03/2021) Evening
(a) 300° C (b) 3422° C
(c) 30° C (d) 1000° C

Sol.364.(b) 3422 °C. Tungsten (or, Wolfram) has the highest melting point. Thus tungsten filament does not melt even when a large amount of heat is produced due to passage of current through the filament. It is exceptionally strong, and brittle in nature. It has the greatest high-temperature strength, and lowest thermal expansion coefficient of any metal.

Q.365. Which electric device is NOT based on Joule's law of heating?
RRB NTPC CBT - I (06/04/2021) Morning
(a) Fuse used in an electric circuit
(b) Electric iron
(c) Electric kettle
(d) Electric plugs and switches

Sol.365.(d) Electric plugs and switches. Joule's law of heating - When an electric current is passed through a high resistance wire, like nichrome wire, the resistance wire becomes very hot and produces heat. Applications - fuse used in an electric circuit, Electric iron, Electric kettle.

Q.366. A power plant where the heat required to make steam to drive turbines to make electricity is obtained by burning fuels is called-
RRB JE 23/05/2019 (Morning)
(a) Solar power plant
(b) Hydro electric power plant
(c) Nuclear power plant

(d) Thermal power plant

Sol.366.(d) Thermal power plant. Nuclear power plants produce electricity from the heat created when atoms of nuclear elements are split within a nuclear reactor. This process is called nuclear fission. Hydro electric power is a renewable source of energy that generates power by using a dam or diversion structure to alter the natural flow of a river or other body of water. Solar power plant is a facility that converts solar radiation, made up of light, heat into electricity.

Q.367. What is the minimum temperature to which a fuel must be heated so that it may catch fire and start burning ?
RRB JE 25/05/2019 (Evening)
(a) Ignition temperature
(b) Neutral temperature
(c) Boiling temperature
(d) Normal temperature

Sol.367.(a) Ignition temperature. The normal boiling point is the temperature at which the vapor pressure is equal to the standard sea-level atmospheric pressure. At sea level, water boils at 100° C (212° F). The average normal body temperature is generally accepted as 98.6°F (37°C).

Q.368. Among the following, identify the substance which has the highest specific heat capacity.
RRB ALP Tier - II (21/01/2019) Morning
(a) snow (b) aluminum
(c) water (d) Kerosene

Sol.368.(c) water (H_2O). Specific Heat - It is the quantity of heat required to raise the temperature of one gram of a substance by one Celsius degree. Specific Heat of water - 4.186 joule/gram °C. Aluminum (Al), atomic number 13 - . Aluminum has a density lower than those of other common metals about one-third that of steel. Kerosine - It is also called paraffin or paraffin oil, a flammable hydrocarbon liquid commonly used as fuel.

Q.369. To change a temperature from the Kelvin scale to the Celsius scale, you have to :
RRB Group D 19/09/2018 (Afternoon)
(a) divide the the given temperature by 273
(b) subtract 273 form the given temperature
(c) multiply the given temperature by 273
(d) add 273 to the given temperature

Sol.369.(b) Subtract 273 from the given temperature. Formula (For converting Kelvin to Celsius), C = K - 273. Temperature Scales: Thermometers measure temperature according to well-defined scales of measurement. The three most common temperature scales are the Fahrenheit, Celsius, and Kelvin scales. Kelvin is the SI unit of temperature. The Celsius scale has a freezing point of water at 0ºC and the boiling point of water at 100ºC. On the Fahrenheit scale, the freezing point of water is at 32ºF and the boiling point is at 212ºF.

Q.370. During the melting of solid, its temperature
RRB Group D 22/09/2018 (Afternoon)
(a) Decreases
(b) increases
(c) May increase or decrease depending on the nature of solid
(d) Does not change

Sol.370.(d) Does not change. Latent heat of Fusion is the amount of heat energy required to change a unit mass of a substance from solid to liquid state at its melting point without changing its temperature. The SI unit of latent heat of fusion is joules per kilogram (J/kg).

Q.371. The heat produced by current in wire during time t is determined by _____.
RRB Group D 23/09/2018 (Afternoon)
(a) $H = I^2 R$ (b) $H = IRt$
(c) $H = I^2t$ (d) $H = I^2Rt$

Sol.371.(d) $H = I^2Rt$ (Joule's Equation) where H is heat produced, I is current flow, R is resistance and t is time**.** Heating effect of Current - When an electric current is passed through a conductor, it generates heat due to the hindrance caused by the conductor to the flowing current. SI Unit of Heat - joules. Applications - Electric iron, Kettle, Toaster, Heater, Electric fuse.

Q.372. The _____ is not based on practical applications of the thermal effect of electric current.
RRB Group D 24/09/2018 (Afternoon)
(a) electric toaster (b) Electric bell
(c) Electric flat iron (d) Electric kettle

Sol.372.(b) Electric bell : It is based on the principle of magnetic effect of current. Applications of thermal effect of electric current : Electric iron, electric toaster, electric oven, electric heater, electric bulb, electric fuse, etc.

Q.373. Why do particles in liquid water at 0°C have more energy than particles in ice at the same temperature?
RRB Group D 16/10/2018 (Afternoon)
(a) Because the particles in water absorb heat energy during the process of transformation from ice to liquid water.
(b) Because water particles absorb heat energy during the process of conversion from ice to water vapor.
(c) Because water particles radiate heat energy during the process of transformation from ice to liquid water.
(d) Because ice particles absorb heat energy during the process of transformation from ice to liquid water.

Sol.373.(d) When ice melts to become water, the process is known as fusion. During fusion, the ice absorbs heat energy from its surroundings without a change in temperature. This absorbed energy is used to break the bonds holding the ice crystals together, which increases the potential energy of the water molecules. Therefore, particles in liquid water at 0°C have more energy than particles in ice at the same temperature.

Q.374. According to Joule's law of heat, the heat generated in a circuit depends on some factors. Which of the following can be blamed in this?
RRB Group D 1/11/2018 (Afternoon)
(a) Current flowing in the circuit
(b) Current, resistance of the conductor and time period for current to flow in it.
(c) resistance of the conductor
(d) Current and time period of flow of current

Sol.374.(b) According to Joule's law of heating, the heat produced in the wire is directly proportional to the square of the current, resistance of the wire, and time for which the current flows through the circuit. So, $H = I^2RT$.

Numericals :-

Q.375. The 37° C temperature is equal to nearly:
RRB NTPC CBT - II (13/06/2022) Shift 1
(a) 99.4°F (b) 98.6°F
(c) 97.4°F (d) 100.4°F

Sol.375.(b) 98.6° F. Relation between celsius (°C) and Fahrenheit (°F) : °C
$= (°F - 32) \times \frac{5}{9}$

$37 = (F° - 32) \times \frac{5}{9}$

$37 \times \frac{9}{5} = (F° - 32)$

$66.6 + 32 = F° \Rightarrow 98.6° = F°$

Q.376. $-273.15°C$ temperature is equal to:
RRB NTPC CBT - I (15/03/2021) Evening
(a) 173 K (b) 23 K (c) 100 K (d) 0 K

Sol.376.(d) 0 K. The kelvin (symbol: K) is the base unit of thermodynamic temperature in the International System of Units (SI). To convert from Celsius to Kelvin, we use the formula: K = C + 273.15. In this case, we are given that the temperature is -273.15°C. Putting this into the formula, we get: K = -273.15 + 273.15 ⇒ K = 0

Q.377. - 200° Celsius = _____ Fahrenheit
RRB ALP Tier - II (21/01/2019) Afternoon
(a) 73° (b) -328° (c) -392° (d) -73°

Sol.377.(b) - 328°. Given, C = − 200°C
Formula to convert Celsius into Fahrenheit,

$F = \frac{9}{5} C + 32 \Rightarrow \frac{9}{5} \times (-200) + 32$

$(-360) + 32 = (-328°) F.$

Q.378. Select the most appropriate option.
0°C = _____ F.
RRB Group D 23/09/2018 (Morning)
(a) 180 (b) 273 (c) 32 (d) 23

Sol.378.(c) 32.

∵ F = $\frac{9}{5}$ °C + 32. Given that the temperature is 0°C so, F = $\frac{9}{5}$ (0) + 32

⇒ F = 32.

Q.379. The value of 100°C on the Kelvin scale is-
RRB Group D 27/09/2018 (Afternoon)
(a) - 373 K (b) 273 K (c) 373 K (d) 73 K

Sol.379.(c) 373 K. The temperature in Kelvin (K) is equal to the temperature in degrees celsius (ºC) plus 273.15. The Celsius scale is a temperature scale introduced by Anders Celsius. The Kelvin scale is a temperature scale introduced by Lord Kelvin in 1848. 0°C celsius is also equal to 32 fahrenheit.

Q.380. What is the standard room temperature in Kelvin?
RRB ALP Tier - I (21/08/2018) Evening
(a) 198K (b) 293K (c) 373 K (d) 273 K

Sol.380.(b) 293K. The Standard room temperature in Celsius is 27°. Conversion from Celsius to Kelvin : K = 273.15 + C.
Conversion from Fahrenheit to Celsius : $\frac{(F-32) \times 5}{9}$ = C.

Fluid Mechanics

Q.381. Which branch of physics deals with properties of fluids at rest?
RRB NTPC CBT - I (04/01/2021) Morning
(a) Optics (b) Thermodynamics
(c) Hydrostatics (d) Astrophysics

Sol.381.(c) Hydrostatics: Particularly with the pressure in a fluid or exerted by a fluid (gas or liquid) on an immersed body. Optics: The branch of physics that studies the behavior and properties of light. Thermodynamics: The branch of physics that deals with the relationships between heat and other forms of energy. Astrophysics: The branch of physics that deals with the physical properties of celestial objects.

Q.382. Kerosene oil rises up in a wick of lantern because of:
RRB NTPC CBT - I (11/01/2021) Morning
(a) Osmosis (b) Capillarity
(c) Diffusion (d) Gravitation

Sol.382.(b) Capillarity -
The phenomenon of liquids rising or being drawn into narrow spaces or tubes against the force of gravity. **Diffusion**: The movement of molecules from an area of higher concentration to an area of lower concentration. Example - A tea bag immersed in a cup of hot water will diffuse into the water and change its colour. **Osmosis**: The movement of solvent molecules (usually water) through a semipermeable membrane from a region of lower solute concentration to higher solute concentration. Example - absorption of water from the soil.

Q.383. Which of the following is NOT based on the Archimedes' Principle?
RRB NTPC CBT - I (06/04/2021) Morning
(a) Designing of airplane wings
(b) Designing of ships and submarines
(c) Hydrometers
(d) Lactometers

Sol.383.(a) Designing of airplane wings. Archimedes' Principle - It states that an object immersed in a fluid experiences an upward buoyant force equal to the weight of the fluid it displaces. Applications - Used in designing ships and submarines, Used in lactometers to determine the purity of milk, Used in hydrometers to determine density of fluids.

Q.384. The friction in liquids is called:
RRB NTPC CBT - I (08/04/2021) Evening
(a) Morbidity (b) Viscosity
(c) Rancidity (d) Rigidity

Sol.384.(b) Viscosity: Measure of a fluid's resistance to flow**.** SI unit of viscosity is N-s/m^2 or pascal-second (Pa - s). Example - Honey, Molasses, Melted chocolate. Rigidity - The inability of a solid to change its shape. Example - Table, chair, fan.

Q.385. Why does a cork float in water while an iron nail sinks?
RRB JE 30/05/2019 (Morning)
(a) Due to the difference in their densities
(b) Due to the cork's floating capacity
(c) Due to the difference in their forms
(d) Due to the same force acting on both

Sol.385.(a) Due to the difference in their densities. Cork has a lower density than water and iron nail has more density than water. Density - The amount of matter present per unit volume, measured in Kg m^{-3}. Density = Mass / Volume. A substance having lower density than a liquid will float on it and a substance having higher density than a liquid will sink in it.

Q.386. Lactometers, which are used to determine the purity of sample of milk, works on which principle ?
RRB JE 30/05/2019 (Afternoon)
(a) Principle of scalar chain
(b) Archimedes principle
(c) Principle of periscope
(d) Principle of potentiometer

Sol.386.(b) Archimedes principle. Hydrometer (used to determine the density of liquids). It is also based on the Archimedes principle. The hydrometer basically consists of a weighted, sealed, long-necked glass bulb immersed in the measured liquid; the flotation depth shows the liquid density, and the neck can be calibrated to read the actual gravity value. **Principle of periscope -** It is based on the Laws of Reflection which states that the light from the object falls on a mirror. Principle of potentiometer - The potential difference between any two points of the potentiometer wire is directly proportional to the length of wire.

Q.387. Buoyant force's _____ depends on the density and volume of the fluid.
RRB JE 31/05/2019 (Afternoon)
(a) Energy (b) Direction
(c) Magnitude (d) Power

Sol.387.(c) Magnitude. Buoyancy (buoyant force) is an upward force exerted by a fluid on an immersed object in a gravity field. It works on **Archimedes' principle**. In a column of fluid, pressure increases with depth as a result of the weight of the overlying fluid. Thus the pressure at the bottom of a column of fluid is greater than at the top of the column. **Applications:** Boat sailing on the river, Iceberg floating on water, Helium balloon rising in the air.

Q.388. When does an object float on a liquid ?
RRB JE 01/06/2019 (Afternoon)
(a) When the density of the object is less than that of the liquid
(b) When the density of the object is more than that of the liquid
(c) When both the liquid and the object have the same densities
(d) When the object has very high density

Sol.388.(a) Density: It is the mass of a body per unit volume. Example - dense material like Iron takes more mass in a given volume than of wood.

Formula: $Density\ (\rho) = \frac{mass\ (m)}{Volume\ (V)}$

SI Unit is kg/m^3.
Sinking: The object will sink, if the density of the object is more than the density of the liquid it is placed in.

Q.389. What is the other name of the buoyant force exerted by water on an immersed body?
RRB JE 27/06/2019 (Morning)
(a) Mechanical force (b) Upthrust
(c) Frictional force (d) Pressure

Sol.389.(b) Upthrust (Buoyancy) : It is an upward force exerted by a fluid that opposes the weight of a partially or fully immersed object. Example : A boat or a ship floating in the water and the floating of cork in water. When an object is floating on a water surface then the apparent weight of the floating object is Zero. Mechanical force - The force generated by the means of a machine. Frictional force - A force that resists relative motion between two surfaces in contact.

Q.390. When the density of an object immersed in a liquid is less than that of the liquid, what happens?
RRB JE 27/06/2019 (Evening)
(a) The object floats
(b) The object sinks
(c) The object rotates in the center of the liquid
(d) The object moves inside the liquid with uniform velocity

Sol.390.(a) The object floats. Whenever an object is immersed in a liquid, either partially or fully, an upward force is exerted on the object by the liquid. This upward force is called upthrust or buoyant force. Example - Feather in water. If the density of an object immersed in a liquid is higher than that of the liquid, the object will sink. Example - Rock in water.

Q.391. An Object floats in water with one-third of its volume under water. The density of the the object is n times the density of water where n is:
RRB Group D 23/09/2018 (Afternoon)
(a) $\frac{1}{6}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

Sol.391.(b) $\frac{1}{3}$ **.** Archimedes' principle states that the buoyant force exerted on a body submerged in a liquid is equal to the weight of the liquid displaced. Archimedes' Principle Formula : $F_b = \rho \times g \times V$, where F_b is the buoyant force, ρ is the density of the fluid, V is the submerged volume, and g is the acceleration due to gravity. Applications : Submarine, Hot-air balloon, Hydrometer.

Q.392. Density is the ratio of :
RRB Group D 24/09/2018 (Evening)
(a) mass × volume (b) volume / mass
(c) mass + volume (d) mass / volume

Sol.392.(d) mass / volume. Density is mass per unit volume. $\rho = \frac{m}{V}$. Density is the amount of space which a substance or an object occupies. The SI unit of density is kg/m³. Relative density is a comparative measure of the density of a substance to the density of a reference substance. It has no unit.

Q.393. If you fill a glass completely with water and ice and the ice melts completely, what will happen?
RRB Group D 01/10/2018 (Afternoon)
(a) Water will start flowing out
(b) All the snow will settle to the bottom
(c) The water level will remain the same
(d) The water level will decrease as the snow melts.

Sol.393.(c) According to Archimedes, floating material displaces water equal to its weight. As floating ice melts, the water level remains unchanged because dissolved ice retains the same volume.

Q.394. If an object sinks then the buoyancy exerted by the liquid on the object will be _____.
RRB Group D 09/10/2018 (Afternoon)
(a) More than the weight of the object
(b) equal to the weight of the object
(c) less than the weight of the object
(d) zero

Sol.394.(c) less than the weight of the object. The upward force exerted by a liquid on a body when immersed in a liquid is known as buoyant force. When an object is floating in a liquid, the buoyant force exerted by the liquid on the object is equal to the weight of the object. This principle is known as Archimedes' principle.

Q.395. When a body is completely or partially immersed in a fluid, a force is applied on it in the upward direction, which is equal to the weight of the fluid displaced by that body. By which rule is this explained?
RRB Group D 15/10/2018 (Morning)
(a) Archimedes' principle (b) Lenz's law
(c) Pauli's exclusion law (d) Faraday's law

Sol.395.(a) Archimedes' principle : This principle explains why objects float or sink in fluids and is used to determine the buoyant force acting on objects submerged in fluids. Lenz's law is related to electromagnetic induction. Pauli's exclusion principle is related to the behavior of electrons in atoms. Faraday's law of electrolysis is related to equivalent weight of the electrolyte.

Q.396. Which of the following factors depends on the resultant of buoyancy force acting on an object in a given fluid?
RRB Group D 16/10/2018 (Afternoon)
(a) The density of the liquid and the mass of the object immersed in it.
(b) Weight of the object immersed in it.
(c) Density of the liquid and volume of the object immersed in it.
(d) The size of the object immersed in it.

Sol.396.(c) Buoyant force : This is the upward force exerted by a fluid on an object immersed in it. It arises due to the pressure difference between the top and bottom of the object caused by the fluid's weight.

Q.397. A stone is tied to a spring balance. Under which of the following conditions the reading on spring balance will show the least weight?
RRB Group D 16/10/2018 (Evening)
(a) When the stone is partially submerged in the water in a beaker.
(b) When the stone is completely

submerged in the water in a beaker.
(c) When the stone is on the surface of water taken in a beaker.
(d) When the stone is suspended in air.

Sol.397.(b) Buoyant force: When an object is submerged in a fluid, it experiences an upward force known as the buoyant force. This force is equal to the weight of the fluid displaced by the object. Hence, the body experiences least weight.

Q.398. The density of an iron nail is _____ the density of water.
RRB Group D 22/10/2018 (Morning)
(a) more than (b) equal to
(c) there is no relation (d) less than

Sol.398.(a) more than. This is because the density of an iron nail is about 7.8 g/cm^3 while the density of water is 1 g/cm^3 at 25 °C. Density is the ratio of mass to volume, and iron has more mass than water for the same volume. Therefore, iron is denser than water and sinks in it.

Q.399. In liquids, a small fraction of particles at the surface have :
RRB Group D 25/10/2018 (Morning)
(a) more potential energy
(b) more kinetic energy
(c) less potential energy
(d) less kinetic energy

Sol.399.(b) more kinetic energy. At a given temperature in any gas, liquid or solid, there are particles with different amounts of kinetic energy. In the case of liquids, a small fraction of particles at the surface, having higher kinetic energy, is able to break away from the forces of attraction of other particles and gets converted into vapour. This phenomenon of change of liquid into vapours at any temperature below its boiling point is called evaporation.

Q.400. Ice floats on water because its density is:
RRB ALP Tier - I (20/08/2018) Afternoon
(a) more than water (b) same as water
(c) less than water (d) zero

Sol.400.(c) less than water. Any substance that has a lower density in its solid state than in its liquid state will float. Density is the substance's mass per unit of volume. SI unit kg/m³. Formula ρ = m/V, where ρ is the density, m is the mass of the object and V is the volume of the object.

Q.401. What is the upward force exerted by water called?
RRB ALP Tier - I (21/08/2018) Morning
(a) Gravitation (b) Buoyant force
(c) Friction (d) Density

Sol.401.(b) Buoyant force. Archimedes principle: When a body is immersed in a liquid, an upward thrust equal to the weight of the liquid displaced, acts on it. Apparent weight = actual weight − buoyant force = mg − ρgV, where m = mass of the object, ρ = density of the fluid, g = acceleration due to gravity and V = volume of liquid displaced by the object.

Q.402. What is the physical state of water at 12 °C?
RRB ALP Tier - I (29/08/2018) Afternoon
(a) Liquid (b) Ionic (c) Gas (d) Solid

Sol.402.(a) Liquid. Below zero degrees (32 degrees Fahrenheit), Water becomes ice and above 100 degrees (212 degrees Fahrenheit) it becomes gas. Properties of Water (H_2O, it is formed by the covalent bond of hydrogen and oxygen atoms**)** - Three states water (solids, liquids, and gas), has a polar nature, Amphoteric in Nature **(**react both as a base and as an acid), Solvency of Water (Universal solvent due to high dielectric constant).

Numericals :-

Q.403. When an object is immersed in water, its weight reduces from 4 N in air to 2 N in water. Calculate the amount of buoyant force acting on an object in water.
RRB Group D 23/10/2018 (Afternoon)
(a) 3 N (b) 5 N (c) 2 N (d) 8 N

Sol.403.(c) 2 N.
Given that, The weight of the body in the air = 4 N.
When immersed in water, the weight of the body = 2N.
In water, there will be a buoyancy force which opposes the weight of the body.
Therefore the buoyant force is equal to = 4N - 2N = 2N.

Q.404. What amount of water can reach a height of 10 m by a pump of 1 kW in a minute ? (Take g = 10 m/s²)
RRB Group D 07/12/2018 (Afternoon)
(a) 100 kg (b) 600 kg
(c) 1000 kg (d) 500 kg

Sol.404.(b) 600 kg.
Given : Power of the pump = 1kW,
Acceleration due to gravity (g) = 10 m/s²,
Height (h) = 10 m, Time (t) = 1 minute or 60 s.

$\because$ Power = $\frac{Work\ done}{time}$

= $\frac{(mass \times acceleration) \times Distance}{time}$

$\Rightarrow 1 \times 10^3 = \frac{(mass \times 10) \times 10}{60}$.

$\Rightarrow 60 \times 10^3$ = Mass × 10 ×10.
Mass = 600 kg.

Electric Current and its Effects

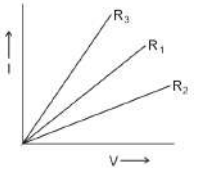
Q.405. The filament of a bulb is made extremely thin and long in order to achieve:
RRC Group D 17/08/2022 (Morning)
(a) High resistance (b) High current
(c) High resistivity (d) High voltage

Sol.405.(a) High resistance. Tungsten is used in filament of the bulb because it has the highest melting point of any metal and the higher the temperature, the higher the efficiency and the whiter the light. Gases in the bulb – helium, neon, nitrogen and argon.

Q.406. Which of the following statements is/are correct for a current carrying solenoid?
(i) It can be used to magnetize a piece of soft iron.
(ii) It acts like a bar magnet
(iii)The field lines are concentric circles
RRC Group D 17/08/2022 (Morning)
(a) Only (i) (b) Both (i) and (iii)
(c) Only (ii) (d) Both (i) and (ii)

Sol.406.(d) Both (i) and (ii). The solenoid is a type of electromagnet, the purpose of which is to generate a controlled magnetic field through a coil wound into a tightly packed helix. Magnetic field due to a straight current-carrying conductor - When current is passed through it, a magnetic field is produced around it. Magnetic field due to current through a circular loop - Every point on the wire carrying current gives rise to a magnetic field that appears as straight lines at the center.

Q.407. The I-V graph of three resistances R_1,$R_2$and R_3, is shown in the figure below. The correct relation between R₁ R₂ and R_3 is:



RRC Group D 17/08/2022 (Afternoon)
(a) $R_3 > R_1 > R_2$ (b) $R_3 < R_1 < R_2$
(c) $R_1 < R_2 < R_3$ (d) $R_1 > R_2 > R_3$