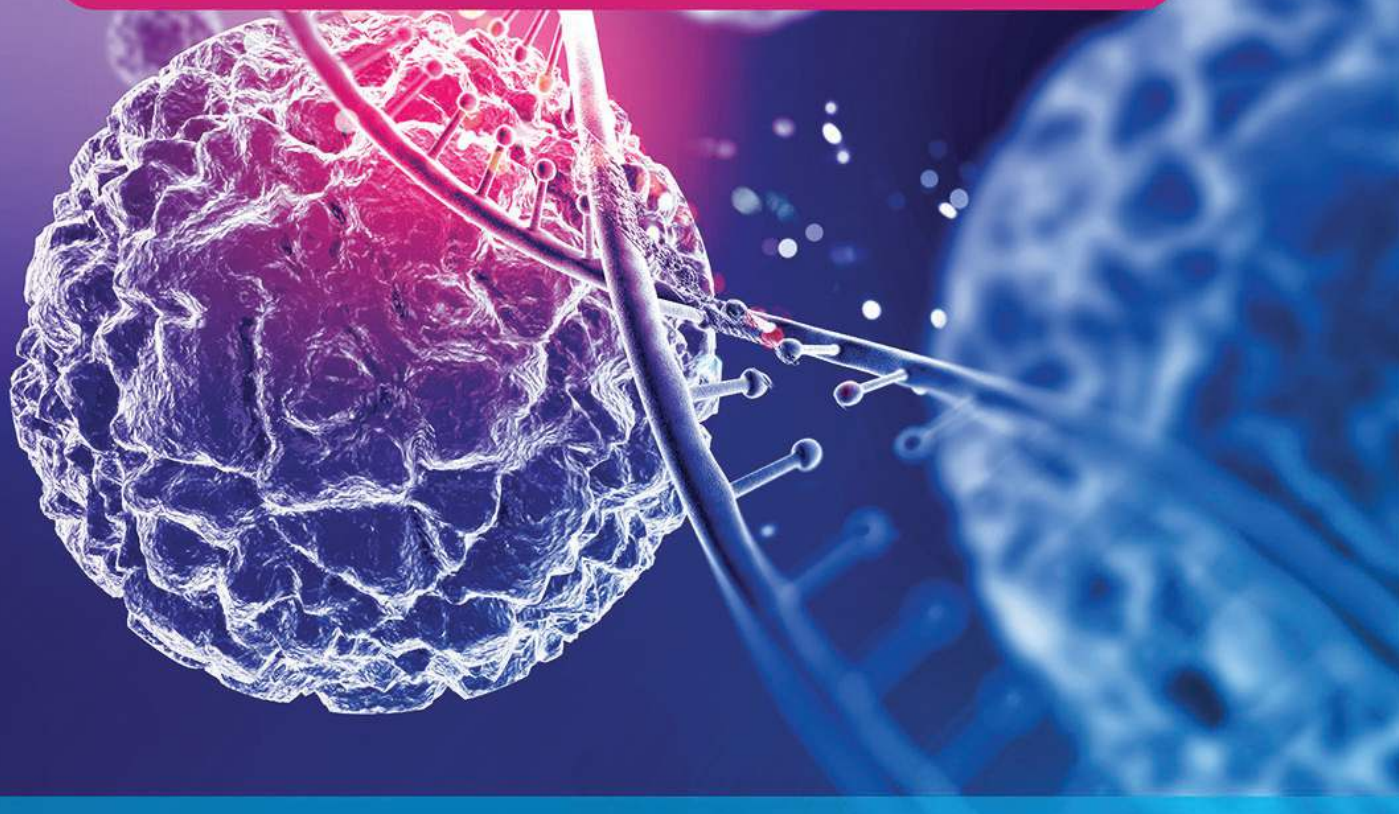


Objective
**GENERAL
SCIENCE**

Abhishek Dubey

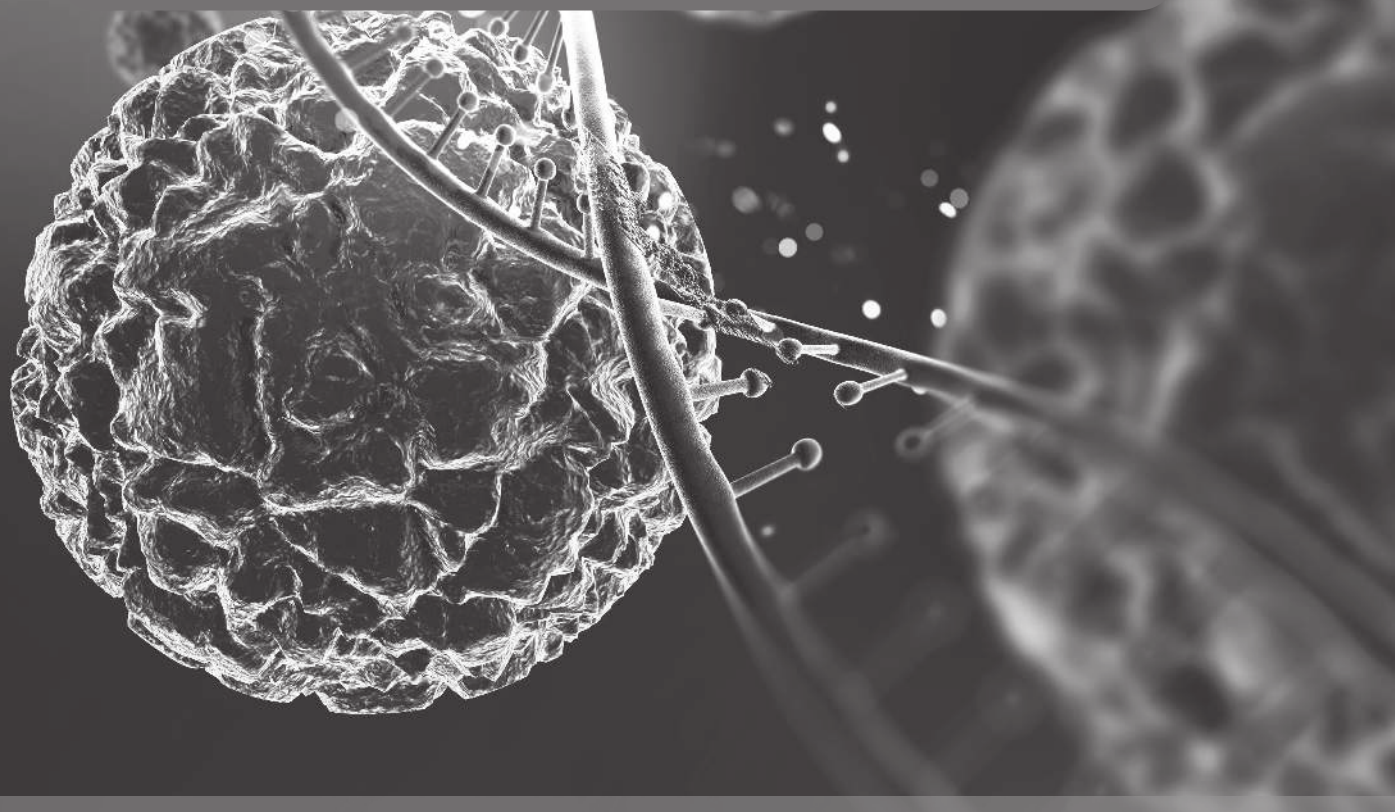


Level 1 Questions SSC CGL, CPO, AILET, State PSC Exam, DUET, LIC, Bank PO, TET and Railway.

Level 2 Questions UPSC CS, NDA, CDS, NTA, UGC NET, ICAR, JRF, RBI, NEET, IIT-JEE and ONGC

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Preface

We feel immense pleasure in introducing the first edition of 'General Knowledge Question Bank' for competitive exams aspirants. This book covers a wide range of general knowledge in a single concise volume for exams like UPSC CS, SSC, CGL, CPO, AILET, DUET, LIC, BANK PO, TET, NDA, NTA, UGC, JRF, RBI, ONGC.

The book follows a methodical approach to help you provide an in-depth understanding of the various areas tested in the GK section such as history, polity and Indian Constitution, economics, general science, miscellany, etc.

The book is demarcated into Level 1 & 2 as per the level of difficulty presented in the different levels of competitive exams. Both the levels contain a comprehensive theory followed by the practice questions for the students to answer. The answer key to all the questions is provided with a proper explanation for the students to evaluate and analyze them.

The book has been consciously written in a reader-friendly tone, avoiding any kind of technical jargon or complex vocabulary so as to explain the concepts in a simple manner to the students to make the most of it.

In spite of our best efforts, the possibilities of some errors of omission cannot be ruled out. Constructive suggestions will be appreciated and thankfully acknowledged.

-Publisher

A COMPLETE 2-YEAR-STUDY STRATEGY FOR YOUR COMPETITIVE EXAMINATIONS!

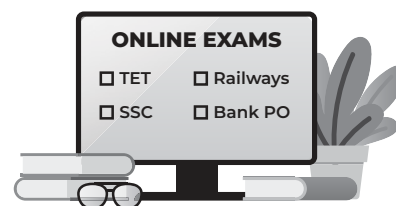
Students, now that you have passed your Class 10th board examinations and are moving to the higher secondary, senior secondary or junior college level, this is the time to decide for those who aspire to study for competitive exams or look for opportunities in PSUs and similar avenues.

As the 12th examination nears, the duration to prepare for your competitive examination shortens. This article will suggest you the best ways for preparing the competitive exams which you will appear for, right after your 12th board examination. However, you have 2 years to prepare and study for competitive exams and we believe 2 years is enough time to prepare if you have the right strategy.

Some popular competitive exams that students opt for after school or college - SSC CGL, CPO, AILET, State PSC Exam, DUET, LIC, Bank PO, TET, Railway, UPSC - NDA, CDS, NTA UGC NET, ICAR, JRF, RBI and ONGC

So, what are the best books for competitive exams? How do you frame a complete 2-year-study strategy to study for them?

This article has all your answers. Below are 5 powerful tips to follow for the next 2 years to make your preparation effective:



» **Write down your syllabus** : The first and foremost step in your exam preparation is to get a thorough understanding of the syllabus. Look for the latest updates and marking schemes in the syllabus as it is subjected to change annually. Write it down somewhere to see it all the time to stay focused.

» **Know your resources/ books** : Most of you would opt for offline classes for preparation. But, we believe in giving self-study a chance. There are ample resources available online for self-preparation. Falling for too many books or online websites would only result in you wasting your time shuffling between them. We would suggest having a limited and reliable set of resources.

You can check out reliable study resources like Oswal Publishers that have a great collection of sample papers and content for students.

» **Prepare a timetable** : Once you are sorted with the study resources and syllabus, we would suggest you to prepare the timetable. Do not go for the entire 2 years instead prepare a 1-year timetable for studying and covering the syllabus. The remaining 1 year can be dedicated to mock tests and evaluation.

» **Mock tests** : Now that you have studied the chapters and are done with the first half of the study strategy, it's time for evaluation! This may include collecting a good set of question papers (of previously held exams) or important questions which can be easily accessed through an online search.

These tips will help you lower your stress on the day of examination and provide you with the confidence to perform better. Trusted sources like Oswal Publishers provide collections of useful sample papers and mock tests online for better preparation.

Never leave things for tomorrow. Have the discipline and sincerity that will help you reach your goal. Following the above-discussed pointers will definitely drive you towards success. To learn more about the easy preparation for exams, Oswal Publishers is always within your reach!

Good luck with your exams!

1

Units, Motion, Work and Gravitation

Level-1

- Newton's law of gravitation is called universal law because:
 - force is always attractive
 - it is applicable to lighter and heavier bodies
 - it is applicable at all times
 - it is applicable at all places of universe for all distances between all particles
- The rms velocity of molecules of a gas at temperature T is V_{rms} . Then the root mean square of the component of velocity in any one particular direction will be:
 - V_{rms}
 - $V_{rms}/3$
 - $V_{rms}/\sqrt{3}$
 - $3V_{rms}$
- On increasing the angular velocity of the earth, the value of g in India:
 - Will decrease
 - Will increase
 - Will remain unchanged
 - Can increase or decrease
- The leaning tower of Pisa does not fall because:
 - it is tapered at the top
 - it covers a large base area
 - its centre of gravity remains at the lowest position
 - the vertical line through the centre of gravity of the tower falls within the base
- What is the speed of light in vacuum?
 - 3.0×10^8 m/s
 - 2.7×10^8 m/s
 - 3.9×10^8 m/s
 - 2.2×10^8 m/s
- A body is in a state of rest at infinite distance. If it is made a satellite of earth, which of the following physical quantities will be reduced:
 - Gravitational force
 - Kinetic energy
 - Potential energy
 - Mass
- A sample of gas is at 0°C . The temperature at which its rms speed of the molecules will be doubled is:
 - 103°C
 - 273°C
 - 723°C
 - 819°C
- If a lift is moving up with a uniform speed the apparent weight of a body in the lift will be:
 - Equal to the true weight
 - Less than the true weight
 - Higher than the true weight
 - Zero
- 1 kilowatt hour =
 - 3.6×10^6 Joule
 - 36×10^6 Joule
 - 3.6×10^8 Joule
 - 36×10^8 Joule
- A man is standing on a boat in still water. If he walks towards the shore the boat will:
 - move towards the shore
 - move away from the shore
 - remain stationary
 - sink
- A man inside a moving train tosses a coin, the coin falls behind him. The train is moving:
 - forward with a uniform speed
 - backward with a uniform speed
 - forward with deceleration
 - forward with acceleration
- The difference in the length of a mean solar day and a sidereal day is about:
 - 1 minute
 - 4 minutes
 - 15 minutes
 - 56 minutes
- Fathom is the unit of:
 - Sound
 - Light
 - Depth
 - None of the above
- The angle subtained by a coin of radii 1 cm held at a distance of 80 cm from your eyes is:
 - 1.43°
 - 0.72°
 - 0.0125°
 - 0.025°
- Function of a rake angle on the flute of a tap is used to reduce the required:
 - Torque
 - Speed
 - Length
 - None of the above
- A person sitting in an open car moving at constant velocity throws a ball vertically into air, the ball falls:
 - exactly in the hand of thrower
 - outside the car
 - in the car a head of the person
 - in the car behind the person
- A power drill can set a house on fire this can be possible due to:
 - Gravity
 - Friction
 - Both (a) and (b)
 - Neither (a) nor (b)
- What is the measurement of the gravitational pull on an object?
 - Volume
 - Weight
 - Length
 - None of the above
- ___ produces change in a body's state of rest or of uniform motion in a straight line:
 - Mass
 - Velocity
 - Acceleration
 - Force
- What is the ionosphere actually composed of?
 - Ozone
 - Oxygen
 - Electrons and positive ions
 - Both nitrogen and oxygen
- A truck and a car are moving with equal velocity on applying brakes, both will stop after certain distance, then:
 - truck will cover less distance before stopping
 - car will cover less distance before stopping
 - both will cover equal distance
 - none of these

22. Motion can be described in terms of:
 (a) Distance moved (c) Either (a) or (b)
 (b) Displacement (d) None of the above
23. The natural tendency of objects to resist a change in their state of rest or of uniform motion is called:
 (a) Inertia
 (b) Momentum
 (c) First law of motion
 (d) Second law of motion
24. Whom was the universal law of gravitation propounded by?
 (a) Newton (c) Kepler
 (b) Galileo (d) None of the above
25. A man is standing on a spring platform. Reading of spring balance is 60 kg cut. If man jumps outside from the platform, then reading of spring balance will:
 (a) increase (c) remain same
 (b) became zero (d) first (a) and then (b)
26. **Assertion:** A horse has to pull a cart harder. During the first few steps of his motion.
Reason: The first few steps are always difficult.
 (a) Both assertion and reason are true and reason is the correct explanation of the assertion
 (b) Both assertion and reason are true but reason is not correct explanation of the assertion
 (c) Assertion is true, but reason is false
 (d) Assertion and reason are false
27. In elastic collision, 100% energy transfer takes place when:
 (a) $m_1 = m_2$ (c) $m_1 > m_2$
 (b) $m_1 > m_2$ (d) $m_1 = 2m_2$
28. Which of the following statements is/are correct?
 (a) International Space Station is present in Low Earth Orbit
 (b) Earth Mapping and Observation satellites uses Polar Orbit
 (c) Both (a) and (b)
 (d) Neither (a) nor (b)
29. Why is Thumba suitable for launch of equatorial rockets?
 (a) Thumba lies on the line of the geomagnetic equator of Earth
 (b) Pollution level is low and upper air circulation is missing
 (c) Both (a) and (b)
 (d) Neither (a) nor (b)
30. The Chandrasekhar Limit is related to:
 (a) Radio Waves
 (b) Dwarf stars
 (c) Escape Velocity of a satellite
 (d) None of these
31. IMAX is related to:
 (a) Motion picture film format
 (b) Sound system in 3D format
 (c) Robotics
 (d) Television technology
32. Parallax second (PARSEC) is a unit of:
 (a) Time (c) Distance
 (b) Pressure (d) Torque
33. What is one astronomical unit?
 (a) Average distance between Earth and the Sun
 (b) Average distance between Earth and the Moon
 (c) Distance travelled by light in one year
 (d) None of these
34. Which of the following is a scalar quantity?
 (a) Power
 (b) Electric field
 (c) Magnetic momentum
 (d) All of the above
35. What is the unit of solid angle?
 (a) Degree (c) Radian
 (b) Steradian (d) None of these
36. 1 Light Year means:
 (a) 9.4607×10^{12} km (c) Both (a) and (b)
 (b) 5.8786×10^{12} mile (d) Neither (a) nor (b)
37. Which of the following physical quantities is/are dimensionless?
 (a) Specific gravity (c) Both (a) and (b)
 (b) Strain (d) Neither (a) nor (b)
38. Black hole is:
 (a) Super surface of atmosphere
 (b) Ozone layer
 (c) Super dense planetary material
 (d) None of these
39. If force and displacement of particle in direction of force are doubled, work would be:
 (a) Double (c) Half
 (b) 4 times (d) 1/4 times
40. Read the following statement :
Statement 1 : An object shall weigh more at pole than at equator when weighed by using physical balance.
Statement 2 : It shall weigh the same at pole and equator when weighed by using a physical balance.
Statement 3 : It shall weigh the same at pole and equator when weighed by using a spring balance.
Statement 4 : It shall weigh more at the pole than at equator when weighted using a spring balance.
 Which of the above statement is/are correct:
 (a) S_1 and S_2 (c) S_2 and S_3
 (b) S_1 and S_4 (d) S_2 and S_4
41. A pregnant woman in her advanced stage of pregnancy develop back pains. What is the reason for that?
 (a) Her back gets stressed as the weight on her back increases
 (b) Her centre of gravity shifts forward
 (c) The hormones released during pregnancy induces the back-pain
 (d) Both (a) and (b)
42. If the earth rotates faster than its present speed, the weight of an object will:
 (a) increase at the equator but remain unchanged at the poles
 (b) Decrease at the equator but remain unchanged at the poles
 (c) Remain unchanged at the equator but decrease at the poles
 (d) Remain unchanged at the equator but increase at the poles
43. If the distance between the earth and the sun becomes half its present value, the number of days in a year would have been:
 (a) 64.4 (c) 182.5
 (b) 129 (d) 730
44. A person is standing on a frictionless horizontal ground. How can he move by a certain distance on this ground?
 (a) By sneezing (c) By running
 (b) By Jumping (d) By rolling

(CDS 2017 II)

45. 1 Joule is equal to:
 (a) 1 m/sec (c) 1 N/sec
 (b) 1 pascal / m (d) 1 newton metre
46. A person throws an object on a horizontal frictionless plane surface. It is noticed that there are two forces acting on this object: (i) gravitational pull and (ii) normal reaction of the surface. According to the third law of motion, the net resultant force is zero. Which one of the following can be said for the motion of the object?
(CDS 2017 II)
 (a) The object will move with acceleration
 (b) The object will move with deceleration
 (c) The object will move with constant speed, but varying direction
 (d) The object will move with constant velocity
47. Consider the following statement:
 "If you feel you are trapped in a black hole, don't give up. There is a way out."
 Who among the following made the above statement?
(CDS 2016 II)
 (a) Albert Einstein (c) C.V. Raman
 (b) Stephen Hawking (d) Abdus Salam
48. Pascal is the SI unit of the force applied perpendicular to the surface of an object per unit area over which that force is distributed. Choose the correct option.
 (a) Pressure (c) Velocity
 (b) Temperature (d) None of these
49. Which of the following can't be absorbed by Black Hole?
 (a) Particles (c) Both a and b
 (b) Light (d) Neither a nor b
50. Which of the following purpose requires polar orbits?
 (a) Earth Mapping (c) Both a and b
 (b) Reconnaissance (d) Neither a nor b
51. If suddenly the gravitational force of attraction between the earth and a satellite revolving around it becomes zero, then the satellite will:
 (a) Continue to move in its orbit with same speed
 (b) move tangentially to the original orbit with same speed
 (c) become stationary in its orbit
 (d) move towards the earth
52. When a bus starts suddenly, then passengers in the bus tend to fall backwards. This event is an example of
(SSC CPO 2017)
 (a) Inertia of rest (c) Inertia of direction
 (b) Inertia of motion (d) None of these
53. What is a white dwarf star?
 (a) Its mass and volume is comparable to that of the Earth
 (b) It is a cloud of gas and dust in outer space
 (c) It is a hypothetical star that is created from a red dwarf star that has exhausted most of its hydrogen fuel supply
 (d) It is formed when a low-mass star has exhausted all its central nuclear fuel and lost its outer layers as a planetary nebula
54. Which force keeps a satellite from falling on the earth?
 (a) Gravitational force of the Sun
 (b) Earth's gravitational pull
 (c) Centripetal force
 (d) Centrifugal force
55. Which of the following is correct?
 (a) For geostationary orbit a satellite is launched from a place with higher latitude
 (b) For polar orbit a satellite is launched from somewhere close to the equator
 (c) Both (a) and (b)
 (d) Neither (a) nor (b)
56. Which of the following is not a vector quantity?
 (a) Torque (c) Speed
 (b) Displacement (d) None of the above
57. Why it is difficult to walk on sand than on a concrete floor?
 (a) Ice is soft when compared to concrete
 (b) There is more friction between the sand and feet
 (c) Both (a) and (b)
 (d) None of these
58. What is the unit of refractive index?
 (a) Metre (c) None
 (b) Degree (d) None of these
59. Momentum of an object depends on which factors?
(SSC CPO 2017)
 I. Mass of the object
 II. Speed of the object
 III. Volume of the object
 (a) I only (c) I and III only
 (b) I and II only (d) II and III
60. The astronomical unit is an unit of -
 (a) Distance (c) Luminous Intensity
 (b) Weight (d) Time
61. Solar Mass =
 (a) 2×10^{30} kg (c) 2×10^{35} kg
 (b) 2×10^{30} g (d) 2×10^{35} g
62. What is the approximate height of any geostationary satellite from earth's surface (in km)? **(SSC CPO 2017)**
 (a) 36,000 (c) 48,000
 (b) 45,000 (d) 30,000
63. 'Ampere' is the unit of:
 (a) Voltage (c) Resistance
 (b) Electrical current (d) Power
64. If a lift goes up in an accelerated motion, then your apparent body weight will be:
 (a) More or less than true weight
 (b) More than the true weight
 (c) Less than the true weight
 (d) Equal to the true weight
65. 1 erg =
 (a) 10^5 J (c) 10^7 J
 (b) 10^6 J (d) 10^8 J
66. What is the unit of solid angle?
 (a) Degree (c) Radian
 (b) Steradian (d) None of these
67. Which of the following physical quantities is/are dimensionless?
 (a) Specific gravity (c) Both (a) and (b)
 (b) Strain (d) Neither (a) nor (b)
68. Jet engine works on principle of conservation of.....
(SSC CPO 2017)
 (a) Heat (c) Linear momentum
 (b) Mass (d) Angular momentum

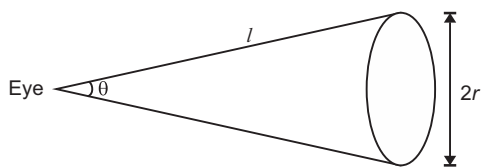
69. Which of the following quantity is a measure of inertia?
(SSC CPO 2017)
- (a) velocity (c) weight
(b) acceleration (d) mass
70. Solar watches become sluggish in summer, because:
- (a) Days are long in summer.
(b) There is friction in the horoscope.
(c) The length of the pendulum increases.
(d) The weight of the pendulum changes.
71. Satellite is kept moving in its orbit around the earth. It is due to:
- (a) Centrifugal force
(b) Centripetal force
(c) Gravitational force or lack of it
(d) Some other forces
72. The known force of nature can be divided into four classes, viz, gravity, electromagnetism, weak nuclear force and strong nuclear force. With reference to them which one of the following statement is not correct?
- (a) Gravity is the strongest of the four.
(b) Electromagnet is act only on particles within electric charge.
(c) Weak nuclear Force process, radioactivity
(d) Strong nuclear force holds protons and neutrons inside the nucleus of an atom.
73. If a person sitting in a lift then he will feel that his weight gets increased?
- (a) When the elevator going upward expeditiously.
(b) When the elevator going down expeditiously.
(c) Going upward with constant velocity.
(d) Going downward with constant velocity.
74. It's a cricket ball which then rolls on a level ground. After covering a short distance, the ball become to rest. The ball slows to a stop because:
- (a) The batsman did not hit the ball hard enough.
(b) Velocity is proportional to the force exerted on the ball.
(c) There is a force on the ball opposite the motion.
(d) There is no unbalanced force on the ball. So the ball would try to become to the rest.
75. The time period of a pendulum:
- (a) Depends on the mass
(b) Depends on the length
(c) Depends on the time
(d) Depends on temperature
76. A girl is swimming on a swing in sitting position. When the girl stand up the period of the swing will:
- (a) Be shorter
(b) Be longer
(c) Depends on the height of the girl
(d) Not change
77. What will happen if an object is thrown into space with a speed of 10 km/ second?
- (a) The object will go into space
(b) It will return to earth
(c) It will rotate into the orbit of Earth
(d) It will burst out
78. There is no atmosphere on the Moon because:
- (a) It is near to the sun
(b) It receives light from the Sun
(c) It revolves around the earth
(d) The escape velocity of gas molecules on it is less than the root square velocity here.
79. Match the following:
- | | |
|---------------|--------------------------|
| Quantity | SI unit |
| 1. Frequency | p. ohm |
| 2. Force | q. Hertz |
| 3. Resistance | r. Newton (SSC CPO 2018) |
- Option:
- (a) 1- q, 2-r, 3-p (c) 1-r, 2-q, 3-p
(b) 1-p, 2-r, 3-q (d) 1-q, 2-p, 3-r
80. While drawing water from a well with a bucket, the string snaps and the person drawing the water falls backward. This happens due to:
- (a) Newton's First Law of Motion
(b) Newton's Second Law of Motion
(c) Newton's Third Law of Motion
(d) Law of Galileo
81. 1 Parsec = _____ m
- (a) 31 decametres (c) 31 petametres
(b) 27 petametres (d) 27 decametres
82. The physics phenomenon when, in polar regions like Alaska and Northern Canada, a splendid display of colours is seen in the sky in called a/an:
- (a) aurora borealis
(b) star shower
(c) active galactic nucleus
(d) star intrinsic intensity
83. A show board pulled up by a tow rope travels at the rate of 5 m/s up a mountain. If 3000 watt of power is used, what force was applied to it? (CAPF SI 2019)
- (a) 50 N (c) 600 N
(b) 100 N (d) 15000 N
84. The weight of an object on the moon is equal to.....of its weight on the earth. (SSC CPO 2019)
- (a) 1/6th (c) 1/4th
(b) 1/8 th (d) 1/10 th
85. Once a satellite has been launched into orbit the only force governing its motion is the force of..... (SSC CPO 2019)
- (a) friction (c) gravity
(b) elasticity (d) fuel driven

Answer with Explanations

Level-1

- (d) Newton's law of universal gravitation states that every particle attracts every other particle in the universe with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres.
- (a) The V_{rms} is defined as square root of the mean of the squares of the values for the one time period of the sine wave. Following is the formula for V_{pp} to V_{rms} conversion. $V_{rms} = 0.3535 \times V_{pp}$
- (a) Value of g depends on the rotation of earth according to formula. $g' = g - rw^2$, where w is angular velocity. Thus, value of g decrease.

4. (a) Because the vertical line through the centre of gravity of the tower is passing through the base.
5. (a) In vacuum all types of electromagnetic radiations, regardless of wavelength, travel at the same speed, i.e., 3.0×10^8 m/s (2.997925×10^8 m/s, to be precise). This is called speed of light and is given the symbol 'c'.
6. (c) In Physics, potential energy is the energy held by an object because of its position relative to other objects, stresses within itself, its electric charge, or other factors.
7. (d) A sample of gas is at 0°C . The temperature at which its r.m.s. speed of the molecules will be doubled is 819°C .
8. (a) When a lift remains stationary or moves either upward or downward at a uniform speed, then the apparent weight of a body in the lift will be equal to its true weight.
9. (a) $1 \text{ kilo watt hour} = 1 \text{ kilowatt} \times 1 \text{ hour}$
 $= 1000 \text{ watt} \times 3600 \text{ second}$
10. (b) This is according to Newton's third law of motion-to every action there is equal and opposite reaction.
11. (d) When the man tosses a coin, the coin falls behind him because the train is moving forward with acceleration.
12. (b) The sidereal day is about 4 minutes (more precisely, 3 minutes 56 seconds) shorter than a mean solar day (of 24 hours).
13. (c) A fathom is a unit of length in the imperial and the U.S. customary systems equal to 6 feet, used especially for measuring the depth of water.
14. (a) Here: $l = 80 \text{ cm}$, $2r = 2 \text{ cm}$



$$\theta = \frac{\text{Arc}}{\text{Radius}} = \frac{2r}{l} = \frac{2}{80} = \frac{1}{40} \text{ rad}$$

$$= \left(\frac{180}{\text{A}} \times \frac{1}{40} \right) = 1.43^\circ$$

15. (a) Function of a rake angle on the flute of a tap is used to reduce the required torque. Rake angle is a parameter used in various cutting and machining processes, describing the angle of the cutting face relative to the work. There are three types of rake angles: positive, negative, and neutral.
16. (a) Both the person and the ball share the horizontal velocity of the car. Hence the ball falls exactly in the hand of the thrower.
17. (b) When a power-drill operates, it produces friction. This produces heat. This may cause a fire in the house if not worked carefully.
18. (b) The weight of a body is equal to the product of the mass of the body and the gravitational pull. Gravity

is a force which tries to pull two objects toward each other. Anything which has mass also has a gravitational pull. The more massive an object is, the stronger its gravitational pull is. Earth's gravity is what keeps you on the ground and what causes objects to fall.

19. (d) In physics, a force is any interaction that, when unopposed, will change the motion of an object. A force can cause an object with mass to change its velocity, i.e. to accelerate.
20. (c) The ionosphere is the ionized part of Earth's upper atmosphere, from about 60 km to 1,000 km altitude. It is made up of electrons and positive ions.
21. (b) Being lighter than truck, the car has less kinetic energy. On applying brakes with the same force, the car will cover less distance before coming to rest.
22. (c) Motion is a change of position; it can be described in terms of the distance moved or the displacement.
23. (a) The natural tendency of objects to resist a change in their state of rest or of uniform motion is called inertia.
24. (c) While Sir Issac Newton is the one who proposed the universal law of gravitation, Johannes Kepler had before him proposed three laws on planetary motion, which were later used by Newton to explain the gravitational force that work between planets.
25. (d) To jump outside the platform, the man pushes the platform, so the reading of the spring balance first increases and then becomes zero.
26. (c) During the first few steps of his motion, the horse has to work against the limiting friction and once the horse starts moving, the horse has to work against kinetic friction which is less than the limiting friction.
27. (a) During elastic collision between two equal masses, the velocities get exchange. Hence energy transfer is maximum when $m_1 = m_2$.
28. (c) Most satellites, the International Space Station, the Space Shuttle, and the Hubble Space Telescope are all in Low Earth Orbit (commonly called "LEO"). Polar orbits are often used for earth-mapping, earth observation, capturing the earth as time passes from one point.
29. (a) Thumba is a place located in Kerala state of India. It has Thumba Equatorial Rocket Launching System. Thumba is lies on the line of the geomagnetic equator of Earth which is highly suitable for space research and rocket launching.
30. (b) The Chandrasekhar limit is the maximum mass of a stable white dwarf star.
31. (a) IMAX that is image maximum is a film format created by IMAX Corporation that has the capacity to display images of far greater size and resolution than conventional film display.
32. (a) The parsec is a unit of length used to measure large distances to astronomical objects outside the Solar System. A parsec is defined as the distance at which one astronomical unit subtends an angle of one arc

second, which corresponds to 648000 astronomical units.

33. (a) The astronomical unit is a unit of length, roughly the distance from Earth to the Sun.
34. (a) Power is energy (or work) per unit time. Time is not considered a vector quantity, and neither is energy or work – work isn't directional. So power is the ratio of two scalar quantities, and is thus scalar, not vector. Work is also a scalar quantity.
35. (b) The steradian or square radian is the SI unit of solid angle.
36. (a) The light-year is a unit of length used to express astronomical distances and measures about 9.46 trillion kilometres or 5.88 trillion miles.
37. (c) Both are dimensionless.
38. (c) Black hole in a super dense planetary material formed due to the continued compression of the core of a star during supernova explosion.
39. (b) Work = force \times displacement. If force and displacement both are doubled then work would be four times.
40. (b) S_2 is correct because whatever be the value of g , the same force is acting on both the pans. Using a spring balance, the value of g is greater at the pole. Therefore mg at the pole is greater. S_4 is correct, S_2 and S_4 are correct.
41. (b) The Centre of Gravity of pregnant women extends forward, beyond the area bounded by her feet. To maintain her balance she extends her upper body backward to bring her Centre of Gravity above her feet. This causes the back pain.
42. (b) The effective value of acceleration due to gravity is given by $g' = g - \omega^2 R \cos^2 l$.
Which is due to rotation of earth. Rotation of the earth results in the decreased weight apparently. This decrease in weight is not felt at the poles as the angle of latitude is 90° .
43. (b) According to Kepler's third law the ratio of the squares of the periods of any two planets revolving about the sun is equal to the ratio of the cubes of their average distances from the sun, i.e.

$$\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{r_1}{r_2}\right)^3 = \left(\frac{r_1}{\frac{1}{2}r_1}\right)^3 = 8$$

$$\Rightarrow \frac{T_1}{T_2} = 2\sqrt{2}$$

$$\therefore T_1^2 = \frac{T_2^2}{2\sqrt{2}} = \frac{365 \text{ day}}{2\sqrt{2}}$$

$$= 129 \text{ days}$$

44. (a) When we sneeze, air exiates with force through our nose and mouth. According to Newton's third laws of motion, there is an equal and opposite reaction for every action. So, a frictionless horizon which cannot grip us will make us move in opposite direction .

45. (d) The joule is a derived unit of energy in the International System of units. It is equal to the energy transferred to (or work done on) an object when a force of one newton acts on that object in the direction of its motion through a distance of one metre (1 newton metre or N-m).
46. (d) When an object is said to be moving with constant velocity the resultant force acting on the body is zero. To bring change in momentum an external force is required to change the momentum.
47. (b) The celebrated physicist has a new theory about where lost information ends up after being sucked into a black hole, a place where gravity compresses matter to a point where the usual laws of physics break down.
48. (a) Pressure is the force applied perpendicular to the surface of an object per unit area over which that force is distributed. Gauge pressure is the pressure relative to the ambient pressure. Various units are used to express pressure. Pascal is the SI unit of Pressure.
49. (d) A black hole is a region of space-time exhibiting such strong gravitational effects that nothing-not even particles and electromagnetic radiation such as light-can escape from inside it. In many ways a black hole acts like an ideal black body, as it reflects no light.
50. (c) Polar orbits are often used for Earth-mapping, Earth observation, capturing the Earth as time passes from one point, reconnaissance satellites, as well as for some weather satellites. The Iridium satellite constellation also uses a polar orbit to provide telecommunications services.
51. (b) Due to inertia motion it will move tangentially to the original orbit with same velocity.
52. (a) When the bus moves, the lower part of his body begins to move along with the bus while the upper part of his body continues to remain at rest due to inertia. That is why, a person falls backward when the bus starts.
53. (d) It is a star, approximately the size of the earth, that has undergone gravitational collapse and is in the final stage of evolution for low-mass stars, beginning hot and white and ending cold and dark. The nearest known white dwarf is Sirius B, at 8.6 light years, the smaller component of the Sirius binary star. There are currently thought to be eight white dwarfs among the hundred star systems nearest the Sun.
54. (c) A satellite's orbit works because of a balance between two forces viz.
- Centripetal force.
 - Force of the Earth's gravitational pull on the satellite.
- An artificial satellite is always falling towards earth, but it has enough tangential velocity to continue fall indefinitely. Centripetal force on the satellite balances the gravitational attractive force of the earth. This balance does not depend upon the mass and size of the satellite.

55. (d) The place from which a satellite is launched is important in determining its orbit.
- A satellite launched from a place with higher latitude would have a higher angle of inclination, suitable to launch satellites into polar orbits
 - To put a satellite into equatorial orbit, it would be best to launch it from somewhere close to the equator.
56. (c) Speed, being a scalar quantity, is the rate at which an object covers distance. The average speed is the distance (a scalar quantity) per time ratio. Speed is ignorant of direction. On the other hand, velocity is a vector quantity; it is direction-aware.
57. (d) As we press against the sandy ground in the backward direction, the sand gets pushed away and as a result we get very small reaction from the ground, making it difficult to walk. Another reason is that the friction on sand is very low. Hence we are unable to move on sand.
58. (c) Refractive index has no units because the refractive index is the ratio of the speed of light within the material of interest divided by the speed of light in a vacuum, thus, the consistent units of measure (metres per second, or kilometers per second, etc.) cancel out and you're left with just a number.
59. (b) Momentum of a body is the quantity of motion possessed by the body. It is equal to the product of mass and velocity of the body.
60. (a) The astronomical unit is a unit of length, roughly the distance from Earth to the Sun. However, that distance varies as Earth orbits the Sun, from a maximum (aphelion) to a minimum (perihelion) and back again once a year. Originally conceived as the average of Earth's aphelion and perihelion, since 2012 it has been defined as exactly 149597870700 metres or about 150 million kilometres.
61. (a) The solar mass (MS) is a standard unit of mass in astronomy, equal to approximately 2×10^{30} kg. It is used to indicate the masses of other stars, as well as clusters, nebulae, and galaxies. It is equal to the mass of the Sun. The above mass is about 332946 times the mass of Earth (M_E), or 1047 times the mass of Jupiter (MJ).
62. (a) The height of a satellite above the earth's surface is given by

$$h = \left[\frac{T^2 R^2 g}{4\pi^2} \right]^{1/3} - R$$

But $T = 24 \text{ hour} = 86400 \text{ second}$
 $R = \text{Radius of the earth} = 6400 \text{ km}$
 $g = 9.8 \text{ ms}^{-2} = 0.0098 \text{ kms}^{-2}$

$$h = \left[\frac{(86400)^2 \times (6400)^2 \times 0.0098}{4 \times 9.87} \right]^{1/3} - 6400$$

$$= 42330 - 6400$$

$$= 35930$$

$$\approx 36000 \text{ km.}$$

63. (b) Ampere or amp (symbol: A) is the unit of electric current. The Ampere unit is named after Andre-Marie Ampere, from France. One Ampere is defined as the current that flows with electric charge of one Coulomb per second.
64. (b) If there were large upward force, greater than both the weight of the lift and the weight of the man, both will move up with an acceleration say a . The man will feel as if his weight has increased by an amount ma where m is his mass. If the man moves up or down with constant speed, the man will feel his weight mg , since here the upward force is also mg .
65. (c) The erg is a unit of energy and work equal to 10^7 joules. It originated in the centimetre-gram-second (CGS) system of units. It has the symbol erg. The erg is not an SI unit. An erg is the amount of work done by a force of one dyne exerted for a distance of one centimeter. $1 \text{ erg} = 10^7 \text{ J} = 100 \text{ nJ}$.
66. (b) The steradian or square radian is the SI unit of solid angle. It is used in three-dimensional geometry, and is analogous to the radian, which quantifies planar angles. The steradian or square radian is the SI unit of solid angle. It is used in three-dimensional geometry, and is analogous to the radian, which quantifies planar angles.
67. (c) A physical quantity is a quantity in physics that can be measured. Or a physical quantity is a physical property that can be quantified. Specific gravity is the ratio of the density of a substance to the density of a reference substance; equivalently, it is the ratio of the mass of a substance to the mass of a reference substance for the same given volume. Thus it has no dimension. Strain is a force tending to pull or stretch something to an extreme or damaging degree. It is also dimensionless.
68. (c) In jet engines, a large volume of gases produced by the combustion of fuel is allowed to escape through a jet in the backward direction. Due to the very high speed or velocity, the backward rusting gases have a large momentum. They impart an equal and opposite momentum to the jet engine due to which the jet engine moves forward with a great speed. Thus, we can say that the jet engines work on the principle of conservation of linear momentum.
69. (d) Mass of a body is the measure of its inertia. If a body has more mass, it has more inertia, i.e. it is more difficult to change, its state of rest or of uniform motion. For example, if we kick a football, it flies a long way. If we kick a stone of the same size, it hardly moves. The stone opposes the change in its motion better than the football because of its more mass. Thus stone has more inertia than football.
70. (c) Earth orbits around the sun on a tilted axis. (Probably because our planet collided with some other massive object billions of years ago, back when it was still being formed. So between March and September, Earth's Northern Hemisphere gets more exposure to direct sunlight over the course of a day.

71. (b) Centripetal force is real force that counteracts the centripetal force and prevent object from flying out keeping it moving instead with a uniform speed along a circular path. Gravity is the centripetal force that keeps planet moving around the sun in satellite moving around the planet.
72. (a) Gravitational force is the weakest force among the four fundamental forces while nuclear force holds the position of strongest force among them.
73. (a) Let the mass of the person is m and weight is W in the elevator going upward with acceleration (a). The force acting on person:
1. The first due to gravity = mg .
 2. The force giving the acceleration = ma according to Newton's second law-

$$W - mg = ma$$

$$W = m(g+a)$$
- So, it is clear that when elevator is going up what a person actually feel a little heavier than his usual weight and on the other hand when elevator accelerates downward the person feel a little reduction than his usual weight.
74. (c) A batsman hits a cricket ball which is rolls on a level ground. After covering a short distance, the ball become to rest because there is no external force i.e. frictional force acting on the moving ball opposing its motion. If there is no frictional force on the ball will roll continuously.
75. (b) The time period of a pendulum depends on its length.
 As we know that $T = 2\pi\sqrt{\frac{l}{g}}$,
- The result is that the one variable that affects the period the pendulum is the length of the string. Increase in the length lead to increase in the period.
76. (a) A girl is swinging on a swing in sitting position but when she stands up, she is effectively moving her mass higher. Thus shortening the length of the pendulum. Shortening this length will decrease the period or the period of the swing will be shorter.
77. (b) 11.2 kilometre per second is the escape velocity of the Earth which is minimum speed that is required to escape the earth's gravity. If an object thrown is less than this, it will return to earth.
78. (d) Moon has no atmosphere because the value of acceleration due to gravity g on the surface of the moon is small. Therefore, the value of escape velocity on the surface of the moon is small. The value of root mean square velocity of the molecule of different gases is much above the value of escape velocity on the moon. That is why all the molecules of gases escapes and there is no atmosphere on the moon.
79. (a) Frequency is defined as 1/time period, and its unit is given as Hertz. Resistance is ratio of voltage to current and its unit is ohm. Force is equal to mass \times acceleration and its unit is given by Newton.
80. (c) Newton's third law of motion states that "To every action, there is an equal and opposite reaction". Thus

the person who was drawing water was applying an equal force with which the bucket was being pulled down due to gravity. When the string snapped, the man falls down.

81. (c) Parallaxic second is the unit of distance because parallaxic second is abbreviation of parsec. Parsec: Parsec is the unit for larger distances. It is the distance at which star would make parallax of one second of arc. 1 Parsec = 3.0857×10^{16} m \sim 31 petametres.
82. (a) An aurora sometimes referred to as polar lights (aurora polaris), northern lights (aurora borealis), or southern lights (aurora australis), is a natural light display in the earth's sky= predominantly seen in high-latitude regions (around the Arctic and Antarctic).
83. (c) As $P = F \cdot v$.

$$\Rightarrow F = \frac{P}{v} = \frac{3000}{5} = 600 \text{ N.}$$
84. (a) Acceleration due to gravity on the moon is given by:

$$g_m = \frac{M_m \left(\frac{R_e}{R_m} \right)^2}{M_e} \times g_e$$

where,

g_m = acceleration due to gravity on the moon

g_e = acceleration due to gravity on earth

M_m = Mass of moon

M_e = Mass of earth

R_e = Radius of the earth

R_m = Radius of the moon

which comes out to be 1.63 ms^{-2} . As weight of an object is equal to mg . so. The weight of an object on the moon becomes $\frac{1}{6}$ th of its weight on the earth.

85. (c) At a certain horizontal velocity the satellite will not hit the earth, but will always be in a state of the free fall under gravity and attempt to fall to the earth but missing its all the time. Then the satellite will follow a stable circular path around the earth and will become a satellite of the earth.

Level-2

1. Consider List-I and List-II of the physical quantities and their respective units:

| List-I (Physical Quantities) | List-II (Units) |
|---------------------------------|------------------------------|
| A. Acceleration | 1. Meter/second ² |
| B. Force | 2. Newton-second |
| C. Work Done | 3. Newton |
| D. Impulse | 4. Joule |

Match the above correctly:

A B C D

(a) 1 2 3 4

(b) 3 4 1 2

(c) 2 3 4 1

(d) 1 3 4 2

2. Find the unmatched pair out of the following:

(a) Work - Joule (c) Pressure - Fermi

(b) Force - Newton (d) Mass - kg

3. Consider List-I and List-II of the parametric quantities and their respective units:

| List-I (Units) | List-II (Parametric Quantities) |
|-------------------|------------------------------------|
| A. Watt | 1. Heat |
| B. Knot | 2. Sea - Navigation |
| C. Nautical Mile | 3. Power |
| D. Calorie | 4. Speed of a ship |

Match the above correctly:

- A B C D
 (a) 3 1 4 2
 (b) 1 2 3 4
 (c) 3 4 2 1
 (d) 2 4 1 3

4. Consider List-I and List-II of the parametric quantities and their respective units:

| | |
|------------|-----------------------|
| A. Joule | 1. Electric Current |
| B. Ampere | 2. Work |
| C. Volt | 3. Electric Potential |
| D. Calorie | 4. Heat |

Match the above correctly:

- A B C D
 (a) 2 1 3 4
 (b) 1 2 3 4
 (c) 4 3 2 1
 (d) 1 3 2 4

5. Which one of the following is not correctly matched?

- (a) Angstrom Unit of wavelength of light
 (b) Light Year Unit of measuring time
 (c) Both a and b
 (d) Neither a nor b

6. Consider List-I and List-II of the parametric quantities and their respective units:

| List-I | List-II |
|---------------|-------------|
| A. High Speed | 1. Mach |
| B. Wavelength | 2. Angstrom |
| C. Pressure | 3. Pascal |
| D. Frequency | 4. Hertz |

Match the above correctly:

- A B C D
 (a) 2 1 3 4
 (b) 1 2 4 3
 (c) 1 2 3 4
 (d) 2 1 4 3

7. Joule: Energy:: Pascal: ?

- (a) Mass (c) Distance
 (b) Pressure (d) Luminous Flux

8. Which one of the following is not correctly matched?

- (a) Decibel - Unit of sound intensity
 (b) Horsepower - Unit of Power
 (c) Nautical miles - Unit of naval distance
 (d) Celsius - Unit of heat

9. Consider List-I and List-II of the parametric quantities and their respective units

| List-I | List-II |
|------------|----------------------------|
| A. Cusec | 1. Pressure |
| B. Byte | 2. Intensity of earthquake |
| C. Richter | 3. Rate of flow |
| D. Bar | 4. Computer |

Match the above correctly:

- A B C D
 (a) 1 2 3 4
 (b) 3 4 2 1
 (c) 4 3 2 1
 (d) 3 4 1 2

10. Consider the following situation:

1. You are in a research-ship
 2. You have to locate a submerged island
 Which of the following would you use?

- (a) Audiometer (c) Sextant
 (b) Galvanometer (d) SONAR

11. Scientists of Britain have built a "Gravity Tractor". Identify the same from the following

- (a) A double storeyed 'Jugaad' type tractor trolley to be used in public transport
 (b) A tractor with a mechanism to sweep public roads and is economical to run.
 (c) A bullet train run on the principle on earth's gravity with the help of powerful magnets.
 (d) A space-craft with a mechanism which would check asteroids from hitting the earth.

12. Which one of the following is not correctly matched.

- (a) Anemometer - Wind Speed
 (b) Ammeter - Electric Current
 (c) Tacheometer - Pressure Difference
 (d) Pyrometer - High Temperature

13. Orbital decay, a process of prolonged reduction in the altitude of a satellite's orbit is caused by which of the following reasons?

1. Atmosphere drag
 2. Tides
 3. Gravitational pull

Correct code:

- (a) 1 only (c) 1 and 3 only
 (b) 3 only (d) 1,2 and 3

14. If you want to check whether the milk delivered by your milkman is as pure as he promises then you will use:

- (a) Lacometer (c) Lactometer
 (b) Butyrometer (d) Thermometer

15. Which one of the following is correctly matched?

- (a) Thermoresistor - Electric Thermometer
 (b) Capacitor - Thermometer
 (c) Gas meter - Electric anemometer
 (d) Junction Diode - Amplifier

16. Consider List-I and List-II of the parametric quantities and their respective units:

| List-I | List-II |
|---------------------|----------------------------------|
| A. Stethoscope | 1. To measure intensity of light |
| B. Sphygmomanometer | 2. To check purity of gold |
| C. Caratometer | 3. To hear heart sound |
| D. Lux meter | 4. To measure blood pressure |

Match the above correctly:

- A B C D
 (a) 1 2 3 4
 (b) 4 3 2 1
 (c) 3 4 2 1
 (d) 2 1 4 3

17. If you are using RADAR, then you are:
 (a) Detecting object by using light waves
 (b) Reflecting sound waves to detect objects
 (c) Determining the presence and location of objects with radio waves
 (d) Tracking rain-bearing clouds
18. Consider List-I and List-II of the parametric quantities and their respective units

| List-I | List-II |
|---------------|-------------------------|
| A. Fathometer | 1. Atmospheric pressure |
| B. Barometer | 2. Atmospheric humidity |
| C. Hygrometer | 3. Height |
| D. Altimeter | 4. Depth of sea |

Match the above correctly:

- | | | | |
|-------|---|---|---|
| A | B | C | D |
| (a) 2 | 3 | 1 | 4 |
| (b) 4 | 1 | 2 | 3 |
| (c) 4 | 2 | 3 | 1 |
| (d) 3 | 1 | 2 | 4 |
19. Which one of the following is not correctly matched?
 (a) Manometer Pressure
 (b) Carburetor Internal Combustion Engine
 (c) Cardiograph Heart Movement
 (d) Seismometer Curvature of surface
20. Phonometer is used to measure which one of the following?
 (a) The power of human voice
 (b) Extremely high temperature
 (c) Frequency of electromagnetic waves
 (d) Atmospheric humidity
21. A teacher is teaching about the energy of wind. Which form of energy is the teacher talking about?
 (a) Only potential
 (b) Only kinetic
 (c) Electrical
 (d) Potential and kinetic both
22. You are on a train. The train is stationary. Suddenly the train starts to move and your head moves backward. This happens because of:
 (a) Inertia of rest
 (b) Inertia of motion
 (c) Moment of inertia
 (d) Conservation of mass
23. **Assertion (A):** A man is standing on a completely frictionless surface and can't move.
Reason (R): If no external force act on a system, its momentum cannot change.
 Code:
 (a) Both A and R are true and R is the correct explanation of A
 (b) Both A and R are true but R is not a correct explanation of A
 (c) A is true but R is false
 (d) A is false but R is true
24. A person walking on ice slips regularly while walks easily on concrete road. What can be the possible reason?
 (a) Ice is brittle than the road.

- (b) Road is harder than the ice.
 (c) Ice does not offer any reaction when we push it with our foot.
 (d) Ice has a lesser friction than the road.

25. Choose the correct conclusion which can be drawn from the statement:
 Statement: To start-off a loaded cart, one has to push it with more force than the force required to keep it moving.
 Conclusion:
 (a) The weight of a moving object is less
 (b) The wheels tend to slip initially
 (c) There is less friction once the cart starts moving
 (d) Practice makes perfect
26. Who among the following is known for 'Brahmasphuta Siddhant' and predated Newton's theory by declaring that all things gravitate to earth?
 (a) Aryabhatta (c) Brahmagupta
 (b) Varahamihira (d) None of these
27. You can never stand straight in space. What could be the possible reason for this?
 (a) There is no gravity
 (b) The gravitation forces of other planets and satellites will throw you off-balance.
 (c) Solar wind exert an upward force
 (d) Atmospheric pressure is very low
28. If from a spaceship, a leather-ball is released, then how will the ball react? It will:
 (a) Fall toward the earth
 (b) Move along with the spaceship with the same speed
 (c) Move at lower speed
 (d) Move at higher speed
29. You go to a roof and drop three things - a piece of wood, wax and iron. All the three are of equal size. Which one will reach the ground first?
 (a) Wood
 (b) Wax
 (c) Iron
 (d) Reach at the same time
30. **Assertion (A):** The weight of human being on moon is 1/6 in comparison to earth.
Reason (B): The moon has higher gravity than the earth.
 Codes:
 (a) Both A and R are true and R is correct explanation of A.
 (b) Both A and R are true but R is not correct explanation of A.
 (c) A is true but R is false.
 (d) A is false but R is true.
31. The relative velocity V_{AB} or V_{BA} of two bodies A and B may be:
 1. greater than velocity of body A
 2. greater than velocity of body B
 3. less than the velocity of body A
 4. less than the velocity of body B
 (a) 1 and 2 only (c) 1, 2 and 3 only
 (b) 3 and 4 only (d) 1, 2, 3 and 4
32. A jet plane moves up in air because:
 (a) the gravity does not act on bodies moving with high speeds
 (b) the thrust of the jet compensates for force of gravity

- (c) the flow of air around the wings causes an upward force, which compensates for the force of gravity
 (d) the weight of air whose volume is equal to the volume of the plane is more than the weight of the plane.

33. Which of the following pairs is correctly matched?

| List-I | List-II |
|---------------|----------------------|
| A. Radium | 1. Alexander Fleming |
| B. Penicillin | 2. Madam Curie |
| C. X-ray | 3. Edward Jenner |
| D. Smallpox | 4. W.K. Roentgen |

Code:

- A B C D
 (a) 2 1 4 3
 (b) 2 3 4 1
 (c) 3 4 1 2
 (d) 4 1 2 3
34. The earth travels in its Orbit at a speed of approx _____. Why do we not feel this high speed?
 (a) 600 km/h; Because they are too small compared to the size of Earth.
 (b) 400 km/h; Our relative speed with respect to the earth along the earth's orbit is zero
 (c) 400 km/h; Because they are too small compared to the size of earth.
 (d) 600 km/h; The gravity of the earth constantly pulls us word the earth's centre.
35. Suppose on earth the gravitational force suddenly disappears, then which of the following will be experienced by the people on the earth?
 (a) The weight of an object will become zero but the mass will remain the same
 (b) The mass of the object will become zero but the weight will remain same
 (c) Both the mass and the weight of the object will become zero
 (d) The mass of the object will increase
36. We know there is the gravitational force of the earth that attracts objects to the ground, yet, spacecrafts that orbit the earth don't crash on the ground. This is because the earth's gravitational force:
 (a) Does not exist at such distance.
 (b) Is neutralized by attraction of the Moon.
 (c) Provides the necessary speed for its steady motion.
 (d) Provides the necessary acceleration for its motion.
37. A rigid of mass 2 kg is dropped from a stationary balloon kept at the height of 50m from the ground. The speed of the body when it just touches the ground and the body when it just touches the ground and the total energy when it is dropped from the balloon are respectively. (Acceleration due to gravity = 9.8 m/s^2) (NDA 2019 II)
 (a) 980 ms^{-1} and 980 J
 (b) $\sqrt{980} \text{ ms}^{-1}$ and $\sqrt{980} \text{ J}$
 (c) 980 ms^{-1} and $\sqrt{980} \text{ J}$
 (d) $\sqrt{980} \text{ ms}^{-1}$ and 980 J

38. There are four classes in which known force of nature can be divided. With reference to this which one of the following statement is not correct?

- (a) Gravity is the strongest of the four
 (b) Electromagnet is act only on particles within electric charge
 (c) Weak nuclear force process, radioactivity
 (d) Strong nuclear force holds protons and neutrons inside the nucleus of an atom

39. A person sits inside a lift on its floor. As the lift moves he is feeling heavy. This will happen only:

- (a) When the elevator will go upward expeditiously
 (b) When the elevator will go down expeditiously
 (c) When the elevator will go upward with constant velocity
 (d) When the elevator will go downward with constant velocity

40. A footballer kicks the football. After rolling for a short distance, the ball become to rest. The ball slows to a stop because-

- (a) The footballer did not kick the ball hard enough
 (b) The ground is very rough
 (c) There is a force on the ball opposite the motion
 (d) There is no unbalanced force on the ball. So the ball would try to become to the rest

41. Which of the following is/are correct?

1. When a ship enters a sea from a river, it rises a little.
 2. The density of seawater is greater than that of river water.

In the context of the above statements, which of the following is true?

- (a) Only 1 (c) Both 1 and 2
 (b) Only 2 (d) None of the above

42. Consider the following statements:

A simple pendulum is set into oscillation

Then:

1. The acceleration is zero when the bob passes through the mean position.
 2. In a cycle the bob attains a given velocity twice.
 3. Both acceleration and velocity of the bob are zero when it reaches its extreme position during the oscillation.
 4. The amplitude of oscillation of the simple pendulum decreases with time.

Which of these statements are correct?

- (a) 1 and 2 (c) 1, 2 and 4
 (b) 3 and 4 (d) 2, 3 and 4

43. If V_a , V_w and V_s respectively are the speed of sound in air water and steel, then:

- (a) $V_a < V_w < V_s$ (c) $V_w < V_s < V_a$
 (b) $V_s < V_w < V_a$ (d) $V_s < V_a < V_w$

44. For the production of electricity, turbines and dynamo uses which energy to convert it into electrical energy?

- (a) Chemical energy (c) Mechanical energy
 (b) Solar energy (d) Magnetic energy

45. Two bodies of mass M each are placed R distance apart. In another system, two bodies of mass 2M each are placed R/2 distance apart. If F be the gravitational force between

the bodies in the first system, then the gravitational force between the bodies in the second system will be:

(NDA 2019 II)

- (a) 16 F (c) 4 F
(b) 1 F (d) None of these

46. A car starts from Bengaluru, goes 50 km in a straight line towards the south, immediately turns around and returns to Bengaluru. The time taken for this round trip is 2 hours the magnitude of the average velocity of the car for this round trip. (NDA 2019 II)

- (a) is 0
(b) is 50 km/h
(c) is 25 km/h
(d) can not be calculated without knowing acceleration

47. The speed of a car travelling on a straight road is light below at successive intervals of 1 s:

| | | | | | |
|-------------|---|---|---|---|---|
| Time (s) | 0 | 1 | 2 | 3 | 4 |
| Speed (m/s) | 0 | 2 | 4 | 6 | 8 |

which of the following is/are correct? The car travels:

- with a uniform acceleration of 2 m/s^2 .
- 16 m in 4 s.
- with an average speed of 4 m/s^2 .

Select the correct answer using the code given below:

(NDA 2017 I)

- (a) 1,2 and 3 (c) 1 and 2 only
(b) 2 and 3 only (d) 1 only

Answer with Explanations

Level-2

- (d) Acceleration is the rate of change of velocity of an object, with respect to time. The S.I. unit of acceleration is the meter per second square (m/s^2). The S.I. Unit of Force is Newton (N). The S.I. unit of Impulse is the Newton second (N-s). The S.I unit of work is Joule.
- (c) Pascal is the unit of pressure or stress in the International System of Units (SI). Dyne is the unit of force in CGS system. Clearly, option (c) is not correctly matched.
- (c) The SI unit of power is Watt (W), which is equal to one joule per second. Knot is the unit of measuring of speed of a ship. Nautical mile is a unit of distance use by navigators in sea. Calorie is a unit of measuring heat and energy. Thus option (c) correctly matched.
- (a) Joule is the SI unit of work. Ampere, Watt, Volt and Calorie are the unit of Electric Current, Power, Electric Potential and heat respectively.
- (b) Light year is not a unit of measuring time, but a unit of measuring distance. The remaining pair is correctly matched.
- (c) In sound the mach number is a dimensionless quantity presenting the ratio of the speed of a body to the speed of sound in the surrounding medium. Supersonic travel is a rate of an object that exceeds the speed of sound (Mach-I). So mach is used to present the high speed. Wavelength is measured in Angstrom while pressure is measured in Pascal and Frequency in Hertz.
- (b) Joule is the unit of energy, while Pascal is the unit of pressure. This is a question that would also test the logical reasoning capability of the candidate.
- (d) Celsius is a scale and unit of measurement for temperature. Heat is measured in calories. Nautical mile is used to measure distance at sea 1 nautical mile is equal to 1.1852 km. The SI unit of power is Watt(W),which is equal to Joule per second. Another unit of power include horsepower (hp) or metric horsepower. 1 horsepower is equal to 746 watts. Decibel is used to measure the sound intensity.
- (b) Cusec is measure of flow rates and is informal shorthand for cubic feet per second (28.317 liters per second). Byte is a unit of digital information in computing and Communication that consist of eight bits. The Richter magnitude scale (also Richter scale) assign a magnitude number to quantify the released by the earthquake. The bar is metric (but not SI) unit of pressure exactly equal to 100,000 Pascal.
- (d) SONAR [Sound Navigation and Ranging] is used to locating submerged objects in an ocean. It is based on a very simple principle i.e. pulse of ultrasonic waves is sent into the water, it strikes the target and bounced back toward the source. It helps to detect or locate submerged submarines and icebergs.
- (d) A 'Gravity tractor' (GT) is a spacecraft with a mechanism that can deflect another object in space without physically contacting it. It will use only its gravitational field to transverse the required impulse. It can effect potentially hazardous asteroid that might hit earth.
- (c) A Tacheometer is a type of theodolite used for rapid measurement and determines electronically or electro-optically the distance to target and is highly automated in its operations. The remaining is correctly matched. Pyrometer is a device used for measuring relatively high temperature, such as is encountered in furnaces. Anemometer is a device for measuring wind speed, An ammeter is a measuring instrument used to measure electric current in a circuit. Electric current is measured in Ampere (A).
- (d) Orbital decay, a process of prolonged reduction in the altitude of a satellite orbit is caused due to atmosphere drag, tides and gravitational pull.
- (c) Lactometer is used for the measurement of the density of the milk. Butyrometer is used to measure fat contain in milk of milk product.
- (a) Thermoresistor is a device which act as an electronic thermometer. This device change its resistance with changes in temperature. So, option (a) is correctly matched. A capacitor is a passive two-terminal electronic component that stores electrical energy in an electric field. A gas meter is a specialised flow meter, used to measure the volume of fuel gases such as natural gas and liquefied petroleum gas.

A semiconductor is a rectifying device in which the barrier between the two regions of opposite conductivity (n-type and p-type) type produces the rectification. All solar cells are junction diodes.

16. (c) Stethoscope is an acoustic medical instrument used for listening to the action of someone's heart sound. Sphygmomanometer is used to measure blood pressure. Caratometer is an internationally acclaimed device for checking the purity of gold. Lux meter is used to measure the intensity of light.
17. (c) RADAR stands for Radio detecting and ranging. As dedicated by the name, it is based on the use of radio waves. It refers to the technique of using radio waves to detect the presence of objects. Today, it is used for wide variety of applications, such as determination of the range, angles or velocity of the objects.
18. (c) Fathometer is an instrument used to determine the depth of water or a submerged object by means of ultrasound waves. The barometer is used to measure atmospheric pressure. Hygrometer is used to measure atmospheric moisture and Altimeter is used to measure altitude/height of an object above a fixed level.
19. (d) According to the options, option(d) is not correctly matched. Seismometer is an instrument used to measure seismic waves generated by earthquakes. Carburetor is a device that blends air and fuel for an internal combustion engine. Cardiograph is an instrument used to record the mechanical movement of heart. Manometer is an instrument that uses a column of liquid to measure pressure.
20. (a) Phonometer is an instrument used for testing the force of human voice in speaking. It was invented by Thomas Alva Edison.
21. (b) The kinetic energy is the energy in moving objects or mass. The kinetic energy of wind (wind energy) can be converted into electrical or mechanical energy. So the teacher is talking about kinetic energy.
22. (a) According to Newton's first law of motion sometime referred as law of inertia which states that an object at rest stays at rest and object in motion stays at motion with same speed and in same direction unless acted upon an unbalanced force. When a train suddenly starts, the passenger tends to fall backward. This is because the lower part of the body which is in contact with the train begins to move while the upper part of the body tends to maintain its position. As a result, the upper part tends to fall backward.
23. (b) Movement is not possible on frictionless surface as friction is required for movement. Hence, statement A is correct. Momentum is a property that a moving object has due to its mass and motion. Hence, when there is no external force applied on any moving object its momentum can-not change. Hence, statement R is correct.
24. (d) It is difficult to walk on the ice then road because Ice has a lesser friction then the road. The roughness of road's surface gives you much friction force which enables you to move forward on road.
25. (c) The static friction that holds an object in place is greater than the kinetic friction that slow down a moving object. In other words, once you start an object moving, the friction decreases from the static friction holding the object in place. You have seen this in trying to slide a heavy box across the floor. It may be very difficult to move, but once it start sliding, it is easier to push.
26. (c) Brahmagupta was the 7th century mathematician and astronomer. He was born in Bhinmal Rajasthan. He is best known for his 'Brahmasphuta Siddhant' in which he declared all the things gravitate to earth.
27. (a) In space Astronaut can-not stand erect. This is because there is no gravity or micro-gravity. In this condition people or object appear to be weightless. Micro-gravity effect the human body in several ways. For example muscle and bones can become weaker without gravity.
28. (b) If any object is released from an orbiting spaceship, it will move along the spaceship at same speed.
29. (d) A piece of equal size of woods, wax and iron falling from the same height, reach at the same time, because the same gravitational acceleration (g) is applied to all object.
30. (c) The moon is the Earth's only natural satellite. The surface gravity of the moon is only 1/6 that of the Earth. So, the weight of a human will be 1/6 of that on the earth.
31. (d) All options are correct
- (i) When two bodies A and B move in opposite directions then relative velocity between them V_{AB} or V_{BA} are greater than individual velocity V_A and V_B .
- (ii) When two bodies A and B move in parallel direction, then
- $$V_{AB} = V_A - V_B \Rightarrow V_{AB} < V_A$$
- $$\text{and } V_{BA} = V_B - V_A \Rightarrow V_{BA} < V_B$$
32. (b) When jet plane flies, it ejects gases in backward direction with high speed. According to Newton's third law, these emerged gases provides the momentum to jet plane in forward direction plus compensates the force of gravity.
33. (a) Radium is chemical element discovered by Marie Curie and her husband Pierre Curie on 21st December, 1898. Penicillin was discovered by Alexander Fleming in 1928. X ray was discovered by William Roetgen in 1895 experiment with cathode radiation. Edward Jenner is well known around the world for innovative contribution to immunization and the ultimate eradication of smallpox.
34. (b) The earth spins and moves through space in orbit around the sun. We don't feel this moment because we are spinning and moving through space with the earth. Since we are standing on the earth, we

move as much (and as fast) as the earth moves. One way to recognise the earth's movement is to locate object that not attached to earth, like the Sun or star. For example, if we are in a car which is moving at a constant speed on a smooth surface, we will not feel its motion. However, car accelerate or when the brakes are applied, we do feel the motion.

35. (a) If the gravitational force of the earth suddenly disappears, then the weight of an object will become zero but the mass will remain the same.

36. (d) There are two factors associated with the ability of satellite to remain in its orbit around the earth. The first is that the satellite was accelerated by the launch vehicle. The second factor is the gravitational attraction of the Earth which produce the necessary acceleration for its motion in a curved path.

37. (d) Given :

$$\begin{aligned} \text{Mass of the body} &= 2 \text{ kg} \\ \text{Height} &= 50 \text{ m} \\ \text{Total energy} &= mgh \\ &= 2 \times 9.8 \times 50 \\ &= 980 \text{ Joule} \\ \text{From equation, } v^2 &= u^2 + 2gh \\ v^2 &= (0)^2 + 2 \times 9.8 \times 50 \\ &= 980 \\ \Rightarrow v &= \sqrt{980} \text{ m/s} \end{aligned}$$

38. (a) Gravitational force is the weakest force among the four fundamental forces while nuclear force holds the position of strongest force among them.

39. (a) Let the mass of the person is m and weight is w in the elevator going upward with acceleration (a). The force acting on person-

- The first due to gravity = mg .
- The force giving the acceleration = ma according to Newton's second law:

$$\begin{aligned} W &= mg + ma \\ W &= m(g + a) \end{aligned}$$

So, it is clear that in elevator is going up what a person actually feel a little heavier than his usual weight and on the other hand when elevator accelerates downward the person feel a little reduction than his usual weight.

40. (c) A footballer kicks the football which then rolls on a level ground. After covering a short distance, the ball become to rest because there is no external force i.e. frictional force acting on the moving ball opposing its motion. If there is no frictional force acting on the ball then it will roll continuously.

41. (c) 1. The gravitational force on the mass of the ship. (Its weight)

- The density of the fluid in which it floats.
If you float a ship in a dense fluid, say liquid mercury, it will displace less, and therefore float higher than it will in a less dense fluid because it will only displace an amount of that fluid equal to its own weight.

42. (c) When an object, which is simple periodic motion passes through it mean;

- No force act on it.
- Its acceleration becomes zero.
- Maximum velocity
- Maximum kinetic energy
- Potential energy is zero

When the object reaches the position of extreme then,

- Its acceleration is maximum
- Counter force acting on that is maximum
- Kinetic energy is zero
- Has maximum potential energy
- Has zero velocity

In each rotation, the pendulum twice attains a specific velocity. In addition, inter normal circumference oscillation of usual pendulum decreases with time, statement 1, 2 and 4 are correct and statement 3 is wrong.

43. (a) As we know that the speed of sound is different for different types of medium. In general, sound travels faster in liquid than gases and faster in solid than in liquid.

44. (c) Dynamos and Generators convert mechanical rotation into electric power. Dynamo - a device that makes direct current electric power using electro-magnetism.

45. Newton's universal gravitational law is

$$F = K \frac{m_1 m_2}{r^2}$$

In system 1

$$F = K \frac{M \times M}{R^2} = K \left(\frac{M}{R} \right)^2$$

$$F' = K \frac{(2M)(2M)}{(R/2)^2} = 16K \left(\frac{M}{R} \right)^2$$

$$\therefore F' = 16F$$

Hence the magnitude of the gravitational force between them will increase by 16 times.

46. (a) The average velocity of an object is total displacement by the total time taken, since the displacement is zero, the average velocity is also zero.

47. (a) Given, Initial speed of car : $u = 0$ Final speed of car $v = 8 \text{ m/s}$, Total time $t = 4 \text{ s}$

$$\begin{aligned} \text{As } v &= u + at \\ 8 &= 0 + a \times 4 \end{aligned}$$

$$a = 2 \text{ m/s}^2$$

$$\text{As, } v^2 = u^2 + 2as$$

$$\text{k } (8)^2 = 0 + 2 \times 2 \times s$$

$$64 = 4s$$

$$s = 16 \text{ m}$$

Again

$$\text{Average speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$= \frac{16}{4} = 4 \text{ m/s}$$

2

Electricity, Magnetism and Nuclear Physics

Level-1

- Out of the following is not a property of field lines:
 - Field lines are continuous curves without any breaks
 - Two field lines cannot cross each other
 - Field lines start at positive charges and end at negative charges
 - They form closed loops
- The conducting power of magnetic lines of force as compared to air is called:
 - Permittivity
 - Permeability
 - Conductivity
 - Superconductivity
- The ease with which a magnetic substance can be magnetized is called:
 - Permeability
 - Conductivity
 - Susceptibility
 - Permittivity
- The susceptibility is more in :
 - Steel
 - Soft iron
 - Copper
 - None of these
- The retaining power of magnetism is more in:
 - Steel
 - Soft iron
 - Copper
 - None of these
- Para magnetic substances are those which tend to move fromparts of the magnetising field.
 - Stronger to weaker
 - Weaker to stronger
 - Same
 - None of these
- Paramagnetic substances are :
 - Aluminium
 - Platinum
 - Salts of Nickel
 - All of these
- A paramagnetic liquid contained in a watch glass if placed on two pole pieces very near one another the liquid shows an elevation in the:
 - Upper
 - Middle
 - Down
 - None
- Susceptibility of paramagnetic material is :
 - Small positive
 - Small negative
 - More than positive
 - None
- For paramagnetic material susceptibility is inversely proportional to :
 - Volume
 - Density
 - Absolute temperature
 - None of these
- In the external magnetic field diamagnetic substances move:
 - from weaker to stronger
 - from stronger to weaker
 - do not move
 - None of these
- When a diamagnetic material is suspended it sets itself:
 - Parallel to the field
 - Perpendicular to field
 - Right angled to the field
 - None of these
- The susceptibility of a diamagnetic material has a :
 - Positive value
 - Low negative value
 - Negative value
 - None of these
- Iron, cobalt, nickel and their alloys are :
 - Diamagnetic
 - Paramagnetic
 - Ferro magnetic
 - None of these
- The susceptibility of a ferro-magnetic substance is :
 - Large negative
 - Large positive
 - Low positive
 - None of these
- The temperature at which the ferro magnetic materials become paramagnetic materials is :
 - Absolute temperature
 - Ordinary temperature
 - Curie temperature
 - None of these
- A sheet of aluminium foil of negligible thickness is introduced between the plates of a capacitor. The capacitance of the capacitor.
 - decreases
 - remains unchanged
 - becomes infinite
 - increases
- The residual intensity of magnetisation left in the specimen when the magnetizing field is switched off is called.
 - Coercivity
 - Retentivity
 - Saturated
 - None of these
- The strength of the reverse magnetic field needed to make the intensity of magnetization zero is :
 - Coercivity
 - Retentivity
 - Residual
 - None of these
- The potential to which a conductor is raised, depends on:
 - the amount of charge
 - geometry and size of the conductor
 - both (a) and (b)
 - only on (a)
- The unit of magnetic induction is :
 - Weber
 - Weber/m²
 - Weber/ m
 - None of these
- The unit of intensity of magnetisation is :
 - Ampere
 - Ampere-turns
 - Ampere/ m
 - Amp-turns / metre
- The area of B-H loop increases with increase in the strength of :
 - Electric field
 - Magnetising field
 - Hysteresis
 - None of these
- The silicon-iron is called:
 - Steel
 - Core
 - Transformer Steel
 - None

25. The pole pieces of electromagnets are made by:
 (a) Alnico (c) Permalloy's
 (b) Mu metal (d) None of these
26. The susceptibility is inversely proportional to the absolute temperature:
 (a) Curie Temperature (c) Ohm's Law
 (b) Curie Law (d) None of these
27. The curie temperature of iron is
 (a) 893 K (c) 1043 K
 (b) 631 K (d) None of these
28. All charges in nature occur are an integral multiple of:
 (a) $q = e$ (c) $q = ne$
 (b) $q = n$ (d) None of these
29. The charged bodies whose dimensions are small in comparison with the distance between them is called :
 (a) Charge (c) Point charge
 (b) Specific charge (d) None of these
30. Metals, human body, graphite are some of the examples of:
 (a) Conductors (c) Semi conductors
 (b) Insulators (d) None of these
31. Bodies which do not allow the charge are called :
 (a) Conductors (c) Insulators
 (b) Capacitors (d) None of these
32. Force between two point charges is directly proportional to the product of charges and inversely proportional to square of the distance between them, this is:
 (a) Ampere's law (c) Coulomb's Law
 (b) Gas law (d) None of these
33. The value of relative permittivity for air is equal to :
 (a) 1 (c) -1
 (b) 0 (d) None of these
34. The force that acts on a unit positive charge placed at that point is known as:
 (a) Magnetic field (c) Electric intensity
 (b) Electric field (d) Both (b) and (c)
35. _____ is a pair of equal and opposite point charges q and $-q$, separated by a distance $2a$.
 (a) Electric Dipole (c) Tripole
 (b) Electric Pole (d) None of these
36. When a capacitor is connected to a battery:
 (a) a current flows in the circuit for some time, then decreases to zero
 (b) no current flows in the circuit at all
 (c) an alternating current flows in the circuit
 (d) none of the above
37. Which one of the following substance when is heated, its conductivity increases?
 (a) Metal (c) Semiconductor
 (b) Insulator (d) both (b) and (c)
38. Ohm's law is valid if:
 (a) V is directly proportional to I^3
 (b) The relation between V and I is non-unique
 (c) V is directly proportional to I^2
 (d) V depends on I linearly
39. The resistance of an incandescent lamp is:
 (a) greater when switched off
 (b) smaller when switched on
 (c) greater when switched on
 (d) the same whether it is switched off or switched on
40. The ratio of the charge given to the conductor to the potential developed in the conductor is called:
 (a) Potential difference (c) Resistivity
 (b) Capacitance (d) None of these
41. The unit of capacitance is :
 (a) Ampere (c) Farad
 (b) Ohm (d) None of these
42. The practical units of capacitance are:
 (a) μF (c) Both (a) and (b)
 (b) pF (d) None of these
43. A capacitor is a device for storing :
 (a) Electric current (c) Electric charge
 (b) Voltage (d) None of these
44. The capacitance depends on the geometry of the conductors and nature of :
 (a) The element (c) The content
 (b) The medium (d) None of these
45. An insulating material in which all the electrons are tightly bound to the nucleus of the atom is called:
 (a) Polarization (c) Polar Molecules
 (b) Dielectrics (d) None
46. Ebonite, mica, and oil are few examples of :
 (a) Dielectrics (c) Insulators
 (b) Conductors (d) Both (a) and (c)
47. O_2 , N_2 , H_2 are the example for :
 (a) Polar molecules
 (b) Non polar molecules
 (c) Conductors
 (d) None of these
48. The centre of gravity of the positive charge is separated from the centre of gravity of the negative charges is called
 (a) Non-polar molecule (c) Dielectrics
 (b) Polar molecule (d) None of these
49. The another name for positive rays is :
 (a) Canal rays (c) UV rays
 (b) X-rays (d) None of these
50. Which of the following statements is correct:
 (a) liquids obey fully the ohm's law
 (b) liquids obey partially the ohm's law
 (c) there is no relation between current and potential difference for liquids
 (d) none of the above
51. A galvanometer can be converted into an ammeter by connecting:
 (a) low resistance in series
 (b) high resistance in parallel
 (c) low resistance in parallel
 (d) high resistance in series
52. Which of the following is not correctly matched?
 (a) Voltmeter—Potential difference
 (b) Ammeter—Electric current
 (c) Potentiometer—E.M.F.
 (d) Galvanometer—Electric resistance

53. Match List-I with List II and select the correct answer using the codes given below:

| List-I | List-II |
|------------|--------------------------|
| A. Joule | 1. Henry–ampere/sec |
| B. Watt | 2. Farad–Volt |
| C. Volt | 3. Coulomb–Volt |
| D. Coulomb | 4. Oersted–cm |
| | 5. Amp–gauss |
| | 6. Amp ² –ohm |

Codes:

- A B C D
 (a) 1 6 5 4
 (b) 3 6 1 2
 (c) 3 6 1 5
 (d) 2 6 1 3
54. An electron and a proton starting from rest get accelerated through potential difference of 100 kV. The final speeds of the electron and the proton are v_e and v_p respectively. Which of the following relations is correct? **(CDS 2019 II)**
 (a) $v_e > v_p$ (b) $v_e = v_p$
 (c) $v_e < v_p$ (d) Can't be determined
55. The resistivity ρ of a material may be expressed in units of: **(CDS 2020 I)**
 (a) ohm (b) ohm/cm (c) ohm-cm (d) ohm-cm²
56. Scattering of α -particles by a thin gold foil suggests the presence of: **(CDS 2020 II)**
 (a) Electron in an atom
 (b) Proton in an atom
 (c) Positively charged nucleus at the centre of an atom
 (d) Isotopes of gold
57. The direction of magnetic field at any location on the earth's surface is commonly specified in terms of: **(CDS 2018 I)**
 (a) field declination
 (b) field inclination
 (c) both field declination and field inclination
 (d) horizontal component of the field
58. A circuit has a fuse having a rating of 5 A. What is the maximum number of 100 W-220 W bulbs that can be safely connected in parallel in the circuit?
 (a) 20 (b) 15 (c) 11 (d) 10
59. In the gamma decay of a nucleus: **(CDS 2016)**
 (a) the mass number of the nucleus changes whereas its atomic number changes
 (b) the mass number of the nucleus does not change whereas its atomic number changes
 (c) both the mass number and the atomic number of the nucleus change
 (d) neither the mass number nor the atomic number of the nucleus changes
60. Suppose voltage V is applied across a resistance R. The power dissipated in the resistance is P. Now the same voltage V is applied across a parallel combination of three equal resistors each of resistance R. Then the power dissipated in the second case will be: **(CDS 2017)**
 (a) P (b) 3P (c) P/3 (d) 2P/3

61. Which of the following is used as control rods in Atomic sector? **(CPO 2017)**
 (a) Sodium (b) Uranium (c) Graphite (d) Boron
62. Light energy emitted by stars is due to:
 (a) breaking of nuclei
 (b) joining of nuclei
 (c) burning of nuclei
 (d) reflection of solar light
63. What is the source of energy in stars?
 (a) fusion (b) chemical reaction (c) gravitational collapse (d) fission
64. During the β -decay:
 (a) an atomic electron is released
 (b) an electron, already present with the nucleus, is ejected
 (c) a proton in the nucleus decays emitting an electron
 (d) a neutron in the nucleus decays emitting an electron
65. When a radioactive substance emits an α -particle, its position in the periodic table is lowered by: **(AIIMS 2016)**
 (a) one place (b) two places (c) three places (d) four places
66. Carbon dating is best suited for determining the age of fossils, if their age in years is of the order of:
 (a) 10^3 (b) 10^4 (c) 10^5 (d) 10^6
67. Radioactive nuclei that are injected into a patient, collect at certain sites within its body, undergoing radioactive decay and emitting electromagnetic radiation. These radiations can then be recorded by a detector. This procedure provides an important diagnostic tool called
 (a) gamma camera (b) CAT scan (c) radiotracer technique (d) gamma ray spectroscopy
68. Isotopes have:
 (a) same number of protons
 (b) same number of nucleons
 (c) same number of neutrons
 (d) same number of positrons
69. A chain reaction in fission of uranium is possible because:
 (a) large amount of energy is released
 (b) more than one neutron is given out
 (c) small amount of energy is released
 (d) fragments in fission are radioactive
70. Radioactive radiations are harmful to the living organs. To avoid harm during storage, radioactive samples are stored in lead boxes. Lead is used because it is:
 (a) heavy (b) strong (c) good absorber (d) bad conductor
71. Mass equivalent to energy 931 MeV is:
 (a) 6.02×10^{-27} kg (b) 1.66×10^{-27} kg (c) 16.66×10^{-27} kg (d) 6.02×10^{-27} kg
72. The production of X-rays is due to the transition of electrons:
 (a) with the target atom due to transfer of momentum
 (b) of heavy target atoms from high to low energy level
 (c) with the target atom from low to high energy level
 (d) none of these

73. X-rays are produced when an element of high atomic weight is bombarded by high energy:
 (a) protons (c) neutrons
 (b) electrons (d) photons
74. Which of the following is most suitable for the core of the electromagnets?
 (a) Cu-Ni alloy (c) steel
 (b) soft-iron (d) Air
75. For protecting, a sensitive equipment from external magnetic field, it should be:
 (a) placed inside an iron can
 (b) wrapped with insulated wire, through which current is passed
 (c) surrounded with fire copper gauge
 (d) placed inside an aluminium can
76. Susceptibility of a magnetic substance is found to depend on temperature and the strength of the magnetic field. The material is a:
 (a) diamagnet (c) ferromagnet
 (b) paramagnet (d) superconductor
77. Fleming's left and right hand rules are used in:
 (a) DC motor and AC generator
 (b) DC generator and AC motor
 (c) DC motor and DC generator
 (d) both rules are same, any one can be used
78. The power in a two-wire transmission line travels:
 (a) Inside the conductors
 (b) Outside the conductors
 (c) Both inside and outside the conductors
 (d) None of the above
- Assertions and Reasons:**
Directions for questions 79 and 80:
 In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
 (a) If both assertion and reason are true and reason is the correct explanation of the assertion
 (b) If both assertion and reason are true but reason is not the correct explanation of the assertion
 (c) If assertion is true, but reason is false
 (d) Both assertion and reason are false statements
79. **Assertion:** Faraday's laws are consequence of the conservation of energy.
Reason: In a purely resistive a.c. circuit, the current lags behind the emf in phase.
80. **Assertion:** The presence of large magnetic flux through a coil maintains a current in the coil, if the circuit is continuous.
Reason: Only a change in magnetic flux will maintain an induced current in the coil.
81. The capacitance of a parallel plate condenser does not depend upon:
 (a) The distance between the plates
 (b) Area of the plates
 (c) Medium between the plates
 (d) Metal of the plates
82. The core of any transformer is laminated, so as to:
 (a) reduce the energy loss due to eddy currents
 (b) make it light weight
 (c) make it robust and strong
 (d) increase the secondary voltage
83. A choke coil has:
 (a) low inductance and high resistance
 (b) high inductance and low resistance
 (c) low inductance and low resistance
 (d) high inductance and high resistance
84. A fuse wire is characterized by.....
 (a) High resistance and high melting point
 (b) Low resistance and high melting point
 (c) High resistance and low melting point
 (d) None of these
85. Magnetic effect of current was discovered by :
 (a) Faraday (c) Kirchoff
 (b) Oersted (d) None of the above
86. Which of the following is the speciality of the Meissner effect?
 (a) Ferromagnetism (c) Superconductivity
 (b) Thermodynamics (d) None of these
87. Which among the following is a source of Atomic Energy?
 (a) Uranium (c) Platinum
 (b) Iron (d) None of these
88. Horizontal and vertical components of earth's magnetic field are equal, then angle of dip is:
 (a) 60° (c) 30°
 (b) 45° (d) 90°
89. How many neutrons are produced in the fission of one U-235 nuclei?
 (a) 2 or 3 (c) 6 or 7
 (b) 4 or 5 (d) 8 or 9
90. What is the silicon?
 (a) Conductor (c) Semiconductor
 (b) Insulator (d) None of the above
91. Which of the following is conserved in a nuclear reaction?
 (a) Only mass
 (b) Only energy
 (c) Only momentum
 (d) Mass, energy and momentum
92. Nuclear energy is measured in :
 (a) Newton (c) Fermi
 (b) Electron volts (d) Tesla
93. Which of the following can be measured by a conductivity meter?
 (a) Pressure in a liquid
 (b) Salinity in aquaculture
 (c) Strength of an acid
 (d) Strength of an alkali
94. If a current is passed through a spring, then the spring will:
 (a) expand (c) remains same
 (b) compress (d) none of these
95. When deuterium and helium are subjected to an accelerating field simultaneously, then:
 (a) both acquire same energy
 (b) deuterium accelerates faster
 (c) helium accelerates faster
 (d) neither of them is accelerated
96. Solar energy can be converted into electrical energy using :
 (a) Daniel Cell (c) Photovoltaic cell
 (b) Lithium ion cell (d) Ni cell
97. Galvanizing is a process of :
 (a) Zinc diffusion

- (b) Thin phosphate coating on steel
(c) Zinc coating on steel by hot dipping
(d) Very thin coating of on steel
98. X-rays are beams of:
(a) Electrons (c) Protons
(b) Photons (d) None of these
99.is the process of coating zinc by hot dipping.
(a) Anodising (c) Galvanising
(b) Brazing (d) Sherardizing
100. A parallel plate capacitor is charged. If the plates are pulled apart:
(a) the capacitance increases
(b) the potential differences increases
(c) the total charge increases
(d) the charge and potential difference remain the same
101. Which of the following element was first produced artificially?
(a) Neptunium (c) Francium
(b) Plutonium (d) Technetium
102. Neutrons are slowed down in a nuclear reactor by :
(a) Fissionable material (c) Control rods
(b) Moderator (d) Cooling system
103. Atoms whose nuclei have the same number of neutrons but different numbers of protons is called :
(a) Isobars (c) Isotones
(b) Isotopes (d) None of these
104. Which of the following is used as a fuel by the Prototype Fast Breeder Reactor (PFBR)?
(a) Thorium (c) Uranium-238
(b) Uranium-235 (d) Plutonium
105. Which of the following is used as a fuel by the Proton Exchange Membrane (PEM)?
(a) Hydrogen gas (c) Both (a) and (b)
(b) Oxygen gas (d) Neither (a) nor (b)
106. Natural uranium contains ____ of Uranium – 235.
(a) 0.4% (c) 0.6%
(b) 0.5% (d) 0.7%
107. What are the control rods in nuclear reactors made of?
(a) Cadmium (c) Both (a) and (b)
(b) Silver (d) Neither (a) nor (b)
108. Nuclear sizes are expressed in :
(a) Fermi (c) Newton
(b) Angstrom (d) Tesla
109. Energy is produced in the Sun by :
(a) Nuclear fission (c) Radioactivity
(b) Nuclear fusion (d) Both (a) and (b)
110. No current will flow between two charged bodies if they have the same:
(a) Resistance
(b) Charge
(c) Potential
(d) Charge/ potential ratio
111. Which metal can be used for producing electricity?
(a) Uranium (c) Copper
(b) Iron (d) Aluminium
112. A dynamo which is said to generate electricity actually acts as a:
(a) Source of ions
(b) Source of electric charge
(c) Converter of energy
(d) Source of electrons
113. What gases are filled in fluorescent tube?
(a) Neon (b) Sodium
(c) Mercury (d) Mercury and neon
114. Photovoltaic cells are:
(a) Solar cells (c) Sulphur cells
(b) Thermal cells (d) Molar cells
115. The important nuclear fuel available in India in abundance is:
(a) Uranium (c) Iridium
(b) Thorium (d) Plutonium
116. Which one of the following cannot be used as a nuclear fuel?
(a) Uranium (c) Calcium
(b) Thorium (d) Plutonium
117. The electric current does not flow between two properly connected charged bodies if they are having:
(a) Same charge (c) Same resistivity
(b) Same capacity (d) Same potential
118. Which elements is the best conductor of electricity?
(a) Silver (c) Aluminium
(b) Copper (d) Iron
119. Full form of C.F.L. is:
(a) Compact fluorescent lamp
(b) Centrally fixed lamp
(c) Chemical fluorescent lamp
(d) Condensed fluorescent lamp
120. A mobile phone charger is:
(a) An inverter
(b) A UPS
(c) A step up transformer
(d) A step down transformer
121. Alternate current is not preferable :
(a) To charge storage battery
(b) To run/start a electric motor
(c) To transmit electric power
(d) To heat up electric toaster
122. Which of the following option represents the consumption of power in ascending order:
(a) Television, fan, electronic press, electronic kettle
(b) Television, fan, electronic kettle, electronic press
(c) Fan, television, electronic press, electronic kettle
(d) Electronic press, electronic kettle, fan, television
123. In the cell (battery), which of the following are used as electrolytes?
(a) Ammonium chloride and zinc chloride.
(b) Sodium chloride and calcium chloride.
(c) Magnesium chloride and zinc chloride.
(d) Ammonium chloride and Calcium chloride.
124. Nickel-Cadmium (Ni-Cd) battery is used in:
(a) Calculator
(b) Cordless electronic appliances
(c) Transistors
(d) All of the above
125. One of the most useful instruments for measurement of potential difference, current and resistance is:
(a) Watt meter
(b) Electrostatic instrument
(c) Voltmeter
(d) None of the above

126. Transformer is used for:
 (a) Converting AC into DC
 (b) Converting DC into AC
 (c) To step up DC voltages
 (d) To step up or step down AC voltages
127. Ohm's law is valid in case of :
 (a) Superconductor (c) Semiconductor
 (b) Insulator (d) Conductor
128. Danish engineer Valdemar Poulsen invented the arc transmitter in:
 (a) 1898 (c) 1956
 (b) 1902 (d) 1972
129. Hysteresis in any instrument means:
 (a) The repeatability of the instrument
 (b) The reliability of the instrument
 (c) The Inaccuracy due to change in temperature
 (d) The change in same reading when input is first increased and then decreased
130. A 100 watt electric bulb is used for 10 hours. What will be the cost of electricity consumed, if the consumption cost is Rs. 5 per unit?
 (a) Rs. 5 (c) Rs. 25
 (b) Rs. 10 (d) Rs. 50
131. Electricity consumption bill is based on the measurement:
 1. Watt
 2. Voltage
 3. Ohm
 4. Ampere
 Select your answer of the following codes:
 (a) Only 1 (c) 2 and 3
 (b) 1 and 2 (d) 1 and 4
132. Of the two bulbs in a house, one glows brighter than the other. In this context which of the following statements is correct?
 (a) The brightness does not depend on the resistance.
 (b) Both the bulbs have same the resistance.
 (c) The bright bulb has larger resistance
 (d) The dim bulb has larger resistance
133. Kirchoff's first law, i.e. $\Sigma I = 0$ at a junction, deals with the conservation of:
 (a) charge (c) momentum
 (b) energy (d) angular momentum
4. (b) Iron has magnetic properties. Magnetic materials may be classified as diamagnetic, paramagnetic, or ferromagnetic on the basis of their susceptibilities. Diamagnetic materials, such as bismuth, when placed in an external magnetic field, partly expel the external field from within themselves.
5. (a) The soft iron inside the coil makes the magnetic field stronger because it becomes a magnet itself when the current is flowing. Soft iron is used because it loses its magnetism as soon as the current stops flowing.
6. (b) Paramagnetic substances are those which get weakly magnetised when placed in an external magnetic field. They have tendency to move from a region of weak magnetic field to strong magnetic field, i.e., they get weakly attracted to a magnet.
7. (b) Aluminium, Calcium, Chromium, Lithium, Magnesium, Niobium, Oxygen, Platinum, Tungsten are paramagnetic substances.
8. (b) For a paramagnetic material both μ and μ_r depend not only on the material, but also (in a simple fashion) on the sample temperature. As the field is increased or the temperature is lowered, the magnetisation increases until it reaches the saturation value M_s , at which point all the dipoles are perfectly aligned with the field.
9. (a) Magnetic susceptibility is a measure of how a magnetic material responds to an external field. It is small and positive for materials, which are called paramagnetic. It is small and negative for materials, which are termed diamagnetic.
10. (c) This disappearance of magnetisation with temperature is gradual. It is a phase transition reminding us of the melting of a solid crystal. The temperature of transition from ferromagnetic to paramagnetism is called the Curie temperature T_c .
11. (b) Diamagnetic substances are those which have tendency to move from stronger to the weaker part of the external magnetic field. In other words, unlike the way a magnet attracts metals like iron, it would repel a diamagnetic substance.
12. (c) A bar of diamagnetic material placed in an external magnetic field. The field lines are repelled or expelled and the field inside the material is reduced. When placed in a non-uniform magnetic field, the bar will tend to move from higher to lower field. When a diamagnetic material is suspended it sets itself at a right angle to the field.
13. (b) Magnetic susceptibility is a measure of how a magnetic material responds to an external field. It is small and positive for materials, which are called paramagnetic. It is small and negative for materials, which are termed diamagnetic.
14. (c) When a magnetizing force is applied, the domains become aligned to produce a strong magnetic field within the part. Iron, nickel, and cobalt are examples of ferromagnetic materials. Components with these

Answer with Explanations

Level-1

- (d) The lines of force are continuous smooth curves without any breaks. They may not always form closed loops.
- (b) Permeability, also called magnetic permeability, is a constant of proportionality that exists between magnetic induction and magnetic field intensity.
- (c) In electromagnetism, the magnetic susceptibility is a measure of how much a material will become magnetized in an applied magnetic field. Mathematically, it is the ratio of magnetization M (magnetic moment per unit volume) to the applied magnetizing field intensity H .

materials are commonly inspected using the magnetic particle method.

15. (b) The susceptibility of ferromagnetic materials is very large. That is why they can be magnetised easily and strongly.
16. (c) The ferromagnetic property depends on temperature. At high enough temperature, a ferromagnet becomes a paramagnet. The domain structure disintegrates with temperature. This disappearance of magnetisation with temperature is gradual. It is a phase transition reminding us of the melting of a solid crystal. The temperature of transition from ferromagnetic to paramagnetism is called the Curie temperature T_c .
17. (b) As aluminium is a metal and its thickness is negligible, the potential differences between the plates remain unchanged. Thus the capacitance will remain unchanged.
18. (b) The residual intensity of magnetisation left in the specimen when the magnetizing field is switched off is called retentivity.
19. (a) The material should have high retentivity so that the magnet is strong and high coercivity so that the magnetisation is not erased by stray magnetic fields, temperature fluctuations or minor mechanical damage. Further, the material should have a high permeability. Steel is one-favoured choice. It has a slightly smaller retentivity than soft iron but this is outweighed by the much smaller coercivity of soft iron. Other suitable materials for permanent magnets are alnico, cobalt steel etc.
20. (c) $V = \frac{Q}{C} = Q \frac{d}{\epsilon A}$
- Thus, the potential of a conductor depends on the amount of charge, geometry and size of the conductor.
21. (b) SI unit of B is tesla (T) or weber/m² i.e. Wb/m² or Nsc⁻¹m⁻¹. This can be found by equation $F = qvB$. This can be found by equation $F = qvB \sin \theta$.
22. (c) The magnetic moment developed per unit volume of a material when placed in a magnetising field is called intensity of magnetisation.
23. (b) A hysteresis loop shows the relationship between the induced magnetic flux density (B) and the magnetizing force (H). It is often referred to as the B-H loop.
- The hysteresis curve allows us to select suitable materials for permanent magnets. The material should have high retentivity so that the magnet is strong and high coercivity so that the magnetisation is not erased by stray magnetic fields, temperature fluctuations or minor mechanical damage.
24. (c) Electrical steel (lamination steel, silicon electrical steel, silicon steel, relay steel, transformer steel) is an iron alloy tailored to produce specific magnetic properties: small hysteresis area resulting in low power loss per cycle, low core loss, and high permeability.

25. (c) Permalloy is the term for a nickel iron magnetic alloy. Generically, it refers to an alloy with about 20% iron and 80% nickel content.
- Permalloy has a high magnetic permeability, low coercivity, near zero magnetostriction, and significant anisotropic magnetoresistance. The low magnetostriction is critical for industrial applications, where variable stresses in thin films would otherwise cause a ruinously large variation in magnetic properties.
26. (b) Its discoverer is Pierre Curie (1859- 1906). The constant C is called Curie's constant. Thus, for a paramagnetic material both μ and μ_r depend not only on the material, but also (in a simple fashion) on the sample temperature. As the field is increased or the temperature is lowered, the magnetisation increases until it reaches the saturation value M_s , at which point all the dipoles are perfectly aligned with the field.
27. (c) Cobalt - 1394 K
Iron - 1043 K
 Fe_2O_3 - 893 K
Nickel - 631 K
Gadolinium - 317 K
28. (c) This expression tells the relation that what should be the total charge on a body if it has got n number of electrons or protons.
- Here
 q = total charge
 n = no of electrons or protons
 e = charge on a electron or a proton
- Let's suppose there are 5 electrons in a charged body so it's total charge can be calculated as
 $q = 5 \times 1.6 \times 10^{-19} \text{ C}$
That is equal to $8 \times 10^{-19} \text{ C}$
- This not only tells about charge but also show us that the charge is transferred in a body at a integral multiple of e that is the charge on a electron.
29. (c) Electric field is defined as the electric force per unit charge. The direction of the field is taken to be the direction of the force it would exert on a positive test charge. The electric field is radially outward from a positive charge and radially in toward a negative point charge.
30. (a) Conductors are materials that permit electrons to flow freely from particle to particle. An object made of a conducting material will permit charge to be transferred across the entire surface of the object. If charge is transferred to the object at a given location, that charge is quickly distributed across the entire surface of the object.
31. (c) In contrast to conductors, insulators are materials that impede the free flow of electrons from atom to atom and molecule to molecule. If charge is transferred to an insulator at a given location, the excess charge will remain at the initial location of charging.

32. (c) The quantitative expression for the effect of force between two charges is known as Coulomb's law. Coulomb's law states that the electrical force between two charged objects is directly proportional to the product of the quantity of charge on the objects and inversely proportional to the square of the separation distance between the two objects.
33. (a) The relative permittivity of a material is its (absolute) permittivity expressed as a ratio relative to the vacuum permittivity.
- Permittivity is a material property that affects the Coulomb force between two point charges in the material. Relative permittivity is the factor by which the electric field between the charges is decreased relative to vacuum.
34. (d) The concept of electric field was first introduced in the unit on static electricity. In that unit, electric force was described as a non-contact force. A charged balloon can have an attractive effect upon an oppositely charged balloon even when they are not in contact. The electric force acts over the distance separating the two objects. Electric force is an action-at-a-distance force.
35. (a) An electric dipole is a pair of equal and opposite point charges q and $-q$, separated by a distance $2a$. The line connecting the two charges defines a direction in space. By convention, the direction from $-q$ to q is said to be the direction of the dipole.
36. (a) A current flows in the circuit during the time and capacitor is charged. After the capacitor gets fully charged, the current stops flowing.
37. (d) The conductivity of an insulator or a semiconductor increases with the increase in temperature.
38. (d) According to ohm's law,
- $$V \propto I \text{ or } V = RI$$
- From the above relation it is clear that ohm's law is valid if V depends on I linearly.
39. (c) $R \propto \frac{1}{\tau}$ where τ is relaxation time.
- when lamp is switched on, temperature of filament increases, hence τ decreases so R increases.
40. (b) Capacitance is the ratio of the change in an electric charge in a system to the corresponding change in its electric potential.
41. (c) The SI unit of capacitance is the farad (symbol: F), named after the English physicist Michael Faraday. A 1 farad capacitor, when charged with 1 coulomb of electrical charge, has a potential difference of 1 volt between its plates.
42. (c) One farad is a very large unit of capacitances. For practical purposes, we use its following submultiples
- $$1 \text{ microfarad} = 1 \mu\text{F} = 10^{-6}\text{F}$$
- $$1 \text{ pico farad} = 1 \text{ pF} = 10^{-12}\text{F}$$
43. (c) capacitor an arrangement of two conductors separated say an insulating medium that is used to store electric charge and electric energy.
44. (b) The capacitance is a function only of the geometry of the design (e.g. area of the plates and the distance between them) and the permittivity of the dielectric material between the plates of the capacitor. For many dielectric materials, the permittivity and thus the capacitance, is independent of the potential difference between the conductors and the total charge on them.
45. (b) A dielectric material is a substance that is a poor conductor of electricity, but an efficient supporter of electrostatic field. If the flow of current between opposite electric charge poles is kept to a minimum while the electrostatic lines of flux are not impeded or interrupted, an electrostatic field can store energy.
46. (d) These all are insulators. Porcelain insulators are made from clay, quartz or alumina and feldspar, and are covered with a smooth glaze to shed water. Insulators made from porcelain rich in alumina are used where high mechanical strength is a criterion.
47. (b) A molecule in which the centre of mass of positive charges coincide with the centre of mass of negative charges is called a non-polar molecule. Non-polar molecules have symmetrical shapes, They have normally zero dipole moment.
48. (b) A polar molecule has a net dipole as a result of the opposing charges (i.e. having partial positive and partial negative charges) from polar bonds arranged asymmetrically. Water (H_2O) is an example of a polar molecule since it has a slight positive charge on one side and a slight negative charge on the other.
49. (a) An anode ray (also positive ray or canal ray) is a beam of positive ions that is created by certain types of gas-discharge tubes. They were first observed in Crookes tubes during experiments by the German scientist Eugen Goldstein, in 1886.
50. (b) In V - I graph, we will not get a straight line in case of liquids.
51. (c) To convert a galvanometer into an ammeter a low value resistance called shunt is to be connected in parallel to it.
52. (d) Galvanometers are electrical devices used for detection or measurement of the electric currents.
53. (b) Joule denoted by coulomb-volt. Watt denoted by $\text{amp}^2\text{-ohm}$. Volt denoted by henry-amp/sec. Coulomb denoted by Farad-volt.
54. (a) Both when accelerated through a potential difference of 100 kV, they will have the same energy. The mass of the electron is less than the mass of a proton, hence it will move faster (momentum).
55. (c) Resistance $R = \text{Resistivity} \times \text{length/area}$
- $$\therefore \text{ohm} = \text{resistivity} \times \text{cm/cm}^2$$
- $$= \text{resistivity/cm}$$
- $$\therefore \text{resistivity} = \text{ohm-cm}$$
56. (c) Rutherford's explanation, which he published in May, 1911 was that the scattering was caused by a hard, dense core at the center of the atom-called nucleus.
57. (c) The direction of the magnetic field at any location on earth's surface is commonly specified in terms of two

angles, field declination and field inclination. Magnetic inclination is the angle between the horizontal plane and the total field vector, measured positive into earth and magnetic declination is the angle between magnetic north and true north.

58. (c) Total permissible power of fuse
 $= 5 \text{ A} \times 220 \text{ V}$
 $= 1100 \text{ W}$
 Power of 1 bulb = 100 W, so
 Number of bulb = $\frac{1100}{100} = 11$
59. (d) The emission of gamma rays does not alter the number of protons or neutrons in the nucleus but instead has the effect of moving the nucleus from a higher to a lower energy state (unstable to stable).
60. (b) $P = I^2R$ where I = current
 P = electric power
 R = resistance
 Here all the resistance are connected in parallel combination and in parallel combination, the value of resistance decreases and dissipation of power increase, hence 3 times more power will be dissipated.
61. (d) It is essential to have a control on the chain reaction in a reactor. The substances used for this purpose are those which absorb neutrons. Such substances are cadmium and boron.
62. (b) Light energy emitted by stars is due to fusion of light nuclei.
63. (a) Energy is generated in stars due to fusion of light nuclei.
64. (d) In a beta decay, an electron and an antineutrinos are created and emitted from the nucleus via the reaction:

$$n \rightarrow p + e^- + \bar{\nu}$$
 where $\bar{\nu}$ is anti neutrino.
65. (b) When a radioactive substance emits an α -particle, its atomic number decreases by 2 and so its position in the periodic table is lowered by 2 places.
66. (b) Carbon dating is best suited for determining the age of fossils, if their age is of the order of 10^4 years.
67. (c) The diagnostic tool is called radiotracer technique. A radioactive tracer, radiotracer or radioactive label, is a chemical compound in which one or more atoms have been replaced by a radionuclide so by virtue of its radioactive decay it can be used to explore the mechanism of chemical reactions by tracing the path that the radioisotope follows from reactants to products. It is used in PET scans, SPECT scans and technetium scans.
68. (a) Isotope, one of two or more species of atoms of a chemical elements with the same atomic number and position in the periodic table and nearly identical chemical behaviour but with different atomic masses and physical properties. Every chemical element has one or more isotopes.
69. (b) A chain reaction in uranium is possible because more than one neutron is given out in each fission.
70. (c) Lead is very dense, and therefore a good shield against gamma rays. It is good absorber of radioactive radiations.
71. (b) $E = 931 \text{ MeV} = 931 \times 1.6 \times 10^{-13} \text{ J}$

$$\Delta m = \frac{E}{c^2} = \frac{931 \times 1.6 \times 10^{-13}}{(3 \times 10^8)^2}$$
 $= 1.66 \times 10^{-27} \text{ kg}$
72. (b) When the cathode rays strike heavy target atoms, they knock out some electrons of the inner orbits. Then the electrons of the outer orbits jump to the inner orbits, giving characteristic X-rays photons.
73. (b) X-rays are produced when an element of high atomic weight is bombarded by high energy electrons.
74. (b) Soft iron is preferred for the core of electromagnets because of its high permeability and low retentivity.
75. (a) When the equipment is placed inside the iron can, the magnet lines of force tend to pass through the ferromagnetic iron can and the equipment gets protected from the external magnetic field.
76. (b) The susceptibility of a paramagnetic substance depends both on the temperature and strength of the magnetising field.
77. (c) DC motor employs Fleming's left hand rule while DC generator employs Fleming's right hand rule.
78. (b) Power in a two-wire transmission line travels outside the conductors.
79. (c) Faraday's laws of electro-magnetic induction concern with the conversion of mechanical energy into electric energy in accordance with the law of conservation of energy. But in a purely resistive a.c. circuit, the emf is in phase with the current.
80. (d) If there is no change in the magnetic flux linked with the coil, there is no induced current. The current induced in a coil is directly proportional to the rate of change of magnetic flux linked with the coil.
81. (d) The capacitance of parallel plate capacitor depends on dielectric material, surface area, and separation between two plates.
82. (a) The alternating magnetic flux induces eddy currents in the iron core which leads to some energy loss in the form of heat. This loss can be reduced by using laminated iron-core.
83. (b) A choke coil has high inductance and low resistance.
84. (c) Fuse has low resistance with comparison to the load resistance of the circuit but has high resistance when compared to the wire of same length. Thus when asked whether a fuse has high resistance or low resistance, we should answer that a fuse has high resistance with low melting point.
85. (b) The magnetic effect of electric current is known as electromagnetic effect. It was discovered by Oersted.
86. (c) The Meissner effect is the expulsion of a magnetic field from a superconductor during its transition to the superconducting state.

87. (a) Uranium is a chemical element with symbol U and atomic number 92. It is a silvery-grey metal in the actinide series of the periodic table. A uranium atom has 92 protons and 92 electrons, of which 6 are valence electrons.
88. (b) $\tan \delta = \frac{B_V}{B_H} = 1 \therefore \delta = 45^\circ$
89. (a) Fission of U-235 nuclei typically releases 2 or 3 neutrons, with an average of almost 2.5.
90. (c) Silicon is a chemical element with symbol Si and atomic number 14. It is a semi-conductor.
91. (d) Mass, energy and momentum are conserved in a nuclear reaction. In nuclear physics and nuclear chemistry, a nuclear reaction is semantically considered to be the process in which two nuclei, or else a nucleus of an atom and a subatomic particle from outside the atom, collide to produce one or more nuclide's that are different from the nuclide that began the process.
92. (b) Electron volt is an unit of energy commonly used in atomic and nuclear physics and is equal to the energy gained by an electron (a charged particle carrying unit electronic charge) when the electrical potential at the electron increases by one volt.
93. (b) An electrical conductivity meter (EC meter) measures the electrical conductivity in a solution. It can also thus measure the salinity of a solution.
94. (b) Different turns of the spring carry currents in the same direction, so they attracts each other.
95. (d) Both deuterium and helium are neutral particles. They cannot be accelerated by electric or magnetic field.
96. (c) A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.
97. (c) Galvanisation or galvanising is the process of applying a protective zinc coating to steel or iron, to prevent rusting. The most common method is hot-dip galvanising, in which the parts are submerged in a bath of molten zinc.
98. (b) Electrons are a fundamental constituent of atoms and are negatively charged particles. X-rays are beams of photons. It is electromagnetic radiation. The frequency of x-rays is higher than that of visible light, but in other respects it is similar to visible light.
99. (c) Galvanisation or galvanizing is the process of applying a protective zinc coating to steel or iron, to prevent rusting. The most common method is hot-dip galvanizing, in which the parts are submerged in a bath of molten zinc.
100. (b) As $V = Ed$
 where V = potential difference
 E = electric field
 d = distance between the plates
- As V remains the same, so V increases as distance increases.
101. (d) Technetium is a chemical element with atomic number 43. It was the first automatically produced element. Technetium was first isolated by Carlo Perrier and Emilio Segre in 1937.
102. (b) In thermal nuclear reactors, the coolant acts as a moderator that must slow down the neutrons before they can be efficiently absorbed by the fuel. It allows neutrons to slow down to energies where they can easily cause a nucleus to fission.
103. (c) Atoms of a particular element must have the same number of protons but can have different numbers of neutrons. When an element has different variants that, while all having the same number of protons, have differing numbers of neutrons, these variants are called isotopes.
104. (c) The Prototype Fast Breeder Reactor (PFBR) is a 500 MWe fast breeder nuclear reactor presently being constructed at the Madras Atomic Power Station in Kalpakkam, India. The Indira Gandhi Centre for Atomic Research (IGCAR) is responsible for the design of this reactor. PFBR is using uranium-238 not thorium, to breed new fissile material, in a sodium-cooled fast reactor design with no moderators required.
105. (c) A proton-exchange membrane, or polymer-electrolyte membrane, is a semi-permeable membrane generally made from ionomers and designed to conduct protons while acting as an electronic insulator and reactant barrier, e.g. to oxygen and hydrogen gas.
106. (d) Natural uranium contains 0.7% of the U-235 isotope. The remaining 99.3% is mostly the U-238 isotope which does not contribute directly to the fission process (though it does so indirectly by the formation of fissile isotopes of plutonium). Isotope separation is a physical process to concentrate ('enrich') one isotope relative to others.
107. (c) Control rods are used in nuclear reactors to control the fission rate of uranium and plutonium. They are composed of chemical elements such as boron, silver, indium and cadmium that are capable of absorbing many neutrons without themselves fissioning.
108. (a) The femtometre is an SI unit of length equal to 10⁻¹⁵ metres, which means a quadrillionth of one. This distance can also be called a fermi and was so named in honour of physicist Enrico Fermi, as it is a typical length-scale of nuclear physics.
109. (b) The sun generates energy from a process called nuclear fusion. During nuclear fusion, the high pressure and temperature in the sun's core cause nuclei to separate from their electrons. Hydrogen nuclei fuse to form one helium atom. During the fusion process, radiant energy is released.
110. (c) An electric charge always flows from a body at higher potential to a body at a lower potential irrespective of the amounts of charges contained in them. In the

question, no current flows. So there is no potential difference.

- 111.** (a) The main use of Uranium in the civilian sector is to fuel nuclear power plants. 1 kg of U-235 can theoretically produce about 20 terajoules of energy which is equivalent to 1500 tons of Coal.
- 112.** (c) A dynamo, which is also known as an electrical generator produces direct current through a commutator. It is basically a device which converts mechanical rotation into electric current according to Faraday's law.
- 113.** (d) Fluorescent lamps are filled with the low pressure gases specially Mercury and noble gases like Argon, Neon, Xenon and Krypton.
- 114.** (a) The conversion of light energy into electrical energy is based on the phenomenon called photovoltaic effect. A photovoltaic cell is the basic unit of the system where the photovoltaic effect is utilized to produce electricity from light energy. Silicon is most widely used semiconductor material for constructing photovoltaic cell.
- 115.** (b) According to a report of Department of Atomic Energy in India, there are approximately 10.70 million tons of monazite, which contains 9,63,000 tons of Thorium Oxide (ThO_2). India is one country that has an abundance of thorium. Andhra Pradesh has 35% of thorium reserve of India.
- 116.** (c) The most common fissile nuclear fuels are uranium-235 (^{235}U) and plutonium-239 (^{239}Pu). Thorium is more abundant in nature than uranium. Thorium can be used as a nuclear fuel through breeding to uranium-233 (^{233}U). Calcium is not used as a nuclear fuel.
- 117.** (d) According to Ohm's law, if there is a potential difference (V) across a resistor then there is a current (I) flowing through it. Current flows in a circuit as a result of difference in potential between two points in the circuit.
- 118.** (a) Electrical conductivity is a measure of the amount of electrical current under a material can carry. The most electrically conductive element is silver followed by copper, aluminium and iron.
- 119.** (a) C.F.L. is short form of Compact Fluorescent Lamp. C.F.L. uses significantly less energy than traditional light bulbs (75% less).
- 120.** (d) A mobile phone charger works on the simple principle of conversion of AC (alternating current) to DC (direct current). As we connect charger to 220V AC switchboard, the first job of the charger is to step down the high 220 V in 9 V or 10 V. A step down transformer is used in mobile phone charger.
- 121.** (a) Direct Current is used to charging the batteries with the help of rectifier which converts AC to DC. Thus alternate current is not preferable for it.
- 122.** (c) Manufacturer of electronic equipment sets a power rating for every equipment, which shows the maximum power that can be consumed by the specific device. According to the question, the ascending or increasing order of the electronic items by their power rating are- Fan, television, electronic press, electronic kettle.
- 123.** (a) The electrodes in the battery contain atoms of certain conducting materials. For instance, in an alkaline battery, the anode is typically made of zinc, and manganese dioxide acts as the cathode. And the electrolyte between and inside those electrodes contains ions.
- 124.** (d) The nickel-cadmium battery is type of a rechargeable battery using nickel oxide Potassium hydroxide and metallic cadmium as electrodes, while potassium hydroxide is an alkaline electrolyte. It is used in calculator, cordless electronic appliances, Transistors, portable power tools, photo flashlight etc.
- 125.** (d) Multimeter is used to measure potential difference, current and resistances. Voltmeter is used to measure only potential difference. is used to step up and step down the alternating current. There are two types of coils in transformers (i) Primary coil, (ii) Secondary coil. Alternate current flows through the primary coil which inflicts the potential in the secondary coil.
- 126.** (d) The transformer is used to step up and step down the alternating current. There are two types of coils in transformers (i) Primary coil. (ii) Secondary coil. Alternate current flows through the primary coil which inflicts the potential in the secondary coil.
- 127.** (d) Ohm's law holds for circuits containing only resistive elements (no capacitances or inductances) for all forms of driving voltage or current, regardless of whether the driving voltage or current is constant (DC) or time-varying such as AC. At any instant of time Ohm's law is valid for such circuits.
- 128.** (b) Danish engineer Valdemar Poulsen invented the arc transmitter in 1902.
- 129.** (d) The hysteresis error of a pressure sensor is the maximum difference in output at any measurement value within the sensor's specified range when approaching the point first with increasing and then with decreasing pressure.
- 130.** (a) Energy consumption of 100 watt electric bulb which is used for 10 hours $100 \times 10 = 1000$ watt hour = 1 kilo watt hour = 1 Unit.
According to question the cost of 1 unit of electricity Rs 5.
- 131.** (a) Electricity consumption bill is based on the measurement of kilowatt/hour (kW/h). The kilowatt hour is a unit of energy equal to 1000 watt.
- 132.** (d) The bulb which decays more energy will generate more brightness.
- 133.** (a) Kirchhoff's first law deals with the conservation of charge when currents in a circuit are steady, charge cannot accumulate or originate at any point of the circuit. So whatever charge flows towards the junction in any time interval, an equal charge must flow away from that junction in the same time interval.

Level-2

- If the potential difference applied to an X-ray tube is doubled while keeping the separation between the filament and the target as same, what will happen to the cut off wavelength. (NDA 2017 I)
 - will remain same
 - will be doubled
 - will be halved
 - will be four times of the original wavelength
- Suppose a rod is given a negative charge by rubbing it with wool, which one of the following statements is correct in this case? (NDA 2017 I)
 - The positive charges are transferred from rod to wool
 - The positive charges are transferred from wool to rod
 - The negative charges are transferred from rod to wool
 - The negative charges are transferred from wool to rod
- Consider the following statements regarding a motor car battery:
 - The voltage is usually 12 V.
 - Electrolyte used is hydrochloric acid.
 - Electrodes are lead and copper
 - Capacity is expressed in ampere-hourWhich of the above statements are correct?
 - 1 and 2
 - 2 and 3
 - 3 and 4
 - 1 and 4
- Consider the following statements: An ordinary light bulb has a rather short life because the:
 - Filament wire is not uniform.
 - Bulb cannot be evacuated completely.
 - Wires supporting the filament melt at high temperatures.Which of the above statements are correct?
 - 1 and 3
 - 2 and 3
 - 1, 2 and 3
 - 1 and 2
- Which one of the following metals is used as semiconductor in transistors?
 - Copper
 - Germanium
 - Graphite
 - Silver
- Which one of the following is an important component of a transistor?
 - Arsenic
 - Germanium
 - Osmium
 - Radium
- Assertion (A):** Copper rods are generally preferred to iron rods for making lightning conductors.
Reason (R): Copper is better conductor of electricity atmospheric conditions.
Codes:
 - Both (A) and (R) are true and (R) is the correct explanation of (A).
 - Both (A) and (R) are true, but (R) is not the correct explanation of (A)
 - (A) is true, but (R) is false
 - (A) is false, but (R) is true
- The magnetic field strength of a current carrying wire at a particular distance from the axis of the wire: (NDA 2018 II)
 - depends upon the current in the wire
 - depends upon the radius of the wire
 - depends upon the temperature of the surroundings
 - none of the above
- In a three-pin electrical plug longest pin should be connected to:
 - Ground terminal
 - Live terminal
 - Neutral terminal
 - Any terminal
- A fuse is used in main electric supply as a safety device. Which one of the following statements about the fuse is incorrect?
 - It is connected in parallel with the main switch
 - It is made mainly from silver alloys
 - It must have a low melting point
 - It must have a very high resistance
- Domestic electrical wiring is basically a:
 - Series connection
 - Parallel connection
 - Combination of series and parallel connections
 - Series connection within each room and parallel connection elsewhere
- Which of the following are semiconductors?
 - Silicon
 - Quartz
 - Ceramics
 - GermaniumChoose the correct answer from the following alternatives:
 - 1 and 2
 - 1 and 3
 - 1 and 4
 - 3 and 4
- One of these particles is claimed to have invented which rebut the Einstein's theory of relativity.
 - Microwave Photon
 - Neutrino
 - Liquid crystal
 - Light emitting diode
- Which one of the following is not radioactive?
 - Astatine
 - Francium
 - Tritium
 - Zirconium
- Water is heated with a coil of resistance R connected to domestic supply. The rise of temperature of the water will depend on:
 - Supply voltage
 - Current passing through the coil
 - Time for which voltage is suppliedSelect the correct answer from among the following : (NDA 2019 II)
 - 1,2 and 3
 - 1 and 2 only
 - 1 only
 - 2 and 3 only
- Consider the following statements :
Assertion (A) : Lightning conductors prevent buildings from damages in the event of lightning strike.
Reason (R) : The electric charge conduct to ground through the wire, instead of passing through the structure.
Select the correct answer using the codes given below:
Code:
 - Both (A) and (R) are correct, and (R) is the correct explanation of (A)
 - Both (A) and (R) are correct, but (R) is not the correct explanation of (A)
 - (A) is correct but (R) is wrong
 - (A) is correct but (R) is wrong.