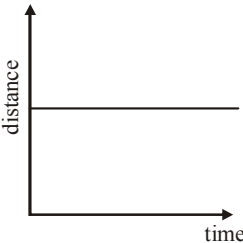


1. Which one of the following Indian scientists was elected as a fellow of the Royal Society of London for his contribution in the field of Plant Physiology and Physics ? [2007 -II]
(a) Ashutosh Mukherjee (b) Jagdish Chandra Bose
(c) Prafulla Chandra Ray (d) P C Mahalanodis
2. **Assertion (A):** Steam is more harmful for human body than the boiling water in case of burn. [2008 -II]
Reason (R): Boiling water contains more heat than steam.
(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 the correct explanation of A
(c) A is true, but R is false
(d) A is false, but R is true
3. Why is it difficult to see through fog? [2008 -II]
(a) Rays of light suffer total internal reflection from the fog droplets
(b) Rays of light are scattered by the fog droplets
(c) Fog droplets absorb light
(d) The refractive index of fog is extremely high
4. The density of water varies with temperature which helps the aquatic animals to live in cold water. At what temperature is the density of water maximum? [2008 -II]
(a) 1°C (b) 2°C (c) 3°C (d) 4°C
5. Who gave the first evidence of the big-bang theory? [2008 -II]
(a) Edwin Hubble (b) Albert Einstein
(c) S Chandrasekhar (d) Stephen Hawking
6. A ray of light is incident on a plane mirror at an angle 30° with the normal at the point of incidence. The ray will be deviated from its incidence direction by what angle? [2008 -II]
(a) 30° (b) 60°
(c) 120° (d) None of these
7. What would be the best choice for window material to keep the outside heat away? [2008 -II]
(a) Single-pane glass
(b) Double-pane glass without a gap in between
(c) Double-pane glass with water filled in between
(d) Double-pane glass with air in between
8. Bar is a unit of which one of the following? [2008 -II]
(a) Force (b) Energy
(c) Pressure (d) Frequency
9. On which one of the following conservative laws, does a rocket work? [2008 -II]
(a) Mass (b) Energy
(c) Linear momentum (d) Angular momentum
10. **Assertion (A):** In a pressure cooker food is cooked above boiling point. [2008 -II]
Reason (R): Boiling point of water increases as the pressure increases.
(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 the correct explanation of A
(c) A is true, but R is false
(d) A is false, but R is true
11. The phenomenon of mirage occurs due to which one of the following? [2008 -II]
(a) Polarisation of light
(b) Dispersion of light
(c) Diffraction of light
(d) Total internal reflection of light
12. Which one of the following common devices works on the basis of the principle of mutual induction? [2008 -II]
(a) Tubelight (b) Transformer
(c) Photodiode (d) LED
13. Television signal cannot be received generally beyond a particular distance due to [2009 -I]
(a) curvature of the Earth (b) weakness of antenna
(c) weakness of signal (d) absorption of signal in air
14. If a small raindrop falls through air [2009 -I]
(a) its velocity goes on increasing
(b) its velocity goes on decreasing
(c) its velocity goes on increasing for sometime and then becomes constant
(d) it falls with constant speed for sometime and then its velocity increases
15. Consider the following statements [2009 -I]
X-rays
1. can pass through aluminum.
2. can be deflected by magnetic field.
3. move with a velocity less than the velocity of ultraviolet ray in vacuum.
Which of the statements given above is/are correct?
(a) 1, 2 and 3 (b) Only 1
(c) 2 and 3 (d) 1 and 2
16. Which one of the following is the permissible level of noise in a silent zone at day time? [2009 -I]
(a) 50 dB (b) 60 dB (c) 65 dB (d) 75 dB
17. By which one of the following, an old written material which cannot be read easily, can be read [2009 -I]
(a) γ -rays (b) X-rays
(c) IR-rays (d) Radiofrequency waves
18. Earthquake (shock) waves are [2009 -II]
(a) infrasonic waves (b) ultrasonic waves
(c) seismic (d) infrared waves
19. Laser is a device to produce [2009 -II]
(a) a beam of white light (b) coherent light
(c) microwaves (d) X-rays

20. A perfect black body has the unique characteristic feature as
 (a) a good absorber only [2009 -II]
 (b) a good radiator only
 (c) a good absorber and a good radiator
 (d) neither a radiator nor an absorber
21. Fat can be separated from milk in a cream separation because of [2009 -II]
 (a) cohesive force (b) gravitational force
 (c) centrifugal force (d) centripetal force
22. Which one of the following is not result of surface tension? [2009 -II]
 (a) Vapour formation above the liquid surface
 (b) Convex shape of liquid meniscus
 (c) Liquid rising in a capillary
 (d) Spherical shape of mercury fallen on the floor
23. Hair of a shaving brush cling together when the brush is removed from water due to [2010 -I]
 (a) viscosity (b) surface tension
 (c) friction (d) elasticity
24. Consider the following statements [2010 -I]
 1. Clear sky appears blue due to poor scattering of blue wavelength of visible light.
 2. Red part of light shows more scattering than blue light in the atmosphere.
 3. In the absence of atmosphere, there would be no scattering of light and sky will look black.
 Which of the statements given above is/are correct?
 (a) Only 1 (b) 1 and 2
 (c) Only 3 (d) All of these
25. The most familiar form of radiant energy in sunlight that causes tanning and sunburning of human skin, is called [2010 -I]
 (a) ultraviolet radiation (b) visible radiation
 (c) infrared radiation (d) microwave radiation
26. A boy throws four stones of same shape, size and weight with equal speed at different initial angles with the horizontal line. If the angles are 15° , 30° , 45° and 60° , at which angle the stone will cover the maximum horizontally? [2010 -I]
 (a) 15° (b) 30° (c) 45° (d) 60°
27. Which one of the following statement is true? [2010 -II]
 (a) Temperatures differing 25° on the fahrenheit (F) scale must differ by 45° on the celsius (C) scale
 (b) 0°F corresponds to -32°C
 (c) Temperatures which differ by 10° on the celsius scale must differ by 18° on the Fahrenheit scale
 (d) Water at 90°C is warmer than water at 202°F
28. A diffraction pattern is obtained using a beam of red light. Which one among the following will be the outcome, if the red light is replaced by blue light? [2010 -II]
 (a) Bands disappear
 (b) Diffraction pattern becomes broader and further apart
 (c) Diffraction pattern becomes narrower and crowded together
 (d) No change
29. Raw mangoes shrivel when pickled in brine. The phenomenon is associated with [2010 -II]
 (a) osmosis
 (b) reverse osmosis
 (c) increase of surface tension of fluid
 (d) decrease of surface tension of fluid
30. The apparent weight of a steel sphere immersed in various liquids is measured using a spring balance. The greatest reading is obtained for the liquid [2010 -II]
 (a) having the smallest density
 (b) having the largest density
 (c) in which the sphere was submerged deepest
 (d) having the greatest volume
31. If an object having mass of 1 kg is subjected to a force of 1 N it moves with [2010 -II]
 (a) a speed of 1 m/s (b) a speed of 1 km/s
 (c) an acceleration of 10 m/s^2 (d) an acceleration of 1 m/s^2
32. An athlete diving off a high springboard can perform a variety of exercises in the air before entering the water below. Which one of the following parameters will remain constant during the fall? [2010 -II]
 (a) The athlete's linear momentum
 (b) The athlete's moment of inertia
 (c) The athlete's kinetic energy
 (d) The athlete's angular momentum
33. The pressure exerted on the ground by a man is greatest [2010 -II]
 (a) when he lies down in the ground
 (b) when he stands on the toes of one foot
 (c) when he stands with both foot flat on the ground
 (d) all of the above yield the same pressure
34. A passenger in a moving train tosses a five rupee coin. If the coin falls behind him, then the train must be moving with a uniform [2010 -II]
 (a) acceleration (b) deceleration
 (c) speed (d) velocity
35. As the sunlight passes through the atmosphere, the rays are scattered by tiny particles of dust, pollen, soot and other minute particulate matters present there. However, when we look up, the sky appears blue during mid-day because [2010 -II]
 (a) blue light is scattered most
 (b) blue light is absorbed most
 (c) blue light is reflected most
 (d) ultraviolet and yellow component of sunlight combine
36. The force acting on a particle executing simple harmonic motion is [2010 -II]
 (a) directly proportional to the displacement and is directed away from the mean position
 (b) inversely proportional to the displacement and is directed towards the mean position
 (c) directly proportional to the displacement and is directed towards the mean position
 (d) inversely proportional to the displacement and is directed away from the mean position
37. Which one of the following statements is correct? [2010 -II]
 (a) The angle of contact of water with glass is acute while that of mercury with glass is obtuse
 (b) The angle of contact of water with glass is obtuse, while that of mercury with glass is acute
 (c) Both the angle of contact of water with glass and that of mercury with glass are acute
 (d) None of the above
38. Why are inner lining of hot water geysers made up of copper? [2010 -II]
 (a) Copper has low heat capacity
 (b) Copper has high electrical conductivity
 (c) Copper does not react with steam
 (d) Copper is good conductor of both heat and electricity

39. Half portion of a rectangular piece of ice is wrapped with a white piece of cloth while the other half with a black one. In this context, which one among the following statements is correct? [2011 -I]
 (a) Ice melts more easily under black wrap
 (b) Ice melts more easily under white wrap
 (c) No ice melts at all under the black wrap
 (d) No ice melts at all under the white wrap
40. In scuba-diving, while ascending towards the water surface, there is a danger of bursting the lungs. It is because of [2011 -I]
 (a) Archimedes' principle
 (b) Boyle's law
 (c) Gay-Lussac's law of combining volumes
 (d) Graham's law of diffusion
41. The blackboard seems black because it [2011 -I]
 (a) reflects every colour (b) does not reflect any colour
 (c) absorbs black colour (d) reflects black colour
42. Mr X was advised by an architect to make outer walls of his house with hollow bricks. The correct reason is that such walls [2011 -I]
 (a) make the building stronger
 (b) help keeping inside cooler in summer and warmer in winter
 (c) prevent seepage of moisture from outside
 (d) protect the building from lightning
43. If a ship moves from freshwater into seawater, it will [2011 -I]
 (a) sink completely (b) sink a little bit
 (c) rise a little higher (d) remain unaffected
44. Viewfinders, used in automobiles to locate the position of the vehicles behind, are made of [2011 -I]
 (a) plane mirror (b) concave mirror
 (c) convex mirror (d) parabolic mirror
45. The cat can survive fall from a height much more than human or any other animal. It is because the cat [2011 -II]
 (a) can immediately adjust itself to land on all four paws and bend the legs to absorb the impact of falling
 (b) has elastic bones
 (c) has thick and elastic skin
 (d) also gets injury equally with other animals, but has tremendous endurance, resistance and speedy recovery
46. Fire fly gives us cold light by virtue of the phenomenon of [2011 -II]
 (a) fluorescence (b) phosphorescence
 (c) chemiluminescence (d) effervescence
47. Transformer is a kind of appliance that can [2011 -II]
 1. increase power 2. increase voltage
 3. decrease voltage
 4. measure current and voltage
 Select the correct answer using the codes given below
 (a) Only 4 (b) 1 and 4
 (c) 2 and 3 (d) 2, 3 and 4
48. A body has a mass of 6 kg on the Earth; when measured on the Moon, its mass would be [2011 -II]
 (a) nearly 1 kg (b) less than 1 kg
 (c) less than 6 kg (d) 6 kg
49. When a ball drops onto the floor it bounces. Why does it bounce? [2011 -II]
 (a) Newton's third law implies that for every action (drop) there is a reaction (bounce)
 (b) The floor exerts a force on the ball during the impact
 (c) The floor is perfectly rigid
 (d) The floor heats up on impact
50. If the door of a running refrigerator in a closed room is kept open, what will be the net effect on the room? [2011 -II]
 (a) It will cool the room
 (b) It will heat the room
 (c) It will make no difference on the average
 (d) It will make the temperature go up and down
51. The focal length of convex lens is [2011 -II]
 (a) the same for all colours
 (b) shorter for blue light than for red
 (c) shorter for red light than for blue
 (d) maximum for yellow light
52. When you pull out the plug connected to an electrical appliance, you often observe a spark. To which property of the appliance is this related? [2011 -II]
 (a) Resistance (b) Inductance
 (c) Capacitance (d) Wattage
53. The time period of a simple pendulum having a spherical wooden bob is 2 s. If the bob is replaced by a metallic one twice as heavy, the time period will be [2013 -II]
 (a) more than 2 s (b) 2 s
 (c) 1 s (d) less than 1 s
54. A liquid is kept in a regular cylindrical vessel upto a certain height. If this vessel is replaced by another cylindrical vessel having half the area of cross-section of the bottom, the pressure on the bottom will [2013 -II]
 (a) remain unaffected
 (b) be reduced to half the earlier pressure
 (c) be increased to twice the earlier pressure
 (d) be reduced to one-fourth the earlier pressure
55. In SONAR, we use [2013 -II]
 (a) ultrasonic waves (b) infrasonic waves
 (c) radio waves (d) audible sound waves
56. Two identical piano wires have same fundamental frequency when kept under the same tension. What will happen if tension of one of the wire is slightly increased and both the wires are made to vibrate simultaneously? [2013 -II]
 (a) Noise (b) Beats
 (c) Resonance (d) Non-linear effects
57. After rising a short distance the smooth column of smoke from a cigarette breaks up into an irregular and random pattern. In a similar fashion, a stream of fluid flowing past an obstacle breaks up into eddies and vortices which give the flow irregular velocity components transverse to the flow direction. Other examples include the wakes left in water by moving ships the sound produced by whistling and by wind instruments. These examples are the results of [2013 -II]
 (a) laminar flow of air (b) streamline flow of air
 (c) turbulent flow of air (d) viscous flow at low speed
58. Which one among the following correctly defines a unit magnetic pole in SI units? [2013 -II]
 It is the pole which when placed in air at a distance of
 (a) 1 foot from an equal and a similar poled repels it with a force of 1 pound
 (b) 1 m from an equal and a similar pole repels it with a force of 1 N
 (c) 1 cm from an equal and a similar pole repels it with a force of 1 dyne
 (d) 1 metre from an equal and a similar pole repels it with a force of 1 N/m^2

59. Before X-ray examination (coloured X-ray) of the stomach, patients are given suitable salt of barium because [2013 -II]
 (a) barium salts are white in colour and this helps stomach to appear clearly
 (b) barium is a good absorber of X-rays and helps stomach to appear clearly
 (c) barium salts are easily available
 (d) barium allows X-rays to pass through the stomach
60. The best colours for a sun umbrella will be [2013 -II]
 (a) black on top and red on inside
 (b) black on top and white on inside
 (c) red on top and black on inside
 (d) white on top and black on inside
61. When ice melts, its [2013 -II]
 (a) volume decreases
 (b) volume increases
 (c) volume and mass both decrease
 (d) volume decreases while mass increases
62. In step-down transformer, the AC output gives the [2013 -II]
 (a) current more than the input current
 (b) current less than the input current
 (c) current equal to the input current
 (d) voltage more than the input voltage
63. A **rectifier** is an electronic device used to convert [2013 -II]
 (a) AC voltage into DC voltage
 (b) DC voltage into AC voltage
 (c) sinusoidal pulse into square pulse
 (d) None of the above
-
- DIRECTION (Q. 64) :** The following question consist of two statements, Statement I and Statement II. You are to examine these two statements carefully and select the answers to these items using the codes given below.
-
- Codes**
 (a) Both the statements are true and statement II is the correct explanation of statement I
 (b) Both the statements are true, but statement II is not the correct explanation of statement I
 (c) Statement I is true, but statement II is false
 (d) Statement I is false, but statement II is true
64. **Statement I:** Pulling a lawn roller is easier than pushing it. **Statement II:** Pushing increases the apparent weight and hence the force of friction. [2013 -II]
65. It is difficult to cut things with a blunt knife because [2013 -II]
 (a) the pressure exerted by knife for a given force increases with increase in bluntness
 (b) a sharp edge decreases the pressure exerted by knife for a given force
 (c) a blunt knife decreases the pressure for a given force
 (d) a blunt knife decreases the area of intersection
66. When deep sea fishes are brought to the surface of the sea, their bodies burst. This is because the blood in their bodies flows at very [2013 -II]
 (a) high speed (b) high pressure
 (c) low speed (d) low pressure
67. A bus travels at a speed of 50 km/h to go from its origin of its destination at a distance of 300 km and travels at a speed of 60 km/h to return to the origin. What is the average speed of the bus? [2013 -II]
 (a) 54.55 km/h (b) 55 km/h
 (c) 55.55 km/h (d) 54 km/h
68. A device, which is used in our TV set, computer, radio set for storing the electric charge, is [2013 -II]
 (a) resistor (b) inductor
 (c) capacitor (d) conductor
69. Which type/types of pen uses/use capillary action in addition to gravity for flow of ink? [2013 -II]
 (a) Fountain pen
 (b) Ballpoint pen
 (c) Gel pen
 (d) Both ballpoint and gel pens
70. If two conducting spheres are separately charged and then brought in contact [2013 -II]
 (a) the total energy of the two spheres is conserved
 (b) the total charge on the two spheres is conserved
 (c) both the total energy and the total charge are conserved
 (d) the final potential is always the mean of the original potential of the two spheres
71. The gas used in a refrigerator is [2013 -II]
 (a) cooled down on flowing
 (b) heated up on flowing
 (c) cooled down when compressed
 (d) cooled down when expanded
72. The celsius temperature is a/an [2013 -II]
 (a) relative temperature (b) absolute temperature
 (c) specific temperature (d) approximate temperature
73. Light Emitting Diode (LED) converts [2013 -II]
 (a) light energy into electrical energy
 (b) electrical energy into light energy
 (c) thermal energy into light energy
 (d) mechanical energy into electrical energy
74. Dual Energy X-ray Absorptiometry (DEXA) is used to measure [2013 -II]
 (a) spread of solid tumour
 (b) bone density
 (c) ulcerous growth in stomach
 (d) extent of brain haemorrhage
75. The main source of energy in sun is [2013 -II]
 (a) nuclear fusion (b) nuclear fission
 (c) chemical reaction (d) mechanical energy
76. By what mechanism does scent spread all over the room if the lid is opened? [2013 -II]
 (a) Pressure in the bottle
 (b) Compression from the bottle
 (c) Diffusion
 (d) Osmosis
77. Which one among the following is not a correct statement? [2013 -II]
 (a) Cathode rays are negatively charged particles
 (b) Cathode rays are produced from all the gases
 (c) Electrons are basic constituents of all the atoms
 (d) Hydrogen ions do not contain any proton
78. Which one among the following colours has the highest wavelength? [2013 -II]
 (a) Violet (b) Green (c) Yellow (d) Red
79. Dispersion process forms spectrum due to white light falling on a prism. The light wave with shortest wavelength [2013 -II]
 (a) refracts the most
 (b) does not change the path
 (c) refracts the least
 (d) is reflected by the side of the prism

80. Magnetic, electrostatic and gravitational forces come under the category of [2013 - II]
 (a) non-contact forces (b) contact forces
 (c) frictional forces (d) non-frictional forces
81. A ray of white light strikes the surface of an object. If all the colours are reflected the surface would appear [2013 - II]
 (a) black (b) white (c) grey (d) opaque
82. Motion of an oscillating liquid column in a U-tube is [2013 - II]
 (a) periodic but not simple harmonic
 (b) non-periodic
 (c) simple harmonic and time period is independent of the density of the liquid
 (d) simple harmonic and time period depends on the density of the liquid
83. Dirty cloths containing grease and oil stains are cleaned by adding detergents to water. Stains are removed because detergent [2013 - II]
 (a) reduces drastically the surface tension between water and oil
 (b) increases the surface tension between water and oil
 (c) increases the viscosity of water and oil
 (d) decreases the viscosity in detergent mixed water
84. You are asked to jog in a circular track of radius 35 m. Right one complete round on the circular track, your displacement and distance covered by you respectively [2014 - I]
 (a) zero and 220 m (b) 220 m and zero
 (c) zero and 110 m (d) 110 m and 220 m
85. When an incandescent electric bulb glows [2014 - I]
 (a) the electric energy is completely converted into light
 (b) the electric energy is partly converted into light energy and partly into heat energy
 (c) the light energy is converted into electric energy
 (d) the electric energy is converted into magnetic energy
86. In cricket match, while catching a fast moving ball, a fielder in the ground gradually pulls his hands backwards with the moving ball to reduce the velocity to zero. The act represents [2014 - I]
 (a) Newton's first law of motion
 (b) Newton's second law of motion
 (c) Newton's third law of motion
 (d) Law of conservation of energy
87. Two layers of a cloth of equal thickness provide warmer covering than a single layer of cloth with double the thickness. Why? [2014 - I]
 (a) Because of the air encapsulated between two layers
 (b) Since effective thickness of two layers is more
 (c) Fabric of the cloth plays the role
 (d) Weaving of the cloth plays the role
88. A mobile phone charger is [2014 - I]
 (a) an inverter (b) a UPS
 (c) a step-down transformer (d) a step-up transformer
89. No matter how far you stand from a mirror, your image appears erect. The mirror is likely to be [2014 - I]
 (a) either plane or convex (b) plane only
 (c) concave (d) convex only
90. The position, relative size and nature of the image formed by a concave lens for an object placed at infinity are respectively [2014 - I]
 (a) at focus, diminished and virtual
 (b) at focus, diminished and real
 (c) between focus and optical centre, diminished and virtual
 (d) between focus and optical centre, magnified and real
91. The upper and lower portions in common type of bi-focal lenses are respectively [2014 - II]
 (a) concave and convex
 (b) convex and concave
 (c) both concave of different focal lengths
 (d) both convex of different focal lengths
92. Tungsten is used for the construction of filament in electric bulb because of its [2014 - II]
 (a) high specific resistance (b) low specific resistance
 (c) high light emitting power (d) high melting point
93. Inactive Nitrogen and Argon gases are usually used in electric bulbs in order to [2014 - II]
 (a) increase the intensity of light emitted
 (b) increase the life of the filament
 (c) make the emitted light coloured
 (d) make the production of bulb economical
94. In the phenomenon of dispersion of light, the light wave of shortest wavelength is [2014 - II]
 (a) accelerated and refracted the most
 (b) slowed down and refracted the most
 (c) accelerated and refracted the least
 (d) slowed down and refracted the least
95. An oscilloscope is an instrument which allows us to see waves produced by [2014 - II]
 (a) Visible light (b) X-rays
 (c) Sound (d) Gamma rays
96. The distribution of electrons into different orbits of an atom, as suggested by Bohr, is [2014 - II]
 (a) 2 electrons in the K-orbit, 6 electrons in the L-orbit, 18 electrons in the M-orbit
 (b) 2 electrons in the K-orbit, 8 electrons in the L-orbit, 32 electrons in the M-orbit
 (c) 2 electrons in the K-orbit, 8 electrons in the L-orbit, 18 electrons in the M-orbit
 (d) 2 electrons in the K-orbit, 8 electrons in the L-orbit, 16 electrons in the M-orbit
97. Carbon or Graphite rods are used in atomic reactors as moderators for sustained nuclear chain reaction through nuclear fission process. In this process [2014 - II]
 (a) the neutrons are made fast
 (b) the protons are made fast
 (c) the neutrons are made slow
 (d) the protons are made slow
98. 
 The distance-time graph for an object is shown above. Which one of the following statements holds true for this object? [2014 - II]
 (a) The object is moving with uniform speed
 (b) The object is at rest
 (c) The object is having non-linear motion
 (d) The object is moving with non-uniform speed

99. For a harmonic oscillator, the graph between momentum p and displacement q would come out as [2014-II]
 (a) a straight line (b) a parabola
 (c) a circle (d) an ellipse

DIRECTION (Q. 100): The following question consist of two statements, Statement I and Statement II. You are to examine these two statements carefully and select the answers to these items using the code given below :

Code:

- (a) Both the statements are individually true and Statement II is the correct explanation of Statement I.
 (b) Both the statements are individually true, but Statement II is not the correct explanation of Statement I.
 (c) Statement I is true, but Statement II is false.
 (d) Statement I is false, but statement II is true.

100. **Statement I :** When a gun is fired it recoils, i.e., it pushes back, with much less velocity than the velocity of the bullet.
Statement II : Velocity of the recoiling gun is less because the gun is much heavier than the bullet. [2015-I]

101. In an observation, α -particles, β -particles and γ -rays have same energies. Their penetrating power in a given medium in increasing order will be

(a) α, β, γ (b) β, γ, α (c) α, γ, β (d) β, α, γ

102. A person standing 1 m in front of a plane mirror approaches the mirror by 40 cm. The new distance between the person and his image in the plane mirror is

(a) 60 cm (b) 1.2 m (c) 1.4 m (d) 2.0 m

103. In respect of the difference of the gravitational force from electric and magnetic forces, which one of the following statements is true ?

(a) Gravitational force is stronger than the other two.
 (b) Gravitational force is attractive only, whereas the electric and the magnetic forces are attractive as well as repulsive.
 (c) Gravitational force has a very short range.
 (d) Gravitational force is a long range force, while the other two are short range forces.

104. Creation of something from nothing is against the law of

(a) constant proportions
 (b) conservation of mass-energy
 (c) multiple proportions
 (d) conservation of momentum

105. An electron and a proton are circulating with same speed in circular paths of equal radius. Which one among the following will happen, if the mass of a proton is about 2,000 times that of an electron ?

(a) The centripetal force required by the electron is about 2,000 times more than that required by the proton
 (b) The centripetal force required by the proton is about 2,000 times more than that required by the electron
 (c) No centripetal force is required for any charged particle
 (d) Equal centripetal force acts on both the particles as they rotate in the same circular path

106. An object is raised to a height of 3 m from the ground. It is then allowed to fall on to a table 1 m high from ground level. In this context, which one among the following statements is correct ?

(a) Its potential energy decreases by two-thirds its original value of total energy.
 (b) Its potential energy decreases by one-third its original value of total energy.

(c) Its kinetic energy increases by two-thirds, while potential energy increases by one-third.
 (d) Its kinetic energy increases by one-third, while potential energy decreases by one-third.

107. Two pieces of conductor of same material and of equal length are connected in series with a cell. One of the two pieces has cross-sectional area double that of the other. Which one of the following statements is correct in this regard ?

(a) The thicker one will allow stronger current to pass through it.
 (b) The thinner one would allow stronger current to pass through it.
 (c) Same amount of electric current would pass through both the pieces producing more heat in the thicker one.
 (d) Same amount of electric current would pass through both the pieces producing more heat in the thinner one.

108. A wire-bound standard resistor used manganin or constantan. It is because

(a) these alloys are cheap and easily available
 (b) they have high resistivity
 (c) they have low resistivity
 (d) they have resistivity which almost remains unchanged with temperature

109. Which one among the following is used in making lead pencils ?

(a) Charcoal (b) Graphite
 (c) Coke (d) Carbon black

110. Sodium metal should be stored in

(a) Alcohol (b) Kerosene oil
 (c) Water (d) Hydrochloric acid

111. A body is falling freely under the action of gravity alone in vacuum. Which one of the following remains constant during the fall? [2015-II]

(a) Potential energy (b) Kinetic energy
 (c) Total linear momentum (d) Total mechanical energy

112. X-rays are [2015-II]

(a) deflected by an electric field but not by a magnetic field
 (b) deflected by a magnetic field but not by an electric field
 (c) deflected by both a magnetic field and an electric field
 (d) not deflected by an electric field or a magnetic field

113. The focal length of the lens of a normal human eye is about [2015-II]

(a) 25 cm (b) 1 m (c) 2.5 mm (d) 2.5 cm

114. Newton's laws of motion do not hold good for objects [2015-II]

(a) at rest
 (b) moving slowly
 (c) moving with high velocity
 (d) moving with velocity comparable to velocity of light

115. Which one of the following statements is not correct? [2015-II]

(a) Weight of a body is different on different planets.
 (b) Mass of a body on the earth, on the moon and in empty space is the same.
 (c) Weightlessness of a body occurs when the gravitational forces acting on it are counter-balanced.
 (d) Weight and mass of a body are equal at sea level on the surface of the earth.

116. A brick is thrown vertically from an aircraft flying two kilometres above the earth. The brick will fall with a
 (a) constant speed [2015-II]
 (b) constant velocity
 (c) constant acceleration
 (d) constant speed for some time then with constant acceleration as it nears the earth
117. The outside rearview mirror of modern automobiles is marked with warning "objects in mirror are closer than they appear". Such mirrors are [2015-II]
 (a) plane mirrors
 (b) concave mirrors with very large focal lengths
 (c) concave mirrors with very small focal lengths
 (d) convex mirrors
118. Which one of the following statements is not correct ? [2016-I]
 (a) Sound wave in gases are longitudinal in nature
 (b) Sound wave having frequency below 20 Hz are known as ultrasonic waves
 (c) Sound waves having higher amplitudes are louder
 (d) Sound waves with high audible frequencies are sharp
119. A myopic person has a power of 1.25 dioptre, what is the focal length and nature of his lens ? [2016-I]
 (a) 50 cm and convex lens (b) 80 cm and convex lens
 (c) 50 cm and concave lens (d) 80 cm and concave lens
120. Which one of the following statements about bar magnet is correct ? [2016-I]
 (a) The pole strength of the north-pole of a bar magnet is larger than that of the south-pole
 (b) When a piece of bar magnet is bisected perpendicular to its axis, the north and south pole get separated
 (c) When a piece of bar magnet is bisected perpendicular to its axis two new bar magnets are formed
 (d) The poles of a bar magnet are unequal in magnitude and opposite in nature
121. A person rings a metallic bell near a strong concrete wall. He hears the echo after 0.3 s. if the sound moves with a speed of 340 m/s, how far is the wall from him? [2016-I]
 (a) 102m (b) 11m (c) 51m (d) 30m
122. The rate of change of momentum of a body equal of the resultant : [2016-I]
 (a) energy (b) power (c) force (d) impulse
123. The SI unit of mechanical power is : [2016-I]
 (a) Joule (b) Watt
 (c) Newton-Second (d) Joule-Second
124. The spring constant of a spring depends on its [2016-II]
 (a) length only
 (b) material only
 (c) length and its diameter
 (d) thickness, its diameter and its material
125. In a bipolar junction transistor [2016-II]
 (a) all the three regions (the emitter, the base and the collector) have equal concentrations of impurity
 (b) the emitter has the least concentration of impurity
 (c) the collector has the least concentration of impurity
 (d) the base has the least concentration of impurity
126. The pressure exerted by a 760 mm column of mercury at 0°C is known as [2016-II]
 (a) 1 pascal (b) 1 atmosphere
 (c) 1 bar (d) 1 poise
127. Which one of the following physical quantities has the same dimensions as that of Planck's constant h ? [2016-II]
 (a) Linear momentum (b) Angular momentum
 (c) Force (d) Potential energy
128. In total internal reflection, the light travels from [2016-II]
 (a) rarer to denser medium and it occurs with no loss of intensity
 (b) denser to rarer medium and it occurs with no loss of intensity
 (c) rarer to denser medium and it occurs with loss of intensity
 (d) denser to rarer medium and it occurs with loss of intensity
129. The energy of a photon, whose momentum is $10 \text{ MeV}/c$, where c is the speed of light, is given by [2016-II]
 (a) 10MeV (b) 100MeV (c) 1 MeV (d) 0.1 MeV
130. Liquids and gases never show [2016-II]
 (a) diamagnetic property (b) paramagnetic property
 (c) ferromagnetic property (d) electromagnetic property
131. Light travels in a straight line (rectilinear propagation of light). This statement does hold if the medium of travel for light is [2016-II]
 (a) of variable refractive index
 (b) made up of slabs of different refractive indices
 (c) homogeneous and transparent
 (d) inhomogeneous and transparent
132. When a piece of pure silicon is doped with aluminium, then [2017-I]
 (a) the conductivity of the doped silicon piece will remain the same
 (b) the doped silicon piece will become n-type
 (c) the doped silicon piece will become p-type
 (d) the resistivity of the doped silicon piece will increase
133. 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 [2017-I]
 (a) P (b) $3P$ (c) $P/3$ (d) $2P/3$
134. Which one of the following is not a semiconductor? [2017-II]
 (a) Silicon (b) Germanium
 (c) Quartz (d) Gallium arsenide
135. A parallel-plate capacitor, with air in between the plates, has capacitance C . Now the space between the two plates of the capacitor is filled with a dielectric of dielectric constant 7. Then the value of the capacitance will become [2017-I]
 (a) C (b) $\frac{C}{7}$ (c) $7C$ (d) $14C$
136. For which one of the following does the centre of mass lie outside the body? [2017-I]
 (a) A fountain pen (b) A cricket ball
 (c) A ring (d) A book
137. Consider the electromagnetic radiations having wavelengths 200 nm, 500nm and 1000 nm. Which wavelength(s) of the following can make visual sensation to a human eye? [2017-I]
 (a) 200 nm and 500 nm (b) 500 nm and 1000 nm
 (c) 500 nm only (d) 200 nm and 1000 nm

138. A copper wire of radius r and length ℓ has a resistance of R . A second copper wire with radius $2r$ and length l is taken and the two wires are joined in a parallel combination. The resultant resistance of the parallel combination of the two wires will be [2017-I]
- (a) $5R$ (b) $\frac{5}{4}R$ (c) $\frac{4}{5}R$ (d) $\frac{R}{5}$
139. A parallel-plate capacitor of capacitance C_1 is made using two gold plates. Another parallel-plate capacitor of capacitance C_2 is made using two aluminium plates with same plate separation, and all the four plates are of same area. If ρ_g and ρ_a are respectively the electrical resistivities of gold and aluminium, then which one of the following relations is correct? [2017-I]
- (a) $C_1 > C_2$ (b) $C_2 > C_1$
(c) $C_1 \rho_a = C_2 \rho_g$ (d) $C_1 = C_2$
140. A photon of X-ray has energy of 1 keV. A photon of visible radiation has energy of 3 eV. In this context, which one of the following statements is not correct? [2017-I]
- (a) The wavelength of X-ray photon is less than the wavelength of visible radiation photon.
(b) Both the photons have different energies.
(c) The speeds of both the photons in vacuum are different.
(d) The frequency of X-ray photon is higher than the frequency of visible radiation photon.
141. The optical phenomenon that is primarily responsible for the observation of rainbow on a rainy day is [2017-I]
- (a) diffraction (b) interference
(c) dispersion (d) reflection
142. Which one of the following statements is not correct? [2017-II]
- (a) The cathode rays originate from cathode and proceed towards the anode in a cathode-ray discharge tube.
(b) The television picture tubes are nothing but cathode-ray tubes.
(c) The cathode rays themselves are not visible.
(d) The characteristics of cathode rays depend upon the nature of the gas present in the cathode-ray tube.
143. The wires are made having same length l and area of cross-section A . Wire 1 is made of copper and wire 2 is made of aluminium. It is given that the electrical conductivity of copper is more than that of aluminium. In this context, which one of the following statements is correct? [2017-II]
- (a) The resistance of wire 1 will be higher than that of wire 2.
(b) The resistance of wire 2 will be higher than that of wire 1.
(c) The resistance of both the wires will be the same.
(d) If same current is flown through both the wires, the power dissipated in both the wires will be the same.
144. A ray of light is incident on a plane mirror at an angle of 40° with respect to surface normal. When it gets reflected from the mirror, it undergoes a deviation of [2017-II]
- (a) 40° (b) 100° (c) 90° (d) 80°
145. Infrared, visible and ultraviolet radiations/light have different properties. Which one of the following statements related to these radiations/light is not correct? [2017-II]
- (a) The wavelength of infrared is more than that of ultraviolet radiation.
(b) The wavelength of ultraviolet is smaller than that of visible light.
(c) The photon energy of visible light is more than that of infrared light.
(d) The photon energy of ultraviolet is lesser than that of visible light.
146. After using for some time, big transformers get heated up. This is due to the fact that [2017-II]
- current produces heat in the transformers
 - hysteresis loss occurs in the transformers
 - liquid used for cooling gets heated
- Select the correct answer using the code given below.
- (a) 1 only (b) 2 and 3 only
(c) 1 and 2 only (d) 1, 2 and 3
147. A person is standing on a frictionless horizontal ground. How can he move by a certain distance on this ground? [2017-II]
- (a) By sneezing (b) By jumping
(c) By running (d) By rolling
148. Which one of the following types of glasses is used for making optical instruments? [2017-II]
- (a) Pyrex glass (b) Soft glass
(c) Hard glass (d) Flint glass
149. Joule-Thomson process is extremely useful and economical for attaining low temperature. The process can be categorized as [2017-II]
- (a) isobaric process (b) isoenthalpic process
(c) adiabatic process (d) isochoric process
150. Ultrasonic waves are produced by making use of [2017-II]
- (a) ferromagnetic material (b) ferrimagnetic material
(c) piezoelectric material (d) pyroelectric material
151. A person thrown 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? [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.
152. Desalination of seawater is done by using reverse osmosis. The pressure applied to the solution is [2017-II]
- (a) larger than osmotic pressure
(b) smaller than osmotic pressure
(c) equal to osmotic pressure
(d) equal to atmospheric pressure
153. Which one of the following elements is used as a timekeeper in atomic clocks? [2018-I]
- (a) Potassium (b) Caesium
(c) Calcium (d) Magnesium
154. Why is argon gas used along with tungsten wire in an electric bulb? [2018-I]
- (a) To increase the life of the bulb
(b) To reduce the consumption of electricity
(c) To make the emitted light colored
(d) To reduce the cost of the bulb

155. Which one of the following is the correct relation between the Kelvin temperature (T) and the Celsius temperature (t_c)? [2018-I]
 (a) These are two independent temperature scales
 (b) $T = t_c$
 (c) $T = t_c - 273.15$
 (d) $T = t_c + 273.15$
156. Sound waves **cannot** travel through a [2018-I]
 (a) copper wire placed in air
 (b) silver slab placed in air
 (c) glass prism placed in water
 (d) wooden hollow pipe placed in vacuum
157. Which one of the following is the value of one nanometer? [2018-I]
 (a) 10^{-7} cm (b) 10^{-6} cm (c) 10^{-4} cm (d) 10^{-3} cm
158. Consider the following statements : [2018-I]
 1. There is no net moment on a body which is in equilibrium.
 2. The momentum of a body is always conserved.
 3. The kinetic energy of an object is always conserved.
 Which of the statements given above is/are correct?
 (a) 1, 2 and 3 (b) 2 and 3 only
 (c) 1 and 2 only (d) 1 only
159. Working of safety fuses depends upon [2018-I]
 1. magnetic effect of the current
 2. chemical effect of the current
 3. magnitude of the current
 4. heating effect of the current
 Select the correct answer using the code given below.
 (a) 1, 2, 3 and 4 (b) 1, 2 and 3 only
 (c) 3 and 4 only (d) 4 only
160. Which of the following represents a relation for 'heat lost = heat gained'? [2018-I]
 (a) Principle of thermal equilibrium
 (b) Principle of colors
 (c) Principle of calorimetry
 (d) Principle of vaporization
161. Two metallic wires made from copper have same length but the radius of wire 1 is half of that of wire 2. The resistance of wire 1 is R . If both the wires are joined together in series, the total resistance becomes [2018-I]
 (a) $2R$ (b) $\frac{R}{2}$ (c) $\frac{5}{4}R$ (d) $\frac{3}{4}R$
162. When the Sun is near the horizon during the morning or evening, it appears reddish. The phenomenon that is responsible for this observation is [2018-I]
 (a) reflection of light (b) refraction of light
 (c) dispersion of light (d) scattering of light
163. A wire of copper having length l and area of cross-section A is taken and a current I is flown through it. The power dissipated in the wire is P . If we take an aluminium wire having same dimensions and pass the same current through it, the power dissipated will be [2018-I]
 (a) P (b) $<P$ (c) $>P$ (d) $2P$
164. The pressure of a fluid varies with depth h as $P = P_0 + \rho gh$, where ρ is the fluid density. This expression is associated with [2018-I]
 (a) Pascal's law (b) Newton's law
 (c) Bernoulli's principle (d) Archimede's principle
165. A particle moves with uniform acceleration along a straight line from rest. The percentage increase in displacement during sixth second compared to that in fifth second is about [2018-II]
 (a) 11% (b) 22% (c) 33% (d) 44%
166. If two miscible liquids of same volume but different densities P_1 and P_2 are mixed, then the density of the mixture is given by [2018-II]
 (a) $\frac{P_1 + P_2}{2}$ (b) $\frac{2P_1P_2}{P_1 + P_2}$
 (c) $\frac{2P_1P_2}{P_1 - P_2}$ (d) $\frac{P_1P_2}{P_1 + P_2}$
167. The position vector of a particle is $\vec{r} = 2t^2\hat{x} + 3t\hat{y} + 4\hat{z}$. Then the instantaneous velocity $\vec{v}$ and acceleration $\vec{a}$ respectively lie [2018-II]
 (a) on xy -plane and along z -direction
 (b) on yz -plane and along x -direction
 (c) on yz -plane and along y -direction
 (d) on xy -plane and along x -direction
168. Two persons are holding a rope of negligible mass horizontally. A 20 kg mass is attached to the rope at the midpoint; as a result the rope deviates from the horizontal direction. The tension required to completely straighten the rope is ($g = 10 \text{ m/s}^2$) [2018-II]
 (a) 200 N (b) 20 N
 (c) 10 N (d) infinitely large
169. Which one of the following does not convert electrical energy into light energy? [2018-II]
 (a) A candle (b) A light-emitting diode
 (c) A laser (d) A television set
170. The visible portion of the electromagnetic spectrum is [2018-II]
 (a) infrared (b) radiowave
 (c) microwave (d) light
171. When a convex lens produces a real image of an object, the minimum distance between the object and image is equal to [2018-II]
 (a) the focal length of the convex lens
 (b) twice the focal length of the convex lens
 (c) four times the focal length of the convex lens
 (d) one half of the focal length of the convex lens
172. The direction of magnetic field at any location on the earth's surface is commonly specified in terms of [2018-II]
 (a) field declination
 (b) field inclination
 (c) both field declination and field inclination
 (d) horizontal component of the field
173. In which of the following, heat loss is primarily not due to convection? [2018-II]
 (a) Boiling water
 (b) Land and sea breeze
 (c) Circulation of air around blast furnace
 (d) Heating of glass surface of a bulb due to current in filament
174. If the wavelengths corresponding to ultraviolet, visible and infrared radiations are given as λ_{UV} , λ_{VIS} and λ_{IR} respectively, then which one of the following gives the correct relationship among these wavelengths? [2019-I]
 (a) $\lambda_{UV} < \lambda_{IR} < \lambda_{VIS}$ (b) $\lambda_{UV} > \lambda_{VIS} > \lambda_{IR}$
 (c) $\lambda_{UV} > \lambda_{IR} > \lambda_{VIS}$ (d) $\lambda_{UV} < \lambda_{VIS} < \lambda_{IR}$

175. 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 one of the following relations is correct? [2019-I]
 (a) $V_e > V_p$ (b) $V_e < V_p$
 (c) $V_e = V_p$ (d) Cannot be determined
176. If two vectors $\vec{A}$ and $\vec{B}$ are at an angle then [2019-I]
 (a) $|\vec{A}| + |\vec{B}| = |\vec{A} + \vec{B}|$ (b) $|\vec{A}| + |\vec{B}| > |\vec{A} + \vec{B}|$
 (c) $|\vec{A}| + |\vec{B}| < |\vec{A} + \vec{B}|$ (d) $|\vec{A}| + |\vec{B}| = |\vec{A} - \vec{B}|$
177. When hot water is placed into an empty water bottle, the bottle keeps its shape and does not soften. What type of plastic is the water bottle made from? [2019-I]
 (a) Thermoplastic (b) PVC
 (c) Polyurethane (d) Thermosetting
178. Which one of the following methods is/are state function/ functions? [2019-I]
 1. $q + w$ 2. q 3. w 4. $H - TS$
 Select the correct answer using the code given below.
 (a) 1 and 4 only (b) 1, 2 and 4
 (c) 2, 3 and 4 (d) 1 only
179. For a certain reaction, $\Delta G^\circ = -45 \text{ kJ/mol}$ and $\Delta H^\circ = -90 \text{ kJ/mol}$ at 0°C . What is the minimum temperature at which the reaction will become spontaneous, assuming that ΔH° and ΔS° are independent of temperature? [2019-I]
 (a) 273 K (b) 298 K (c) 546 K (d) 596 K
180. In spherical polar coordinates (γ, θ, α), θ denotes the polar angle around z-axis and α denotes the azimuthal angle raised from x-axis. Then the y-component of $\vec{p}$ is given by [2019-I]
 (a) $P \sin \theta \sin \alpha$ (b) $P \sin \theta \cos \alpha$
 (c) $P \cos \theta \sin \alpha$ (d) $P \cos \theta \cos \alpha$
181. For an ideal gas, which one of the following statements does not hold true? [2019-I]
 (a) The speed of all gas molecules is same.
 (b) The kinetic energies of all gas molecules are not same.
 (c) The potential energy of the gas molecules is zero.
 (d) There is no interactive force between the molecules.
182. The Hooke's law is valid for [2019-I]
 (a) only proportional region of the stress-strain curve
 (b) entire stress-strain curve
 (c) entire elastic region of the stress-strain curve
 (d) elastic as well as plastic region of the stress-strain curve
183. Which one of the following is the correct sequence of passage of light in a compound microscope? [2019-I]
 (a) Condenser - Objective lens - Eye-piece - Body tube
 (b) Objective lens - Condenser - Body tube - Eyepiece
 (c) Condenser - Objective lens - Body tube - Eyepiece
 (d) Eyepiece - Objective lens - Body tube - Mirror
184. Soap solution used for cleaning purpose appears cloudy. This is due to the fact that soap micelles can [2019-II]
 (a) refract light (b) scatter light
 (c) diffract light (d) polarize light
185. People prefer to wear cotton clothes in summer season. This is due to the fact that cotton clothes are [2019-II]
 (a) good absorbers of water (b) good conveyors of heat
 (c) good radiators of heat (d) good absorbers of heat
186. Magnification is [2019-II]
 (a) actual size of specimen/observed size
 (b) observed size of specimen/actual size
 (c) actual size of specimen – observed size
 (d) actual size of specimen $\times$ observed size
187. Consider the following statements : [2019-II]
 1. Particles of matter intermix on their own.
 2. Particles of matter have force acting between them.
 Which of the statements given above is/are correct ?
 (a) 1 only (b) 2 only
 (c) Both 1 and 2 (d) Neither 1 nor 2.
188. If an object is at rest, then the time (X-axis) versus distance (Y-axis) graph [2019-II]
 (a) is vertical (b) is horizontal
 (c) has 45° positive slope (d) has 45° negative slope
189. If the speed of a moving magnet inside a coil increases, the electric current in the coil [2019-II]
 (a) increases (b) decreases
 (c) reverses (d) remains the same
190. The frequency (in Hz) of a note that is one octave higher than 500 Hz is [2019-II]
 (a) 375 (b) 750 (c) 1000 (d) 2000
191. A car undergoes a uniform circular motion. The acceleration of the car is [2019-II]
 (a) zero
 (b) a non-zero constant
 (c) a non-zero but not a constant
 (d) None of the above
192. An echo is heard after 5 seconds of the production of sound which moves with a speed of 340 m/s. What is the distance of the mountain from the source of sound which produced the echo ? [2019-II]
 (a) 0.085 km (b) 0.85 km (c) 0.17 km (d) 1.7 km
193. A 100 W electric bulb is used for 10 hours a day. How many units of energy are consumed in 30 days ? [2019-II]
 (a) 1 (b) 10 (c) 30 (d) 300
194. Scattering of α -particles by a thin gold foil suggests the presence of [2020-I]
 (a) electron in an atom
 (b) proton in an atom
 (c) positively charged nucleus at the centre of an atom
 (d) isotopes of gold
195. The property of the sound waves that determines the pitch of the sound is its [2020-I]
 (a) frequency (b) amplitude
 (c) wavelength (d) intensity
196. Which one of the following is **not** a property of the X-rays? [2020-I]
 (a) They are deflected by electric fields.
 (b) They are not deflected by magnetic fields.
 (c) They have high penetration length in matter.
 (d) Their wavelength is much smaller than that of visible light.
197. Which one of the following is **not** true about the image formed by a plane mirror? [2020-I]
 (a) It is of the same size as the subject.
 (b) It is laterally inverted.
 (c) It is real image.
 (d) It is formed as far behind the mirror as the object is in front.
198. In a periscope, the two plane mirrors are kept [2020-I]
 (a) parallel to each other
 (b) perpendicular to each other
 (c) at an angle of 60° with each other
 (d) at an angle of 45° with each other

199. If the speed of light in air is 3×10^8 m/s, then the speed of light in a medium of refractive index $\frac{3}{2}$ is [2020-I]
(a) 2×10^8 m/s (b) $\frac{9}{4} \times 10^8$ m/s
(c) $\frac{3}{2} \times 10^8$ m/s (d) 3×10^8 m/s
200. Which one of the following types of radiation has the shortest wavelength? [2020-I]
(a) Radio waves (b) Visible light
(c) Infrared (IR) (d) Ultraviolet (UV)
201. The unit of the force constant k of a spring is [2020-I]
(a) N-m (b) N/m (c) N-m² (d) N/m²
202. If x is the temperature of a system in Kelvin and y is the temperature of the system in °C, then the correct relation between them is [2020-I]
(a) $x = 273 - y$ (b) $x = 273 + y$
(c) $x = 173 + y$ (d) $x = 173 - y$
203. The resistivity ρ of a material may be expressed in units of [2020-I]
(a) ohm (b) ohm/cm
(c) ohm-cm (d) ohm-cm²
204. The electromagnetic waves, which are used for satellite communication, are [2020-I]
(a) infrared radiations (b) ultraviolet radiations
(c) radio waves (d) visible lights



32. (d) When an athlete jumps from the spring board, he curls his body by rolling his arms and legs in. By doing so, he decreases moment of inertia of his body and hence angular speed increases to conserve the angular momentum, as $I_1 \omega_1 = I_2 \omega_2 = \text{constant}$.
33. (b) Pressure is normal force per unit area, therefore, for lesser value of area pressure is greatest.
34. (a) As the passenger tosses the coin, it goes up and is in motion with the initial speed of the train but if the train is accelerated, so its speed increases. But the coin is in the air with initial speed of train, so the train slightly moves forward from the coin with the person and coin falls behind him. It happens when train is moving with accelerated motion.
35. (a) As, scattering $\propto \frac{1}{\lambda^4}$
Since, wavelength of blue colour is least among three primary colours red, green and blue, so violet colour scattered most. The scattered light in the sky contains blue colour in plenty and therefore sky appears blue.
36. (c) The restoring force acting on the particle is always proportional to the displacement of the particle from the equilibrium position and is always directed towards the equilibrium position.
37. (a) For ordinary water and glass it is about 8° (acute angle) and for mercury and glass it is about 135° (obtuse angle).
38. (d) Copper is a good conductor of both heat and electricity due to this it is used in all such appliance where quick heat transfer is required.
39. (a) Ice under black wrap will melt easily because dark colour (black) absorbs the most of light energy falling on it.
40. (b) As scuba driver ascends towards the water surface, water pressure decreases, so according to Boyle's law air in his lungs expands to occupy a greater volume. Which increases the chances of bursting the lungs.
41. (b) Blackboard absorbs all the colours of light falling on it and does not reflect any colour due to which it appears black.
42. (b) The hollow bricks provide thermal insulations; the air in hollow bricks, does not allow outside heat or cold in the house to go out or come in the house. So, it keeps house cool in summer and warm in winter.
43. (c) When a body is immersed in a fluid, the fluid exerts an upward force on it, called buoyant force. and buoyant force $\propto$ density of fluid.
As the density of sea water is higher than that of the fresh water.
So extra buoyant force and ship will rise a little higher.
44. (c) In automobiles, convex mirror is used as a rear view mirror because the image of the vehicle formed is small in size due to this the field of view is increased and the driver of automobile can see the traffic over large area.
45. (a) As the cat falls from a height, it bends the legs to absorb the impact of falling and immediately adjust itself.
46. (c) Fire fly gives us cold light due to chemiluminescence i.e. light produced by chemical reaction.
47. (c) Transformer is an appliance that can increase or decrease voltage.
48. (d) Mass of an object does not change when an object's location changes. It is the weight of the body ($w = mg$) which changes with value of 'g' at that place.
49. (b) When a ball drops on to the floor then floor exerts a force for small time which is equal to change in momentum of the ball.
50. (b) It will heat the room because the heat removed from the inside is released into the room, counteracting any cooling, plus the energy that is used to operate the compressor eventually winds up being heat, therefore increasing the room temperature.
51. (b) The focal length of a convex lens is shorter for blue light than for red.
52. (a) As the plug is pulled out, the value of resistance in the circuit decreases and hence more current tries to flow through the circuit. Pulling out the plug breaks the circuit and to complete the circuit for the flow of electricity a spark is observed.
53. (b) Time period of a simple pendulum
 $T = 2\pi \sqrt{\frac{l}{g}}$ depends on its length 'l' and acceleration due to gravity 'g' and independent of mass of the bob.
54. (a) Pressure exerted by the fluid column depends on height (h), density ρ and acceleration due to gravity (g).
 $P = h\rho g$
i.e. independent of area of cross-section of the vessel.
55. (a) Sonar (sound navigation and ranging) is a technique that uses sound propagation to navigate (usually under water, as in submarine navigation), communicate with or detect objects on or under the surface of the water, such as the vessels as ultrasonic waves which are used having very high frequency $> 20,000$ Hz.
56. (b)
57. (c) Turbulent flow is accompanied by random, irregular, local circular currents called vortices.
58. (b)
59. (b) Barium is a good absorber of X-rays and helps stomach to appear clearly.
60. (d) As white colour reflects all the components of white light and black colour absorbs all the components of white light. So, the best colours for a sun umbrella, white on top and black on inside.
61. (a) When ice melts its density increases i.e. its volume decreases. Mass is an invariant quantity.
62. (a) In step-down transformer $N_p > N_s$, $E_p > E_s$, $I_p < I_s$
Here N, E and I used for no. of turns, emf and current respectively.
63. (a) A rectifier is used to convert AC voltage into DC voltage and inverter converts DC voltage into AC voltage.
64. (a) It is easier to move any body by pulling it than by pushing it. A body starts to move when the applied force is more than the frictional force. This frictional force is proportional to the weight of the body under which it acts. When the lawn roller is pushed by the force (F), the vertical component of the pushing force now increases the weight ($w = mg$) of the roller which in turn results in increase of normal reaction and hence the friction is more.
65. (c) Pressure = $\frac{\text{force}}{\text{area}}$
Bluntness of knife increases area, hence decreases the pressure for a given force.
66. (b) When deep sea fishes are brought to the surface of the sea, their bodies burst, this is because the blood in their bodies flows at very high pressure.
67. (a) Average speed = $\frac{\text{total distance}}{\text{total time}} = \frac{300 + 300}{\frac{300}{50} + \frac{300}{60}}$

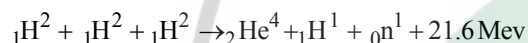
$$\left(\because \text{Time} = \frac{\text{distance}}{\text{speed}} \right)$$

$$= \frac{300 + 300}{6 + 5} = \frac{600}{11} = 54.55 \text{ km/h}$$

68. (c) Capacitor (condenser) is used to store energy in an electric field. Capacitance of a capacitor C, defined as the ratio of charge $\pm Q$ on each conductor to the voltage V between them.

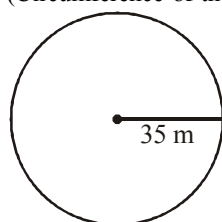
$$C = \frac{Q}{V}$$

69. (a) Fountain pen uses capillary action in addition to gravity for flow of ink.
 70. (b) If two conducting spheres are separately charged and brought in contact, then the total charge on the two spheres is conserved. This is the law of conservation of charge.
 71. (c)
 72. (b) The degree celsius ($^{\circ}\text{C}$) can refer to absolute temperature.
 73. (b) Light Emitting Diode (LED) is semiconductor device – a forward bias p-n junction diode which converts electrical energy into light energy.
 74. (b) Dual Energy X-ray Absorptiometry (DEXA) is used to measure the density or strength of bones.
 75. (a) The sun is the star at the centre of the solar system. It generates its energy by nuclear fusion of hydrogen nuclei into helium.



76. (c) Diffusion refers to the process by which molecules intermingle as a result of their kinetic energy of random motion.
 77. (d) Hydrogen ion has one proton i.e., ${}_1\text{H}^1$. Atomic number = no. of proton = 1 for atom like hydrogen.
 78. (d) Different colours in increasing order of their wavelength: violet, indigo, blue, green, yellow, orange and red.
 79. (a) The light wave with shortest wavelength i.e. violet refracts the most.
 80. (a) All of these forces doesn't need any physical contact to exist hence, non-contact forces.
 81. (b) When an object reflects all the colours of a white light, then it would appear white. White light is the combination of all seven colours (VIBGYOR) of light.
 82. (c) Motion of an oscillating liquid column in a U-tube is called simple harmonic motion with time period independent of on the density of the liquid.
 83. (a) One end of hairpin shaped detergents attracted to water and other to molecules of oil or grease that reduces drastically the surface tension between water and oil.
 84. (a) Displacement = Shortest distance between initial and final point = 0

Distance travelled by you = $2\pi r$
 (Circumference of the circular track)



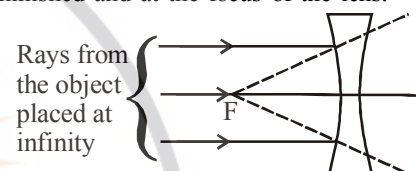
$$= 2 \times \frac{22}{7} \times 35 = 70 \times \frac{22}{7} = 220 \text{ m}$$

85. (b) When current flows through the filament of incandescent electric bulb, it gets heated up. Soon it becomes white hot and starts emitting light.
 86. (b) We know from Newton's second law of motion

$$F_{\text{ext}} = \frac{dP}{dt} \text{ when } dt \text{ is more } F_{\text{ext}} \text{ will be less.}$$

The greater the rate of change of momentum, the greater is the force and vice-versa.

87. (a) Two layers of a cloth are warmer because air trapped between the layers acts as thermal insulator restricting the heat transfer.
 88. (c) A mobile phone charger is basically a step-down transformer which converts high voltage to low voltage.
 89. (a) Image formed by a plane and a convex mirror is always erect. Concave mirror forms image both erect and inverted depends on the position of the object from the mirror.
 90. (a) From the ray diagram, it is very clear that the image of the object placed at infinity from a concave lens is virtual diminished and at the focus of the lens.



Concave lens

91. (a) The upper and lower portions in common type of bifocal lenses are concave and convex respectively.
 92. (d) Tungsten has the highest melting point and lowest vapour pressure of all metals.
 93. (b) The inert gas within the bulb prevents the filament from evaporating. Thus it increases the life of the filament.
 94. (b) Short wavelength is slowed down and refracted the most
 95. (c) Oscilloscope is an instrument which allows us to see waves produced by sound. The microphone can then pick up the sound and convert it to an electrical signal which can be displayed on the oscilloscope.
 96. (c) Maximum n of electrons in K, L, M and N is 2, 8, 18 and 32 respectively.
 97. (c) Moderators like carbon and Graphite are used for slowing down the neutrons in a nuclear reactor. Neutrons from fission have very high speeds and must be slowed greatly by "moderation" to maintain the chain reaction.
 98. (b) 99. (d) 100. (a)
 101. (a) γ - rays are the most penetrating rays
 β - particles are moderately penetrating and
 α - particles are least penetrating.
 102. (b) The distance between person and his image is $60 \text{ cm} \times 2 = 1.2 \text{ m}$
 103. (b) Gravitational force is attractive only whereas the electric and magnetic forces are attractive as well as repulsive.
 104. (b) Creation of something from nothing is against the law of conservation of mass energy.
 105. (b) Centripetal force = $\frac{mv^2}{r}$

Given that,

Mass of proton = $2000 \times$ mass of electron

Radius and speed is same for both proton and electron

$\therefore$ Centripetal force $\propto$ mass

Since mass of proton is 2000 times that of mass of electron,

hence the centripetal force required by proton is about 2000 times more than that required by the electron.

106. (a) 107. (d)
108. (d) Manganin is a trademarked name for an alloy of typically 86% copper, 12% manganese, and 2% nickel. Constantan is a copper-nickel alloy usually consisting of 55% copper and 45% nickel. Its main feature is its resistivity which is constant over a wide range of temperatures. Other alloys with similarly low temperature coefficients are manganin.
109. (b) Graphite is used in making lead pencils due to its ability to leave marks on paper and other objects. Pencil lead is most commonly a mix of powdered graphite and clay.
110. (b) Sodium metal should be stored in kerosene oil. Sodium is a very reactive metal. It is kept in kerosene to prevent it from coming in contact with oxygen and moisture. If this happens, it will react with the moisture present in air and form sodium hydroxide. This is a strongly exothermic reaction, and lot of heat is generated. Thus sodium is kept under kerosene.
111. (d) Mechanical energy is the ability of an object to do work. This energy is equal to the sum of kinetic and potential energy, it is always constant.
112. (d) X-rays are electro magnetic radiations. It has penetrating ability, so it is used in radiography, airport railway security and CT scanning. It is not affected by electric and magnetic fields.
113. (a) The focal length of the lens of a normal human eye is about 2.5 cm. The eye sets focus on a thing by adjusting the eye ball. The lens flexes its curvature to focus on the objects.
114. (d) Newton's laws of motion do not hold good for objects moving with velocity comparable to velocity of light because it does not follow it on this level.
115. (d) Mass is the quantity of matter contained by the object. Weight is the force of gravity acting on a body. Mass is constant anywhere in the universe but weight depends upon the quantity of gravity in a particular place.
116. (c) An object falling from height will show constant velocity so the acceleration will be constant.
117. (d) In convex mirrors, the image is smaller than the object. This mirror provides a wider scope of view so it becomes easy for vehicles use.
118. (b) The sound waves having frequency below 20 Hz are inaudible. Ultrasonic waves are those waves which have the frequency of above 20,000 Hz.
119. (d) The nature of the lens used to correct myopic eye is a concave lens.
- $$\therefore D = \frac{1}{f} = f(\text{metre}) = \frac{1}{D} = \frac{1}{1.25} = \frac{100}{125} = 0.80 \text{ metre} = 80 \text{ cm}$$
120. (c) If any magnet is divided into two parts, every part will be a new magnet.
121. (c) Let the distance is x metre.
Distance = Velocity $\times$ Time
 $x = 340 \times 0.3 = 102 \text{ metre}$ (This is the total distance)
 $\therefore$ The distance of wall is $\frac{102}{2} = 51 \text{ metre}$.
122. (c) Newton's 2nd Law - The rate of Change of momentum always acts in the direction of resultant force acting on a body $\Rightarrow (F = ma)$ (where m = mass; a = acceleration)
123. (b) Watt is the SI unit of mechanical power.

124. (d) $F = -kx$; k = spring constant and it measures stiffness or softness of spring.
Hence K depends on length, radius and material of the spring.
125. (a) A Bipolar Junction Transistor, or BJT, is a solid-state device in which the current flow between two terminals (the collector and the emitter) is controlled by the amount of current that flows through a third terminal (the base).
126. (b) $76 \text{ cm Hg} = 760 \text{ mmHg} = 1 \text{ atm} = 101325 \text{ Pa}$
(mmHg = millimeters of mercury)
(atm = atmosphere)
(Pa = Pascal = N/m^2 , SI unit for pressure)
127. (b) The dimension of Planck's constant can be obtained from any of the equations in which it appears, e.g. $h = E/v$, $\lambda = h/p$, etc.
Planck's Constant $h = 6.626176 \times 10^{-34} \text{ joule-second}$
 $= 6.626176 \times 10^{-34} \text{ m}^2 \text{ kg/s}$
 $[h] = [M L^2 T^{-1}] \text{ _____ (1)}$
Angular momentum $l = r \times p$
 $[l] = [r] [p]$
 $= [L] [M L T^{-1}]$
 $= [M L^2 T^{-1}] \text{ _____ (2)}$
Compare Eqs. (1) and (2). See that both the Planck's constant and angular momentum have the same dimensions.
128. (b)
129. (a) As per the formula Energy of Photon is always equal to the multiple of the Momentum and Speed of light.
Therefore; $P = E/C$ Where P is Momentum, E is Energy and C is Speed of Light
 $10 \text{ MeV}/C = E/C$; {P (Momentum) = $10 \text{ MeV}/C$; as given in Question}
 $E = 10 \text{ MeV}$
130. (c) Liquids and gases show diamagnetic, paramagnetic and electromagnetic property, but it never show ferromagnetic property.
131. (c)
132. (c) Aluminium is a p-type dopant, which means that when a semiconductor (silicon in this case) is doped with aluminium, it creates a hole (positively charged carrier) by accepting an electron from the silicon atom. Electrical conductivity of semiconductors increase and resistivity remains same.
133. (b) Power (P) across a resistor = V^2/R ; In the first case, $P_1 = V^2/R_1$
In the second case, equivalent resistant of parallel combination = $R/3$
Power in second case (P_2) = $(V^2)/(R/3) = 3V^2/R$, So, $P_1/P_2 = 1/3$ or $P_2 = 3P_1$
134. (c) Semiconductors are solid substances that show electrical conductivity either with the addition of an impurity or because of temperature effects. Silicon, Germanium, and Gallium Arsenide are semiconductors as they show electrical conductivity depending on the addition of impurity and temperature. Quartz is an insulator.
135. (c) $7C$
Capacitance = $\frac{K \epsilon_0 A}{d}$
[A = Area of each plate.
 ϵ_0 = Permittivity of free space.
d = distance between plate.

- k^1 = dielectric constant.]
 Since, K^1 = hence new capacitance will be $7C$.
136. (c) The centre of mass of a body is the point where the whole mass of a body is considered to be concentrated. It may lie within or outside the body of an object. Fountain pen, cricket ball and book are all compact body and their centre of gravity lie within the body. The centre of mass of a ring is at its centre which is outside its body.
137. (c) Visual sensation or the perceptual experience of seeing an object is related to the visible spectrum, which is the region of the electromagnetic radiation that is visible to the human eye. Electromagnetic radiation in this range of wavelengths (390-700 nm) is called visible light. 200 and 1000 nm do not lie in the visible range of wavelength.
138. (d) $R = P \frac{1}{A}$ The new resistance will be $\frac{R}{4}$ and resultant resistance will be $\frac{R}{5}$
139. (d) Capacitance is defined as the ability of a system to store electric charge and can be calculated by the formula, $C = Q/V$, where 'Q' is the charge stored on each plate and 'V' is the applied electric potential across the plates capacitors. Capacitance does not depend on the electrical resistivities of the material of capacitors.
140. (c) Electromagnetic radiation consists of photons which move at speed of light within a vacuum.
141. (c) Rainbow can be seen on a rainy day due to the phenomena of dispersion, which is an optical process involving splitting of white light into its constituent colors while passing through a lighter to heavier medium. On a rainy day, white light gets dispersed into its seven colors while passing through rain drops.
142. (d) Cathode ray is a beam of electrons emitted from the cathode of a vacuum tube. It is invisible. Cathode ray tubes are also found in televisions and computer monitors. Since cathode ray is a beam of electrons and all electrons are identical, charge to mass ratio is same for all the gases and does not depend on the nature of gas.
143. (b) The resistance of wire 2 will be higher than that of wire 1.
144. (d) the ray of light will undergo a deviation of 80 degrees.
145. (d) The photon energy of ultraviolet is lesser than that of visible light.
146. (d) After using for some time, big transformers get heated up. This is due to the fact that current produces heat in the transformers, hysteresis loss occurs in the transformers, liquid used for cooling gets heated.
147. (a) Sneezing and farting would move a person standing on the frictionless ground. Any expulsion of fluids should propel the man into motion. Sneezing would result him moving in the direction his back faces and farting would get him forward. The basic principle that governance his movement is, in the horizontal plane is that no external force acts on the body so his momentum can't change.
148. (c) Hard glass is used for making hard glass laboratory apparatus.
149. (c) In thermodynamics, the Joule–Thomson effect describes the temperature change of a real gas or liquid when it is forced through a valve or porous plug while keeping them insulated so that no heat is exchanged with the environment. This procedure is called a throttling process or Joule–Thomson process. Since there is no heat being exchanged it is adiabatic in nature.
150. (c) Ultrasonic waves are generated by a transducer that includes a piezoelectric crystal that converts electrical energy (electric current) to mechanical energy (sound waves).
151. (d) The object will move with constant velocity.
152. (a) Desalination by RO requires the use of an osmotic membrane. The higher the applied pressure above the osmotic pressure, the higher the rate of fresh water transports across the membranes.
153. (b) The principle of operation of an atomic clock is based on atomic physics. It uses the microwave signal that electrons in atoms emit when they change energy levels. An atomic clock uses an electron transition frequency in the microwave, optical, or ultraviolet region of the electromagnetic spectrum of atoms as a frequency standard for its timekeeping element. Caesium-based atomic clocks use the electromagnetic transitions of caesium-133 atoms as a reference point. Caesium is a chemical element with symbol Cs and atomic number 55. It is a soft, silvery-gold alkali metal.
154. (a) Argon gas is used in fluorescent and incandescent light bulbs to stop the oxygen in the light bulbs from corroding the hot tungsten filament. The use of argon in light bulbs prevents the evaporation of the tungsten filaments, which results in increased light bulb life.
155. (d) Temperature in Kelvin = Temperature in Celsius scale + 273.15
156. (d) Sound cannot travel through a vacuum. A vacuum is an area without any air, like space. So sound cannot travel through space because there is no matter for the vibrations to work in.
157. (a) 1 nanometer = 0.00000010 centimeters (cm) or 10^{-7} cm
158. (c) Kinetic energy (KE) is the energy of motion, and kinetic energy is not always conserved in a collision. Kinetic energy has the equation $(1/2)mv^2$.
159. (c) The speed at which a fuse blows depends on how much current flows through it and the material of which the fuse is made. It therefore depends on magnitude and heating effect of the current.
160. (c) When the two bodies are isolated from their surroundings, the amount of heat lost by the hot body must be equal to the amount of heat gained by the cold body. The same principle is used in calorimetry. As heat is energy in transit, this principle is really just conservation of energy.
161. (c) Use the equation $R = \rho \cdot l / A$, Where R = resistance; l = length; A = cross sectional area, ρ = resistivity. Assume the wires are circular cross section. Wire 1 has resistance R. Wire 2 is the same length, but twice the radius, so 4 times the cross sectional area. So wire 2 has a resistance of $R/4$.
 So total resistance of 2 in series = $R + R/4 = 5/4 \cdot R$
162. (d) According to Rayleigh's law, the intensity of scattered light varies inversely as the fourth power of its wavelength. Sunlight consists of seven colours. Of these, red has the maximum wavelength. During sunrise and sunset, the rays have to travel a larger part of the atmosphere because they are very close to the horizon. Therefore, light other than red is mostly scattered away. Most of the red light, which is the least scattered, enters our eyes. Hence, the sun and the sky appear red.

163. (c) A wire of copper having length l and area of cross section A is taken and a current I is flown through it. The power dissipated in the wire is P . If we take an aluminium wire having same dimensions and pass the same current through it, the power dissipated will be $> P$.
164. (a) Pascal's principle, also called Pascal's law, in fluid (gas or liquid) mechanics, statement that, in a fluid at rest in a closed container, a pressure change in one part is transmitted without loss to every portion of the fluid and to the walls of the container.
165. (b) We know that $S_{nth} = u + 1/2 a(2n - 1)$
 $u = 0$
 $S_6 = 0 + 1/2 a(2 \times 6 - 1) = 11/2 a$
 $S_5 = 0 + 1/2 a(2 \times 5 - 1) = 9/2 a$
 So, the percent increase = $S_{6th} - S_{5th} / S_{5th} \times 100$
 $= (11/2 a - 9/2 a) / (9/2 a) \times 100$
 $\Rightarrow 2/9 \times 100 \Rightarrow 22\%$
166. (*)
167. (d) On xy-plane and along x-direction
168. (d) Let T be the tension in the rope: $2T \cos \theta = mg$
 Where $\theta = 90^\circ$,
 $T = mg / 2 \cos 90^\circ$,
 $\cos 90^\circ = 0$
 $So = mg / 0 = \infty$,
 $T = \infty$ Hence tension will be infinite.
169. (a) The heat from the wick melts the wax which gets absorbed in the wick and then gets burnt (which is really oxidation) to produce heat energy as well as light energy.
170. (d) The visible spectrum is the portion of the electromagnetic spectrum that is visible to the human eye. Electromagnetic radiation in this range of wavelengths is called visible light or simply light. A typical human eye will respond to wavelengths from about 380 to 740 nanometers.
171. (c) Let the distance between the object and its real image formed by a convex lens be d . Let the distance of the object from the lens be x ,
 So the image distance from the lens is $(d - x)$,
 Then $x = \frac{d \pm \sqrt{d^2 - 4fd}}{2}$
 For real value of x , $d^2 \geq 4fd$ $d \geq 4f$
 Therefore the minimum distance the objects and its real image formed by convex lens is $4f$.
172. (c) The direction of the magnetic field at any location on Earth's surface is commonly specified in terms of two angles. The angle of the magnetic north relative to the true north is called the Declination or the Variation. When we are facing the Magnetic North, the angle that field makes with the Horizontal is called the Inclination or Magnetic dip.
173. (d) Convection is transfer of heat through more and in bulb transfer due to radiation.
174. (d) 175. (a) 176. (a)
177. (d) Thermoset, or thermosetting, plastics are synthetic materials that strengthen during being heated, but cannot be successfully remolded or reheated after their initial heat-forming. This is in contrast to thermoplastics, which soften when heated and harden and strengthen after cooling.
178. (a) 179. (c) 180. (a)
181. (b) Gas particles are small and the total volume occupied by gas molecules is negligible relative to the total volume of their container. The average kinetic energy of gas particles is proportional to the absolute temperature of the gas, and all gases at the same temperature have the same average kinetic energy.
182. (a) Hooke's law is only really valid up to the proportionality limit, and this is simply because Hooke's law is a proportionality law, i.e. Force is proportional to extension.
183. (c) Correct sequence of passage of light in a compound microscope: light source-condenser-specimen-objective lens-ocular lens-body tube-eyepiece.
184. (b) When soap is mixed in water a colloidal solution is formed. The soap solution has soap micelles which are an aggregate of soap molecules. These micelles are large and they scatter light. That is why the soap solution appears cloudy.
185. (a) Cotton readily absorbs water. This is because the fibers of the cotton have a lot of space between them. ... One reason cellulose makes cotton absorbent is that it contains a negative charge, which helps attract "dipolar" water molecules and absorb them. Another reason is cotton's "hydrophilic properties."
186. (b) Magnification is the process of enlarging the apparent size, not physical size, of something. This enlargement is quantified by a calculated number also called "magnification". When this number is less than one, it refers to a reduction in size, sometimes called minification or de-magnification.
187. (c) A matter is anything that has mass and occupies space. Pen, paper, clips, sand, air, ice, etc. are different forms of matter. Every matter is made up of tiny particles. These particles are so tiny that they can't be seen with naked eyes.
 Every substance is made up of particles. These particles exhibit some characteristics. They can influence the state and properties (physical and chemical) of a substance. The five characteristics shown by particles of matter are as follows.
1. All matter is made of particles
 2. Particles have space between them
 3. Particles are always moving
 4. Particles move faster and get farther apart when heated
 5. Particles are attracted to each other
188. (b) The distance-time graph determines the change in the position of the object. The speed of the object as well can be determined using the line graph. Here the time lies on the x-axis while the distance on the y-axis. The line graph of uniform motion is always a straight line or Horizontal.
189. (a) The speed of the electric current would increase. Increasing the speed of the relative motion between the coil and the magnet – If the same coil of wire passed through the same magnetic field but its speed or velocity is increased, the wire will cut the lines of flux at a faster rate so more induced emf would be produced.
190. (c) An octave can be defined as interval between two points where the frequency at the second point is twice the frequency of the first. $f = 1000$ Hz. Thus, the frequency of a note that is one octave higher than 500 Hz is 1000 Hz.
191. (c) Uniform circular motion is accelerated because the velocity changes due to continuous change in the direction of motion. So even when the body moves to a constant speed its velocity is not constant. Therefore circular motion is an acceleration motion even when the speed remains constant.

Uniform circular motion can be described as the motion of an object in a circle at a constant speed. As an object moves in a circle, it is constantly changing its direction. At all instances, the object is moving tangent to the circle. Since the direction of the velocity vector is the same as the direction of the object's motion, the velocity vector is directed tangent to the circle as well.

192. (b) Duration = 2.5 seconds

Speed = 340 m/s

Distance = speed $\times$ time

$2.5 \times 340 = 850\text{m}$ or 0.85 km is the distance between the source and the mountain

193. (c) A kilowatt-hour is 1,000 watts used for one hour. As an example, a 100-watt light bulb operating for ten hours would use one kilowatt-hour.

How to calculate electric usage cost:

1. Volts $\times$ Amps = Watts

2. Watts $\div$ 1,000 = Kilowatts (kW)

3. Kilowatts (kW) $\times$ Hours of Use = Kilowatt Hours (kWh)

A 100-Watt bulb if kept on for 10 hours will consume: $100 \times 10 = 1000\text{ Watt-Hour} = 1\text{ Kilowatt-Hour (kWh)} = 1\text{ unit}$

194. (c) Scattering of α - Particles by a thin gold foil suggest the presence of Positively charged nucleus at the centre of an atom. Experiment was performed by Rutherford in which he allowed a beam of α - Particles to fall on a thin gold foil.

195. (a) The frequency of a sound wave is what your ear understands as pitch. A higher frequency sound has a higher pitch, and a lower frequency sound has a lower pitch. They have a shorter wavelength of the electromagnetic spectrum.

Requires high voltage to produce X-Rays.

They are used to capture the human skeleton defects.

They travel in a straight line and do not carry an electric charge with them.

They are capable of travelling in a vacuum.

They are powerful waves of electromagnetic energy.

196. (a) X-rays are not deflected by electric and magnetic field.

197. (c) Image formed by a plane mirror is always virtual and erect. The size of the image is equal to that of the object. The image formed is as far behind the mirror as the object is in front of it. The image is laterally inverted.

198. (a) A simple periscope is just a long tube with a mirror at each end. The mirrors are fitted into each end of the tube as shown in the figure. Hence, there are 2 plane mirrors used which are placed parallel to each other.

199. (a) Refractive index of a medium

$$= \frac{\text{Speed of light in air}}{\text{Speed of light in medium}}$$

$$\frac{3}{2} = \frac{3 \times 10^8}{\text{Speed of light in medium}}$$

$$\begin{aligned} \text{Speed of light in medium} &= \frac{3 \times 10^8}{3} \times 2 \\ &= 2 \times 10^8 \text{ m/s} \end{aligned}$$

200. (d) The higher energy, shorter wavelength far UV region spans wavelengths between 91 and 200 nm. Extreme UV radiation has the shortest wavelength range and highest energies of the regions of the ultraviolet spectrum and lies on the border between UV and X-ray radiation.

201. (b) In SI units, displacements are measured in meters (m), and forces in newtons (N or $\text{kg} \cdot \text{m/s}^2$). Therefore, the spring constant k, and each element of the tensor, is measured in newtons per meter (N/m), or kilograms per second squared (kg/s^2).

201. (b) Temperature in Kelvin = $273 +$ temperature in $^{\circ}\text{C}$

Temperature in Kelvin = x (given)

Temperature in $^{\circ}\text{C}$ = y (given)

$\therefore x = 273 + y$

203. (c) The electrical resistivity is the electrical resistance per unit length and per unit of cross-sectional area at a specified temperature. The SI unit of electrical resistivity is the ohm.metre. It is commonly represented by the Greek letter ρ rho.

204. (c) Radio waves are used to carry satellite signals. These waves travel at $300,000\text{ km/s}$ (the speed of light). Communications satellites are used to send and receive radio signals for television, phone or internet communications. Large concave reflectors called satellite dishes are normally used to send and receive these signals.