1. The energy (E), angular momentum (L) and universal gravitational constant (G) are chosen as fundamental quantities. The dimensions of universal gravitational constant in the dimensional formula of Planck's constant (h) is
   (a) zero (b) -1
   (c) 5/3 (d) 1

2. The component of vector $\vec{\mathbf{A}} = a_x\,\hat{\mathbf{i}} + a_y\,\hat{\mathbf{j}} + a_z\,\hat{\mathbf{k}}$ along the direction of $\hat{\mathbf{i}} - \hat{\mathbf{j}}$ is
   (a) $a_x - a_y + a_z$ (b) $a_x - a_y$
   (c) $(a_x - a_y)/\sqrt{2}$ (d) $(a_x + a_y + a_z)$

3. A body thrown vertically up to reach its maximum height in t second. The total time from the time of projection to reach a point at half of its maximum height while returning (in second) is
   (a) $\sqrt{2}t$ (b) $\left(1 + \frac{1}{\sqrt{2}}\right)t$
   (c) $\frac{3t}{2}$ (d) $\frac{t}{\sqrt{2}}$

4. If a body is projected with an angle θ to the horizontal, then
   (a) its velocity is always perpendicular to its acceleration
   (b) its velocity becomes zero at its maximum height
   (c) its velocity makes zero angle with the horizontal at its maximum height
   (d) the body just before hitting the ground, the direction of velocity coincides with the acceleration

5. A river of salty water is flowing with a velocity 2 m/s. If the density of the water is 1.2 g/cc, then the kinetic energy of each cubic metre of water is
   (a) 2.4 J (b) 24 J
   (c) 2.4 kJ (d) 4.8 kJ

6. A ball is dropped from a height h on a floor of coefficient of restitution e. The total distance covered by the ball just before second hit is
   (a) $h(1 - 2e^2)$ (b) $h(1 + 2e^2)$
   (c) $h(1 + e^2)$ (d) he^2

7. Two particles A and B initially at rest, move towards each other, under mutual force of attraction. At an instance when the speed of A is v and speed of B is $2v$, the speed of centre of mass (CM) is
   (a) zero (b) v
   (c) $2.5v$ (d) $4v$

8. Starting from rest, the time taken by a body sliding down on a rough inclined plane at 45° with the horizontal is, twice the time taken to travel on a smooth plane of same inclination and same distance. Then the coefficient of kinetic friction is
   (a) 0.25 (b) 0.33
   (c) 0.50 (d) 0.75

9. A steel wire can withstand a load up to 2940 N. A load of 150 kg is suspended from a rigid support. The maximum angle through which the wire can be displaced from the mean position, so that the wire does not break when the load passes through the position of equilibrium, is
   (a) 30° (b) 60°
   (c) 80° (d) 85°

10. The moment of inertia of a thin circular disc about an axis passing through its centre and perpendicular to its plane is I. Then, the moment of inertia of the disc about an axis parallel to its diameter and touching the edge of the rim is
    (a) I (b) $2I$
    (c) $\frac{3}{2}I$ (d) $\frac{5}{2}I$

11. The orbit of geo-stationary satellite is circular, the time period of satellite depends on

(i) mass of the satellite
(ii) mass of the earth
(iii) radius of the orbit
(iv) height of the satellite from the surface of earth

Which of the following is correct ?

(a) (i) only
(b) (i) and (ii)
(c) (i), (ii) and (iii)
(d) (ii), (iii) and (iv)

12. A particle is executing simple harmonic motion with an amplitude A and time period T. The displacement of the particles after $2T$ period from its initial position is

(a) A (b) $4A$
(c) $8A$ (d) zero

13. A load of 1 kg weight is a attached to one end of a steel wire of area of cross-section 3 mm^2 and Young's modulus 10^{11} N/m^2. The other end is suspended vertically from a hook on a wall, then the load is pulled horizontally and released. When the load passes through its lowest position the fractional change in length is ($g = 10\,m/s^2$)

(a) 0.3×10^{-4} (b) 0.3×10^{-3}
(c) 0.3×10^{3} (d) 0.3×10^{4}

14. The surface tension of soap solution is 0.03 N/m. The work done in blowing to form a soap bubble of surface area 40 cm^2, (in J), is

(a) 1.2×10^{-4} (b) 2.4×10^{-4}
(c) 12×10^{-4} (d) 24×10^{-4}

15. Two rain drops reach the earth with different terminal velocities having ratio 9 : 4. Then the ratio of their volumes is

(a) 3 : 2 (b) 4 : 9
(c) 9 : 4 (d) 27 : 8

16. One litre of oxygen at a pressure of 1 atm and two litres of nitrogen at a pressure of 0.5 atm, are introduced into a vessel of volume 1 L. If there is no change in temperature, the final pressure of the mixture of gas (in atm) is

(a) 1.5 (b) 2.5
(c) 2 (d) 4

17. There is some change in length when a 33000 N tensile force is applied on a steel rod of area of cross-section $10^{-3}m^2$. The change of temperature required to produce the same elongation, if the steel rod is heated, is (The modulus of elasticity is $3 \times 10^{11} N/m^2$ and the coefficient of linear expansion of steel is $1.1 \times 10^{-5}/°C$).

(a) 20° C (b) 15° C
(c) 10° C (d) 0° C

18. In the adiabatic compression, the decrease in volume is associated with

(a) increase in temperature and decrease in pressure
(b) decrease in temperature and increase in pressure
(c) decrease in temperature and decrease in pressure
(d) increase in temperature and increase in pressure

19. Which of the following is true in the case of an adiabatic process, where $\gamma = C_p/C_V$?

(a) $p^{1-\gamma}T^{\gamma}$ = constant
(b) $p^{\gamma}T^{1-\gamma}$ = constant
(c) pT^{γ} = constant
(d) $p^{\gamma}T$ = constant

20. Two slabs A and B of equal surface area are placed one over the other such that their surfaces are completely in contact. The thickness of slab A is twice that of B. The coefficient of thermal conductivity of slab A is twice that of B. The first surface of slab A is maintained at 100° C, while the second surface of slab B is maintained at 25° C. The temperature at the contact of their surfaces is

(a) 62.5° C (b) 45° C
(c) 55° C (d) 85° C

21. When a sound wave of wavelength λ is propagating in a medium, the maximum velocity of the particle is equal to the wave velocity. The amplitude of wave is

(a) λ (b) $\lambda/2$
(c) $\frac{\lambda}{2\pi}$ (d) $\frac{\lambda}{4\pi}$

22. A car is moving with a speed of 72 km/h towards a hill. Car blows horn at a distance of 1800 m from the hill. If echo is heard after 10 s, the speed of sound (in m/s) is

(a) 300 (b) 320
(c) 340 (d) 360

23. The refractive index of a material of a plano-concave lens is 5/3, the radius of curvature is 0.3 m. The focal length of the lens in air is
(a) – 0.45 m (b) – 0.6 m
(c) – 0.75 m (d) – 1.0 m

24. The Young's double slit experiment is performed with blue and with green light of wavelengths 4360 Å and 5460 Å respectively. If x is the distance of 4th maximum from the central one, then
(a) x (blue) = x (green)
(b) x (blue) > x (green)
(c) x (blue) < x (green)
(d) $\frac{x\text{ (blue)}}{x\text{ (green)}} \frac{5460}{4360}$

25. An achromatic combination of lenses produces
(a) images in black and white
(b) coloured images
(c) images unaffected by variation of refractive index with wavelength
(d) highly enlarged images are formed

26. In Fraunhofer diffraction experiment, L is the distance between screen and the obstacle, b is the size of obstacle and λ is wavelength of incident light. The general condition for the applicability of Fraunhofer diffraction is
(a) $\frac{b^2}{L\lambda} >> 1$ (b) $\frac{b^2}{L\lambda} = 1$
(c) $\frac{b^2}{L\lambda} << 1$ (d) $\frac{b^2}{L\lambda} \neq 1$

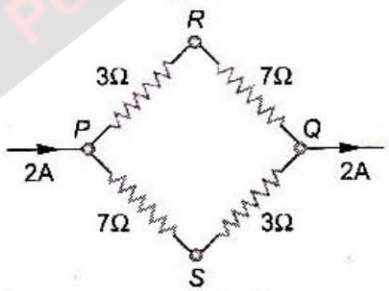
27. With a standard rectangular bar magnet the time period of a vibration magnetometer is 4 s. The bar magnet is cut parallel to its length into four equal pieces. The time period of vibration magnetometer when one piece is used (in second) (bar magnet breadth is small) is
(a) 16 (b) 8
(c) 4 (d) 2

28. The magnetised wire of moment M and length l is bent in the form of semicircle of radius r. Then its magnetic moment is
(a) $\frac{2M}{\pi}$ (b) $2M$
(c) $\frac{M}{\pi}$ (d) zero

29. A charge of 1 μC is divided into two parts such that their charges are in the ratio of 2 : 3. These two charges are kept at a distance 1 m apart in vacuum. Then, the electric force between them (in N) is
(a) 0.216 (b) 0.00216
(c) 0.0216 (d) 2.16

30. Two charges $+q$ and $-q$ are kept apart. Then at any point on the right bisector of line joining the two charges
(a) the electric field strength is zero
(b) the electric potential is zero
(c) both electric potential and electric field strength are zero
(d) both electric potential and electric field strength are non-zero

31. A current of 2 A flows in an electric circuit as shown in figure. The potential difference ($V_R - V_S$), in volts (V_R and V_S are potentials at R and S respectively) is



(a) –4 (b) +2
(c) +4 (d) –2

32. When a battery connected across a resistor of 16 Ω, the voltage across the resistor is 12 V. When the same battery is connected across a resistor of 10 Ω, voltage across it is 11 V. The internal resistance of the battery in ohm is
(a) $\frac{10}{7}$ (b) $\frac{20}{7}$
(c) $\frac{25}{7}$ (d) $\frac{30}{7}$

33. One junction of a certain thermoelectric couple is at a fixed temperature T_r and the other junction is at temperature T. The thermo-electromotive force for this is expressedby $E = k(T - T_r)\left[T_0 - \frac{1}{2}(T + T_r)\right]$.
At temperature $T = \frac{1}{2}T_0$, the thermoelectric power is

(a) $\frac{1}{2}kT_0$ (b) kT_0

(c) $\frac{1}{2}kT_0^2$ (d) $\frac{1}{2}k(T_0 - T_r)^2$

34. In a galvanometer 5% of the total current in the circuit passes through it. If the resistance of the galvanometer is G, the shunt resistance S connected to the galvanometer is

(a) $19G$ (b) $\frac{G}{19}$

(c) $20G$ (d) $\frac{G}{20}$

35. Two concentric coils of 10 turns each are placed in the same plane. Their radii are 20 cm and 40 cm and carry 0.2 and 0.3 A. current respectively in opposite directions. *The magnetic induction (in T) at the centre is*

(a) $\frac{3}{4}\mu_0$ (b) $\frac{5}{4}\mu_0$

(c) $\frac{7}{4}\mu_0$ (d) $\frac{9}{4}\mu_0$

36. The number of turns in primary and secondary coils of a transformer is 50 and 200 respectively. If the current in the primary coil is 4 A, then the current in the secondary coil is

(a) 1 A (b) 2 A

(c) 4 A (d) 5 A

37. X-rays of wavelength 0.140 nm are scattered from a block of carbon. What will be the wavelengths of X-rays scattered at 90° ?

(a) 0.140 nm (b) 0.142 nm

(c) 0.144 nm (d) 0.146 nm

38. An X-ray tube produces a continuous spectrum of radiation with its shortest wavelength of 45×10^{-2} Å. The maximum energy of a photon in the radiation in eV is ($h = 6.62 \times 10^{-34}$ J-s, $c = 3 \times 10^8$ m/s)

(a) 27,500 (b) 22,500

(c) 17,500 (d) 12,500

39. F_{pp}, F_{nn} and F_{np} are the nuclear forces between proton-proton, neutron-neutron and neutron-proton respectively. Then relation between them is

(a) $F_{pp} = F_{nn} \neq F_{np}$ (b) $F_{pp} \neq F_{nn} = F_{np}$

(c) $F_{pp} = F_{nn} = F_{np}$ (d) $F_{pp} \neq F_{nn} \neq F_{np}$

40. Which of the following statements is not correct when a junction diode is in forward bias ?

(a) The width of depletion region decreases.

(b) Free electrons on n-side will move towards the junction.

(c) Holes on p-side move towards the junction.

(d) Electron on n-side and holes on p-side will move away from junction.

Answer – Key

1. a	2. c	3. b	4. c	5. c	6. b	7. a	8. d	9. b	10. d
11. d	12. d	13. a	14. b	15. d	16. c	17. c	18. d	19. a	20. a
21. c	22. c	23. a	24. c	25. c	26. c	27. c	28. a	29. b	30. b
31. c	32. b	33. a	34. b	35. b	36. a	37. b	38. a	39. c	40. d