1. A particle is projected with velocity $2\sqrt{gh}$, such that it just crosses two walls of height h. Find the angle of projection.
   (a) 15° (b) 75°
   (c) 60° (d) 30°

2. For a projectile, $(\text{range})^2$ is 48 times of $(\text{maximum height})^2$ obtained. Find angle of projection.
   (a) 60° (b) 30°
   (c) 45° (d) 75°

3. Which of the following cannot be explained on the basis of wave nature of light ?
   (i) Polarization
   (ii) Optical activity
   (iii) Photoelectric effect
   (iv) Compton effect
   (a) (iii) and (iv)
   (b) (ii) and (iii)
   (c) (i) and (iii)
   (d) (ii) and (iv)

4. An ice cube is sliding down on an inclined plane of angle 30°. Coefficient of kinetic friction between block and inclined plane is $\frac{1}{\sqrt{3}}$. What is acceleration of block ?
   (a) Zero (b) $2\ m/s^2$
   (c) $1.5\ m/s^2$ (d) $5\ m/s^2$

5. A round disc of moment of inertia I_2 about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia I_1 rotating with an angular velocity ω about the same axis. The final angular velocity of the combination of discs is
   (a) $\frac{I_2\omega}{I_1 + I_2}$ (b) ω
   (c) $\frac{I_1\omega}{I_1 + I_2}$ (d) $\frac{(I_1 + I_2)\omega}{I_1}$

6. A particle is executing SHM at mid-point of mean position and extremity. What is the potential energy in terms of total energy (E) ?
   (a) $\frac{E}{4}$ (b) $\frac{E}{16}$
   (c) $\frac{E}{2}$ (d) $\frac{E}{8}$

7. A train is approaching with velocity 25 m/s towards a pedestrian standing on track, frequency of horn of train is 1 kHz. Frequency heard by the pedestrian is ($v = 350$ m/s)
   (a) 1077 Hz (b) 1167 Hz
   (c) 985 Hz (d) 945 Hz

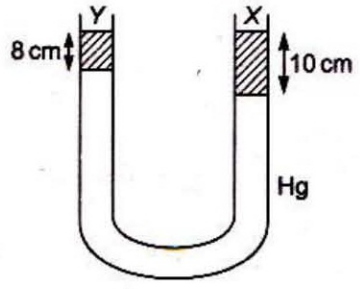
8. A force of 200 N acts tangentially on the rim of a wheel 25 cm in radius. Find the torque.
   (a) 50 N-m (b) 150 N-m
   (c) 75 N-m (d) 30 N-m

9. Focal length of objective and eyepiece of telescope are 200 cm and 4 cm respectively. What is length of telescope for normal adjustment ?
   (a) 196 cm (b) 204 cm
   (c) 250 cm (d) 225 cm

10. Two lenses of power 3D and – 1D are kept in contact. What is focal length and nature of combined lens ?
    (a) 50 cm, convex
    (b) 200 cm, convex
    (c) 50 cm, concave
    (d) 200 cm, concave

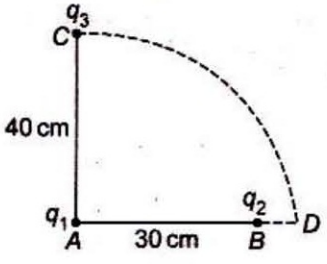
11. Intensity of wave A is $9I$, while that of wave B is I. What is maximum and minimum intensity in YDSE?
    (a) $82I, 80I$ (b) $8I, 10I$
    (c) $16I, 4I$ (d) $4I, I$

12. A liquid X of density $3.36\ g/cm^3$ is poured in a U-tube, which contains Hg. Another liquid Y is poured in left arm with height 8 cm, upper levels of X and Y are same. What is density of Y ?



(a) 0.8 g/cc (b) 1.2 g/cc
(c) 1.4 g/cc (d) 1.6 g/cc

13. Two charges q_1 and q_2 are placed 30 cm apart, as shown in the figure. A third charge q_3 is moved along the arc of a circle of radius 40 cm from C to D. The change in the potential energy of the system is $\frac{q_3}{4\pi\varepsilon_0}k$, where k is



(a) $8q_2$ (b) $8q_1$
(c) $6q_2$ (d) $6q_1$

14. What is order of energy of X-rays (E_X), radio waves (E_R) and microwaves (E_M)?
(a) $E_X < E_R < E_M$ (b) $E_X > E_M > E_R$
(c) $E_M > E_X > E_R$ (d) $E_M < E_R < E_X$

15. A ray of light is incident on a plane mirror, along the direction given by vector $A = 2\hat{i} - 3\hat{j} + 4\hat{k}$. Find the unit vector along reflected ray. Take normal to mirror along the direction of vector $B = 3\hat{i} - 6\hat{j} + 2\hat{k}$.

(a) $\frac{-94\hat{i} + 237\hat{j} + 68\hat{k}}{49\sqrt{29}}$

(b) $\frac{-94\hat{i} + 68\hat{j} - 237\hat{k}}{49\sqrt{29}}$

(c) $\frac{3\hat{i} + 6\hat{j} - 2\hat{k}}{7}$

(d) None of the above

16. Motion of two particles is given by

$$y_1 = 0.25 \sin (310\,t)$$
$$y_2 = 0.25 \sin (316\,t).$$

Find beat frequency.

(a) 3 (b) $\frac{3}{\pi}$
(c) $\frac{6}{\pi}$ (d) 6

17. A coin is of mass 4.8 kg and radius 1 m rolling on a horizontal surface without sliding with angular velocity 600 rotation/min. What is total kinetic energy of the coin ?
(a) 360 J (b) $1440\,\pi^2$ J
(c) $4000\,\pi^2$ J (d) $600\,\pi^2$ J

18. In BJT, maximum current flows in which of the following ?
(a) Emitter region
(b) Base region
(c) Collector region
(d) Equal in all the regions

19. In semiconductors at a room temperature
(a) the valence band is partially empty and the conduction band is partially filled
(b) the valence band is completely filled and the conduction band is partially filled
(c) the valence band is completely filled
(d) the conduction band is completely empty

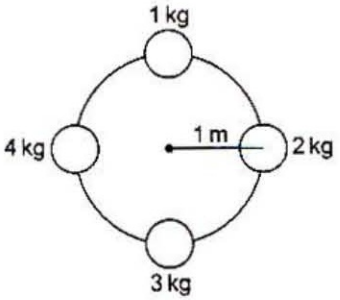
20. In a circuit L, C and R are connected in series with an alternating voltage source of frequency f. The current leads the voltage by 45°. The value of C is

(a) $\frac{1}{2\pi f\,(2\pi fL + R)}$ (b) $\frac{1}{\pi f\,(2\pi fL + R)}$
(c) $\frac{1}{2\pi f\,(2\pi fL - R)}$ (d) $\frac{1}{\pi f\,(2\pi fL - R)}$

21. What is the angle between electric field and equipotential surface ?
(a) 90° always (b) 0° always
(c) 0° to 90° (d) 0° to 180°

22. A satellite moves in elliptical orbit about a planet. The maximum and minimum velocities of satellites are 3×10^4 m/s and 1×10^3 m/s respectively. What is the minimum distance of satellite from planet, if maximum distance is 4×10^4 km ?
(a) 4×10^3 km (b) 3×10^3 km
(c) $4/3 \times 10^3$ km (d) 1×10^3 km

23. Four balls each of radius 10 cm and mass 1 kg, 2 kg, 3 kg and 4 kg are attached to the periphery of massless plate of radius 1 m. What is moment of inertia of the system about the centre of plate ?



(a) 12.04 kg-m^2 (b) 10.04 kg-m^2
(c) 11.50 kg-m^2 (d) 5.04 kg-m^2

24. A Carnot engine has efficiency 1/5. Efficiency becomes 1/3 when temperature of sink is decreased by 50 K. What is the temperature of sink ?
(a) 325 K (b) 375 K
(c) 300 K (d) 350 K

25. A cyclist moves in such a way that he takes 60° turn after 100 m. What is the displacement when he takes 7th turn ?
(a) 100 m (b) 200 m
(c) $100\sqrt{3}$ m (d) $100/\sqrt{3}$ m

26. A spring of spring constant k is cut into two equal parts. A block of mass m is attached with one part of spring. What is the frequency of the system if ν is frequency of block with original spring ?
(a) $\sqrt{2}\nu$ (b) $\nu/2$
(c) 2ν (d) ν

27. Why is there sudden increase in current in zener diode ?
(a) Due to rupture of bonds
(b) Resistance of depletion layer becomes less
(c) Due to high doping
(d) None of the above

28. Coefficient of coupling between two coils of self-inductances L_1 and L_2 is unity. It means
(a) 50% flux of L_1 is linked with L_2
(b) 100% flux of L_1 is linked with L_2
(c) $\sqrt{L_1}$ time of flux of L_1 is linked with L_2
(d) None of the above

29. One mole of an ideal gas at an initial temperature of T kelvin does $6R$ joule of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is 5/3, the final temperature of gas will be
(a) $(T + 2.4)$ K (b) $(T - 2.4)$ K
(c) $(T + 4)$ K (d) $(T - 4)$ K

30. A drum of radius R and mass M, rolls down without slipping along an inclined plane of angle θ. The frictional force
(a) converts translational energy to rotational energy
(b) dissipates energy as heat
(c) decreases the rotational motion
(d) decreases the rotational and translational motion

31. If in a nuclear fusion process, the masses of the fusing nuclei be m_1 and m_2 and the mass of the resultant nucleus be m_3, then
(a) $m_3 = m_1 + m_2$ (b) $m_3 = |m_1 - m_2|$
(c) $m_3 < (m_1 + m_2)$ (d) $m_3 > (m_1 + m_2)$

32. If the angle between the vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ is θ, the value of the product $(\vec{\mathbf{B}} \times \vec{\mathbf{A}}) \cdot \vec{\mathbf{A}}$ is equal to
(a) $BA^2 \cos\theta$ (b) $BA^2 \sin\theta$
(c) $BA^2 \sin\theta \cos\theta$ (d) zero

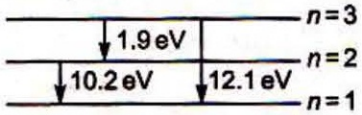
33. A beam of light composed of red and green rays is incident obliquely at a point on the face of a rectangular glass slab. When coming out on the opposite parallel face, the red and green rays emerge from
(a) two points propagating in two different non-parallel directions
(b) two points propagating in two different parallel directions
(c) one point propagating in two different directions
(d) one point propagating in the same direction

34. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 s for every circular lap. The average velocity and average speed for each circular lap respectively is
(a) 0, 0 (b) 0, 10 m/s
(c) 10 m/s, 10 m/s (d) 10 m/s, 0

35. If a bar magnet of length l and cross-sectional area A is cut into two equal parts as shown in figure, then the pole strength of each pole becomes

(a) half (b) double
(c) one-fourth (d) four times

36. Three photons coming from excited atomic hydrogen sample are observed, their energies are 12.1 eV, 10.2 eV and 1.9 eV. These photons must come from



(a) single atom
(b) two atoms
(c) three atoms
(d) either two or three atoms

37. A police car is travelling in a straight line with a constant speed v. A truck travelling in the same direction with constant velocity $3v/2$ passes, the police car at $t = 0$. The police car starts accelerating 10 s after passing the truck, at a constant rate of $3\,m/s^2$, while truck continues to move at constant speed. If the police car takes 10 s further to catch the truck, find the value of v.

(a) 10 m/s (b) 15 m/s
(c) 20 m/s (d) 30 m/s

38. Consider the statements.

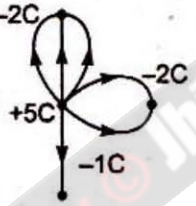
(I) If magnetic field, $\vec{B} = 0$, then magnetic flux is also zero.
(II) If magnetic flux, $\phi = 0$, then magnetic field is also zero.

(a) (I) is true, (II) may be true
(b) Both (I) and (II) are true
(c) (I) may be true, (II) is true
(d) (I) and (II) both are false

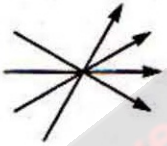
39. Which of the following configurations of electric lines of force is not possible ?

(a)

(b)



(c)



(d) Both (b) and (c)

40. Three guns are aimed at the centre of a circle. They are mounted on the circle, 120° apart. They fire in a timed sequence, such that the three bullets collide at the centre and mash into a stationary lump. Two of the bullets have identical masses of 4.5 g each and speeds of v_1 and v_2. The third bullet has a mass of 2.50 g and a speed of 575 m/s. Find the unknown speeds.

(a) 200 m/s each
(b) 145 m/s and 256 m/s
(c) 536 m/s and 320 m/s
(d) None of the above

Answer – Key

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