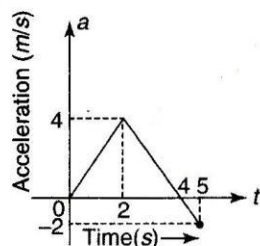
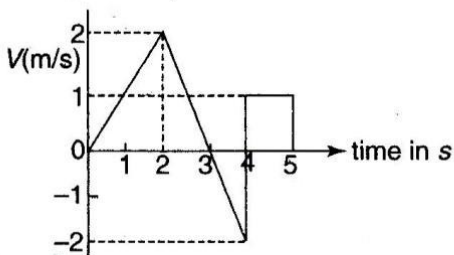


01. Figure shows the graph of acceleration of particle as a function of time. The maximum speed of the particle is (particle starts from rest)



- (a) 7 m/s
(b) 8 m/s
(c) 4 m/s
(d) 16 m/s

02. The velocity-time graph of a body moving along a straight line is as follows:



The displacement of the body in 5 s is

- (a) 5 m (b) 2 m
(c) 4 m (d) 3 m

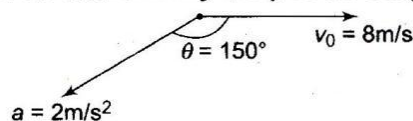
03. Position vector of a particle moving in xy plane at time t is $\vec{r} = a(1 - \cos \omega t)\hat{i} + a \sin \omega t\hat{j}$. The path of the particle is

- (a) a circle of radius a and center at $(a, 0)$
(b) a circle of radius a and center at $(0, 0)$
(c) an ellipse
(d) neither a circle nor an ellipse

04. A particle moves in xy plane. The position vector at any time t is $\vec{r} = \{(2t)\hat{i} + (2t^2)\hat{j}\}m$. The rate of change of θ at time $t = 2$ second (where θ is the angle which its velocity vector makes with positive x -axis) is

- (a) $\frac{2}{17}$ rad/s (b) $\frac{1}{14}$ rad/s
(c) $\frac{4}{7}$ rad/s (d) $\frac{6}{5}$ rad/s

05. The figure shows the velocity and acceleration of a point like body at the initial moment of its motion. The acceleration vector of the body remains constant. The minimum radius of curvature of trajectory of the body is



- (a) 2 m (b) 3 m
(c) 8 m (d) 16 m

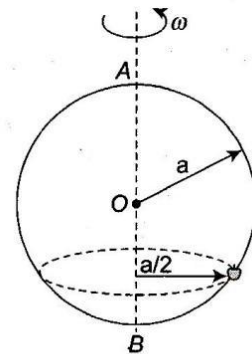
06. A particle is moving along a circular path of radius 5 m and with uniform speed 5 m/s. What will be the average acceleration when the particle completes half revolution?

- (a) zero (b) 10 m/s^2
(c) 10 pm/s^2 (d) $(10/\pi) \text{ m/s}^2$

07. A string of length $l = 1$ m is fixed at one end and carries a mass of 100 gm at other end. The string makes $\sqrt{5}/\pi$ revolutions per second about a vertical axis passing through its second end. What is the angle of inclination of the string with the vertical?

- (a) 30° (b) 45°
(c) 60° (d) 75°

08. A smooth wire is bent into a vertical circle of radius a . A bead P can slide smoothly on the wire. The circle is rotated about vertical diameter AB as axis with a speed ω as shown in figure. The bead P is at rest w.r.t. the circular ring in the position shown. Then ω^2 is equal to:



- (a) $\frac{2g}{a}$
(b) $\frac{2g}{a\sqrt{3}}$
(c) $\frac{g\sqrt{3}}{a}$
(d) $\frac{2a}{g\sqrt{3}}$

09. A constant power P is applied to a particle of mass m . The distance travelled by the particle when its velocity increases from v_1 to v_2 is (neglect friction):

- (a) $\frac{m}{3P}(v_2^3 - v_1^3)$ (b) $\frac{m}{3P}(v_2 - v_1)$
(c) $\frac{3P}{m}(v_2^2 - v_1^2)$ (d) $\frac{m}{3P}(v_2^2 - v_1^2)$

10. Power supplied to a particle of mass 2 kg varies with time as $P = \frac{3t^2}{2}$ watt. Here t is in second. If velocity of particle at $t = 0$ is $v = 0$, the velocity of particle at time $t = 2$ s will be:
- (a) 1 m/s (b) 4 m/s
(c) 2 m/s (d) $2\sqrt{2}$ m/s

11. When a capillary tube is dipped in water, water rises upto 8 cm in the tube. What happens when the tube is pushed down such that its end is only 5 cm above outside water level?
- (a) The radius of the meniscus increases and therefore water does not overflow.
(b) The radius of the water meniscus decreases and therefore does not overflow.
(c) The water forms a droplet on top of the tube but does not overflow.
(d) The water starts overflowing.

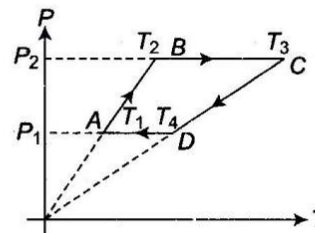
12. The excess pressure due to surface tension inside a spherical drop is 6 units. If eight such drops combine, then the excess pressure due to surface tension inside the larger drop is
- (a) 3 units (b) 6 units
(c) 12 units (d) 48 units

13. A horizontal pipe line carries water in streamline flow. At a point where the cross-sectional area is 10 cm^2 the water velocity is 1 ms^{-1} and pressure is 2000 Pa. The pressure of water at another point where the cross-sectional area is 5 cm^2 is
- (a) 200 Pa (b) 400 Pa
(c) 500 Pa (d) 800 Pa

14. A satellite is moved from one circular orbit around the earth, to another of lesser radius. Which of the following statement is true?
- (a) The kinetic energy of satellite increases and the gravitational potential energy of satellite–earth system increases;
(b) The kinetic energy of satellite increases and the gravitational potential energy of satellite–earth system decreases;
(c) The kinetic energy of satellite decreases and the gravitational potential energy of satellite–earth system decreases;
(d) The kinetic energy of satellite decreases and the gravitational potential energy of satellite–earth system increases.

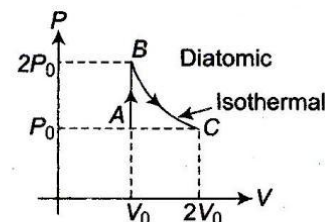
15. An ideal gas heat engine operates in Carnot cycle between 227°C and 127°C . It absorbs 6×10^4 cal of heat at higher temperature. Amount of heat converted to work is
- (a) 2.4×10^4 cal (b) 6×10^4 cal
(c) 1.2×10^4 cal (d) 4.8×10^4 cal

16. P - T curve of a cyclic process is shown. If number of moles of the gas are n , the work done by the gas in the given process is



- (a) $nR(T_1 + T_3 - T_4 + T_2)$ (b) $nR(T_1 - T_3 - T_4 + T_2)$
(c) $nR(T_1 + T_3 + T_4 - T_2)$ (d) $nR(T_1 + T_3 - T_4 - T_2)$

17. P - V curve of a diatomic gas is shown in the figure. Find the total heat given to the gas in the process $A \rightarrow B \rightarrow C$

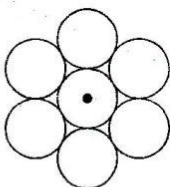


- (a) $P_0V_0 + 2P_0V_0 \ln 2$ (b) $\frac{1}{2}P_0V_0 + P_0V_0 \ln 2$
(c) $\frac{5}{2}P_0V_0 + 2P_0V_0 \ln 2$ (d) $3P_0V_0 + 2P_0V_0 \ln 2$

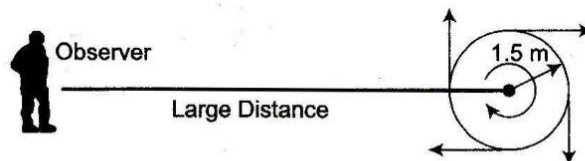
18. Suppose ideal gas equation follows $VP^3 = \text{constant}$. Initial temperature and volume of the gas are T and V respectively. If gas expand to $27V$ then its temperature will become
- (a) T (b) $9T$
(c) $27T$ (d) $T/9$

19. When a sphere rolls without slipping the ratio of its kinetic energy of translation to its total kinetic energy is
- (a) 1 : 7 (b) 1 : 2
(c) 1 : 1 (d) 5 : 7

20. Seven identical disc are arranged in a hexagonal, planar pattern so as to touch each neighbour, as shown in the figure. Each disc has mass m and radius r . What is the moment of inertia of the system of seven disks about an axis passing through the centre of central disk and normal to plane of all disks?



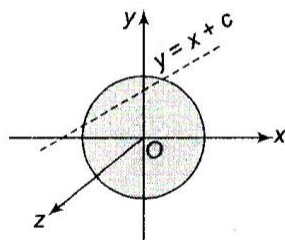
24. A whistle emitting a sound of frequency 440 Hz is tied to a string of 1.5 m length and rotated with an angular velocity of 20 rad/sec in the horizontal plane. Then the range of frequencies heard by an observer stationed at a large distance from the whistle will ($v = 330$ m/s):



- (a) $\frac{7}{2}mr^2$ (b) $\frac{13}{2}mr^2$
 (c) $\frac{29}{2}mr^2$ (d) $\frac{55}{2}mr^2$

- (a) 400.0 Hz to 484.0 Hz (b) 403.3 Hz to 480.0 Hz
 (c) 400.0 Hz to 480.0 Hz (d) 403.3 Hz to 484.0 Hz

21. A uniform disc of radius R lies in the x - y plane, with its centre at origin. Its moment of inertia about z -axis is equal to its moment of inertia about line $y = x + c$. The value of c will be



- (a) $-\frac{R}{2}$
 (b) $\pm \frac{R}{\sqrt{2}}$
 (c) $+\frac{R}{4}$
 (d) $-R$

25. A tuning fork arrangement (pair) produces 4 beats/sec with one fork of frequency 288 cps. A little wax is placed on the unknown fork and it then produces 2 beats/sec. The frequency of the unknown fork is

- (a) 286 cps (b) 292 cps
 (c) 294 cps (d) 288 cps

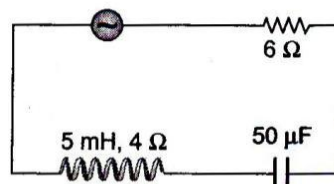
22. A simple pendulum hung from the ceiling of a train moving at constant speed has a period T . If the train starts accelerating or decelerating, then what will be the effect on time period of pendulum?

- (a) Decreases only when train accelerates
 (b) Decreases only when train decelerates
 (c) Decreases in both cases
 (d) Increases in both cases

23. A body cools from 50°C to 49°C in 5 sec. How long will it take to cool from 40°C to 39.9°C ? Assume the temperature of surroundings to be 30°C and Newton's law of cooling to be valid:

- (a) 2.5 s (b) 10 s
 (c) 20 s (d) 5 s

26. In the circuit shown below, the AC source has voltage $V = 20 \cos(\omega t)$ volts with $\omega = 2000$ rad/sec. the amplitude of the current will be nearest to



- (a) 2A (b) 3.3A
 (c) $2/\sqrt{5}$ A (d) $\sqrt{5}$ A

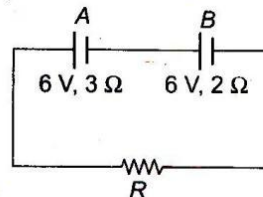
27. Current in the circuit is wattless, if

- (a) Inductance in the circuit is zero
 (b) Resistance in the circuit is zero
 (c) Current is alternating
 (d) Resistance and inductance both are zero

28. An electron initially at rest, is accelerated through a potential difference of 200 volt, so that it acquires a velocity 8.4×10^6 m/s. The value of e/m of electron will be

- (a) 2.76×10^{12} C/kg (b) 1.76×10^{11} C/kg
 (c) 0.76×10^{12} C/kg (d) None of these

29. O^{++} , C^+ , He^{++} and H_2^+ ions are projected on the photographic plate with same velocity in a mass spectrograph. Which one will strike farthest?
 (a) O^{++} (b) C^+
 (c) He^{++} (d) H_2^+
34. Two sources of emf 6 V and internal resistance 3Ω and 2Ω are connected to an external resistance R as shown. If potential difference across battery A is zero, then value of R is



30. According to Bohr's theory, the expressions for the kinetic and potential energy of an electron revolving in an orbit is given respectively by (In H atom)

(a) $+\frac{e^2}{8\pi\epsilon_0 r}$ and $-\frac{e^2}{4\pi\epsilon_0 r}$

(b) $+\frac{8\pi\epsilon_0 e^2}{r}$ and $-\frac{4\pi\epsilon_0 e^2}{r}$

(c) $-\frac{e^2}{8\pi\epsilon_0 r}$ and $-\frac{e^2}{4\pi\epsilon_0 r}$

(d) $+\frac{e^2}{8\pi\epsilon_0 r}$ and $+\frac{e^2}{4\pi\epsilon_0 r}$

31. The ratio of the frequencies of the long wavelength limits of Lyman and Balmer series of hydrogen spectrum is

- (a) 27 : 5 (b) 5 : 27
 (c) 4 : 1 (d) 1 : 4

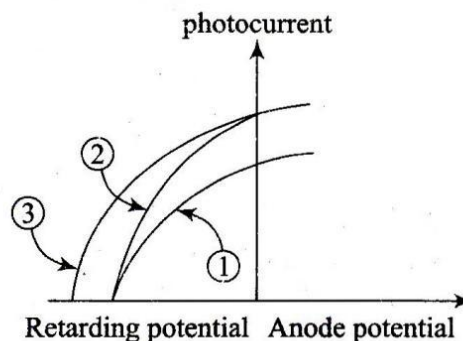
32. The energy that should be added to an electron, to reduce its de-Broglie wavelength from 2×10^{-9} m to 0.5×10^{-9} m will be:

- (a) 1.1 MeV (b) 0.56 MeV
 (c) 0.56 KeV (d) 5.67 eV

33. A 2 volt battery, a 15Ω resistor and a potentiometer of 100 cm length, all are connected in series. If the resistance of potentiometer wire is 5Ω , then the potential gradient of the potentiometer wire is

- (a) 0.005 V/cm (b) 0.05 V/cm
 (c) 0.02 V/cm (d) 0.2 V/cm

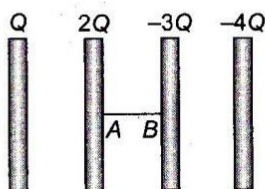
35. The figure shows a plot of photo current versus anode potential for a photosensitive surface for three different radiations. Which one of the following is a correct statement? [2009]



- (a) Curves a and b represent incident radiations of different frequencies and different intensities
 (b) Curves a and b represent incident radiations of the same frequency but of different intensities
 (c) Curves b and c represent incident radiations of different frequencies and different intensities
 (d) Curves b and c represent incident radiations of the same frequency having the same intensity
36. Light of two different frequencies whose photons have energies 1 eV and 2.5 eV respectively illuminate a metallic surface whose work function is 0.5 eV successively. Ratio of its maximum speeds of emitted electrons will be [2011]
- (a) 1 : 2 (b) 1 : 1
 (c) 1 : 5 (d) 1 : 4

37. A positive point charge, which is free to move, is placed inside a hollow conducting sphere with negative charge, away from its centre. It will
- move towards the centre
 - move towards the nearer wall of the conductor
 - remain stationary
 - oscillate between the centre and the nearer wall.

38. Four very large metal plates are given the charges as shown in figure. The middle two are then connected through a wire. Find the charge that will flow through the wire.



- 5Q from A to B
 - 5Q/2 from A to B
 - 5Q from B to A
 - no charge will flow
39. The number of turns in the coil of an ac generator is 5000 and the area of the coil is 0.25m^2 . The coil is rotated at the rate of 100 cycles/sec in a magnetic field of 0.2W/m^2 . The peak value of the emf generated is nearly
- 786 kV
 - 440 kV
 - 220 kV
 - 157.1 kV

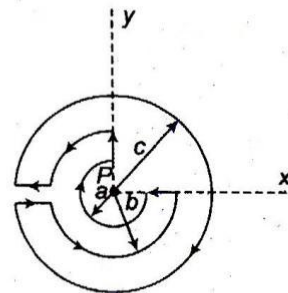
40. In an electromagnetic wave, the amplitude of electric field is 1V/m . the frequency of wave is $5 \times 10^{14}\text{Hz}$. The wave is propagating along z-axis. The average energy density of electric field, in Joule/m^3 , will be
- 1.1×10^{-11}
 - 2.2×10^{-12}
 - 3.3×10^{-13}
 - 4.4×10^{-44}

41. Three identical capacitors are combined differently. For the same voltage to each combination, the one that stores the greatest energy is
- Two in parallel and the third in series with it
 - Three in series
 - Three in parallel
 - Two in series and third in parallel with it

42. A capacitor $4\mu\text{F}$ charged to 50 V is connected to another capacitor of $2\mu\text{F}$ charged to 100 V with plates of like charges connected together. The total energy before and after connection in multiples of (10^{-2}J) is
- 1.5 and 1.33
 - 1.33 and 1.5
 - 3.0 and 2.67
 - 2.67 and 3.0

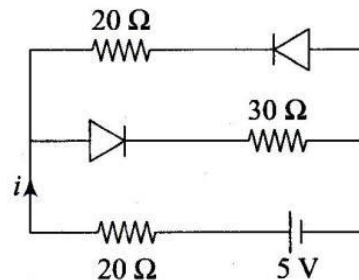
43. An object is kept at a distance of 16 cm from a thin lens and the image formed is real. If the object is kept at a distance of 6 cm from the same lens the image formed is virtual. If the size of the images formed are equal, the focal length of the lens will be
- 15 cm
 - 17 cm
 - 21 cm
 - 11 cm

44. For $c = 2a$, and $a < B < c$, the magnetic field at point P will be zero when



- $a = b$
- $a = \frac{3}{5}b$
- $a = \frac{5}{3}b$
- $a = \frac{1}{3}b$

45. Current in the circuit will be [2001]



- $\frac{5}{40}\text{A}$
- $\frac{5}{50}\text{A}$
- $\frac{5}{10}\text{A}$
- $\frac{5}{20}\text{A}$