

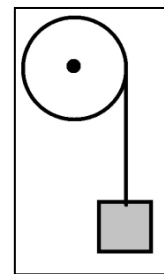
RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE, RAHARA, KOLKATA
Undergraduate Admission Test 2025: Physics Honours

Full Marks : 75

Time : 1 hour

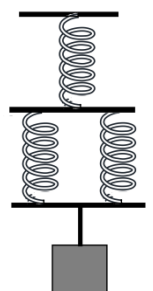
- In a company of 100 people, 99 % are Indians. How many Indians must be let go so that 98% percent Indians remain in the company?
 (a) 1 (b) 2 (c) 45 (d) 50
- The decay rate of radium satisfies the following differential equation $\frac{dm}{dt} = -km$
 Where m is the mass of radium at time t . If at $t = 0$, $m = m_0$ and decay constant $k = 0.000436$ then the half life of radium must be (in years)
 (a) 1590 (b) 1690 (c) 1190 (d) 1000
- 10 people are selected at random. The probability that all 10 birth days are different equals [consider year as consisting of 365 days] :
 (a) $\frac{365!}{10! 355!} \times \frac{1}{365^{10}}$ (b) $\frac{365!}{355!} \times \frac{1}{365^{10}}$ (c) $\frac{10}{365}$ (d) $\frac{10!}{365!}$
- $\lim_{x \rightarrow 0} \frac{(\sin(x)-x)}{x^3}$ is equal to :
 (a) 1/6 (b) -1 (c) -1/6 (d) 1
- A block of mass m_1 is suspended from a pulley of radius a and mass m_2 (as shown in the figure). Assume the pulley is in the shape of circular disc and its rotation is frictionless. The block is falling due to uniform gravitational pull near the earth's surface. Acceleration of the falling block is

- $\left(\frac{2m_1}{2m_1 + m_2}\right) g$
- $\left(\frac{2m_2}{2m_2 + m_1}\right) g$
- $\left(\frac{2m_1}{2m_2 + m_1}\right) g$
- $\left(\frac{2m_2}{2m_1 + m_2}\right) g$



- A block of mass m is suspended from a system of identical springs each having spring constant κ (as shown in the figure). Time period of oscillation of the block is

- $T = 2\pi \sqrt{\frac{3m}{2\kappa}}$
- $T = 2\pi \sqrt{\frac{3m}{5\kappa}}$
- $T = 2\pi \sqrt{\frac{m}{3\kappa}}$
- $T = 2\pi \sqrt{\frac{3m}{\kappa}}$



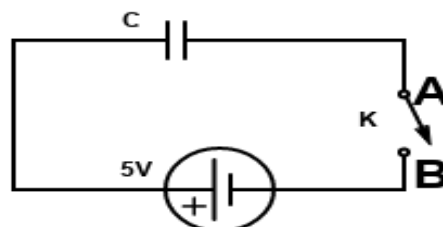
7. Consider a system of particles having three point masses. Mass and Cartesian coordinates of these point masses are tabulated below

Mass in arbitrary unit	(x, y, z) coordinates in arbitrary unit
1.0	$(1, 1, -1)$
2.0	$(2, -3, -1)$
3.0	$(4, 1, -4)$

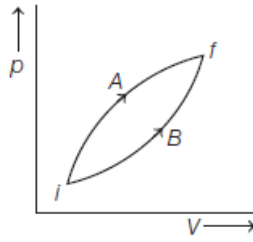
Moment of inertia of the system about z – axis as axis of rotation will be.

- (a) 120 unit (b) 200 unit (c) 99 unit (d) 78 unit
8. See the attached figure. The bob of mass M of a simple pendulum of string length L is released from horizontal position (point P). The string is blocked by a pin mounted at point B (vertically below of point A) such that $AB = h$. The bob will execute a complete circular revolution about point B as centre for the minimum value of h to be
- (a) $h = \frac{L}{2}$
 (b) $h = \frac{2L}{3}$
 (c) $h = \frac{3L}{7}$
 (d) $h = \frac{3L}{5}$
9. From a common point, two particles start moving with same speed of 2 m/s; but along two different directions: $(\hat{i} + \hat{j})/\sqrt{2}$ and $(\hat{i} - \hat{j})/\sqrt{2}$. What will be the distance between them after 3 second?
- (a) 6 m (b) $6\sqrt{3}$ m (c) $6\sqrt{2}$ m (d) 12 m
10. Seven electrical dipoles each constituted of a positive and a negative charges having same magnitude q are placed inside a sphere. The total electrical flux through the whole surface of the sphere is,
- (a) $\frac{7q}{\epsilon_0}$ (b) $\frac{14q}{\epsilon_0}$ (c) $\frac{q}{\epsilon_0}$ (d) Zero
11. If ϵ_0 be the permittivity of free space L the length, ΔV and Δt are the potential difference and the time interval respectively, then the dimensional formula for the quantity $\epsilon_0 L^{-1} \frac{\Delta V}{\Delta t}$ corresponds to,
- (a) Current density (b) Resistivity (c) Surface charge density (d) Electric field
12. Two resistances in series have resistance S , and in parallel P . If $S = nP$, the minimum n is:
- (a) 2 (b) 3 (c) 4 (d) 1
13. A capacitor is connected to a 5V DC cell via a key K. What will be the potential difference between point A and B when K is open?

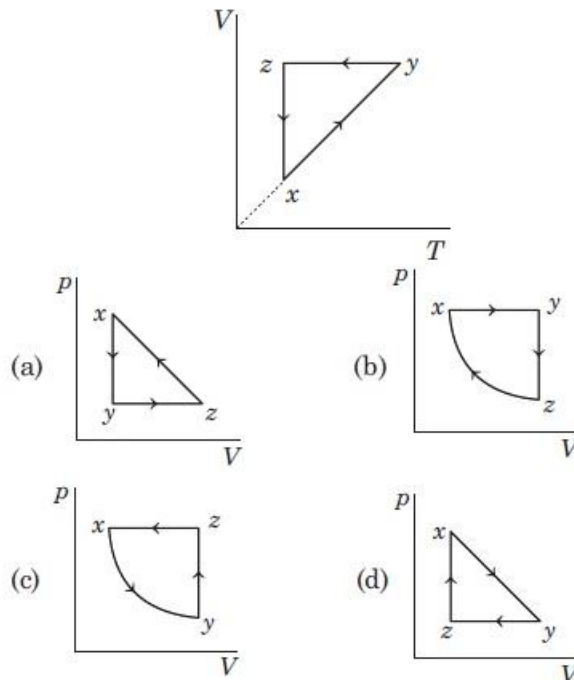
- (a) 5V
 (b) 0V
 (c) less than 5V
 (d) Infinity



14. Following figure shows two processes A and B for a gas. If ΔQ_A and ΔQ_B are the amount of heat absorbed by the system in two cases and ΔU_A and ΔU_B are changes in internal energies respectively, then



- (a) $\Delta Q_A = \Delta Q_B$ and $\Delta U_A = \Delta U_B$
 (b) $\Delta Q_A > \Delta Q_B$ and $\Delta U_A = \Delta U_B$
 (c) $\Delta Q_A > \Delta Q_B$ and $\Delta U_A < \Delta U_B$
 (d) $\Delta Q_A < \Delta Q_B$ and $\Delta U_A > \Delta U_B$
15. For a gas, if the ratio of specific heats at constant pressure and constant volume is γ , then the value of degrees of freedom is
- (a) $\frac{\gamma+1}{\gamma-1}$ (b) $\frac{\gamma-1}{\gamma+1}$ (c) $\frac{\gamma-1}{2}$ (d) $\frac{2}{\gamma-1}$
16. A thermodynamic cycle $xyzx$ is shown on a V-T diagram. The p-V diagram that best describes this cycle is (diagrams are schematic and not to scale):



17. When tension in a string increases by 10%, the speed of wave on the string
- (a) increases by 10% (b) increases by 21%
 (c) decreases by 10% (d) increases by 5%
18. A convex lens of refractive index μ_1 is dipped in a liquid of refractive index μ_2 . Then
- (a) the lens behaves as converging lens if $\mu_2 > \mu_1$
 (b) its focal length will be infinite if $\mu_1 = \mu_2$
 (c) its focal length will be zero if $\mu_1 = \mu_2$
 (d) the lens will not refract any light

19. Two waves whose intensities are of ratio 9:16 are made to interfere. The ratio of maximum and minimum intensities in the interference pattern is,
(a) 49:16 (b) 49:1 (c) 7:1 (d) 4:3
20. When a ray of light enters into glass from air,
(a) frequency and velocity change
(b) frequency and wavelength change
(c) wavelength and velocity change
(d) only frequency changes
21. Displacement of a particle performing Simple Harmonic Motion is given by $x(t) = A \sin(\omega t + \phi)$. At $t = 0$, displacement $x = 2$ unit and its velocity is 2ω unit then amplitude $A =$
(a) $2\sqrt{2}$ unit (b) $5\sqrt{2}$ unit (c) $4\sqrt{2}$ unit (d) $6\sqrt{2}$ unit
22. Breakdown of PN junction diode occurs due to :
(a) large flow of majority carriers in forward bias condition
(b) large flow of minority carriers in forward bias condition
(c) large flow of minority carriers in reversed bias condition
(d) large flow of majority carriers in reversed bias condition
23. If mean life of a radioactive element is 1 year then its half-life will be
(a) 1 year (b) 0.5 year (c) 0.693 year (d) 0.8 year
24. The work function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectric emission from the substance is approximately (Planck constant $h = 6.67 \times 10^{-27}$ erg-s)
(a) 542 nm (b) 412 nm (c) 222 nm (d) 312 nm
25. A cell of e.m.f. 10 volt and internal resistance 0.25 ohm is connected in series with a parallel combination of three resistors 2 ohm, 5 ohm and 10 ohm. What will be the current through 5 ohm resistor?
(a) 1.5 A (b) 1.67 A (c) 2.5 A (d) 2.0 A.