JEE (MAIN)-2025 (Online)

Physics Memory Based Answer & Solutions

EVENING SHIFT

DATE : 04-04-2025

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MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – APRIL, 2025

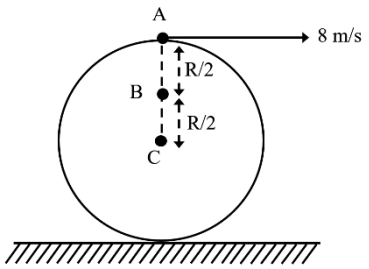
(Held On Friday 4th April, 2025) **TIME : 3 : 00 PM to 6 : 00 PM**

PHYSICS

TEST PAPER WITH SOLUTION

SECTION-A

1. A disc is performing pure rolling, if speed of top point is $8\ m/s$. Find speed of point B.



(1) $3\ m/s$ (2) $6\ m/s$

(3) $4\ m/s$ (4) $2\ m/s$

Ans. **(2)**

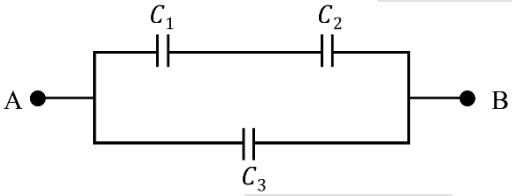
Sol. $v_A = \omega(2R)$

$v_B = \omega\left(\frac{3R}{2}\right)$

$\frac{8}{v_B} = \frac{4}{3}$

$v_B = 6$ m/s

2. The equivalent capacitance between A and B is



(1) $\frac{C_1C_2+C_2C_3+C_3C_1}{C_1+C_2}$

(2) $\frac{C_1C_2+C_2C_3+C_3C_1}{C_2+C_3}$

(3) $C_1C_2 + C_2C_3 + C_3C_1$

(4) $C_1 + C_2 + C_3$

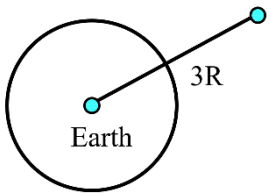
Ans. **(1)**

Sol. $C_{eq} = \frac{C_1C_2}{C_1+C_2} + C_3$

$C_{eq} = \frac{C_1C_2 + C_1C_3 + C_2C_3}{C_1+C_2}$

3. A particle of mass m is at a distance 3R from the centre of Earth. Find minimum kinetic energy of particle to leave Earth's field

(R : Radius of Earth):



(1) 3mgR (2) $\frac{mgR}{3}$

(3) $\frac{3}{2}$mgR (4) $\frac{mgR}{2}$

Ans. **(2)**

Sol. $\frac{-GMm}{3R} + K.E. = 0$

$K.E. = \frac{mgR}{3}$

4. In a YDSE setup, the slits are separated by 1.5 mm and the distance between slits and screen is 2 m. On using light of wavelength 400 nm, it is observed that 20 maximas of double slit experiment lie inside the central maxima of single slit diffraction. The width of each slit is _____ μm

(1) 300 (2) 75

(3) 200 (4) 150

Ans. **(4)**

Sol. $\frac{20\lambda D}{d} = \frac{2\lambda D}{a}$

$\frac{20}{1.5\times10^{-3}} = \frac{2}{a}$

$a = \frac{1.5\times10^{-3}}{10}$

$a = 150\ \mu m$

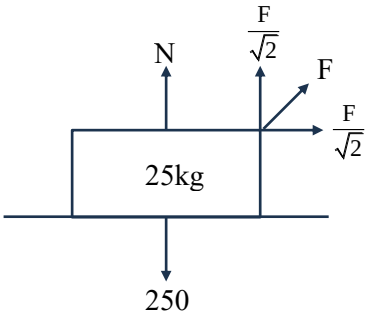
5. A block of mass 25 kg is pulled along a horizontal surface by a force at an angle of 45° with the horizontal. The friction coefficient between the block and the surface is 0.25. The block travels at a uniform velocity. The work done by the applied force during a displacement of 5 m of block is :-

(1) 300 J (2) 500 J

(3) 125 J (4) 250 J

Ans. **(4)**

Sol.



$$\frac{F}{\sqrt{2}} = \mu N$$

$$N = 250 - \frac{F}{\sqrt{2}}$$

$$\frac{F}{\sqrt{2}} = \mu\left(250 - \frac{F}{\sqrt{2}}\right)$$

$$\frac{F}{\sqrt{2}} = \frac{-F}{4\sqrt{2}} + \frac{250}{4}$$

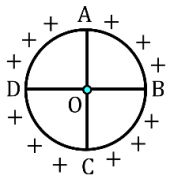
$$\frac{5F}{4\sqrt{2}} = \frac{250}{4}$$

$$\frac{F}{\sqrt{2}} = 50\ N$$

$$W = \frac{F}{\sqrt{2}} \times 5$$

$$W = 50 \times 5 = 250\ J$$

6. A metallic ring is uniformly charged as shown in figure. AC & BD are two mutually perpendicular diameters. Electric field due to arc AB at 'O' is E in magnitude. What would be the magnitude of Electric field at 'O' due to arc ABC ?



(1) Zero (2) E/2

(3) 2E (4) $\sqrt{2}$E

Ans. **(4)**

Sol. $$\frac{\sqrt{2}k\lambda}{R} = E_{AB}$$

$$E'_{ABC} = \frac{2k\lambda}{R} = \sqrt{2}E$$

7. Displacement of a wave is expressed as $x(t) = 5\cos\left(628t + \frac{\pi}{2}\right)$ m. The wavelength of wave when its velocity is 300 m/s is :-

(1) 5 m (2) 1.5 m

(3) 3 m (4) 0.3 m

Ans. **(3)**

Sol. $$f = \frac{628}{2 \times \pi} = 100\ Hz$$

$$\lambda = \frac{v}{f} = \frac{300}{100} = 3m$$

8. Match the column :-

Process		ΔQ	
(a)	Adiabatic	(i)	$\frac{n\gamma R}{\gamma - 1}\Delta T$
(b)	Isobaric	(ii)	0
(c)	Isochoric	(iii)	$nRT\ln\left(\frac{P_1}{P_2}\right)$
(d)	Isothermal	(iv)	$\frac{nR}{\gamma - 1}\Delta T$

(1) (a)-(i), (b)-(ii), (c)-iii, (d)-(iv)

(2) (a)-(ii), (b)-(i), (c)-iv, (d)-(iii)

(3) (a)-(ii), (b)-(iv), (c)-iii, (d)-(i)

(4) (a)-(ii), (b)-(i), (c)-iv, (d)-(iii)

Ans. **(2)**

Sol. (1) Adiabatic, $\Delta Q = 0$

(2) Isobaric, $\Delta Q = 0\ \frac{n\gamma R}{\gamma - 1}\Delta T$

(3) Isochoric, $\frac{nR}{\gamma - 1}\Delta T$

(4) Isothermal, $nRT\left(\frac{P_1}{P_2}\right)$

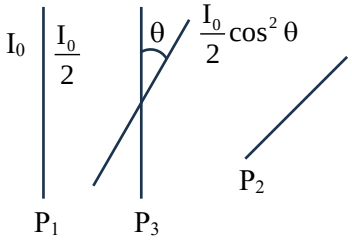
9. Two polarizers P_1 and P_2 are aligned in such a way that intensity is zero. P_3 polarizer is inserted between P_1 and P_2 such that final transmitted ray will have the maximum intensity. Find angle between P_1 and P_3.

(1) $\frac{\pi}{8}$ (2) $\frac{\pi}{3}$

(3) $\frac{\pi}{2}$ (4) $\frac{\pi}{4}$

Ans. **(4)**

Sol.



$\frac{I_0}{2}\cos^2\theta\sin^2\theta$

$\frac{I_0}{8}\sin^2 2\theta$

$2\theta = \frac{\pi}{2}$

$\theta = \frac{\pi}{4}$

10. A medium has relative permittivity $\frac{1}{0.085}$ and relative permeability is $\frac{10}{\pi}$. Find ratio of speed of light in vacuum to the medium.

(1) 1.27 (2) 3.14

(3) 2.28 (4) 6.12

Ans. **(4)**

Sol. $\mu = \frac{c}{v} = \frac{\frac{1}{\sqrt{\mu_0\varepsilon_0}}}{\frac{1}{\sqrt{\mu_m\varepsilon_m}}} = \sqrt{\mu_r\varepsilon_r}$

$\mu = \sqrt{\frac{1}{0.085}\times\frac{10}{\pi}}$

$\mu = 6.12$

11. Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A): Plank's constant and linear momentum have same dimensions.

Reason (R): Bohr's angular momentum is integral multiple of $\frac{h}{2\pi}$.

In the light of the above statements, chose the correct answer from the options given below:

(1) Both (A) and (R) are true and (R) is the correct explanation of (A)

(2) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

Ans. **(4)**

Sol. $\vec{L} = \vec{r}\times\vec{P}$

$\vec{L} = \frac{nh}{2\pi}$

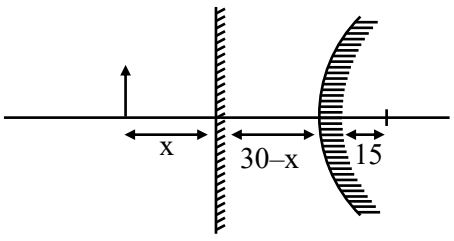
12. An object is placed at a distance of 30 *cm* in front of a convex mirror of focal length 30 *cm*. Now if a plane mirror is placed between convex mirror and the object such that the images from the two mirrors coincide. If the distance between the two mirrors is x *cm* then the value of 2x is:

(1) 15 (2) 30

(3) 7.5 (4) 10

Ans. **(3)**

Sol.



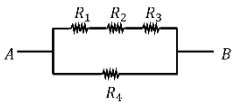
$30 - x + 15 = x$

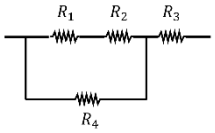
$45 = 2x$

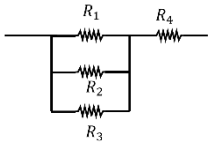
$x = \frac{45}{2}$

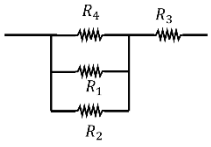
Distance $= 30 - \frac{45}{2} = \frac{15}{2}$

13. If resistor $R_1 = R_2 = R_3 = 5\Omega$ and $R_4 = 10\Omega$. Which circuit diagram is having equivalent resistance = 6Ω across A and B :-

(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

Sol. $R_1 + R_2 + R_3 = 15$

$R_4 = 10$

$R_{eq} = \frac{15 \times 10}{25} = 6\Omega$

14. n identical bulbs each takes power P when connected with main supply. If these bulbs are connected in series with main supply, then power will be

(1) nP (2) $\frac{P}{n}$

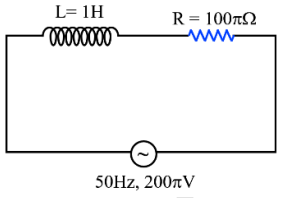
(3) $\frac{P}{n^2}$ (4) n^2P

Ans. **(2)**

Sol. $P = \frac{V^2}{R}$

$P_1 = \frac{V^2}{nR} = \frac{P}{n}$

15. An ac source of 100π volt is connected to the given circuit. Find maximum value of the current in the circuit.



(1) $\sqrt{3}\,A$ (2) $0.5\,A$

(3) $\frac{1}{\sqrt{2}}A$ (4) $2\,A$

Ans. **(4)**

Sol. $Z = \sqrt{R^2 + x_L^2}$

$Z = 100\pi\sqrt{2}$

$i_{rms} = \frac{v_{rms}}{Z} = \frac{200\pi}{100\pi\sqrt{2}} = \sqrt{2}$

$i_{peak} = 2\,A$

16. Choose the incorrect statement from the below options

(1) In n-type semiconductor pentavalent impurities are present.

(2) If trivalent impurities are added to pure semiconductor, it becomes p-type semiconductor.

(3) In n-type semiconductor holes are majority charge carriers.

(4) In p-type semiconductor holes are majority charge carriers.

Ans. **(3)**

Sol. Theoretical

17. If a charged particle is projected in a uniform magnetic field perpendicular to its velocity then the minimum time in which it returns to its original position :-

(1) $\frac{2\pi m}{qB}$ (2) $\frac{\pi m}{qB}$

(3) $\frac{qB}{2\pi m}$ (4) None

Ans. **(1)**

Sol. $t_{min} = T = \frac{2\pi m}{qB}$

SECTION – B

1. Dimensional formula of ratio of electric dipole moment and magnetic moment is $M^xL^yT^zA^w$ then the value of $(x - y)$ will be

Ans. **(1)**

Sol. $\frac{P}{M} = \frac{QL}{iA} = \frac{QL \cdot t}{QA}$

$= \left[M^0L^{-1}T^1A^0\right]$