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JEE (MAIN) 2025

MEMORY BASED QUESTIONS & TEXT SOLUTION

SHIFT-1

DATE & DAY: 03nd April 2025 & Thursday

PAPER-1

Duration: 3 Hrs.
Time: 09:00 – 12:00 IST

SUBJECT: PHYSICS

REGISTERED & CORPORATE OFFICE (CIN: U80302RJ2007PLC024029):
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PART : PHYSICS

1. A straight wire is converted into circle as shown in figure find resistance between A & B

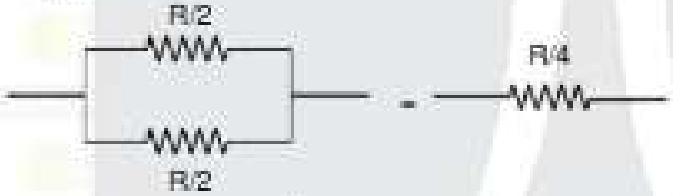
$\ell = 25$ m

$\rho = 5 \times 10^{-6}\ \Omega.m$

(1) 125 (2) 100 (3) 50 (4) 6.25

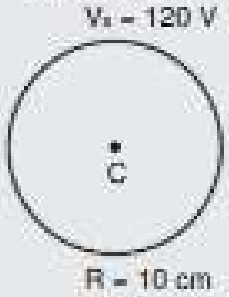
Ans. (4)

Sol. $R = \frac{P\ell}{A}$



$$R_{eq} = \frac{1}{4}\frac{\rho\ell}{A} = \frac{1}{4}\frac{5\times10^{-6}\times25}{5\times10^{-6}} = \frac{25}{4} = 6.25$$

2. The electric potential at the surface of a shell of radius 10 cm is 120 V. Find the potential at its center (v_1), at r = 5 cm from center (v_2) and at r = 15 cm from center (v_3)



	V_1	V_2	V_3
(1)	120	120	80
(2)	40	40	80
(3)	80	80	120
(4)	80	120	80

Ans. (1)

Sol. $V_s = V_1 = 120$ V

$V_2 = V_s = 120$ V

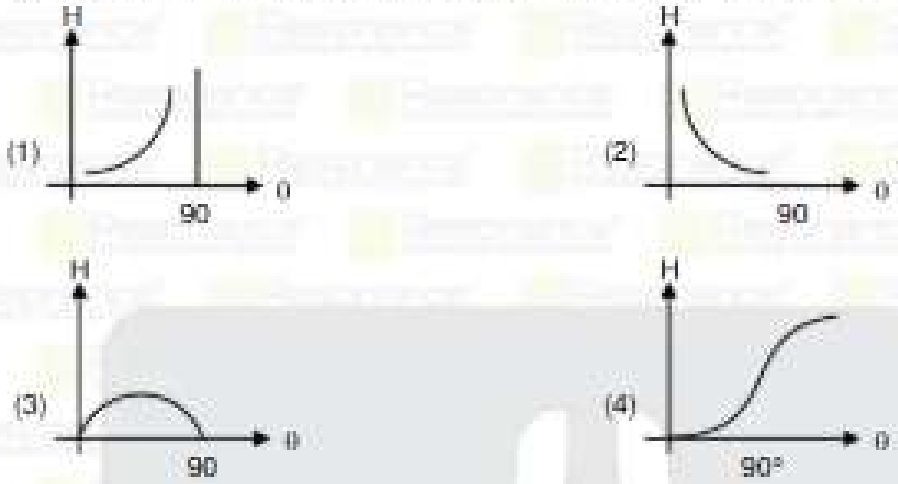
$$\frac{KQ}{R} = 120$$

$$Q = \frac{R}{K}120$$

$$\therefore\ V_3 = \frac{KQ}{15} = \frac{R(120)}{15} = \frac{10}{15}\times120 = 80$$

$V_3 = 80$ V

3. Angle of projection Vs maximum height curve is given. Choose correct graph



Ans. **(4)**

Sol. $H = \frac{u^2 \sin^2\theta}{2g}$

$H \propto \sin^2\theta$

4th is correct option

4. Find the colour corresponding to photons of energy 3eV.

(1) Blue (2) Yellow (3) Green (4) Violet

Ans. **(4)**

Sol. $\lambda_{ph} = \frac{12400}{E}$ e.v. Å

$= \frac{12400}{3}$ Å

= 4130 Å

For violet color 3800Å < λ < 4500Å

So color is violet

5. $I_1 = 4\ I$, $I_2 = 9I$. Find I_{max}/I_{min}

(1) 5 (2) 10 (3) 15 (4) 25

Ans. **(4)**

Sol. $\frac{I_{max}}{I_{min}} = \left(\frac{\sqrt{9I}+\sqrt{4I}}{\sqrt{9I}-\sqrt{4I}}\right)^2 = \left(\frac{3\sqrt{I}+2\sqrt{I}}{3\sqrt{I}-2\sqrt{I}}\right)^2 = \frac{25}{1} = 25$

6. The radii of the curvature for a thin convex lenses are 10 cm and 15 cm respectively. The focal length of the lens is 12 cm. The refractive index of the lens material is

(1) 1.2 (2) 1.8 (3) 1.4 (4) 1.5

Ans. **(4)**

Sol. $\frac{1}{f} = \left(\frac{\mu_L}{\mu_s} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{12} = (\mu - 1)\left(\frac{1}{10} - \frac{1}{-15}\right)$

$\frac{1}{12} = (\mu - 1)\left(\frac{3+2}{30}\right)$

$(\mu - 1) = \frac{1}{12} \times \frac{30}{5}$

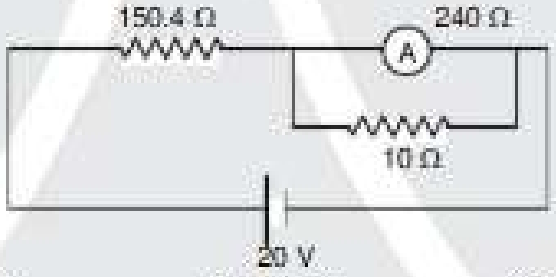
$\mu - 1 = \frac{1}{2}$

$\mu = \frac{1}{2} + 1$

$\mu = \frac{3}{2}$

$\mu = 1.5$ Ans.

7. An ammeter having resistance 240Ω is connected in the given circuit as shown. Find current through the ammeter.



(1) 1 mA (2) 5 mA (3) 100 mA (4) 2.5 mA

Ans. (2)

Sol. $R_{eq} = 150.4 + \frac{10 \times 240}{240 + 10}$

$R_{eq} = 150.4 + \frac{240}{25}$

$R_{eq} = 160\ \Omega$

$i = \frac{V}{R_{eq}} = \frac{20}{160}$

$i = \frac{1}{8}$ A

Current through ammeter is

$i_{amm} = \frac{1}{8} \times \frac{10}{240 + 10}$

$i = \frac{10}{8 \times 250}$

$i = 5$ mA

8. An ideal gas with an adiabatic exponent 1.5. Initially at 27°C is compressed adiabatically from 800 CC to 200 CC. The change in temperature of the gas is :

(1) 600 K (2) 300 K (3) 450 K (4) 273 K

Ans. (2)

Sol. $PV^{\gamma} = \text{constant}$

$TV^{\gamma-1} = \text{constant}$

$T_1V_1^{\gamma-1} = T_2V_2^{\gamma-1}$

$(300)(800)^{\gamma-1} = T_2(200)^{\gamma-1}$

$T_2 = 300\left(\frac{800}{200}\right)^{\gamma-1}$

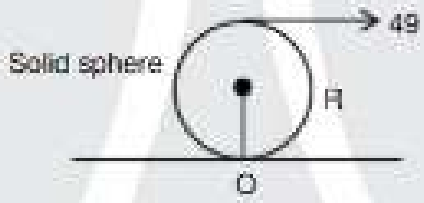
$T_2 = 300(4)^{1/2}$

$T_2 = 300 \times 2$

$T_2 = 600$ K

Change in temperate = 600 – 300 = 300 K

9. A solid sphere of mass 20 kg is pulled with force of 49 N as shown in diagram. Acceleration of sphere assuming no slipping



(1) 2.5 m/s² (2) 2.8 m/s² (3) 1.4 m/s² (4) 3.5 m/s²

Ans. (4)

Sol. $\tau_3 = I_3\alpha$

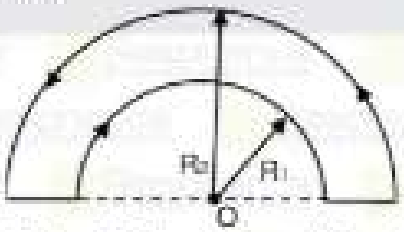
$49 \times 2R = \frac{7}{5}MR^2 \times \frac{a}{R}$

$a = \frac{49 \times 2 \times 5}{7 \times 20}$

$a = \frac{7}{2}$

= 3.5 m/s² Ans .

10. A current carrying wire is bent as shown in the figure. Find magnetic field at centre O of the semi-circules (Take $R_1 = 4\Omega$ and $R_2 = 6\Omega$)



(1) 1×10^{-6} T (2) 1×10^{-4} T (3) 1×10^{-5} T (4) 1×10^{-7} T

Ans. (4)

Sol. $B_1 = \frac{\mu_0 I}{4R_1}$ ⊗

$B_2 = \frac{\mu_0 I}{4R_2}$ ⊙

$B_{net} = \frac{\mu_0 I}{4R_1} - \frac{\mu_0 I}{4R_2}$

$= \frac{\mu_0 I}{4}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$B_{net} = \frac{4\pi \times 10^{-7} \times 12}{4\pi}\left(\frac{1}{4} - \frac{1}{6}\right)$

$\Rightarrow \frac{4\pi \times 10^{-7}}{4\pi}$

$\Rightarrow 1 \times 10^{-7}$ Tesla

11. Power of point source is 450 watt. Radiation pressure on a perfectly reflecting surface at a distance of 2m is :

(1) 1.5×10^{-8} (2) 3×10^{-8} (3) 0 (4) 6×10^{-8}

Ans. **(4)**

Sol.

$I = \frac{P}{Area}$

$I = \frac{P}{4\pi r^2}$

[P = 450 watt]

[r = 2 m]

Radiation pressure = $\frac{2I}{c}$

$= \frac{2 \times 450}{4\pi \times 2^2 \times 3 \times 10^8}$

$= \frac{900}{16\pi \times 3 \times 10^8}$

$\Rightarrow 6 \times 10^{-8}$

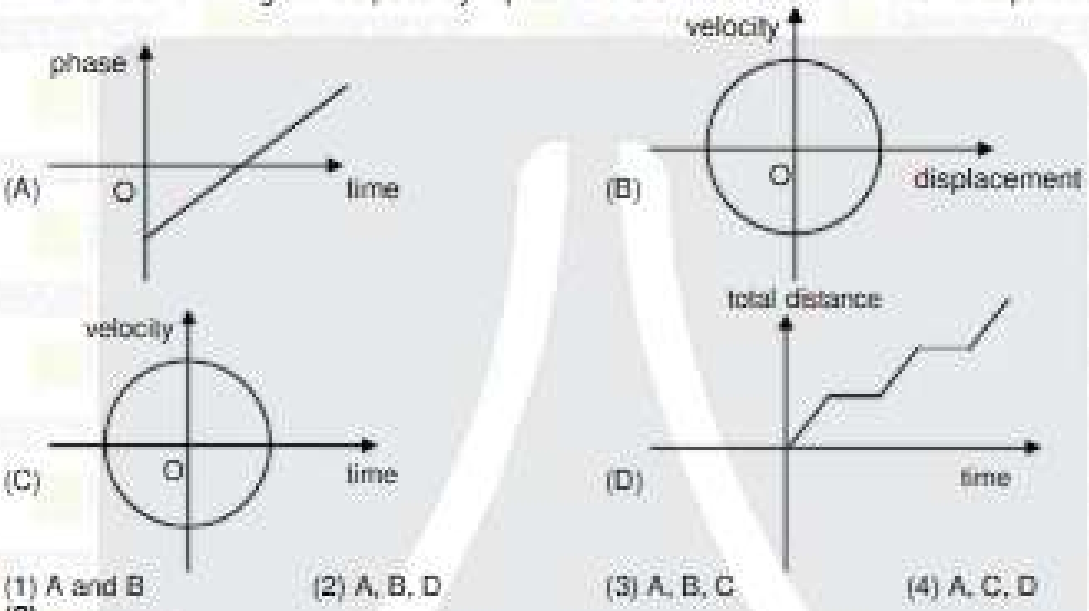
12. Choose the correct option.

(a) Gravitational potential	(i) $M^{-1} L^3 T^{-2}$
(b) Gravitational constant	(ii) $M L^2 T^{-2}$
(c) Acceleration due to gravity	(iii) $M^0 L^2 T^{-2}$
(d) Potential energy	(iv) $M^0 L T^{-2}$

(1) a (iii), b (ii), c (iv), d (i) (2) a (iii), b (i), c (iv), d (ii)
(3) a (ii), b (i), c (iv), d (iii) (4) a (ii), b (iv), c (i), d (iii)

Ans. (2)

13. Which of the following curves possibly represent the one-dimensional motion of a particle?



(1) A and B (2) A, B, D (3) A, B, C (4) A, C, D

Ans. (2)

Sol. For 'B' option ⊗

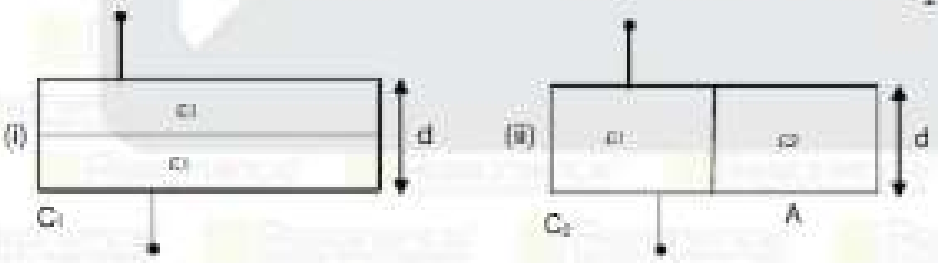
$v^2 = \omega^2 (A^2 - x^2)$

[if $\omega = 1$]

$v^2 = A^2 - x^2$

$v^2 + x^2 = A^2$ this is equation of circle

14. Capacitors with dielectric are shown in figure (symmetric situation). Find $\frac{C_1}{C_2}$



(1) $\frac{4\varepsilon_1\varepsilon_2}{(\varepsilon_1+\varepsilon_2)^2}$ (2) $\frac{4\varepsilon_1\varepsilon_2}{\varepsilon_1+\varepsilon_2}$ (3) $\frac{2\varepsilon_1\varepsilon_2}{(\varepsilon_1+\varepsilon_2)^2}$ (4) $\frac{(\varepsilon_1\varepsilon_2)^2}{(\varepsilon_1+\varepsilon_2)^2}$

Ans. (1)

Sol. $C_1 = \dfrac{\left(\frac{A\varepsilon_1}{d/2}\right)\left(\frac{A\varepsilon_2}{d/2}\right)}{\left(\frac{A\varepsilon_1}{d/2}\right)+\left(\frac{A\varepsilon_2}{d/2}\right)} \Rightarrow \dfrac{\left(\frac{2A\varepsilon_1}{d}\right)\left(\frac{2A\varepsilon_2}{d}\right)}{\frac{2A}{d}(\varepsilon_1+\varepsilon_2)}$

$\Rightarrow \quad \dfrac{2A\varepsilon_1\varepsilon_2}{d(\varepsilon_1+\varepsilon_2)} \quad ...(1)$

$C_2 = \dfrac{A\varepsilon_1}{2d} + \dfrac{A\varepsilon_2}{2d}$

$\Rightarrow \quad \dfrac{A}{2d}(\varepsilon_1+\varepsilon_2) \quad ...(2)$

Ratio

$$\frac{C_1}{C_2} = \frac{\frac{2A\varepsilon_1\varepsilon_2}{d(\varepsilon_1+\varepsilon_2)}}{\frac{A}{2d}(\varepsilon_1+\varepsilon_2)} \Rightarrow \frac{2A\varepsilon_1\varepsilon_2}{d(\varepsilon_1+\varepsilon_2)} \times \frac{2d}{A(\varepsilon_1+\varepsilon_2)} = \frac{4\varepsilon_1\varepsilon_2}{(\varepsilon_1+\varepsilon_2)^2}$$

15. An object is dropped from height S. At a point its kinetic energy is three times its potential energy. Find its height from ground and speed at that pint

(1) $\dfrac{3S}{4}, \sqrt{\dfrac{3gS}{2}}$ (2) $\dfrac{S}{4}, \sqrt{\dfrac{3gS}{2}}$ (3) $\dfrac{S}{2}, \sqrt{gS}$ (4) $\dfrac{S}{4}, \sqrt{\dfrac{3gS}{4}}$

Ans. (2)

Sol. Kinetic Energy = 3U

E = KE + PE

= 3U + U

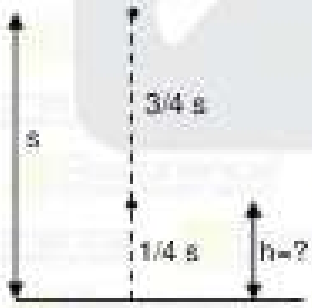
= 4U

mgs = 4U

$U = \dfrac{mgs}{4}$

$mgh = \dfrac{mgs}{4}$

height from the ground $h = \dfrac{s}{4}$



KE = 3U

$KE = 3.\dfrac{mgs}{4}$

$\dfrac{1}{2}mv^2 = \dfrac{3mgs}{4}$

Speed of the particle $v = \sqrt{\dfrac{3gs}{2}}$

16. Find force (in millinewton) on current carrying wire of length ℓ = 4 m, and current of 8A placed perpendicular to the magnetic filed of B = 0.15 tesla.

(1) 4600 mN (2) 4800 mN (3) 4900 mN (4) 4400 mN

Ans. (2)

Sol. $F = I(\vec{l} \times \vec{B})$

$F = BIL$

$= 0.15 \times 8 \times 4$

$= 0.6 \times 8$

$= 4.8$ N

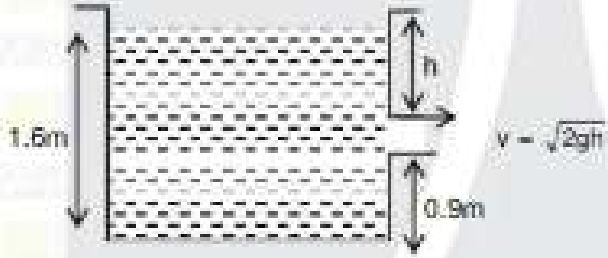
$= 4800$mN

17. A container of height 1.6 m is having a small hole at height of 0.9m from ground then find speed of efflux from the hole (take g = 9.8 m/s²)

(1) 3.71 m/s (2) 2.97 m/s (3) 4.12 m/s (4) 5.79 m/s

Ans. (1)

Sol.



$V = \sqrt{2 \times 9.8 \times 0.7}$

$= 3.71$ m/s

18. Given below are two statements about x-ray spectra of elements :

Statement (I) : A plot of $\sqrt{\nu}$ (ν = frequency of x-ray emitted) vs atomic mass is a straight line.

Statement (II) : A plot of ν (ν = frequency of x-ray emitted) vs atomic number is straight line .

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

(1) Statement (I) is true but statement (II) is false

(2) Statement (I) is false but statement (II) is true

(3) Statement (I) and statement (II) are false

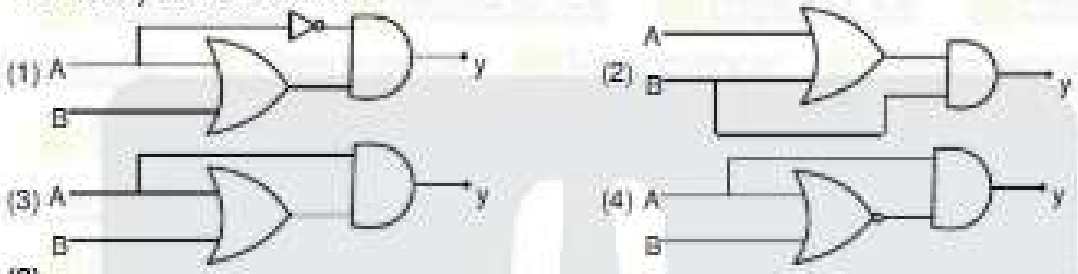
(4) Statement (I) and statement (II) are true

Ans. (3)

19. Truth table of logical circuit given

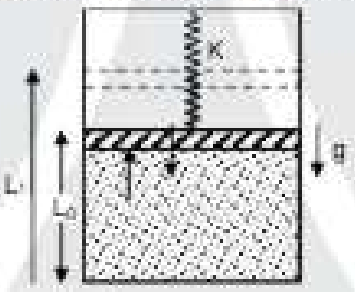
A	B	Y
0	0	0
1	1	1
0	1	0
1	0	1

The Identify the correct circuit :



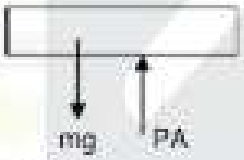
Ans. (3)

20. Given $F_{sp} = -kx^3$ when x is elongation in spring. If gas is heated isothermally at temperature T then find change in kinetic energy of piston when it moves for L_0 to L_1. Initially spring is natural length.



Ans. $\frac{nRT}{L_0}(L_1-L_0)-\frac{K}{4}(L_1-L_0)^4+nRT\ln\left(\frac{L_1}{L_0}\right)=\Delta KE$

Sol.



$F = -kx^3$

$dU = -dW$

$U = \frac{Kx^4}{4} + C$

$W_{spl} = U_f - U_i$

$U_i = C$ as $x = 0$

$U_f = \frac{K}{4}(L_1-L_0)^4 + C$ as $x = L_1 - L_0$

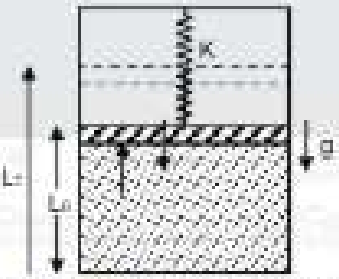
$W_{spl} = -\frac{1}{4}K(L_1-L_0)^4$

$W_{gas} = -nRT\ln\left(\frac{L_1}{L_0}\right)$

$W_g = -mg(L_1-L_0)$

$mg = PA$ $\quad PAL_0 = nRT$

$mg = \frac{nRT}{L_0}$



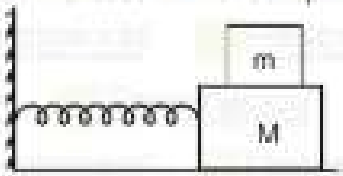
Applying work energy theorem on piston

$W_g + W_{spl} + W_{gas} = \Delta KE$

$-mg(L_1-L_0)-\frac{1}{4}K(L_1-L_0)^4+nRT\ln\left(\frac{L_1}{L_0}\right)=\Delta KE$

$-\frac{nRT}{L_0}(L_1-L_0)-\frac{K}{4}(L_1-L_0)^4+nRT\ln\left(\frac{L_1}{L_0}\right)=\Delta KE$

21. The figure below an oscillating system of two blocks and a spring. The horizontal surface is smooth and the contact between the blocks in rough with coefficient of static friction μ. Considering that the blocks of mass m is always stationary relative to M. choose the correct option regarding the statement below.



(A) Maximum frictional force between blocks is μmg

(B) Time period of oscillation is $2\pi\sqrt{\frac{m+M}{k}}$

(C) Friction, between the blocks at any instant in $\mu (m + m)g$

(1) Only A is correct

(2) Only B is correct

(3) A,B and C is correct

(4) A and B are correct

Ans. **(2)**