02/04/2025
Evening

Aakash
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Memory Based Answers & Solutions

for

JEE (Main)-2025 (Online) Phase-2

(Physics, Chemistry and Mathematics)

Time : 3 hrs. **M.M. : 300**

IMPORTANT INSTRUCTIONS:

(1) The test is of **3 hours** duration.

(2) This test paper consists of 75 questions. Each subject (PCM) has 25 questions. The maximum marks are 300.

(3) This question paper contains **Three Parts**. **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is **Mathematics**. Each part has only two sections: **Section-A** and **Section-B**.

(4) **Section - A :** Attempt all questions.

(5) **Section - B :** Attempt all questions.

(6) **Section - A (01 – 20)** contains 20 multiple choice questions which have **only one correct answer**. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.

(7) **Section - B (21 – 25) contains** 5 **Numerical value** based questions. The answer to each question should be rounded off to the **nearest integer**. Each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.

PHYSICS

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

1. What is the dimensional formula of $\frac{1}{\mu_0\varepsilon_0}$ (where μ_0 is permeability and ε_0 is permittivity of free space).

(1) LT^{-1} (2) L^2T^{-2}

(3) MLT^{-1} (4) ML^2T^{-2}

Answer (2)

Sol. $\frac{1}{\sqrt{\mu_0\varepsilon_0}} = C$

$\frac{1}{\mu_0\varepsilon_0} = C^2$

2. An equilateral prism is made of a material of refractive index $\sqrt{2}$. Find angle of incidence for minimum deviation of the light ray.

(1) 60° (2) 30°

(3) 37° (4) 45°

Answer (4)

Sol. $\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\frac{A}{2}}$

$\frac{60° + \delta_m}{2} = 45°$

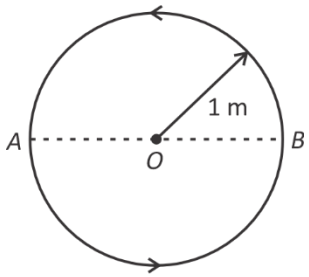
$\delta_m = 30°$

$\delta_m = i + e - A$

$30 = 2i - 60$ $(i = e)$

$i = 45°$

3. A particle moves on a circular path of radius 1 m. Find its displacement when it moves from $A \to B \to A \to B$. Also its distance as it moves from $A \to B \to A \to B \to A$.



(1) Distance = 2 m, displacement = 4π m

(2) Distance = 2 m, displacement = 5π m

(3) Distance = 4π m, displacement = 2 m

(4) Distance = 5π m, displacement = 2 m

Answer (3)

Sol. Displacement = Shortest distance between find and initial positions = 2 m (One and half cycle)

Distance = Total path length covered

= 4π m (Two cycles)

4. The moment of inertia of a ring of mass M and radius R about an axis passing through tangential point in the plane of ring is

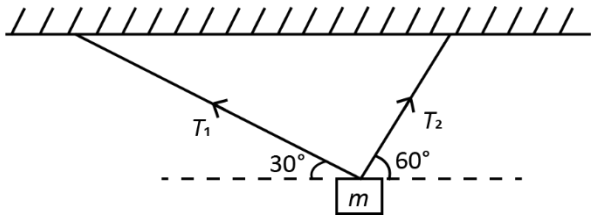
(1) $\frac{5MR^2}{2}$ (2) $\frac{3MR^2}{2}$

(3) $\frac{4MR^2}{3}$ (4) $\frac{2MR^2}{3}$

Answer (2)

Sol. It $= \frac{MR^2}{2} + MR^2 = \frac{3MR^2}{2}$

5. A block of mass m is suspended in a vertical plane with the help of two light strings as shown. Find the ratio of tensions $\frac{T_1}{T_2}$



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

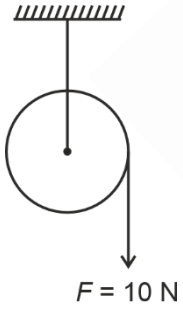
(3) $\frac{1}{\sqrt{3}}$ (4) $\sqrt{3}$

Answer (3)

Sol. $T_1\cos30° = T_2\cos60°$

$$\frac{T_1}{T_2} = \frac{\cos60°}{\cos30°} = \frac{1}{\sqrt{3}}$$

6. A disc of mass M and radius 2 m is hinged keeping axis horizontal. If angular acceleration of disc is 2rad/s^2. Find moment of inertia



(1) 10 kg m^2 (2) 5 kg m^2

(3) 6 kg m^2 (4) 20 kg m^2

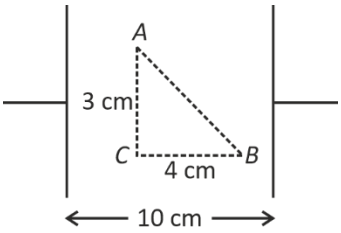
Answer (1)

Sol. $\tau = I\alpha$

$10 \times 2 = 2I$

$I = 10$ kg m^2

7. The figure shows the plates of a parallel plate capacitor with a separation 10 cm and charged to a potential difference V. Find the potential difference between B and A.



(1) $\frac{2V}{5}$

(2) $\frac{V}{2}$

(3) $\frac{3V}{5}$

(4) $\frac{V}{5}$

Answer (1)

Sol. $V = E$ (10 cm)

$V' = E$ (4 cm)

$$V' = \frac{2}{5}V$$

8. Binding energy per nucleon in ^2_1H is x and for ^4_2He is y. Find energy released in the given reaction

$$^2_1H + {}^4_2He \rightarrow {}^4_2He$$

(1) $2x - 2y$

(2) $-4x + 4y$

(3) $4x - 4y$

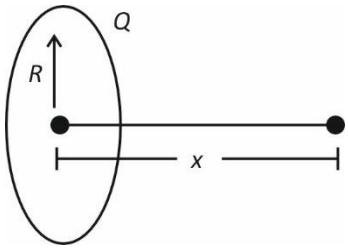
(4) $2y - 4x$

Answer (2)

Sol. $BE = 4y - (2x + 2x)$

$= 4y - 4x$

9. Figure shows a uniformly charged ring having charge Q and radius R. Find the distance from the centre on the axis of the ring where electric field is maximum



(1) $R\sqrt{2}$ (2) $\frac{R}{\sqrt{2}}$

(3) $2R$ (4) R

Answer (2)

Sol. $E=\frac{kQx}{\left(R^2+x^2\right)^{3/2}}$

$\frac{dE}{dx}=0$

$x=\frac{R}{\sqrt{2}}$

10. Two identical drops of radius R and surface tension 'T' coalesce to form a bigger drop. The change in surface energy in this process is

(1) $4\pi R^2T\left[1-2^{-\frac{1}{3}}\right]$ (2) $8\pi R^2T\left[1+2^{\frac{1}{3}}\right]$

(3) $4\pi R^2T\left[1+2^{\frac{1}{3}}\right]$ (4) $8\pi R^2T\left[2^{-\frac{1}{3}}-1\right]$

Answer (4)

Sol. Volume of bigger drop = $\frac{4}{3}\pi R_1^3=2\left(\frac{4}{3}\pi R^3\right)$

$R_1=R(2)^{\frac{1}{3}}$

Initial energy = $(4\pi R^2T)\times 2$

Final energy = $4\pi R^2(2)^{\frac{2}{3}}T$

11. Two galvanometers G_1 and G_2 are having resistors $R_1 = 5\Omega$ and $R_2 = 7\Omega$, number of turns $N_1 = 21$, $N_2 = 15$, magnetic fields $B_1 = 0.25$ T, $B_2 = 0.50$ T and area of coil $A_1 = 3.6 \times 10^{-3}$ cm^2 and $A_2 = 1.8 \times 10^{-3}$ cm^2. Find the ratio of their voltage sensitivity

(1) $\frac{49}{25}$ (2) $\frac{7}{5}$

(3) $\frac{5}{7}$ (4) $\frac{49}{20}$

Answer (1)

Sol. $\tau = NIAB = K\theta$

$\frac{\theta}{V}=\frac{\theta}{RI}=\frac{NAB}{LKR}$

Ratio of voltage sensitivity $=\left(\frac{N_1A_1B_1}{N_2A_2B_2}\right)\frac{R_2}{R_1}$

$=\frac{21}{15}\times\frac{3.6}{1.8}\times\frac{0.25}{0.50}\times\frac{7}{5}$

$=\frac{49}{25}$

12. Match the List-I with the List-II

(i)	Heat capacity	(a)	J kg^{-1} K^{-1}
(ii)	Specific heat capacity	(b)	J K^{-1}
(iii)	Latent heat	(c)	W m^{-1} K^{-1}
(iv)	Thermal conductivity	(d)	J kg^{-1}

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

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

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

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

Answer (4)

13. In a system of measurement, electric charge (Q), permeability (μ_0) and electric current (i) are considered as fundamental quantity. The dimension of linear momentum in this system is

(1) $\left[Q^2\mu_0^2 i\right]$ (2) $\left[Q\mu_0 i\right]$

(3) $\left[Q\mu_0 i^2\right]$ (4) $\left[Q^2\mu_0 i\right]$

Answer (2)

Sol. Let $P \propto (Q)^a (\mu_0)^b (i)^c$

$$\left[MLT^{-1}\right] = K\left[M^b L^b T^{a-2b} A^{a-2b+c}\right]$$

$a = 1, b = 1, c = 1$

14. Which of the following items (labelled i, ii, iii, iv and v) are true

When an ideal gas undergoes adiabatic process, (symbols have their usual meaning)

(i) $\Delta U = 0$

(ii) $w = -\Delta U$

(iii) PV = Constant

(iv) VT = Constant

(v) $W \alpha |T_2 - T_1|$

(1) (i), (ii), (iv)

(2) (ii) and (v)

(3) (ii), (iii), (v)

(4) (i), (ii), (v)

Answer (2)

Sol. $\Delta Q = O$

$\Rightarrow W = -\Delta U$

$= -nC_v(T_2 - T_1)$

15. A wave is travelling along a string. The wavelength (λ) of the wave is 7.5 m and amplitude is 2 cm. At $t = 0$, there is a crest at $x = 0$ and in 0.3 seconds it travels a distance of 12 cm in +ve x-direction. The equation of the wave is

(1) $2\sin\left(\frac{2\pi}{15}x + \frac{6\pi}{25}t\right)$ cm (2) $2\cos\left(\frac{4\pi}{15}x - \frac{8\pi}{75}t\right)$ cm

(3) $2\cos\left(\frac{4\pi}{15}x + \frac{6\pi}{25}t\right)$ cm (4) $2\sin\left(\frac{4\pi}{15}x - \frac{8\pi}{75}t\right)$ cm

Answer (2)

Sol. $\lambda = 7.5$

$$k = \frac{2\pi}{\lambda} = \frac{2\pi}{7.5} = \frac{4\pi}{15}$$

$$v = \frac{12}{0.3} = 40 \text{ cm/s}$$

$$\frac{\omega}{k} = 40 \text{ cm/s}$$

$$\omega = \frac{40}{100} \times \frac{4\pi}{15} = \frac{40\pi}{375} = \frac{8\pi}{75}$$

$$y = 2\cos\left(\frac{4\pi}{15}x - \frac{8\pi}{75}t\right) \text{ cm}$$

16. An equiconvex lens of radius $R = \frac{1}{6}$ m is having power P. Another Bi convex lens of radii R_1 and R_2 is having same power P, then

(1) $R_1 = \frac{1}{9}$m, $R_2 = \frac{1}{3}$ m (2) $R_1 = \frac{1}{6}$m, $R_2 = \frac{1}{3}$ m

(3) $R_1 = \frac{1}{9}$m, $R_2 = \frac{1}{4}$ m (4) $R_1 = \frac{1}{4}$m, $R_2 = \frac{1}{5}$ m

Answer (1)

Sol. $$\frac{1}{f_1} = (\mu - 1)\left(\frac{2}{R}\right) = (\mu - 1)12$$

$$\frac{1}{f_2} = (\mu - 1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = (\mu - 1)12$$

$$\frac{1}{R_1} + \frac{1}{R_2} = 12$$

17. The area of a solenoid is A, length is L, magnetic field inside is B_0 and the relative permeability of medium is 2. The energy stored due to the magnetic field is

(1) $\frac{B_0^2AL}{2\mu_0}$ (2) $\frac{B_0^2AL}{4\mu_0}$

(3) $\frac{4B_0^2AL}{\mu_0}$ (4) $\frac{2B^2AL}{\mu_0}$

Answer (2)

Sol. $E=\frac{B^2}{2\mu}\times AL$

$=\frac{B_0^2AL}{4\mu_0}$

18.

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

21. The radius of first Bohr orbit of Li^{2+} is $\frac{a_0}{X}$, where a_0 is the radius of the first Bohr orbit of H. Find X

Answer (3)

Sol. $r=a_0\frac{n^2}{\not{Z}}$

For Li^{2+} is ground state $n = 1$ and $\not{Z}=3$

$\Rightarrow r=a_0\frac{(1)^2}{3}=\frac{a_0}{3}$

22. The length of the string in 104 m when the tension in it is 5 N. The length becomes 1.56 m when the tension in it is 7 N. The natural length of the string is ____ m.

Answer (1)

Sol. $T = k(l - l_0)$

$\Rightarrow 5 = k(1.4 - l_0)$

$\Rightarrow 7 = k(1.56 - l_0)$

$\Rightarrow 7(1.4 - l_0) = 5(1.56 - l_0)$

$l_0=\frac{7(1.4)-5(1.56)}{2}=1\text{ m}$

23. A concave mirror and a convex mirror of same focal length are given. A real object is placed in front of the mirror at a distance equal to half the focal length. The ratio of lateral magnification in the image produced by concave mirror to that produced by the convex mirror is

Answer (3)

Sol. $m=\frac{f}{f-u}$

$m_{concave}=\frac{-f}{-f-\left(-\frac{f}{2}\right)}=2$

$m_{convex}=\frac{+f}{+f-\left(-\frac{f}{2}\right)}=\frac{2}{3}$

$\frac{m_{concave}}{m_{convex}}=3$

24.

25.