Reliable INSTITUTE
Unleashing Potential

JEE MAIN 2023

JAN ATTEMPT

PAPER-1 (B.Tech / B.E.)

QUESTIONS & SOLUTIONS

Reproduced from Memory Retention

24 JANUARY, 2023

03:00 PM to 06:00 PM

Duration : 3 Hours | Maximum Marks : 300

SUBJECT - PHYSICS

Reliable Institute : A-10, Road No.1, IPIA, Kota-324005 (Rajasthan), India
Tel. : 0744-3535544, 2665544 I Website : www.reliablekota.com I E-mail : info@reliablekota.com

PHYSICS

1. A solenoid having 70 turns per cm current flowing in solenoid is 2 amp. Find magnetic field inside the solenoid.

(1) $860\ \pi \times 10^{-4}$ T (2) $560\ \pi \times 10^{-4}$ T
(3) $280\ \pi \times 10^{-4}$ T (4) $360\ \pi \times 10^{-4}$ T

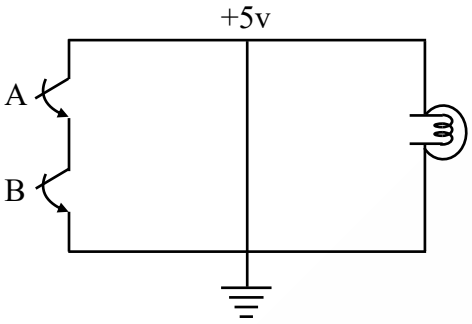
Ans. **(2)**

Sol. $B = \mu_0 \pi I$

$$B = 4\pi \times 10^{-7} \times \frac{70}{10^{-2}} \times 2$$

$$B = 560\pi \times 10^{-4}\ T$$

2.



(1) NAND (2) NOR (3) OR (4) AND

Ans. **(1)**

Sol.

A	B	Output
0	0	1
1	0	1
0	1	1
1	1	0

3. Separation between earth and sun is given by 1.5×10^6 km. Time period of another planet is 2.83 year. Find distance of another planet from sun?

(1) 3×10^6 km (2) 2×10^7 km (3) 3×10^7 km (4) 2×10^6 km

Ans. **(1)**

Sol. $T^2 \propto R^3$

$$\left(\frac{T_1}{T_2}\right)^2 = \left(\frac{R_1}{R_2}\right)^3$$

$$\left(\frac{1}{2.83}\right)^2 = \left(\frac{1.5\times10^6}{R_2}\right)^3$$

$R_2 = (1.5 \times 10^6)\ (2.83)^{2/3}$ km

$= (1.5 \times 10^6)\ (8)^{1/3}$

$= 3 \times 10^6$ km

4. Choose the correct options based on the column shown below.

1. TV signal				(P) 12 GHz
2. Satellite				(Q) 30 MHz
3. AM				(R) 88 MHz
4. FM				(S) 1 MHz
	1	2	3	4
(1)	P	Q	R	S
(2)	Q	P	S	R
(3)	S	Q	R	P
(4)	P	Q	S	R

Ans. **(2)**

5. If two vectors $\dot{P} = \hat{i} + 2m\hat{j} + m\hat{k}$ & $\dot{Q} = 4\hat{i} - 2\hat{j} + m\hat{k}$ are perpendicular to each other, then find value of m.

(1) m = 3 (2) m = 2 (3) m = 8 (4) m = 1

Ans. **(2)**

Sol. $\dot{P} \cdot \dot{Q} = 0$

$(\hat{i} + 2m\hat{j} + m\hat{k}).(4\hat{i} - 2\hat{j} + m\hat{k}) = 0$

$4 - 4m + m^2 = 0$

$m^2 - 2m - 2m + 4 = 0$

$m(m - 2) - 2(m - 2) = 0$

$m = 2$

6. A photon is emitted from n = 4 to n = 1 level in hydrogen atom the corresponding wavelength for this transfer will be [hc = 1240 nm eV].

(1) 88.2 nm (2) 121.7 nm (3) 102.5 nm (4) 97.3 nm

Ans. **(4)**

Sol. $\Delta E = \frac{hc}{\lambda}$

$l = \frac{hc}{\Delta E_{4-1}} = \frac{1240\text{nm eV}}{12.75\text{ eV}} = 97.3\text{ nm}$

7. When ${}_{Z}X^{240}$ nucleus goes for fission, energy released is 200 MeV. Total energy released when 120g of this sample is _____ 10^{25} MeV.

Ans. **6**

Sol. $n_A = \frac{120}{240} = \frac{1}{2}$

$E_{total} = \frac{1}{2} \times 6.02 \times 10^{23} \times 200 MeV = 6 \times 10^{25}$ MeV

8. In an electromagnetic wave electric field and magnetic field is given by

$E = E_0 \sin(kx - \omega t + \phi)$

$B = B_0 \sin(kx - \omega t + \phi)$

Find correct relation.

(1) $\frac{\omega}{k} = \frac{E_0}{B_0}$ (2) $\frac{k}{\omega} = \frac{E_0}{B_0}$

(3) $\frac{\omega}{k} = B_0$ (4) $\omega k = E_0 B_0$

Ans. **(1)**

Sol. $E_0 = B_0 C$

Speed of light $C = \frac{\omega}{k}$

$\frac{E_0}{B_0} = \frac{\omega}{k}$

9. If all the particles have same kinetic energy, The relation between the wavelengths of alpha particle, electron and proton is :

(1) $\lambda_\rho > \lambda_\alpha > \lambda_e$ (2) $\lambda_e > \lambda_\rho > \lambda_\alpha$

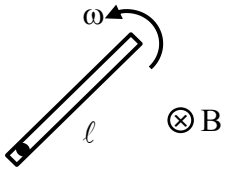
(3) $\lambda_\alpha > \lambda_e > \lambda_\rho$ (4) $\lambda_\alpha > \lambda_\rho > \lambda_e$

Ans. **(2)**

$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2mk}}$

$\therefore \quad \mu_e < m_\rho < m_\alpha \quad \therefore \quad \lambda_e > \lambda_\rho > \lambda_\alpha$

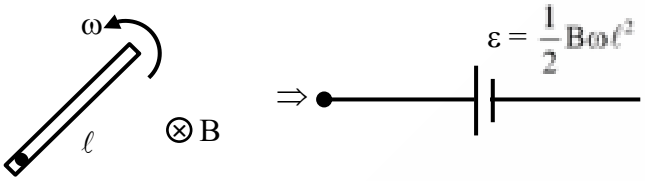
10. A rod of length ℓ is rotating in a uniform magnetic field as shown in figure. Then induced e.m.f across its ends is.



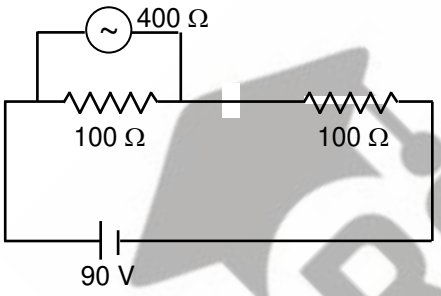
(1) $B\omega\ell^2$ (2) $\frac{B\omega\ell^2}{2}$ (3) $\frac{B\omega\ell^2}{4}$ (4) $\frac{B\omega\ell^2}{8}$

Ans. (2)

Sol.

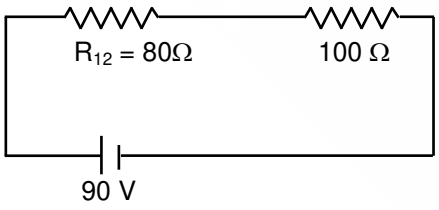


11. Find reading of voltmeter ?



Ans. 40

Sol.



$$\frac{1}{R_{12}} = \frac{1}{100} + \frac{1}{400} = \frac{5}{400}$$

$$R_{12} = 80$$

$$V_{12} = 90 \times \frac{800}{(80+100)} = \frac{90\times 80}{180} = 40V$$

12. When a parallel beam of white light incident on convex lens split into different colours the phenomenon is called.

(1) Spherical aberration (2) Chromatic aberration

(3) Polarization (4) Diffraction

Ans. (2)

13. If frequency can be represented as f = (radius)^a (density)^b (surface tension)^c. Find a, b, c?

(1) $a=\frac{3}{2},\ b=\frac{1}{2},\quad c=\frac{-1}{2}$ (2) $a=\frac{-3}{2},\ b=\frac{-1}{2},\quad c=\frac{1}{2}$

(3) $a=\frac{-3}{2},\ b=\frac{1}{2},\quad c=\frac{-1}{2}$ (4) $a=\frac{1}{2},\ b=\frac{3}{2},\quad c=\frac{-1}{2}$

Ans. **(2)**

Sol. $M^0L^0T^{-1} = L^a (ML^{-3})^b (MT^{-2})^c$

$M^0L^0T^{-1} = L^a M^bL^{-3b} M^cT^{-2c}$

Equivalent the power of MLT

$M \Rightarrow \quad 0 = b + c$

$L \Rightarrow \quad 0 = a - 3b$

$T \Rightarrow \quad -1 = -2c$

$a=\frac{-3}{2},\ b=\frac{-1}{2},\quad c=\frac{1}{2}$

14. A dielectric of 3.5 is inserted and the distance between the plates is doubled. Find new capacitance, if original capacitance was 7.5 pF?

Ans. **13.33**

Sol. $C' = \frac{K\varepsilon_0 A'}{d'} = \frac{7}{2} \times \frac{\varepsilon_0 A}{2d} = \frac{7}{4} \times \frac{15}{2} = \frac{105}{8}$ pF

15. Statement-I : If we move upward and downward from the surface of earth surface acceleration due to gravity decreases in both upward and downward direction.

Statement-II : Acceleration due to gravity changes by same amount when we go up to height h and depth d when h = d.

Choose the correct options based on above statements.

(1) Both statement-I and Statement-II are true.

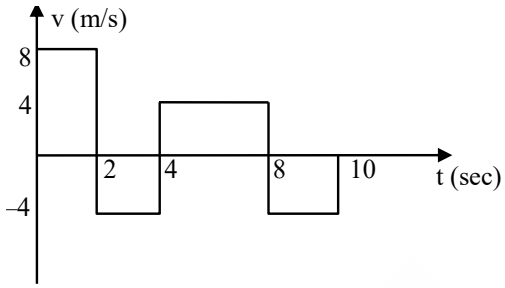
(2) Statement-I is true and Statement-II is false.

(3) Statement-I is false and Statement-II are true.

(4) Both statement-I and Statement-II are false.

Ans. **(2)**

16. A particle follows the above V - t graph, then the ratio of distance travelled and displacement of particle is given by :



(1) 3 : 1 (2) 1 : 3 (3) 2 : 3 (4) 3 : 2

Ans. **(1)**

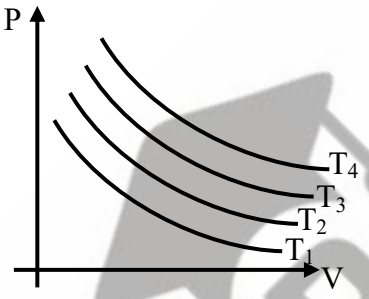
Sol. Distance = 16 + 8 + 16 + 8 = 48 m

Displacement = 16 + 16 – 8 – 8 = 16 m

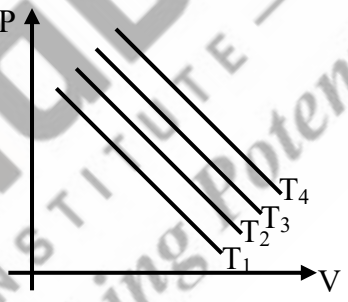
Ratio = $\frac{48}{16} = 3$

17. For an Isothermal expansion of an ideal gas in a closed container at different temperature P-V graph is given. Then choose the correct graph where $T_1 > T_2 > T_3 > T_4$.

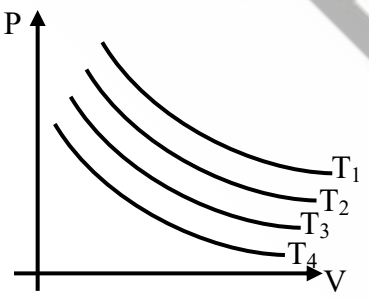
(1)



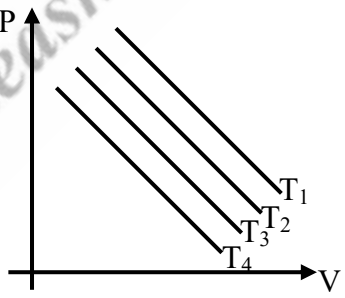
(2)



(3)



(4)



Ans. **(3)**

Sol. PV = C ; C = constant

If temperature will increase then C will increase.

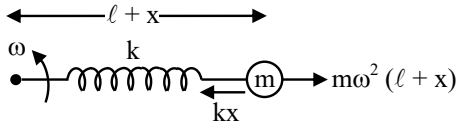
P = $\frac{C}{V}$ $\rightarrow$ rectangular hyperbola

18. A block of mass 200 gm is connected with a spring of spring constant 12.5 N/m. It is rotating in horizontal plane with angular speed 5 rad/sec. Find ratio of elongation in spring and natural length?

(1) $\frac{2}{3}$ (2) $\frac{3}{2}$ (3) $\frac{1}{3}$ (4) $\frac{1}{2}$

Ans. (1)

Sol.



$kx = m\omega^2 (\ell + x)$

$(k - m\omega^2)x = m\omega^2 \ell$

$$\frac{x}{\ell} = \frac{m\omega^2}{k - m\omega^2} = \frac{0.2 \times 25}{\frac{25}{2} - 0.2 \times 25}$$

$$\frac{x}{\ell} = \frac{2}{3}$$

19. A wire is extended by 20% keeping its volume is constant. Find the percentage change in its resistance.

Ans. 44

Sol. $R = \frac{\rho\ell}{A} = \frac{\rho\ell}{V/\ell} = \frac{\rho\ell^2}{V} \propto \ell^2$

$\ell \rightarrow 1.2\ \ell$

$$\frac{\Delta R}{R} = \frac{1.44R - R}{R} \times 100\% = 44\%$$

20. S-1 $\rightarrow$ Steel is used in construction of a bridge and house.

S–2 $\rightarrow$ Modulus of elasticity of steel is high.

(1) S-1 & S-2 both are true

(2) S-1 is true & S-2 is false

(3) S-1 is false & S-2 is true

(4) S-1 & S-2 both are false

Ans. (1)

21. A lens of refractive index 1.5 and focal length 18 cm in air is submerged in water change in focal length of lens is ($\mu_w = \frac{4}{3}$)

Ans. 54

Sol. $\frac{1}{18} = (1.5-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ....(1)

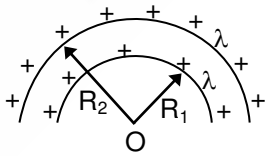
$\frac{1}{f} = \left(\frac{1.5}{\frac{4}{3}} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ ....(2)

$\frac{\text{Eq(1)}}{\text{Eq(2)}}$: $\frac{f}{18} = \frac{1.5-1}{\frac{9}{8}-1} = \frac{1/2}{1/8}$

$f = 18 \times 4 = 72$ cm

change in focal length = 72 – 18 = 54 cm

22. Two semicircular arcs of linear charge density λ are placed as shown in figure. Find the potential at the point O.



(1) $\frac{2\lambda}{\varepsilon_0}$ (2) $\frac{\lambda}{\varepsilon_0}$ (3) $\frac{\lambda}{2\varepsilon_0}$ (4) $\frac{3\lambda}{\varepsilon_0}$

Ans. (3)

Sol. $\frac{K[\lambda(\pi R_1)]}{R_1} + \frac{K\lambda(\pi R_2)}{R_2} = 2k\lambda\pi = \frac{\lambda}{2\varepsilon_0}$

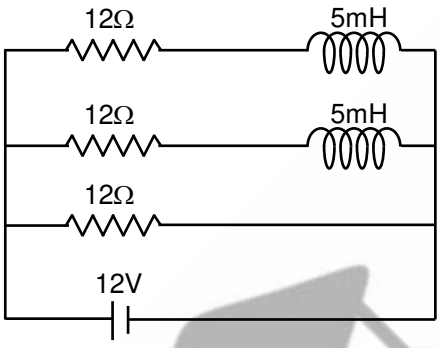
23. Ratio of molar heat capacity at constant pressure and at constant volume for monoatomic and diatomic gas is?

(1) 25 : 21 (2) 21 : 25 (3) 16 : 25 (4) 25 : 16

Ans. (1)

Sol. $\frac{\frac{5}{3}}{\frac{7}{5}} \Rightarrow \frac{5}{3}\times\frac{5}{7} = \frac{25}{21}$

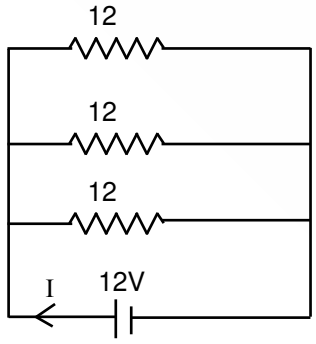
24.



Current through the battery after long time is:

Ans 3

Sol.



After long time

$R_{eq} = \frac{12}{3} = 4\Omega$

$$I = \frac{V}{R_{eq.}} = \frac{12}{4} = 3A$$

25. A solid cylinder of radius R and length L have moment of inertia I_1 and a second solid cylinder of radius $\frac{R}{2}$ and length $\frac{L}{2}$ cut from it have moment of inertia I_2. Find $\frac{I_1}{I_2}$.

(1) 64 (2) 32 (3) 128 (4) 256

Ans. (2)

Sol. $I_1 = M\left(\frac{R^2}{4} + \frac{L^2}{12}\right)$

$I_1 = \frac{M}{4}\left(R^2 + \frac{L^2}{3}\right)$

$M = \rho\pi R^2 L$

$M_2 = \rho\pi\frac{R^2}{8}L = \frac{M}{8}$

$I_2 = \frac{M}{8} \times \frac{1}{4}\left[\frac{R^2}{4} + \frac{L^2}{12}\right]$

$= \frac{M}{128}\left(R^2 + \frac{L^2}{3}\right)$

#IITkipooritaiyyari

Reliable INSTITUTE
Unleashing Potential

ADMISSIONS OPEN

(Session 2023-24)

JEE (Main + Adv.) I JEE (Main)
Junior Division (VI to X)

Appear in ONLINE

Reliable National Entrance Test (R-NET)

Test on Every

SUNDAY

Scholarship up to 90%

AIR 5

MAYANK MOTWANI
Classroom

RELIABLE INSTITUTE : A-10, Road No.1, IPIA, Kota-324005 (Rajasthan), India
Tel. : 0744-3535544, 2665544 I Website : www.reliablekota.com I E-mail : info@reliablekota.com
reliablekota reliablekota reliableinstitutekota reliable_kota reliablekota