JEE-MAIN 2022 JULY ATTEMPT

MEMORY BASED

DATE : 25-07-2022 (SHIFT-II)

PHYSICS

SECTION-A

1. If proton is accelerated by potential difference of V_p and deuteron is by V_D and ratio of de-broglie wavelength of proton and deuteron is $1 : \sqrt{2} \cdot \frac{V_P}{V_D}$ is equal to :

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

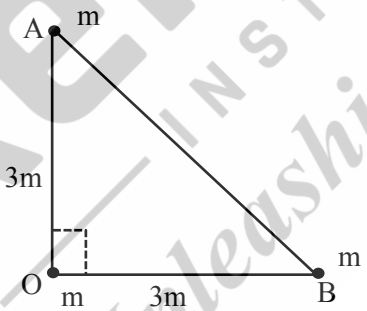
Ans. **(2)**

2. A bullet of mass 200 gm moving with 10 m/s collides a stationary block of 9.8 Kg and sticks to it. Find loss in kinetic energy of bullet:

(1) 98.6 J **(2) 4.9 J** **(3) 9.8 J** **(4) 98 J**

Ans. **(3)**

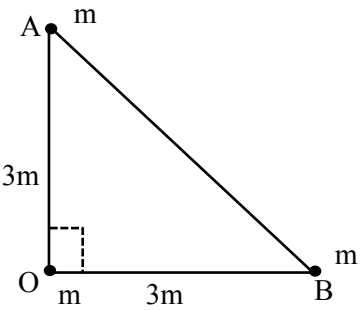
3. Distance of com from point O is :



(1) $\sqrt{2}$m **(2) 2 m** **(3)** $\frac{1}{\sqrt{2}}$m **(4)** $\frac{2}{\sqrt{2}}$m

Ans. **(1)**

Sol.

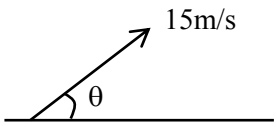


4. For a ground to ground projectile Range is equal of maximum height attained. Find tan θ ?

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

Ans. (2)

Sol.



5. If velocity of a particle increases 5m/s per meter, then find the acceleration of the particle at the instant when velocity became 20 m/s.

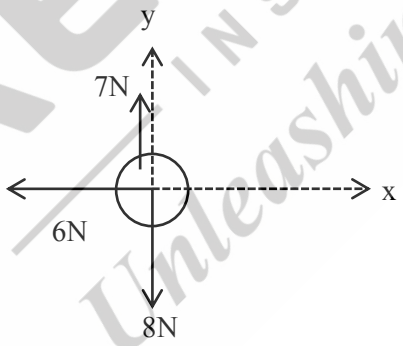
Ans. 100

Sol. $a = \frac{vdv}{dx}$

$= 20 \times 5$

$= 100\ m/s^2$

6. If we want to keep it in equilibrium then find the magnitude and direction (angle from +ve x-axis) that is required to keep this body in equilibrium.



(1) $\sqrt{2}N, 45^o$ **(2) 2N, 45º** **(3)** $2\sqrt{2}N, 60^o$ **(4)** $2\sqrt{2}N, 30^o$

Ans. (A)

7. **Heat Engine-1** **Heat Engine-2**

$T_{source} = 447^oc$ $T_{source} = 627^oc$

$T_{sink} = 147^o c$ $T_{sink} = 47^oc$

Find the ratio of efficiencies if both the engine $\left(\frac{n_1}{n_2}\right)$

(1) 0.65 **(2) 0.79** **(3) 0.83** **(4) 0.92**

Ans. (1)

8. **Maximum present error in Resistance, Current and time are 1%, 2% & 3% respectively. Find maximum error in calculation of heat dissipated (in %)**

(1) 4% **(2) 8%** **(3) 2%** **(4) 6%**

Ans. (2)

9. **A solid spherical ball is half submerged in liquid is at equilibrium. Density ball is ρ kg/m^3 density of liquid is σ kg/m^3 and surface tension of liquid is T. Find radius of ball.**

Ans. $\sqrt{\frac{3T}{g(2\rho-\sigma)}}$

10. **120 gm ice at 0° C is mixed with 300 gm water at 25 °C, find out amount of ice at 0°C temperature (L_f = 80 Cal/gm, specific heat of water 1 Cal/gm °C)**

Ans. **26.25 gm**

Sol. For water $Q_1 = 300 \times 1 \times 25 = 75 \times 10^2$ cal

$Q_2 = 300 \times 80 = 24 \times 10^2$ cal

So total heat is released by water = $Q_1 + Q_2 = 315 \times 10^2$ cal

Now total ice = 300 + 120 = 420

Mass of water = $\frac{315\times10^2}{80} = 393.75$ gm

So mass of ice = 420 – 393.75 = 26.25 gm

11. **If electric field expression in an EM wave is given by E = 540 sin $\pi \times 10^4$ (x – ct). Find peak value of magnetic field if c is speed of light in vacuum?**

Ans. $\boxed{B_0 = 18\times10^{-7}\,T}$

Sol. $C = \frac{E_0}{B_0}$ $\qquad B_0 = \frac{E_0}{C} = \frac{540}{3\times10^8}$

$\mathbf{B_0 = 180 \times 10^{-8}\ T}$

$\boxed{B_0 = 18\times10^{-7}\,T}$

12. **In a sample of H atom, e^- make transition from state n = 5. Find total number of distinct wavelength in emission spectrum?**

(1) 10 **(2) 20** **(3) 30** **(4) 40**

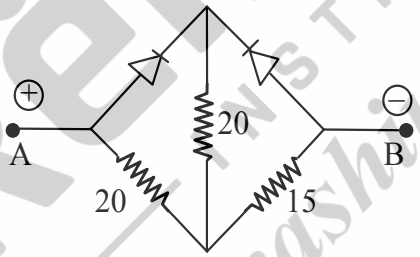
Ans. **(1)**

Sol. $= \frac{(n)(n-1)}{2}$

$= \frac{(5)\times(4)}{2}$

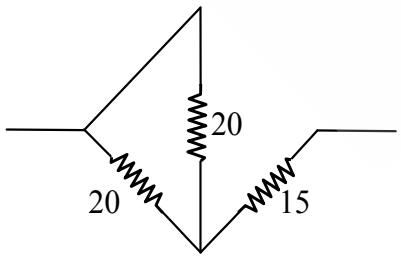
= 10

13. **Using given diodes circuit find out equivalent resistance between terminals A and B.**



Ans. **25Ω**

Sol.



= 25 Ω

14. **For an amplitude modulated wave the maximum and minimum amplitude of wave is given as 6 units and 2 units. Find modulation index of the wave.**

(1) $\frac{1}{3}$ **(2)** $\frac{1}{2}$ **(3)** $\frac{1}{4}$ **(4)** $\frac{1}{5}$

Ans. **(2)**

Sol. **Modulation Index =** $\frac{A_{max}-A_{min}}{A_{max}+A_{min}}=\frac{6-2}{6+2}$

$=\frac{4}{8}=\frac{1}{2}$

15. **A proton and deuteron are moving with same kinetic energy in uniform perpendicular magnetic field. Find out ratio of time period.**

(1) $\frac{1}{5}$ **(2)** $\frac{1}{4}$ **(3)** $\frac{1}{2}$ **(4)** $\frac{1}{3}$

Ans. **(3)**

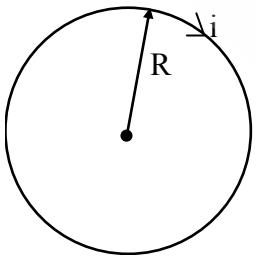
Sol. $T=\frac{2\pi m}{qB}$

$\frac{T_P}{T_d}=\frac{m_p}{m_d}\times\frac{q_d}{q_p}=\frac{m}{2m}\times\frac{q}{q}=\frac{1}{2}$

16. **A coil having 2 turns with current I flowing in it has a magnetic field B at its centre. If the same coil is used and number of turns is increased to 5 and same current flows through coil. Find the new magnetic field at the centre of coil.**

Ans. $\frac{25}{4}B$

Sol.



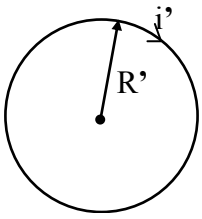
$B_0 = N.\frac{\mu_0 i}{2R}$

Case-I : N = 2

$$B = \frac{2\mu_0 i}{2R} = \frac{\mu_0 i}{R} \quad \text{.....(1)}$$

$5 \times 2\pi R' = 2 \times 2\pi R$

$$R' = \frac{2}{5} \times R$$



$$B' = 5 \times \frac{\mu_0 i}{2 \times \frac{2}{5} R} = \frac{25}{4} \frac{\mu_0 i}{R}$$

$$B' = \frac{25}{4} B$$

17. A second pendulum is at height h = 2R from earth surface then, find length of pendulum

Ans. 1/9

Sol. $T = 2\pi\sqrt{\frac{\ell}{g'}}$; $\quad g' = \frac{g}{\left(1+\frac{h}{R}\right)^2} = \frac{g}{9}$

$$2 = 2\pi\sqrt{\frac{\ell}{g/9}}$$

ℓ = 1/9 m

18. When we pass through a metallic detection then it beeps due to the phenomena of :-

(1) Electro–magnetic induction

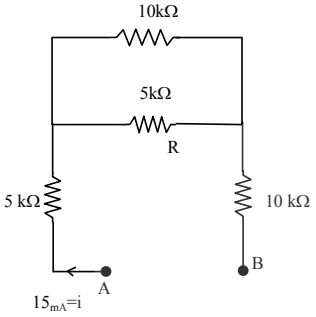
(2) EM interference

(3) L–C resonance

(4) Mutual inductance in AC circuit

Ans. (1)

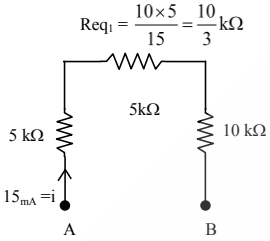
19. A part of closed circuit is shown in figure find potential difference between A and B ($v_A - v_B$):



(1) 275 v **(2) 250 v** **(3) 300 v** **(4) 225 v**

Ans. (1)

Sol.

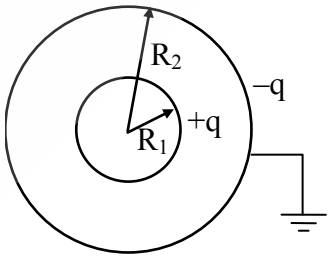


$$\text{Req} = 15 + \frac{10}{3} = \frac{55}{3}$$

$$v_A - v_B = i\,\text{Req}$$

$$= 15 \times 10^{-3}\ \frac{55}{3} \times 10^3\ \text{v} = 275\ \text{v}$$

20. A conductor of radius R_1, having capacitance C is placed in free space. Now, a concentric conducting shell of radius R_2 is placed as shown, so that capacitance of the system is increased to nC. Find $\frac{R_1}{R_2}$.



(1) $\left(1-\frac{1}{n}\right)$ **(2) (n – 1)** **(3)** $\left(1+\frac{1}{n}\right)$ **(4) n**

Ans. (1)

Sol. $\frac{kq}{R_1}-\frac{kq}{R_2}=\frac{q}{nC} \qquad \Rightarrow nC=\frac{1}{k\left(\frac{1}{R_1}-\frac{1}{R_2}\right)}$

$\Rightarrow n4\pi\varepsilon_0 R_1=\frac{4\pi\varepsilon_0}{\left(\frac{1}{R_1}-\frac{1}{R_2}\right)} \Rightarrow R_1\left(\frac{1}{R_1}-\frac{1}{R_2}\right)=\frac{1}{n}$

$\Rightarrow\left(1-\frac{1}{R_2}\right)=\frac{1}{n} \Rightarrow \frac{R_1}{R_2}=\left(1-\frac{1}{n}\right)$

21. An electron jumps from n^{th} orbit to the first orbit. The wavelength of emitted photon is 'λ'. Find the value of 'n'. [Given : $RZ^2 = A$]

Ans. $\sqrt{\frac{\lambda A}{\lambda A-1}}$

Sol. $\frac{1}{\lambda}=RZ^2\left(1-\frac{1}{n^2}\right)=A\left(1-\frac{1}{n^2}\right) \Rightarrow \frac{1}{\lambda A}=1-\frac{1}{n^2} \Rightarrow \frac{1}{n^2}=1-\frac{1}{\lambda A}$

$\Rightarrow n^2=\frac{\lambda A}{\lambda A-1} \Rightarrow n=\sqrt{\frac{\lambda A}{\lambda A-1}}$

22. An electron moving with kinetic energy 0.1 keV enters perpendicularly to the field $B = 10^{-4}$T. Find frequency of revolution.

Ans. $2.8 \times 10^{+6}\ s^{-1}$

23. A potentiometer shows reading of 38cm when connected with 1.2V battery, then the same potentiometer is connected to a 1.8V battery. Find the difference in the length (in cm)

Ans. 18

Sol. Let Potential gradient is A.

Then, A × 36 cm = 1.2 V

and A × x cm = 1.8 V

$\therefore \frac{x}{36}=\frac{1.8}{1.2}=1.5$

$\Rightarrow$ x = 1.5 × 36 cm $\Rightarrow$ x = 54 cm

$\therefore \Delta\ell$ = 54 cm – 36 cm = 18 cm