MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON WEDNESDAY 28th JANUARY 2026) **TIME : 9:00 AM TO 12:00 NOON**

PHYSICS

TEST PAPER WITH SOLUTION

1. Find the ratio of de-Broglie wavelengths of deuteron having energy E and α-particle having energy 2E :

Ans. **(2)**

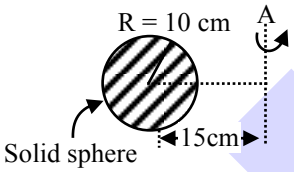
Sol. $\lambda = \frac{h}{\sqrt{2mKE}}$

$$\frac{\lambda_D}{\lambda_\alpha} = \sqrt{\frac{m_\alpha}{m_D}\left(\frac{KE_\alpha}{KE_D}\right)}$$

$$= \sqrt{\left(\frac{4}{2}\right)\left(\frac{2E}{E}\right)}$$

$$\frac{\lambda_D}{\lambda_\alpha} = 2$$

2. As shown in the figure, radius of gyration about the axis shown in $\sqrt{n}$ cm for a solid sphere. Find 'n'.



Ans. **(265)**

Sol. $I_A = Icm + md^2$

$$= \frac{2}{5}mR^2 + md^2$$

$$mk^2 = I_A = m\left[\frac{2}{5}(10)^2 + (15)^2\right]$$

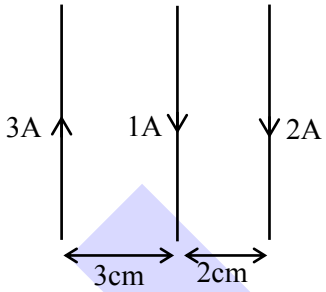
$$k^2 = \left[\frac{2}{5}\times 100 + 225\right]$$

$$k^2 = [40 + 225]$$

$$k = \sqrt{265}\,cm$$

$$n = 265$$

3. Three very long parallel wires carrying current as shown. Find the force acting at 15 cm length of middle wire :



(1) 1 μN (2) 6 μN

(3) 7 μN (4) 5 μN

Ans. **(2)**

Sol. Force per unit length on middle wire :

$$F\text{-net} = \frac{\mu_0(1)(2)}{2\pi\times 2\times 10^{-2}} + \frac{\mu_0(1)(3)}{2\pi\times 3\times 10^{-2}}$$

$$\frac{\mu_0}{2\pi\times 10^{-2}}(1+1)$$

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

$= 4 \times 10^{-5}$ N/m

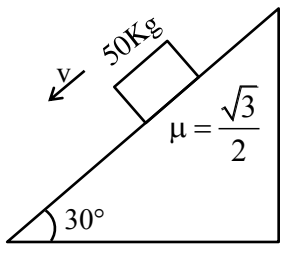
For 15 cm length $F = 4 \times 10^{-5} \times 15 \times 10^{-2}$ N

$= 60 \times 10^{-7}$ N

$= 6 \times 10^{-6}$ N

= 6 μN

4. Find external force F so that block can move on inclined plane with constant velocity.

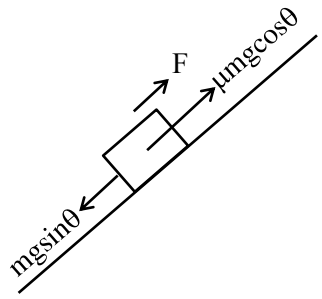


(1) 125 N (2) 120 N

(3) 145 N (4) 115 N

Ans. **(1)**

Sol.



$mg\sin\theta = F + \mu mg\cos\theta$

$F = mg\sin\theta - \mu mg\cos\theta$

$= 500[\sin 30° - \mu\cos 30°]$

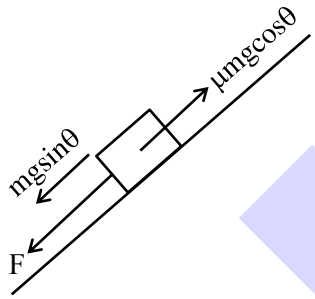
$= 500\left[\frac{1}{2} - \frac{\sqrt{3}}{2}\cdot\frac{\sqrt{3}}{2}\right]$

$= 500\left[\frac{1}{2} - \frac{3}{4}\right]$

$F = 500\left[-\frac{1}{4}\right]$

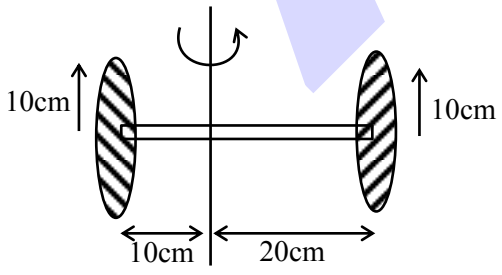
$F = -125N$

$F = 125$ N



$\therefore$

5. In the system of two discs and a rod of mass 600 g each, a torque of magnitude 43×10^5 dyne-cm is applied along the axis of rotation as shown in figure. Find the approx angular acceleration about given axis :



(1) 11 rad/s^2 (2) 100 rad/s^2

(3) 27 rad/s^2 (4) 22 rad/s^2

Ans. (1)

Sol. $\tau = I_{sys}\alpha$

$\tau = (I_{disc1} + I_{disc2} + I_{rod})\alpha$

$\tau = \left(\left(\frac{MR^2}{4} + Md_1^2\right) + \left(\frac{MR^2}{4} + Md_2^2\right) + \left(\frac{M\ell^2}{12} + Md_3^2\right)\right)\alpha$

$43\times10^5\times10^{-7} = \left(\left(\frac{(0.6)(0.1)^2}{4} + (0.6)(0.1)^2\right) + \left(\frac{0.6(0.1)^2}{4} + 0.6(0.2)^2\right) + \left(\frac{(0.6)(0.3)^2}{12} + (0.6)(0.05)^2\right)\right)\alpha$

$43 \times 10^{-2} = ((0.0015 + 0.006) + 0.0015 + 0.024) + (0.0045 + 0.0015)\,\alpha$

$43 \times 10^{-2} = (0.039)\alpha$

$\alpha = 11.025$ rad/s^2

6. Focal length of a convex lens in air is f = 18 cm. It is immersed in a liquid of refractive index 4/3. If change in focal length of lens is $\Delta f = nf$, Find n. [Given refractive index of lens is 1.5] :

Ans. 3

Sol. For lens in air,

$\frac{1}{f} = \left(\frac{\mu_L}{1} - 1\right)\left[\frac{1}{R_1} - \frac{1}{R_2}\right] = \frac{1}{18}$

$\therefore \frac{1}{R_1} - \frac{1}{R_2} = \frac{1}{18}\times 2 = \frac{1}{9}$

In liquid,

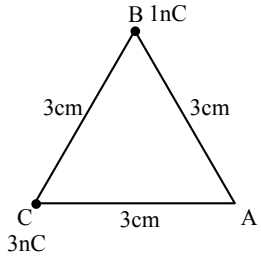
$\frac{1}{f'} = \left(\frac{\mu_L}{\mu_S} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = \left(\frac{1.5\times3}{4} - 1\right)\left(\frac{1}{9}\right) = \frac{1}{8}\times\frac{1}{9}$

$\therefore$ f' = 72 cm

$\therefore \Delta f = (72 - 18)$ cm = 54 cm = 3 × 18 cm

$\therefore$ n = 3

7. Find work done in bringing charge q = 3nC from infinity to point A as shown in the figure :



(1) 11×10^{-7} J (2) 36×10^{-7} J

(3) 12×10^{-7} J (4) 13×10^{-7} J

Ans. (2)

Sol. $W = \frac{Kqq_B}{r_{AB}} + \frac{Kqq_C}{r_{AC}}$

$= \frac{9\times10^9\times3\times10^{-9}}{3\times10^{-2}}[1+3]\times10^{-9}$

$W = 9 \times 4 \times 10^{-7}$

$W = 36 \times 10^{-7}$ J

8. An electromagnetic wave travelling in a medium has its electric field given by :

$E = 2\sin(2 \times 10^{15}t - 10^7x)$. Find the refractive index of the medium :

(1) 1.1 (2) 1.7

(3) 1.3 (4) 1.5

Ans. (4)

Sol. Speed of EM wave : $v = \frac{\omega}{k} = \frac{2\times10^{15}}{10^7}$

$= 2 \times 10^8$

$\therefore \mu = \frac{c}{v} = \frac{3\times10^8}{2\times10^8} = 1.5$

9. A circular coil of radius R carries current such that magnetic field at its centre is 16μT. Find the magnetic field on the axis at a distance of $\sqrt{3}R$ from the centre of coil.

(1) 2μT

(2) 4μT

(3) 3μT

(4) 5μT

Ans. (1)

Sol. Given, $\frac{\mu_0 I}{2R} = 16\mu T$ ...(1)

Then, $\frac{\mu_0 IR^2}{2\left[R^2 + (\sqrt{3}R)^2\right]^{3/2}} = B$ ...(2)

Now, $\frac{B}{16} = \frac{R^2/(2\times8R^3)}{1/2R} \Rightarrow B = 2\mu T$

10. Electric current in a circuit is given by $i = i_0\frac{t}{T}$, then find the rms current for period t = 0 to t = T :

(1) $\frac{i_0}{\sqrt{3}}$ (2) $\frac{i_0}{\sqrt{2}}$

(3) $\frac{i_0}{\sqrt{5}}$ (4) $\frac{i_0}{\sqrt{4}}$

Ans. (1)

Sol. $i_{rms} = \sqrt{\frac{1}{T}\int_0^T [i(t)]^2 dt}$

$i_{rms} = i_0\sqrt{\frac{1}{T}\int_0^T \left(\frac{t}{T}\right)^2 dt}$

$i_{rms} = i_0\sqrt{\frac{1}{T^3}\left[\frac{t^3}{3}\right]_0^T}$

$i_{rms} = \frac{i_0}{\sqrt{3}}$

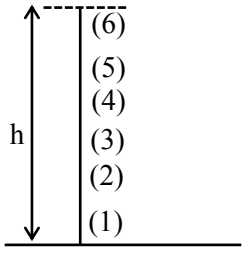
11. Balls are dropped at regular intervals from height 5 m. If the first ball touches the ground when 6th ball is about to be dropped, find the height of 4th ball above the ground at the same instant :

(1) 4.1 m (2) 4.2 m

(3) 4.3 m (4) 4.4 m

Ans. (2)

Sol. time taken by 1st ball to touch ground.



$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times5}{10}} = 1s$

Let 1st ball is dropped at t = 0 then, 6th ball will be dropped at t = 1 s

$t = 0 \rightarrow 1^{st}$ ball

$t = 0.2 \rightarrow 2^{nd}$ ball

$t = 0.4 \rightarrow 3^{rd}$ ball

$t = 0.6 \rightarrow 4^{th}$ ball

$t = 0.8 \rightarrow 5^{th}$ ball

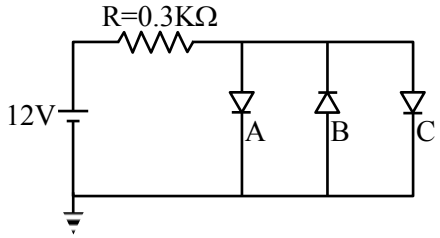
$t = 1 \rightarrow 6^{th}$ ball

So, height dropped by 4^{th} ball : $h = \frac{1}{2}g(0.4)^2$

$= \frac{1}{2} \times 10 \times 0.16 = 0.8$ m

So, height above ground = 5 – 0.8 = 4.2 m

12. Three silicon diodes connected parallel to each other as shown. Forward voltage of diode is 0.7 V. Find current through diode A :



(1) $\frac{113}{3}$mA

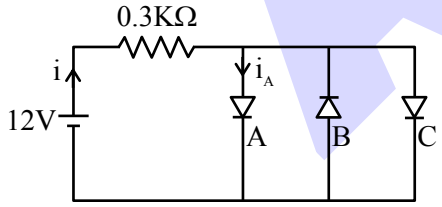
(2) $\frac{113}{6}$mA

(3) $\frac{113}{9}$mA

(4) $\frac{226}{3}$mA

Ans. (2)

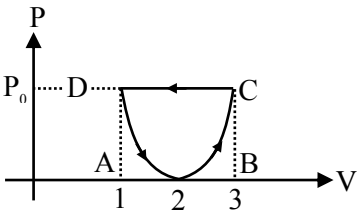
Sol.



$i = \frac{12 - 0.7}{0.3 \times 10^3} \Rightarrow i = \frac{113}{3}$mA

$i_A = \frac{i}{2} = \frac{113}{6}$mA (Option B is correct)

13. For a gas P-V curve is given as shown in the diagram. Curve path follows equations $(V - 2)^2 = 4aP$. Find work done by gas in given cyclic process.



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

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

Ans. (1)

Sol. Work done = Area of parabola

$= \frac{2}{3}$ Area of rectangle ABCD

$= \frac{2}{3}P_0(3-1)$

$= \frac{4P_0}{3}$

$V = 1 \Rightarrow (1-2)^2 = 4aP_0$

$P_0 = \frac{1}{4a}$

$= \frac{4}{3} \times \frac{1}{4a}$

Work done by gas = $\frac{-1}{3a}$

14. An atom $^{8}_{3}X$ is bombarded with electrons, neutrons and protons and in 10 sec, 10 electrons, 10 protons and 9 neutrons are absorbed. If final surface area is x% of initial area, find x :- :

(1) 250% (2) 350%

(3) 225% (4) 900%

Ans. (3)

Sol. $R = R_0A^{1/3}$

$\therefore R_{initial} = R_0\, 8^{1/3} = 2R_0$

$R_{final} = R_0 27^{1/3} = 3R_0$

Initial surface area $= 4\pi(2R_0)^2$

Final surface area $= 4\pi(3R_0)^2$

Final area = 225% of initial area.

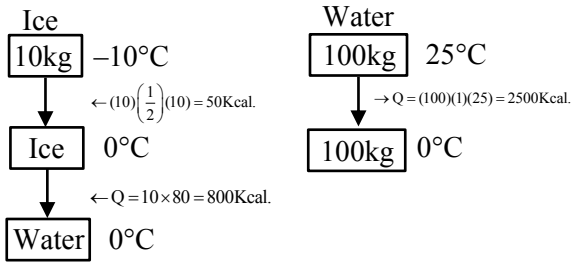
15. 10kg ice at –10°C & 100kg water at 25°C are mixed together. Find final temperature. (Given $S_{ice} = \frac{1}{2}$ cal/g°C, L_{fusion} = 80cal/g and S_{water} = 1cal/g°C

(1) 15°C (2) 10°C

(3) 25°C (4) 20°C

Ans. **(1)**

Sol.



Whole ice will melt. Let final temperature is T. Net heat conserved.

$\therefore m_is_i(0-(-10)) + m_iL_f + m_iS_w(T-0) + m_wS_w(T-25) = 0$

$10\left(\frac{1}{2}\right)(10) + 10\times80 + 10(1)(T-0) + 100(1)(T-25) = 0$

$50 + 800 + 10T + 100T - 2500 = 0$

$110T = 25W - 800 - 50$

$110T = 1650$

$T = \frac{165}{11} = 15°C$

Final temperature T = 15°C

16. A particle moves according to the equation x = Asin(ωt). The potential energy is maximum at time $t = \frac{T}{2\beta}$, where T is the time period of particle. Find the minimum value of β :

Ans. **(2)**

Sol. For SHM starting from mean, PE is maximum after T/4 time.

$\therefore 2\beta = 4 \Rightarrow \beta = 2$

17. Two wires of cross sectional area 1 cm^2 and 2 cm^2 and lengths 20 cm and 30 cm are connected to the same load. If their extensions are same, find the ratio of their Young's modulus :

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

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

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

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

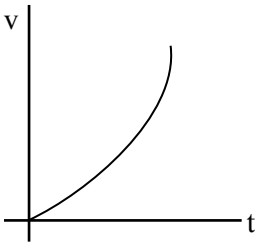
Ans. **(2)**

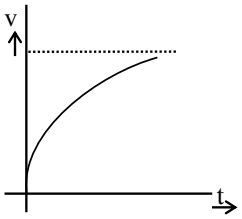
Sol. $\Delta\ell_1 = \Delta\ell_2$

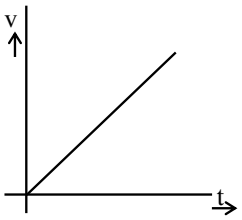
$\Rightarrow \frac{F\ell_1}{A_1Y_1} = \frac{F\ell_2}{A_2Y_2}$

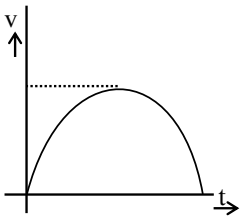
$\frac{Y_1}{Y_2} = \frac{A_2}{A_1} \times \frac{\ell_1}{\ell_2} = \frac{4}{3}$

18. A particle is falling under gravity. Air resistance on particle is F = –kv. Find correct option :

(1) 

(2) 

(3) 

(4) 

Ans. (2)

Sol. $a = g - \frac{kv}{m}$

$$\frac{dv}{dt} = g - \frac{kv}{m} = \frac{gm - kv}{m}$$

$$\int_0^v \frac{dv}{gm - kv} = \int_0^v \frac{1}{m} t$$

$$\left[-\frac{\ell n(gm - kv)}{k} \right]_0^V = \frac{1}{m} t$$

$$\left[-\ell n(gm - kv) \right]_0^V = \frac{k}{m} t$$

$$\ell n\left[\frac{gm}{gm - kv} \right] = \frac{k}{m} t$$

$$\ell n\left[\frac{gm - kv}{gm} \right] = \frac{-k}{m} t$$

$$\ell n\left[1 - \frac{kv}{gm} \right] = \frac{-k}{m} t$$

$$\frac{kv}{gm} = \left(1 - e^{-\frac{k}{m}t} \right)$$

$$v = \frac{gm}{k}\left(1 - e^{-\frac{k}{m}t} \right)$$

19. **Statement-1 :** Planner wavefronts are incident on a prism, remain planner after passing through prism, but if planner wavefronts are passed through a pin hole then wavefronts may become spherical.

Statement-2 : If slit width is increased then curvature of wave front increases.

(1) Statement-1 is correct, statement-2 is incorrect.

(2) Statement-1 is incorrect, statement-2 is correct.

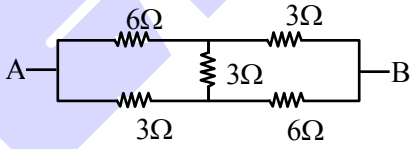
(3) Both statement are correct.

(4) Both statement are incorrect.

Ans. (3)

Sol. On increasing width size radius of curvature of wavefront increases and for very large slits it is almost plane.

20. If equivalent resistance between points A and B is $\frac{X}{5}$ (in Ω), then find value of X:

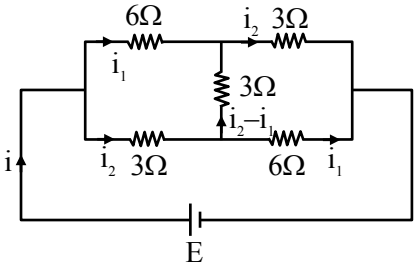


(1) 20 (2) 25

(3) 21 (4) 30

Ans. (3)

Sol.



$$-3i_2 - 6i_1 + E = 0 \quad \ldots(1)$$

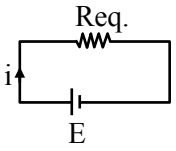
$$3(i_2 - i_1) - 6i_1 + 3i_2 = 0 \quad \ldots(2)$$

$$6i_2 - 9i_1 = 0 \Rightarrow i_2 = \frac{3}{2} i_1$$

From (1) $+3\left(\frac{3}{2}i_1\right)+6i_1=E$

$i_1=\frac{2E}{21}, i_2=E/7$

$\frac{5E}{21}=i=i_1+i_2$



$i=\frac{E}{Req.} \Rightarrow Req.=\frac{21}{5}=\frac{X}{5}$

Value of X is 21.

21. If nothing is kept between jaws, zero of Vernier scale lies right of 0 cm of main scale and 4th line of Vernier scale matches perfectly with any line of main scale. An object is kept between jaws and zero of Vernier scale crosses 15th division of main scale and 5th division of Vernier scale exactly matches with any line of main scale. (Least count = 0.1 mm and 1 MSD = 1mm). Find dimension of object :

(1) 15.1 mm

(2) 15.5 mm

(3) 15.4 mm

(4) 15.9 mm

Ans. (1)

Sol. Reading = MSR + VSR × LC – Zero error

= 15 mm + 5 × 0.1 mm – 4 × 0.1 mm

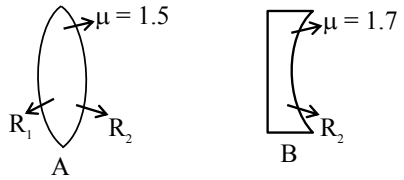
= 15 mm + 0.5 mm – 0.4 mm

Reading = 15.1 mm

Dimension = 15.1 mm

Note : Vernier scale has positive zero error.

22. Two lenses one biconvex and other plano concave have same magnitude of power. The refractive indices of their materials are 1.5 and 1.7 respectively. If the radii of curvature of the lenses are as shown. find the ratio : $\frac{R_1}{R_2}$:



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

Ans. (1)

Sol. $\frac{1}{f_A}=(\mu_A-1)\left[\frac{1}{R_1}-\frac{1}{(-R_2)}\right]$

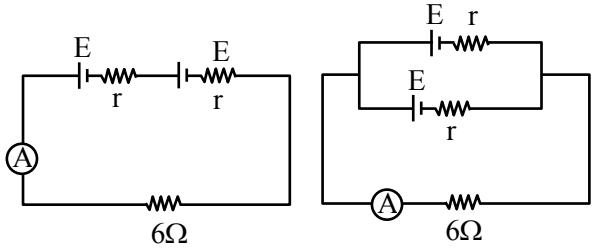
$\frac{1}{f_B}=(\mu_B-1)\left[\frac{1}{\infty}-\frac{1}{R_2}\right]$

$|P_A|=|P_B| \Rightarrow 0.5\left(\frac{1}{R_1}+\frac{1}{R_2}\right)=\frac{0.7}{R_2}$

$\Rightarrow \frac{0.5}{R_1}=\frac{0.2}{R_2}$

$\Rightarrow \frac{R_1}{R_2}=\frac{5}{2}$

23. Figure shows two combinations of real cells with 6Ω internal resistance. If reading of ammeters are same in both cases, find the value of 'r'.



(1) 6Ω (2) 5Ω

(3) 8Ω (4) 12Ω

Ans. (1)

Sol. In 1st case, $i = \frac{2E}{6+2r}$

In 2nd case, $i = \frac{E}{6+\frac{r}{2}}$

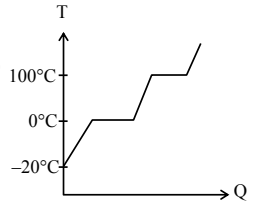
$\therefore \frac{2E}{6+2r} = \frac{E}{6+r/2}$

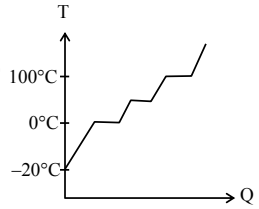
$\Rightarrow \frac{1}{3+r} = \frac{2}{12+r}$

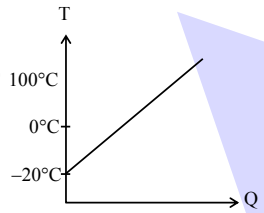
$\Rightarrow 12 + r = 6 + 2r$

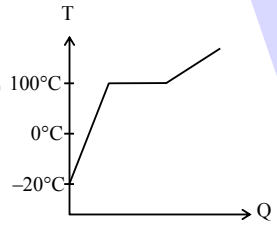
$\Rightarrow r = 6\Omega$

24. Ice is heated from –20°C to 200°C. Which of the following temperature (T) vs heat (Q) graph is correct ?

(1) 

(2) 

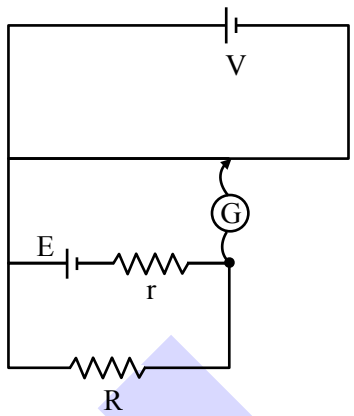
(3) 

(4) 

Ans. **(1)**

Sol. Theoretical

25. For the given circuit, if R = 12Ω, balancing length is 180 cm. When value of R is 4 Ω, then balancing length is 120 cm. Find internal resistance of cell E.



(1) 2 Ω

(2) 5 Ω

(3) 4 Ω

(4) 1 Ω

Ans. **(3)**

Sol. Let potential gradient of potentiometer wire be λ.

$\therefore$ In 1st case

$12\ i_1 = 180\ \lambda = E - i_1 r \Rightarrow E - 15\lambda r = 180\lambda$ ....(1)

In 2nd case

$4\ i_2 = 120\ \lambda = E - i_2 r \Rightarrow E - 30\lambda r = 120\lambda$ ....(2)

From (1) and (2)

$r = 4\Omega$

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