PHYSICS

Q.1 A student performs experiment with common emitter npn transistor which is working as amplifier then which is not correct -

(A) $A_V > 1$ (B) $\beta > 1$

(C) $R_i = \frac{\Delta V_b}{\Delta I_b}$ (D) $R_G = R_i R_0$

[D]

Sol. $R_G = \frac{R_0}{R_i}$ so R_G is incorrect

Q.2 In a semiconductor diode, the barrier potential offers opposition to -

(A) holes in P-region only

(B) free electrons in N-region only

(C) majority carriers in both regions

(D) majority as well as minority carriers in both regions **[C]**

Sol. In depletion zone, internal electric field is directed from n to P side which opposes diffusion of majority charge carriers

Q.3 When both the studs are in contact in a screw gauge then a student finds that 96^{th} division of circular scale is in line with the reference line then the conclusion would be -

(A) the instrument has no zero error, it is perfact

(B) It has +ve zero error, 4 L C

(C) It has –ve zero error, 4 L C

(D) It has –ve zero error, 96 LC **[C]**

Sol. It is –ve zero error. 4 × LC

Q.4 If the zero of the vernier lies on the right hand side and fourth division coincide with the main scale division when the jaws are in contacts so the correction will be -

(A) + 0.04 cm (B) + 0.06 cm

(C) –0.04 cm (D) –0.06 cm **[C]**

Sol. e = 4 × LC = 4 × 0.01 cm = 0.04 cm

c = –0.04 cm

Q.5 An unknown body is measured with a meter scale of unequal length if the mass appears 10g and 11g when it is kept on both the pans respectively. The true mass is -

(A) 10.48 g (B) 10.00 g

(C) 11.00 g (D) 10.50 g **[A]**

Sol. mass = $\sqrt{10\times11}$ = 10.48

Q.6 A Daniel cell is balanced on 125 cm lengths of a potentiometer wire. Now the cell is short circuited by a resistance 2Ω and the balance is obtained at 100 cm. The internal resistance of the Daniel cell is

(A) 0.5 Ω (B) 1.5 Ω

(C) 1.25 Ω (D) 4/5 Ω **[A]**

Sol. $r = \left(\frac{\ell_1}{\ell_2} - 1\right) R$

$= \left(\frac{125}{100} - 1\right) 2 = 0.25 \times 2 = 0.5\ \Omega$

Q.7 In a potentiometer experiment the balancing with a cell is at a length of 240 cm. On shunting the cell with a resistance of 2 Ω the balancing length becomes 120 cm. The internal resistance of the cell is –

(A) 4 Ω (B) 2 Ω

(C) 1 Ω (D) 0.5 Ω **[B]**

Q. 8 The pitch of a screw gauge is 1 mm and there are 50 divisions on its cap. When nothing is put in between the studs, 44^{th} division of the circular scale coincides with the reference line. When a glass plate is placed between the studs, the main scale reads three divisions and the circular scale reads 26 divisions. Calculate the thickness of the plate –

(A) 3.52 mm (B) 3.26 mm

(C) 3.40 mm (D) 3.64 mm **[D]**

Sol. LC = $\frac{1}{50}$ mm = 0.02 mm

error = – 6 × 0.02 = – 0.12

observed reading = 3 mm + 26 × (0.02) mm

= 3.52 mm

true reading = 3.52 – (– 0.12)

= 3.64 mm

Q. 9 In experiments using the metre bridge, post office box and potentiometer, a galvanometer is used. Which property of the galvanometer makes it suitable for these experiments ?

(A) It has a relatively high coil resistance

(B) It indicates rather than measures the magnitude of the current

(C) It can indicate currents flowing through it in either direction

(D) It can be made very sensitive to small currents **[C]**

Sol. In the three experiments, the jockey is moved according to the direction of the deflection of the galvanometer

Q. 10 N division on the main scale of a vernier callipers coincide with (N+1) divisions of the vernier scale. If each division of main scale is x unit, then least count of the instrument is -

(A) $\frac{x}{N}$ (B) x

(C) $\frac{x}{N+1}$ (D) $\left(\frac{N}{N+1}\right)x$ **[C]**

Q. 11 A resistance of 2 Ω is connected across one gap of a meter–bridge (the length of the wire is 100 cm) and an unknown resistance, greater than 2 Ω, is connected across the other gap. When these resistances are interchanged, the balance point shifts by 20cm. Neglecting any correction, the unknown resistance is **–**

(A) 3 Ω (B) 4 Ω

(C) 5 Ω (D) 6 Ω **[A]**

Sol. $\frac{\ell}{(100-\ell)} = \frac{2}{S}$ ….(1)

$\frac{\ell+20}{100-(\ell+20)} = \frac{S}{2}$

$\frac{\ell+20}{80-\ell} = \frac{S}{2}$ …..(2)

by (1) × (2)

$\left(\frac{\ell}{100-\ell}\right) \times \left(\frac{\ell+20}{80-\ell}\right) = 1$

$\Rightarrow \ell^2 + 20\,\ell = 8000 - 180\,\ell + \ell^2$

$\Rightarrow 200\,\ell = 8000$

$\ell = 40$

so $S = \frac{2\times 60}{40} = 3\,\Omega$

Q. 12 Which of the following is the most preferred instrument for measuring length ?

(A) A vernier of least count 0.01 cm

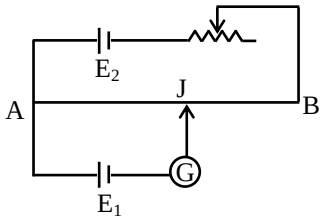
(B) A vernier having 20 divisions on the sliding scale

(C) A vernier having 9 divisions on the sliding scale

(D) A scale having 3 equal parts of each mm **[B]**

Sol. Most preferred should have least least count. So vernier of 20 division

Q. 13 In the potentiometer circuit shown, if for cell E_1 = 5V, the balanced point is at 40 cm from A, then for another battery E_2 = 10 V, the balanced point would be at -



(A) 20 cm from A

(B) 40 cm from A

(C) 80 cm from A

(D) None of these **[C]**

Q. 14 To reduce the pressure on the object we should tighten the screw with -

(A) holding the U frame

(B) holding the circular scale

(C) holding with ratchet

(D) any of the above method **[C]**

Sol. Holding with ratchet

Q. 15 The pitch of a screw gauge is 0.5 mm and there are 50 divisions on circular scale when there is

nothing between the two studs of screw gauge 46th division of circular scale is coinciding with reference line. When a wire is placed between the studs the linear scale reads 2 divisions and 20th division of circular scale coincides with the reference line. The correct statement is -

(A) least count 0.01 cm

(B) zero correction – 0.04 mm

(C) radius is 0.65 mm

(D) all of the above **[C]**

Q. 16 While measuring the speed of sound by performing a resonance column experiment a student gets the first resonance condition at a column length of 18 cm during winter. Repeating the same experiment during summer, she measures the column length to be x cm for the second resonance then -

(A) $x > 54$

(B) $54 > x > 36$

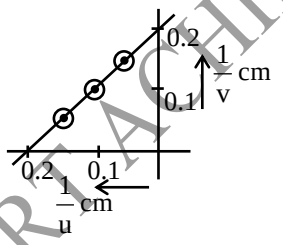
(C) $36 > x > 18$

(D) $18 > x$ **[A]**

Sol. As temperature increases, frequency increases so it will be more than thrice the length, hence (A)

$x > 54$

Q. 17 An experiment with convex lens gives certain result which is represented by a student in the shown graph. What would be the power of the lens used ?



(A) 0.2 D (B) 1 D

(C) 0.1 D (D) 20 D **[D]**

Q. 18 For the half deflection method which of the following stands correct, where G, R and S has the usual meaning ?

(A) $G = \frac{RS}{R-S}$ (B) $R = \frac{GS}{G-S}$

(C) $S = \frac{RG}{R+G}$ (D) All of these **[D]**

Q.19 A small, hollow metal cylinder is closed at one end. Its mass is known. Which of the following instruments are required to find the density of the metal ?

(A) Slide callipers only

(B) Slide callipers and screw gauge

(C) Screw gauge and screw spherometer

(D) Slide callipers and spherometer **[A]**

Q.20 A screw gauge is provided with a "ratchet" arrangement, in the form of a knob at the right end of the spindle. The screw should be rotated by this knob only. The purpose of the is device is–

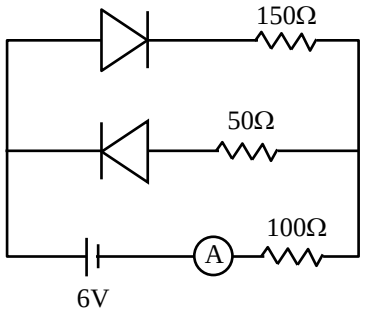
(A) to reduce zero error

(B) to prevent backlash error

(C) to control the rate of rotation of the screw

(D) to prevent damage to the pitch of the screw **[D]**

Q.21 In the given experiment two diodes each with a forward resistance of 50 Ω and with infinite backward resistance are used as shown in the figure. If the battery voltage is 6V, what will be the ammeter reading ?



(A) 0.00 A (B) 0.01 A

(C) 0.03 A (D) 0.02 A **[D]**

Sol. $I = \frac{V}{R} = \frac{6}{150+100+50} = \frac{6}{300} = 0.02$ A

Q.22 A vernier callipers has its main scale of 10 cm equally divided into 200 equal parts. Its vernier scale of 25 divisions coincides with 12 mm on the main scale. The least count of the instrument is–

(A) 0.020 cm (B) 0.002 cm

(C) 0.010 cm (D) 0.001 cm **[B]**

Q.23 In a vernier callipers, ten smallest divisions of the vernier scale are equal to nine smallest

division on the main scale. If the smallest division on the main scale is half millimeter, then the vernier constant is–

(A) 0.5 mm (B) 0.1 mm

(C) 0.05 mm (D) 0.005 mm **[C]**

Q.24 The total length of potentiometer wire is 10 m. The distance between the null points on the potentiometer wire for two cells is 60 cm. If the difference between the emfs of the cells be 0.4 V, the potential qradient along the wire is –

(A) $\frac{3}{2}$ V / m (B) $\frac{1}{3}$ V / m

(C) $\frac{2}{3}$ V / m (D) $\frac{1}{2}$ V / m **[C]**

Sol. $\ell_1 - \ell_2 = 60$ cm

$E_1 - E_2 = 0.4$

$k\ell_1 - k\ell_2 = 0.4$

$k(\ell_1 - \ell_2) = 0.4$

$k = \frac{0.4}{60} = \frac{2}{3}$ V/m

Q.25 A vernier calliper has 20 divisions on the vernier scale, which coincide with 19 on the main scale. The least count of the instrument is 0.1 mm. The main scale divisions are of–

(A) 0.5 mm (B) 1 mm

(C) 2 mm (D) 1/4 mm **[C]**

Q.26 The least count of vernier callipers is 0.1 mm. The main scale reading before the zero of the vernier scale in 10 and the zeroth division of vernier scale coincides with the main scale division. Given that each main scale division is 1 mm. The measured value should expressed as -

(A) 0.01 cm (B) 0.001 cm

(C) 0.1 cm (D) 1.00 cm **[D]**

Sol. Least count = 0.1 mm

Main scale reading = 10 × 1 mm = 10 mm

Vernier scale reading = 0 × 0.1 = 0

So, Reading = 10mm + 0 = 10 mm = 1.00 cm

Q.27 A plane mirror, a metre scale, a plumb line and a vertical pin are required to measure the focal length of which of the following ?

(A) Convex lens (B) Concave lens

(C) Concave mirror (D) Convex mirror **[D]**

Q.28 In an experiment to measure the focal length of a convex lens, the data for image distances (v) for different object distances (u) are plotted to obtain the three graphs of (1) v against u, (2) 1/v against 1/u, and (3) u + v against u. It is possible to find the focal length directly, without any further calculations, from which of these graphs ?

(A) All (B) 1 and 2

(C) 2 and 3 (D) 1 and 3 **[A]**

Q.29 To measure the refracting angle (A) of a prism, the paths of rays reflected from the prism surface are traced using vertical pins placed on a sheet of paper. If the angle of minimum deviation for the prism is δ_m then the angle between the rays reflected from two surfaces of the prism will be–

(A) $A + \delta_m$ (B) $2(A + \delta_m)$

(C) 2A (D) A **[C]**

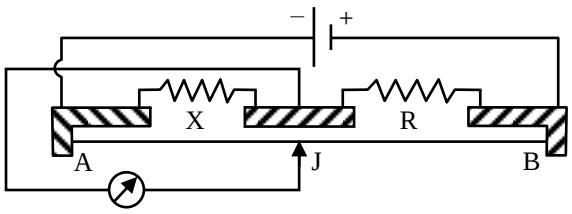
Q.30 A student measured the diameter of a wire using a screw gauge with least count 0.001 cm and listed the measurements. The correct measurement is -

(A) 5.320 cm (B) 5.3 cm

(C) 5.32 cm (D) 5.3200 cm **[A]**

Sol. Least count is 0.001 cm, so 5.320 cm

Q.31 The figure shows a metre-bridge circuit, with AB = 100 cm, X = 12 Ω and R = 18 Ω, and the jockey J in the position of balance.



If R is now made 8 Ω, through what distance will **J** have to be moved to obtain balance?

(A) 10 cm (B) 20 cm

(C) 30 cm (D) 40 cm **[B]**

Sol. $\frac{X}{R} = \frac{l}{100 - l}$ for balance

Initially, $\frac{12}{18}=\frac{l}{100-l}$, finally $\frac{12}{8}=\frac{l'}{100-l'}$

Or JJ′ = $l' - l$ = 20 cm

Q.32 Vernier scale of Vernier calipers has 50 divisions which coincide with 49 main scale divisions. Find the Vernier constant. Given: there are 20 main scale divisions cm^{-1}.

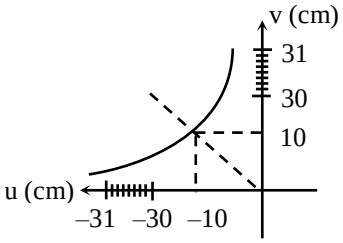
(A) 100 µm (B) 1000 µm

(C) 10 µm (D) None of these **[C]**

Sol. VC = $\frac{1}{50}$ × (value of 1 MSD)

$= \frac{1}{50}\times\frac{1}{20} = 0.001$ cm

Q.33 Graph of position of image vs position of a point object from a convex lens is shown in the figure. The focal length of the lens is –



(A) (0.50 ± 0.05) cm (B) (5.00 ± 0.05) cm

(C) (0.50 ± 0.10) cm (D) (5.00 ± 0.10) cm **[B]**

Sol. 2f = 10

f = 5 cm

$\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$

$\frac{df}{f^2}=\frac{dv}{v^2}+\frac{du}{u^2}$

$df = f^2\left(\frac{dv}{v^2}+\frac{du}{u^2}\right)$

u = 10, v = 10, du = $\frac{1}{10}$, dv = $\frac{1}{10}$

so $df = 25\left(\frac{1}{10(10)^2}+\frac{1}{10(10)^2}\right) =$

$25\left[\frac{2}{10\times100}\right]$

df = 0.05 so (5.00 ± 0.05) cm.

Q.34 The arms of a physical balance are equal but an object weighs 7.00 kg when placed in the left pan and 7.50 kg placed in the right pan. What is the actual mass of the object ?

(A) 7.00 kg (B) 7.25 kg

(C) 7.50 kg (D) 7.15 kg **[B]**

Sol. $M = \frac{M_1+M_2}{2}$

$M = \frac{7.00+7.50}{2}$ = 7.25 kg.

Q.35 In an experiment surface tension of water at 20°C is found 7.26×10^{-2} N/m. If he does the experiment at a temperature 30°C, then the surface tension of water will be –

(A) more than 7.26×10^{-2} N/m

(B) less than 7.26×10^{-2} N/m

(C) equal to 7.26×10^{-2} N/m

(D) can't say anything **[B]**

Sol. As temperature increases, surface tension decreases.

Q.36 A pendulum is vibrating in a medium. The amplitude of vibrations becomes $\frac{1}{2}$ after 40 sec. Its amplitude will be $\frac{1}{8}$ of its initial amplitude after -

(A) 80 seconds

(B) 120 seconds

(C) 40 seconds

(D) 160 seconds **[B]**

Sol. $A^2 = A_0^2 e^{-\lambda t}$

$\left(\frac{A_0}{2}\right)^2 = A_0^2 e^{-40\lambda}$

……(1)

$\left(\frac{A_0}{8}\right)^2 = A_0^2 e^{-\lambda t}$

……(2)

so by (1) and (2)

3 × 40 = t

t = 120 sec

Q.37 Voltmeter reads the potential difference across the terminal of an old battery as 1.40 volt while a potentiometer reads its voltage to be 1.55 volt. The voltmeter resistance is 280 Ω. Then:

(A) the emf of the battery is 1.4 V

(B) the emf of the battery is 1.55 V

(C) the internal resistance r of the battery is 30 Ω

(D) the internal resistance r of the battery is 5 Ω

[C]

Sol. The potentiometer measures the exact value of emf of a battery.

$\therefore$ E = 1.55 V

Also, 1.4 = I(280)

$\therefore$ I = 0.005 A

Also, V = E – Ir

$$\therefore r = \frac{E-V}{I} = \frac{1.55-1.40}{0.005} = \frac{0.15}{0.005} = 30\ \Omega$$

Q.38 A screw gauge has a least count of 0.001 cm. The number of devisions through which zero mark of circular scale has crossed the refrence line is 2. The zero error is –

(A) –0.02 mm (B) –0.005 cm

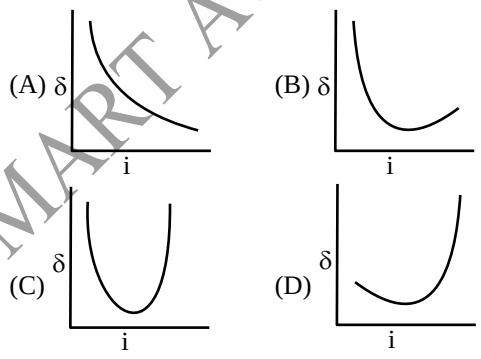
(C) + 0.02 (D) + 0.02 cm **[A]**

Sol. Least count = 0.001 cm

Zero Error = – (2 × 0.001)

= – 0.002 cm = –0.02 mm

Q.39 In the experiment to find the minimum deviation for a galss prism, by ray tracing, the deviation (δ) is measured for different values of the angle of incidence (i). Which of the following plots of δ against i is closest to the experimental result ?



[B]

Q.40 A tangent galvanometer has a coil of 50 turns and a radius of 20 cm. The horizontal components of the earth's magnetic field is $B_H = 3 \times 10^{-5}$ T, the current which gives the deflection of 45° is -

(A) 0.12 A

(B) 0.19 A

(C) 0.32 A

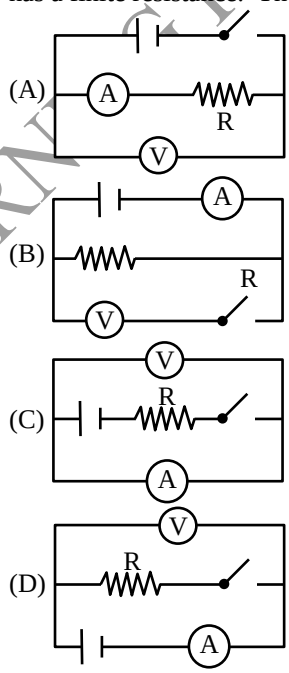
(D) 0.21 A **[B]**

Sol. i = K tan θ

$$= \frac{2rB_H}{\mu_0 n} \tan\theta$$

$$= \frac{2\times0.2\times3\times10^{-5}}{4\pi\times10^{-7}\times50} \tan 45° = 0.19\ A$$

Q.41 Which of the circuits shown below is best suited to measure the resistance of a coil, R ? The symbols have their usual meanings. The ameter has a finite resistance. The voltmeter is ideal.



[D]

Q.42 The smallest division on the main scale of a vernier callipers is 1 mm, and 10 vernier division coincide with 9 scale divisions. While measuring the diameter of a sphere, the zero mark of the vernier scale lies between 2.0 and 2.1cm and the fifth division of the vernier scale coincide with a scale division. What is the diameter of the sphere ?

(A) 2.15 cm (B) 2.00 cm

(C) 2.05 cm (D) 2.10 cm **[C]**

Sol. LC = $\frac{1}{10}$ mm = 0.01 cm

diameter = 2 + 5 × (0.01)

= 2.05 cm

Q.43 The legs of a spherometer are 5 cm apart. There are 10 division cm^{-1} on linear scale and circular scale has 100 divisions. The height **h** of a convex mirror measured in 2 MSD + 37 circular scale divisions. Find radius of curvature of convex mirror.

(A) 20.003 cm (B) 18.408 cm

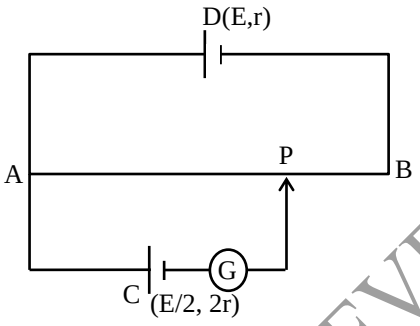
(C) 17.399 (D) 17.983 cm **[B]**

Sol. Least count = $\frac{1/10}{100} = 10^{-3}$ cm

$h = 2 \times (0.1) + 37\,(10^{-3}) = 0.237$ cm

$R = \frac{l^2}{6h} + \frac{h}{2} = \frac{25}{1.362} + 0.118 = 18.408$ cm

Q.44 In the potentiometer arrangement shown, the driving cell D has e.m.f. E and internal resistance r. The cell C whose e.m.f. is to be measured has e.m.f. E/2 and internal resistance 2r. The potentiometer wire is 100 cm long. If the balance is obtained the length AP = ℓ, then-



(A) $\ell = 50$ cm

(B) $\ell > 50$ cm

(C) $\ell < 50$ cm

(D) Balance will not obtained **[B]**

Sol. $V_A - V_B < E$

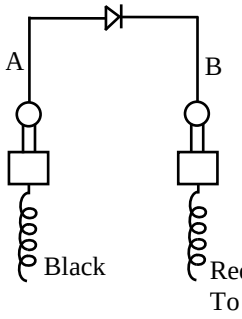
$V_A - V_P = E/2$

$\frac{V_A - V_B}{V_A - V_P} = \frac{\ell_0}{\ell}$

$V_A - V_B = \frac{\ell_0}{\ell}\frac{E}{2} < E$

$\ell > \frac{\ell_0}{2} \Rightarrow \ell > 50$ cm

Q.45 A diode is checked with multimeter as shown, no deflection is obtained. Red and Black wires are interchanged at A and B to find nil deflection. The diode is -



(A) healthy (B) probably faulty

(C) decidedly faulty (D) weak **[C]**

Sol. It is in open condition in both way so it is Faulty

Q.46 The main scale of a vernier callipers reads in millimeter and its vernier in divided into 10 divisions which coincide with a division of the main scale. When the two jaws of the instrument touch each other the seventh division of the vernier scale coincide with a scale divisions and the zero of the vernier lies to the right of the zero of mains scale. Furthermore when a cylinder is tightly placed along its length between the two jaws, the zero of the vernier scale lies slightly to the left of 3.2 cm and the fourth vernier division coincides with a scale division. What is the length of the cylinder?

(A) 3.14 cm (B) 3.07 cm

(C) 3.2 cm (D) 3.04 cm **[B]**

Sol. LC = 0.1 mm

The error = $7 \times 0.1 = 0.7$ mm = 0.07 cm

True reading = 3.1 + 4 (0.01) – 0.07 = 3.07 cm

Q.47 The distance advanced by screw of a screw gauge is 2mm in four rotation. Its cap is divided into 50 division. There is no zero error. If the screw reads 3 divisions on the main scale and 32 divisions on the cap, then the diameter of the wire is -

(A) 3.32 mm (B) 1.82 mm

(C) 2.82 mm (D) 4.7 mm **[B]**

Sol. pitch = 2/4

LC = $\frac{2/4}{50}$ = .01 mm

diameter = $3 \times 0.5 + 32 \times .01$

= 1.5 + .32

= 1.82 mm

Q.48 A body weights 24.2g when placed in one pan of a balance and 20g when placed in other. What is the true mass of the body if the arms have unequal length ?

(A) 24.2g (B) 20 g

(C) 22 g (D) 22.1 g **[C]**

Sol. $M = \sqrt{M_1 M_2}$

$M = \sqrt{24.2 \times 20} = \sqrt{484} = 22$ g

Q.49 The internal resistance of a cell is determined by using a potentiometer. In an experiment, an internal resistance of 100 Ω is used across the given cell. When the key K_2 is closed, the balance length on the potentiometer decreases from 90 cm to 72 cm. Calculate the internal resistance of the cell -

(A) 100 Ω (B) 75 Ω

(C) 50 Ω (D) 25 Ω **[D]**

Sol. $r = R\left(\frac{\ell_1}{\ell_2} - 1\right) = 100\left(\frac{90}{72} - 1\right)$

$r = 25\ \Omega$

Q.50 Following observation are taken from a travelling microscope to determine the refractive index of a liquid. Reading for the bottom of an empty beaker = 12.324 cm. Reading for the bottom of the beaker when partially filled with the liquid = 12.802 cm. Reading for the liquid surface = 13.895 cm. What is the refractive index of the liquid ?

(A) 1.232 (B) 1.389

(C) 1.437 (D) 1.208 **[C]**

Sol. Real depth = $x_3 - x_1 = 13.895 - 12.324 = 1.571$ cm

Apparent depth = $x_3 - x_2 = 13.895 - 12.802 = 1.093$ cm

Refractive index = $\frac{1.571}{1.093} = 1.437$