PHYSICS CLASS XII
CHAPTER – 3 CURRENT ELECTRICITY

Q.1. Why is a slide wire bridge also called a metre bridge?

Ans. Because the length of the wire in a slide wire bridge is 1 metre.

Q.2. In a meter bridge, two unknown resistances R and S, when connected between the two gaps, gives a null point is 40 cm from one end. What is the ratio of R and S?

Ans. l = 40 cm = 0.4 m

But $\frac{P}{Q} = \frac{R}{S} \Rightarrow \frac{l}{1-l} = \frac{R}{S}$

$\Rightarrow \frac{R}{S} = \frac{0.4}{1.0-0.4} = \frac{0.4}{0.6} = \frac{2}{3}$

Q.3. Name the device used to measure the internal resistance of a secondary cell.

Ans. Potentiometer can be used to measure the internal resistance of a secondary cell.

Q.4. A cell of emf 2 V and internal resistance 0.1Ω is connected to a 3.9 Ω external resistance. What will be the potential difference across the terminals of the cell?

Ans. Potential difference V = IR $\left[\because I = \frac{E}{R+r}\right]$

$V = \frac{ER}{R+r} = \frac{2\times3.9}{3.9+0.1} = 1.95V$

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Q.5. In an experiment of meter bridge the balancing length of the wire is l. what would be its value if the radius of the meter bridge wire is double? Justify your answer.

Ans. The balancing length remains same as per relation

$$\frac{R}{S} = \frac{l}{100-l}$$

The balancing length is independent of radius of bridge wire provided that it is throughout uniform.

Q.6. What is the advantage of using thick metallic strips to join wires in a potentiometer?

Ans. Resistance of thick metallic strips is extremely small and hence negligible.

Q.7. Sometimes balance point may not be obtained on the potentiometer wire. Why?

Ans. The balance point may not be obtained on the potentiometer wire because the emf of the auxiliary battery is less than the emf of the cell to be measured.

Q.8. Are Kirchhoff's rules applicable to both AC and circuits?

Ans. Yes, Kirchhoff's rules are equally applicable to AC as well DC circuits.

Q.9. A meter bridge is also called a slide wire bridge why?

Ans. A meter bridge is also called a slide wire bridge because during the experiment the jockey is to be slided over the bridge wire.

Q.10. What is the end error in meter bridge? How do you remove it?

Ans. The end error in meter bridge is due to the following reasons

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(i) The zero mark of the scale provided along the bridge wire may not start from the position where the bridge wire leaves the copper strip and 100 cm mark of the scale may not be at position, where the bridge wire juct touches the other copper strip.

(ii) The resistances of connecting wire and copper strips of meter bridge have not been taken into account.

It can be removed by repeating the experiment by interchanging the known and unknown resistances and by taking the mean of resistances determined.

Q.11. (i) In a meter bridge, the balance point is found to be at 39.5 cm from the left A, if an unknown resistor X is in the left gap and a known resistor Y of resistance 12.5 Ω is in the right gap. Determine resistance of X. Why are the connections between resistors in a wheatstone or meter bridge made of thick copper strips?

(ii) Determine the balance point of the above bridge if X and Y are interchanged?

(iii) What happened if the galvanometer and cell are interchanged at the balance point of the bridge? Would the galvanometer show any current?

Ans. (i) Given, l = 39.5 cm, R = X = ?, S = Y = 12.5 Ω

$\therefore$ $S = \frac{100-l}{l} \times R$

$12.5 = \frac{100-39.5}{39.5} \times X$

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$\Rightarrow \quad X = \frac{12.5 \times 39.5}{60.5} = 8.16\Omega$

Thick copper strips are used to minimise resistance of the connections which are not accounted in the formula.

(ii) If X and Y are interchanged, l_1 and l_2 are also interchanged.

$\therefore \quad l$ = 100 – 39.5 = 60.5 cm

(iii) When galvanometer and cell are interchanged at the balance point of the bridge then the galvanometer will show no current.

Q.12. Vishwajeet purchased cells for his transistor. He felt that cells are not working properly. He wanted to check their emf. So, he took the cells to the physics lab and with the help of potentiometer found their emf. To his surprise emf was less than the value claimed by the manufacture. He lodged the complaint with consumer forum and received the deserving response.

(i) What values are displayed by Vishwajeet?

(ii) Why do you think Vishwajeet used potentiometer instead of voltmeter to find out emf of the cell? For more precise measurement the potential gradient of the potentiometer should be high or low?

Ans. (i) Values displayed by Vishwajeet are

(a) general awareness

(b) presence of mind

(c) use of scientific knowledge

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(ii) Potentiometer is based on null point method. Voltmeter draws current at the time of measurement of potential difference across the cell. So, it does not give the correct value of emf.

For more precise measurement it should be low.

Q.13. It is desired to supply a current of 2 A through a resistance of 10 Ω. As many as 20 cells are provided each of emf 2 V and internal resistance 0.5 Ω. Two friends Shihaj and Sanjeev try their hand on the problem. Shihaj succeeds but Sanjeev fails.

Read the above passage and answer the following questions

(i) Justify the set up of Shihaj?

(ii) What might have gone wrong with Sanjeev when he gets 1.4 A current in the external load?

(iii) What are the basic values shown by Shikaj and Sanjeev in their work?

Ans. (i) Here, n = 20, ε = 2V, r = 0.5 Ω, R = 10 Ω

If all the 20 cells are correctly connected in series to the external load of resistance R, then current in load is $I = \frac{n\varepsilon}{R+nr} = \frac{20\times2}{10+20\times0.5} = 2A.$

It means Shihaj set up is correct.

(ii) If one cell is wrongly connected in series arrangement of cells, it then reduces the total emf of the set up by an amount equals to two times the emf of each cell. Let m cells be connected wrongly by Sanjeev in series of total n cells than he got the current 1.4 A in the external load of resistance R (= 10 Ω). Therefore,

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$$I = 1.4 = \frac{(n-2m)\varepsilon}{(R+nr)}$$

$$= \frac{(20-2m)\times 2}{10+20\times 0.5}$$

On solving, we get m = 3. It means three cells are connected wrongly by Sanjeev.

(iii) Shihaj has proper knowledge and careful handling of the apparatus. That is why he got the required results from his setup. Sanjeev's knowledge is incomplete and his handling is careless. That is why he could not get the required results. Hence, to get proper results, one has to be extra careful and should plug all loopholes.

Q.14. Sarita, a house wife had been using in his house an inverter and a lead acid battery set for the last two years. Suddenly she felt the problem of low voltage and less back up from inverter. Instead of calling an electrician, she tried to set it right herself. On checking, she noted that the level of electrolyte was less than required in the battery. She was having acid for cleaning flush in her house. She poured that acid in the battery to raise the electrolyte to required level. After doing so, she noted that battery was permanently damaged.

Read the above passage and answer the following questions

(i) What wrong was done by Sarita?

(ii) What was the right way for sarita to get rid of the problem?

(iii) What do you learn from the above study?

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Ans. (i) Sarita used acid instead of distilled water in the battery to raise the level of electrolyte.

(ii) Sarita should have called an electrical who is expert in dealing with the inverter and battery.

(iii) A little knowledge is a dangerous thing. Therefore one should handle an appliance or apparatus when one has complete knowledge and information about it.

Q.15. Supraja was doing an experiment (Comparison of emfs) using potentiometer in physics lab. She could not take the reading because the galvanometer showed same side deflection. She checked the circuit and the connections were correct. Her friend Manasa who was doing her experiment nearby came to help Supraja. Manasa increased the voltage of the eliminator (by turning the knob) supplying current to the potentiometer. Supraja tried the experiment again and got the reading. She thanked Manasa for her help.

(i) What are the values displayed by both Supraja and Manasa?

(ii) State on reason why the galvanometer showed same side deflection.

(iii) Distinguish between emf and terminal potential difference.

Ans. (i) Sharing of knowledge, caring for and helping others.

(ii) The emf of the driving cell should be greater than the emf of the experimental cells.

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(iii) The potential difference between the terminals of a cell when the cell is in the open circuit is known as emf and the potential difference between the terminals of a cell when the cell is in the closed circuit is known as potential difference.

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