O P JINDAL SCHOOL, SAVITRINAGAR

PRACTICE PAPER – 07 SOLUTION

CLASS X PHYSICS TOPIS : ELECTRICITY

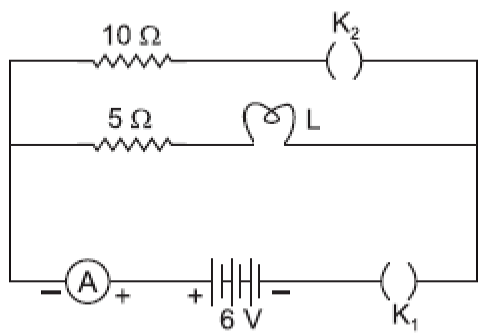
Date : 25/04/20 MM :25

1 List in a tabular form three differences between a voltmeter and an ammeter. 3

ANS: Difference between ammeter and voltmeter

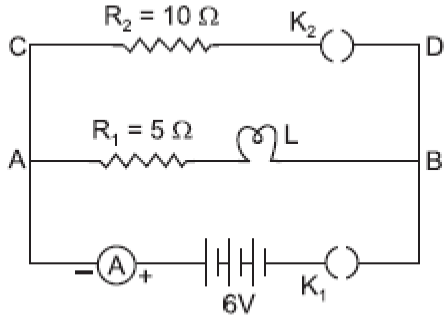
Ammeter	Voltmeter
(a) It measures electric current in a circuit (b) It is connected in series in a circuit. (c) It is a low resistance device.	(a) It measures the potential difference between two points in a circuit. (b) It is connected in parallel across the two points in a circuit. (c) It is high resistance device.

2 Study the circuit shown:



3

A current of 0.6 A is shown by ammeter in the circuit when the key K_1 is closed. Find the resistance of the lamp L. What change in current flowing through the 5 Ω resistor and potential difference across the lamp will take place, if the key K_2 is also closed. Give reason for your answer.



ANS: (a) When K_1 is closed and K_2 is open

$I_1 = 0.6$ A, $R_1 = 5\ \Omega$, $R_L = ?$

Using Ohm's law $V = IR_S$

$\Rightarrow 6 = 0.6 \times (5 + R_L)$ ...$R_S = R_1 + R_L$

$\Rightarrow 10 = 5 + R_L$

$\Rightarrow R_L = 5\ \Omega$

(b) Potential difference across lamp

$V_{L1} = IR_L = 0.6 \times 5 = 3.0$ V

Now key K_2 is also closed.

10 Ω resistor is now connected in parallel with series combination of R_1 and R_L, potential remains same across them.

So, $I_2 \times R_2 = I_1 \times R_s$

$$\Rightarrow \quad \frac{I_1}{I_2} = \frac{R_2}{R_S} = \frac{R_2}{R_1 + R_2} = \frac{10}{5+5} = \frac{10}{10} = 1$$

$$\Rightarrow \quad I_1 = I_2$$

Equivalent resistance of the circuit

$$\frac{1}{R} = \frac{1}{R_2} + \frac{1}{R_S} = \frac{1}{10} + \frac{1}{10} = \frac{1}{5} \qquad \text{... } (R_s = 10\ \Omega)$$

$$R = 5\ \Omega$$

So, total current drawn from the battery

$$I = \frac{V}{R} = \frac{6}{5}\ \text{A}$$

But, $I = I_1 + I_2 = 2I_1 \qquad (I_1 = I_2)$

$$\therefore \quad I_1 = \frac{I}{2} = \frac{1}{2} \times \frac{6}{5} = \frac{3}{5}\ \text{A} = 0.6\ \text{A}$$

So, there will be no change in the current flowing through 5 Ω conductor and potential difference across the lamp will also remain same in both the cases.

3 Electrical resistivities of some substances, in ohm-metre, at 20 °C are given as follows: 3

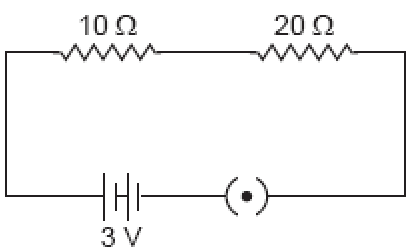
Silver	Copper	Tungsten	Mercury	Iron	Nichrome

1.60×10^{-8}	1.62×10^{-8}	5.2×10^{-8}	94×10^{-8}	10×10^{-8}	10×10^{-6}

(a) Out of the two silver and copper, which one is a better conductor of electric current and why?
(b) Which substance is preferred to be used for electrical transmission lines? Give reason.
(c) Name the material that you would advice to use in the heater element of electric heating device and why?

ANS: (a) Out of the two silver and copper, silver is a better conductor of electric current. This is because, the good conductor of electricity possesses low electrical resistivity. Between the silver and copper, silver has low electrical resistivity.
(b) Silver metal should be preferred for making the transmission line as its resistivity is lowest among the given metals. However due to its high cost, copper is preferred over silver as its resistivity is also low for electrical transmission line.
(c) Nichrome is the material that should be used in the heater element of electric heating device. This is because
(i) It is an alloy of metals.
(ii) Its resistivity is higher than that of its constituent metals.
(iii) It neither gets oxidised nor burn easily at high temperature.
(iv) It shows less rapid variations of resistivity due to change in temperature.

4 Study the following electric circuit and find (i) the current flowing in the circuit and (ii) the potential difference across 10 Ω resistor. 3



ANS: 10 Ω and 20 Ω are connected in series, their equivalent resistance is
$R_s = R_1 + R_2 = 10 + 20 = 30\ \Omega$
(i) Current flowing in the circuit

$$I = \frac{V}{R_s} = \frac{3}{30} = \frac{1}{10} = 0.1\ \text{A}$$

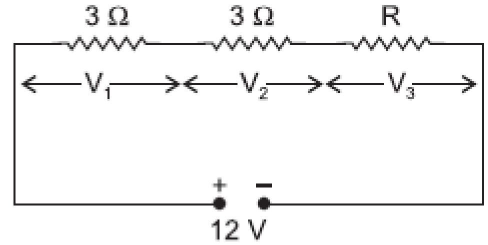
(ii) Potential difference across 10 Ω resistor

$$V = IR = \frac{1}{10} \times 10 = 1 \text{ volt.}$$

5 Two resistors 3 Ω and unknown resistor are connected in a series across a 12 V battery. If the voltage drop across the unknown resistor is 6 V, find
(a) potential across 3 Ω resistance (b) the current through unknown resistor 'R' 3
(c) equivalent resistance of the circuit.

ANS: (a) Same current will flow through each resistor of series combination, the potential drop across both 3 Ω resistor will be same ($V_1 = V_2$). In series, applied potential,

$$\begin{aligned} V &= V_1 + V_2 + V_3 \\ \Rightarrow \quad 12 &= V_1 + V_1 + 6 \\ 2V_1 &= 12 - 6 \\ V_1 &= 3 \text{ volt} \end{aligned}$$



(b) Current through 3 Ω resistance $I = \frac{V}{R} = \frac{3}{3} = 1$ A So, current through unknown resistance R is 1 A. (c) Unknown resistance $R = \frac{V}{I} = \frac{6}{1} = 6\ \Omega$ $\therefore$ Equivalent resistance, $R_s = R_1 + R_2 + R_3 = 3 + 3 + 6 = 12\ \Omega.$

6 Three bulbs each having power P are connected in series in an electric circuit. In another circuit, another set of three bulbs of same power are connected in parallel to the same source.

(i) Will the bulbs in both the circuits glow with the same brightness? Justify your answer. 5

(ii) Now let one bulb in each circuit get fused. Will the rest of the bulbs continue to glow in each circuit? Give reason.

(iii) Representing each bulb by a resistor, draw circuit diagram for each case.

ANS: (i) Bulbs in parallel provide more illumination. This is because in parallel combination.

(a) each bulb gets same voltage and is equal to the applied voltage.

(b) each bulb draws required current from the mains. Hence, they work properly.

Mathematical justification:

For three identical bulbs,

In series, $R_S = 3R$

In parallel, $R_P = \frac{R}{3}$.

The bulbs in the two circuits will not glow equally bright as the current through them is not the same.

In series, $I_S = \frac{V}{R_S} = \frac{V}{3R}$

In parallel, $I_P = \frac{V}{R/3} = \frac{3V}{R}$

So, $I_P > I_S$.

(ii) When one bulb in each circuit get fused,

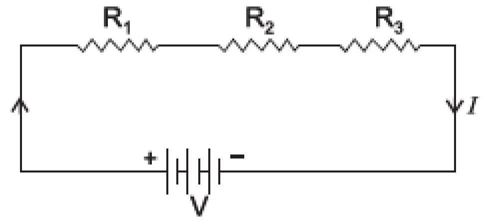
In series: Rest of the bulbs will not glow as circuit becomes an open circuit. This is because in series arrangement, there is only a single path for the flow of current.

In parallel: Rest of the bulbs will continue to glow as in parallel

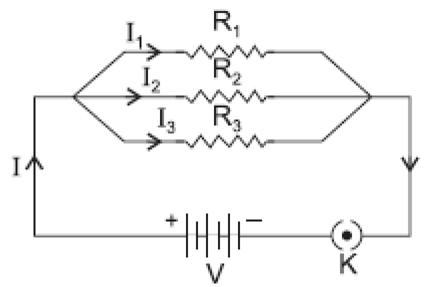
(a) individual branch in the circuit completes its own circuit. or

(b) different paths are available for the flow of current.

For series



For parallel



(iii) Circuit diagram

7 (a) Define electric power. Express it in terms of potential difference V and resistance R.

(b) An electrical fuse is rated at 2A. What is meant by this statement?

(c) An electric iron of 1 kW is operated at 220 V. Find which of the following fuses that respectively rated at 1 A, 3 A and 5 A can be used in it. 5

ANS: (a) Electric power: It is the rate of doing work by an energy source or the rate at which the electrical energy is dissipated or consumed per unit time in the electric circuit is called electric power.

So, $$\text{Power } P = \frac{\text{Work done (W)}}{\text{Time }(t)} = \frac{\text{Electrical energy dissipated}}{\text{Time }(t)} = \frac{VIt}{t} = VI = \frac{V^2}{R}$$

(b) It means, the maximum current will flow through it is only 2 A. Fuse wire will melt if the current exceeds 2 A value through it.

(c) Given: $P = 1$ kW = 1000 W, $V = 220$ V

$$\text{Current drawn, } I = \frac{P}{V} = \frac{1000}{220} = \frac{50}{11} = 4.54 \text{ A}$$

To run electric iron of 1 kW, rated fuse of 5 A should be used.