



SCIENCE CLASS X

CHAPTER-6 ELECTRICITY

Q.1. A bulb in an electric circuit is glowing. Is it a closed or open electric circuit?

Ans. A bulb is glowing in a closed electric because a continuous current is flowing through it.

Q.2. An ammeter has 20 divisions between zero mark and 2A mark on its scale.

What is the least count of ammeter?

Ans. Number of divisions = 20

Maximum reading of ammeter = 2 A

Therefore, Least count = $\frac{2}{20} = \frac{1}{10} = 0.1\text{A}$

Q.3. A student finds that there are 20 divisions between zero mark and 1 V mark of a voltmeter. Find the least count of his voltmeter.

Ans. Number of divisions = 20

Maximum reading of voltmeter = 1V

Therefore, Least count of voltmeter = $\frac{1}{20} = 0.05\text{ V}$

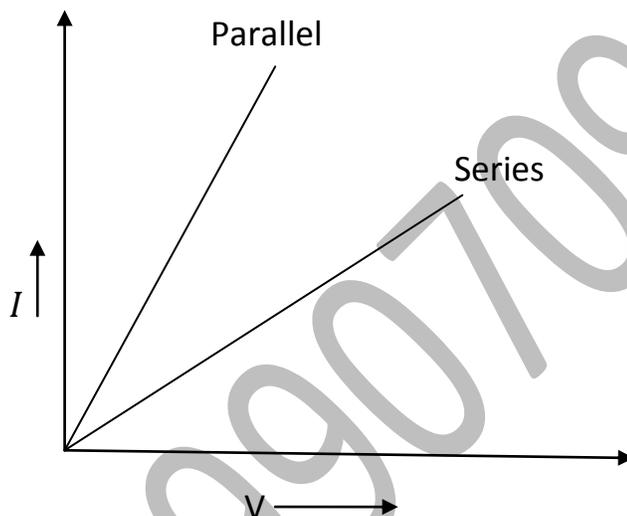
Q.4. Choose all the apparatus for performing the experiment to determine the equivalent resistance of two resistors when connected in series.

Ans. The set of apparatus required for performing the given experiment are battery, ammeter, connecting wires, rheostat, voltmeter, two resistors and key.



Q.5. A student of class X performed experiment on series and parallel combination of two given resistors R_1 and R_2 which obeys Ohm's law. Plot the V-I graph.

Ans. The required V-I graph is given below



Q.6. A student using the same two resistors, ammeter, voltmeter and battery makes two circuit connecting the two resistors first in series and other in parallel. If the ammeter and voltmeter readings in both the cases be I_1, I_2 and V_1, V_2 respectively. Write his observations.

Ans. His observation are $I_1 < I_2$ because in series combination resistor is higher so current is less. But $V_1 = V_2$ because in both the cases battery is same.

Q.7. What happens to the resistance as the conductor is made thicker?

Ans. The resistance decrease as the conductor is made thicker.

Q.8. What happens to the other bulbs in a series circuit if one bulb blows off?

Ans. In a series circuit, if one bulb blows off, then all other bulbs stop glowing.

Q.9. What are the important effects of electric current?



Ans. The important effects of electric current are

- (i) Heating effect
- (ii) Magnetic effect
- (ii) Chemical effect

Q.10. How can an ammeter be converted into a voltmeter?

Ans. An ammeter can be converted into a voltmeter by connecting a high resistance in series with it.

Q.11. What charge is carried by a conductor through which 4.5 A current flows in one minute?

Ans. Current (I) = 4.5A

Time (t) = 1 min = 60 s

Charge carried by a conductor, $Q = It$

$$= 4.5 \times 60 = 270 \text{ C}$$

Q.12. Why does an ammeter have negligible resistance?

Ans. An ammeter have negligible resistance so that maximum amount of current can flow through to measure the accurate amount of current.

Q.13. What causes the potential difference between the two terminals of a cell?

Ans. The chemical reaction occurring inside the cell generates excess of electrons at negative terminal and deficiency of electrons at positive terminal.

Q.14. Resistance of an incandescent filament of a bulb is comparatively much more than that when it is at room temperature. Why?



Ans. This is because when the bulb is switched on, the temperature of filament rises. As the temperature increases, the resistance of conductor increases.

Q.15. Give two examples for application of heating effect of electric current.

Ans. Electric iron and electric welding are two examples for application of heating effect of electric current.

Q.16. Name and define the smallest commercial unit of electricity.

Ans. The smallest commercial unit of electricity is watt hour. It is defined as the amount of electric energy which flows through a conductor in one hour, at power of 1 watt.

Q.17. What do you understand by the term fuse in an electric circuit?

Ans. Fuse is the weakest link placed in series in an electric circuit, which melts when the circuit gets overloaded or short circuited.

Q.18. Why closed path is required for the flow of current?

Ans. The closed path is required for the flow of current because it makes possible to move the electrons in a particular direction.

Q.19. When two ends of a metallic wire are connected across the terminals of a cell, some potential difference is set up between its ends. In which direction is set up between its ends. In which direction electrons are flowing through the conductors?

Ans. Electrons are flowing through the conductors from its lower potential end to its higher potential end.

Q.20. List any two important properties of electric charge.



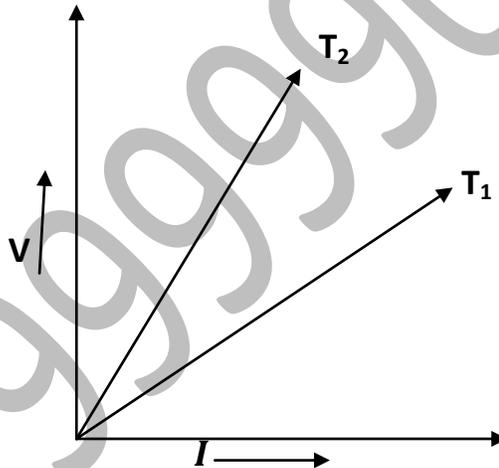
Ans. The two important properties of electric charge are

- (i) Like charges repel each other while unlike charges attract each other.
- (ii) Electric charge is conserved.

Q.21. The resistance of a resistor is kept constant and the potential difference across its two ends is decreased to half of its former value. State the change that will occur in the current flowing through it.

Ans. Current will reduce to half of its former value.

Q.22. The voltage- current (V-I) graph of a temperatures T_1 and T_2 is shown in figure. Which of the two temperatures is higher and why?



Ans. Resistance is equal to the slope of I - V graph. Here, slope of graph for temperature T_2 is higher so resistance of temperature T_2 is higher. Temperature T_2 is higher because resistance is proportional to temperature i.e., $T_2 > T_1$ as $R \propto T$.

Q.23. What is the total resistance of n resistors, each of resistance R , connected in parallel?



Ans. Total resistance of n identical resistors each of resistance R in parallel is given

$$\text{by } \frac{1}{R_p} = n \left(\frac{1}{R} + \frac{1}{R} + \frac{1}{R} + \dots + \frac{1}{R} \right)$$

$$R_p = \frac{R}{n}$$

Q.24. Nichrome is used to make the element of electric heater. Why?

Ans. Nichrome is used to make the element of electric heater because it is an alloy with high resistivity and high melting point.

Q.25. Why do we use copper and aluminium wires for transmission of electric current?

Ans. They are used for transmission of electric current because copper and aluminium have low resistivity and they are good conductors of electricity.

Q.26. Alloys are used in electrical heating devices rather than pure metals. Why?

Ans. Alloys do not oxidise readily at high temperature, so they are most resistant to corrosion. This is the reason due to which they are used in electric heating devices.

Q.27. Tungsten is used almost exclusively for filament of electric bulb. Support your view.

Ans. Resistivity of tungsten is very high as it is an alloy and it does not oxidise readily at very high temperature that's why it is used to make filaments of electric bulb exclusively.

Q.28. Why does the chord of an electric heater not glow while the heating does?



Ans. The chord of an electric heater is made of copper which has extremely low resistance. Due to this negligible resistance, heat is produced in it.

The heating element of an electric heater is made of nichrome wire. It glows because large amount of heat is produced to its high resistance.

Q.29. An electric bulb is rated 220 V and 100 W. Calculate the power consumed when it is operated on 110 V.

Ans. Given, $V_1 = 220V$, $P_1 = 100 W$

$V_2 = 110 V$, $P_2 = ?$

$$P_1 = \frac{V_1^2}{R} \implies 100 = \frac{(220)^2}{R} \dots\dots (i)$$

Let the power consumed be P_2 , when operated at 110 V.

Then, $P_2 = \frac{(110)^2}{R} \dots\dots(ii)$

From eqs. (i) and (ii), we get

$$\frac{P_2}{100} = \left(\frac{110}{220}\right)^2$$

$$\implies P_2 = \frac{1}{4} \times 100 = 25W$$

Q.30. n resistors, each of resistance R are first connected in series and then in parallel. What is the ratio of the total effective resistance of the circuit in series to parallel combination?

Ans. In series combination, $R_1 = nR$

In parallel combination, $R_p = \frac{R}{n}$

Therefore, $\frac{R_S}{R_P} = \frac{nR}{R/n} = n^2$



Q.31. A current of 1 A is drawn by a filament of an electric bulb. Find the number of electrons passing through a cross-section of the filament in 16 s.

Ans. Current, $I = \frac{Q}{t} = \frac{ne}{t}$

Therefore $n = \frac{It}{e}$

but here, $I = 1\text{A}$, $t = 16\text{s}$

and $e = 1.6 \times 10^{-19}$ electrons

therefore $n = \frac{1 \times 16}{1.6 \times 10^{-19}} = 10^{20}$

Q.32. If the current I through a resistor is increased by 100% (assume that temperature remains unchanged), find the increase in power dissipated.

Ans. $P = I^2R$,

Current after increased by 100 % = $I + \frac{100I}{100} = 2I$

$P' = (2I)^2R = 4I^2R$,

Therefore, Percentage increase of power dissipation

$$\begin{aligned} &= \frac{P' - P}{P} \times 100 \\ &= \frac{4I^2R - I^2R}{I^2R} \times 100 \\ &= 3 \times 100 = 300\% \end{aligned}$$

Q.33. What does quantization of charge mean?

Ans. It means that the total charge carried by a conductor is equal to the integral multiple of charge carried by a single electron.

Q is the amount of charge carried by n electrons, each having charge $e = 1.6 \times 10^{-19}$ C, then $Q = ne$



Q.34. A metallic wire of resistance R is cut into ten parts of equal length. Two pieces each are joined in parallel. What combinations are joined in parallel. What will be the effective resistance of the combination?

Ans. The resistance of a conductor is directly proportional to the length of the conductor. The resistance of each piece of wire, when it is cut into ten parts of equal length is

$$r = \frac{R}{10}$$

Two such pieces when joined in series, the equivalent resistance of these two parts

$$= r + r = 2r = \frac{2R}{10} = \frac{R}{5}$$

5 such elements are connected in parallel. Therefore, the total resistance R' will be

$$\begin{aligned} \frac{1}{R'} &= \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} + \frac{1}{R/5} \\ &= \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} = \frac{25}{R} \\ \Rightarrow R' &= \frac{R}{25} \end{aligned}$$

Q.35. An electrician connected a fuse wire of 15 A rating againwer outlets. Rahul was observing his activity and asked him why he had connected a wrong fuse. The electrician said that it would not be affected by power fluctuations frequently. Rahul, however, scolded him for such wrong practice and got the fuse changed.

On the basis of above passage, answer the following questions



(a) What values of Rahul are worthy of appreciation?

(b) Which characteristics of the electrician would you address?

(c) What would have happened if Rahul agreed with the electrician?

Ans. (a) Rahul is alert, careful, logical and firm on action.

(b) The electrician is careless, unconcerned and does not make constructive use of his knowledge and skill.

(c) If Rahul had agreed with the electrician, it would lead to heavy losses during the time of voltage fluctuations as fuse wire would not break the circuit.

Q.36. Why does the cord of an electric heater not glow while heating element does?

Ans. Heating element material has high resistivity. So, a lot of electrical energy is dissipated as heat and light, cord material has low resistivity. So, less heat is produced.

Q.37. What determines the rate at which energy is delivered by a current?

Ans. Electrical power determines the rate at which energy is delivered by a current.

Q.38. What is meant by Ohm's Law?

Ans. The current passing through a conductor is directly proportional to the potential difference across its ends, such that the physical conditions like temperature, density, etc remain unchanged.

$$V \propto I$$

$$\text{Or } V = RI$$



Q.39. Define electric circuit.

Ans. A closed and continuous path through which electric current flows. components of electric circuit are cell/ battery bulb, switch/key, fuse, connecting wire, ammeter, voltmeter, rheostat, galvanometer, etc.

Q.40. What is potential difference?

Ans. It is work done per unit charge in moving a unit positive charge between two points.

$$V = \frac{V_B - V_A}{Q} = \frac{W}{Q} \text{ or } 1V = 1 \text{ J/C}$$

Its is scalar quantity.

Measured by voltmeter

$$1\text{MV} = 10^{-3}\text{V},$$

$$1\text{KV} = 10^3\text{V},$$

M: 9999907099