# CHAPTER -12

ELECTRICITY

HOTS Questions and Answers

Q.1   What is represented by joule/coulomb?

Q.2   A charge of 2C moves between two plates, maintained at a p.d of 1V. What is the energy acquired by the charge?

Q.3   Why are copper wires used as connecting wires?

Q.4   A wire of resistivity ρ is stretched to double its length. What is its new resistivity?

Q.5   What is the resistance of connecting wire?

Q.6   What is the resistance of an ammeter?

Q.7   What is the resistance of a Voltmeter?

Q.8   Which has more resistance: 100W bulb or 60W bulb?

Q.9   How will you join three resistances, each of 2Ω so that the effective resistance is 3Ω?

Q.10 What happens to the current in a circuit if its resistance is doubled?

Q.11 What happens to the resistance of a circuit if the current through it is doubled?

Q.12 How does the resistance of a wire depend upon its radius?

Q.13 Two wires are of the same length, same radius, but one of them is of copper and the other is of iron. Which will have more resistance?

Q.14 Two wires of same material and same length have radii r_1 and r_2. Compare their resistances.

Q.15 Given a resistors each of resistors R. How will you combine them to get the
   (i) maximum and (ii) minimum effective resistance? What is the ratio of the maximum to minimum resistance?

Q.16 A wire of length L and resistance R is stretched so that its length its doubled. How will its (a) Resistance change (b) Resistively change ?

Q.17 Two students perform the experiments on series and parallel combinations of two given resistors R1 and R2 and plot the following V-I graphs.
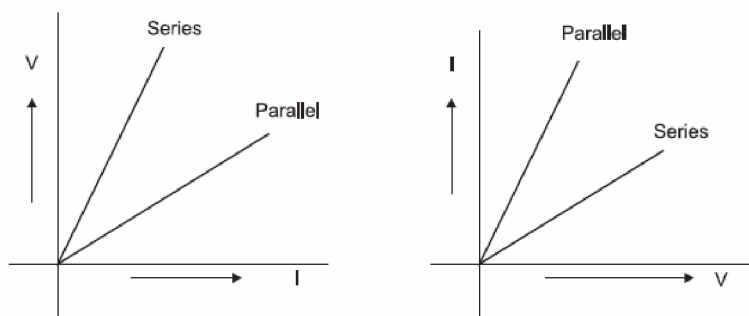
Which of the graphs is (are) correctly labelled in terms of the words 'series' and parallel' Justify your answer.

Q.18 A household uses the following electric appliances :
    (i) Refrigerator of rating 400W for ten hours each day.
    (ii) Two electric fans of rating 80W each for twelve hours each day.
    (iii) Six electric tubes of rating 18W each for 6 hours each day.
    Calculate the electricity bill of the household for the month of June if the cost per unit of electric energy is Rs. 3.00.

Q.19 Ammeter burns out when connected in parallel. Give reasons.

Answers of questions no 1-19

A.1 It represents potential difference.

A.2 $W=QV=2\times1=2J$

A.3 The electrical resistivity of copper is low.

A.4 It remains same because resistivity depends on nature of material.

A.5 The resistance of a connecting wire, which is made of good conductor, is negligible.

A.6 The resistance of an ammeter is very small and for an ideal ammeter, its value is zero.

A.7 The resistance of a voltmeter is very high and for an ideal voltmeter, its value is infinity.

A.8 As $R\alpha\ 1/P$.Thus, the resistance of 60W bulb is more.

A.9 A parallel combination of two resistances (which will be 1Ω) joined in series with the third resistance ($2\ \Omega$)

A.10 As $I\ \alpha\ 1/R$, the current is reduced to half of its previous value.

A.11 The resistance of the circuit does not depend on the current through it.

A.12 As $R\ \alpha\ 1/A$, $R\ \alpha\ 1/\pi r^2$ i.e. $R\ \alpha\ 1/r^2$.

A.13 As $R = \rho l/A$, but A and l are same it depends only on resistivity and it is more for iron so iron has more resistance.

A.14 If R_1 and R_2 are resistances, then $R_1/R_2 = r_2^2/r_1^2$ because ρ and l are same.

A.15 for maximum resistance $Rs= nr$ (Equivalent of series combination)
    for minimum resistance $Rp= r/n$ (Equivalent of parallel combination)
             $Rs/Rp= n^2$

A.16 (a) If the original length of the wire is l and its cross-sectional area is A, then $R = \rho l/A$.When length becomes 2l, cross-sectional area reduces to A/2 because volume does not change. The new resistance $=\rho\ (2l)/A/2=4\ \rho l/A = 4R$
    (b) Resistively does not change.

A.17 Both are correct because $\Delta V/\Delta I=$ resistance(R) and $\Delta I/\Delta V=1/R$
    Series means high resistance and parallel means low resistance.

A.18 Electrical energy consumed per day $= 400\times10+2\times80\times12+6\times18\times6$
                             $=4000+1920+648$
                             $= 6568$ Wh
                             $= 6.568$ kWh

    Electrical energy consumed in 30 days$= 6.568\times30$
 $= 197$ kWh (units)
    Electric Bill $=$ 197×3
             $=$ Rs 591.

A.19 Ammeter consists of a wire of low resistance when connected in parallel, a large amount of current passes through it hence gets burnt i.e. short circuited.

More Questions for Practice

Q.1 Name a substance whose resistance almost remains unchanged by increase of temperature.

Q.2 Name two special characteristics of heater coil.

Q.3 A wire of resistance 4Ω is bent to form a circle. What is the resistance between two diametrically opposite ends ?

Q.4 How does the resistance of a conductor change if its temperature is increased?

Q.5 A current of 4A flows in a wire of resistance 60Ω.Calculate electrical energy consumed in 2 minutes.

Q.6 V-I graph for two resistors is given. Which of the two has minimum resistance?
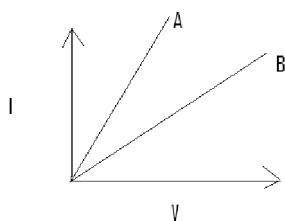
Q.7 Alloys are used in electrical heating devices rather than pure metals. Give one reason.

Q.8 An electric geyser has the ratings 2000W, 220V marked on it. What should be the minimum rating, in whole number of a fuse wire that may be required for safe use with this geyser?

Q.9 The electrical resistivity of few materials is given below in ohm-meter. Which of these materials can be used for making element of a heating device?

A 6.84×10^{-8}
B 1.60×10^{-8}
C 1.00×10^{-4}
D 2.50×10^{12}
E 4.40×10^{-5}
F 2.30×10^{17}

Q.10 Where do we connect a fuse: with live wire or with neutral wire?

Q.11 What is the resistance of an air gap?

Q.12 Name two safety measures commonly used in electric circuits and appliances.

Q.13 Two metallic wires A and B are connected in parallel. Wire A has length l and radius r, wire B has a length $2l$ and radius 2r. Compute the ratio of the total resistance of parallel combination and the resistance of wire A.

Q.14 What is the meaning of the term 'frequency' of an alternating current? What is its value in India? Why is an alternating current considered to be advantageous over direct current for long-range transmission of electric energy?

Q.15 A TV set picture tube shoots out a beam of electrons. The current due to this beam is 10 mA. How many electrons will strike the TV screen every second?

Q. 16 An electric wire is stretched to increase its length by 25%.By what % will the resistance be increased and what will be increase in its resistivity?

Q.17 An electric iron of resistance 20Ω takes a current of 5 A. Calculate the heat developed in 30 sec.

Q.18   A 60 W electric lamp gives off energy in the form of light at the rate of 7.5 J/s. What percentage of energy does the lamp transform into light?

Q.19   The voltage-current variation of two metallic wires A and B at constant temperature are shown in fig. Assuming that the wires have the same length and same diameter, explain which of the two wires will have larger resistivity.
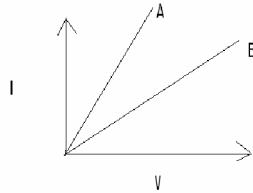
Q.20 You are given following current-time graphs from two different sources:
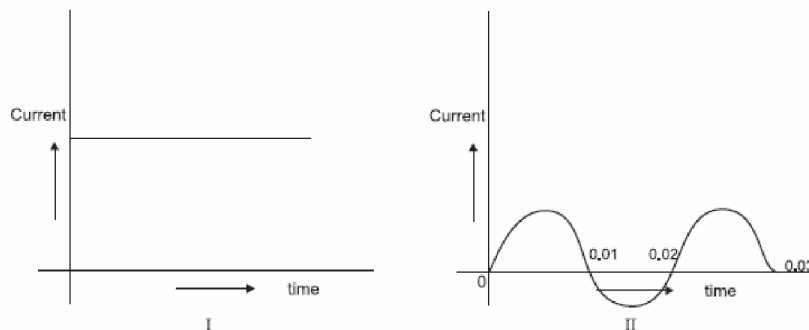
(i) Name the type of current in two cases.
(ii) Identify any one source for each type of these currents.
(iii) What is the frequency of current in case II in India?

Q.21 The electric power consumed by a device may be calculated by using either of the two expressions $P = I^2R$ or $P = V^2/R$. The first expression indicates that it is directly proportional to R whereas the second expression indicates inverse proportionality. How can the seemingly different dependence of P on R in these expressions be explained.

Q.22. Draw a schematic diagram of a circuit containing the following electrical components:(a) a resistance (b) a voltmeter (c) an electric bulb (d) a cell (e) an ammeter and (f) plug key