Chapter - (Electricity) **Class :- 10**

TOPIC :- 1

Very Short Answer Type Questions

Q.1. Define the SI unit of potential difference.

Q.2. Name the device that helps to maintain a potential difference across a conductor.

Q.3. State in brief the meaning of an electric circuit.

Q.4. State the relationship between 1 ampere and 1 coulomb.

Q.5. What is meant by potential difference between two points?

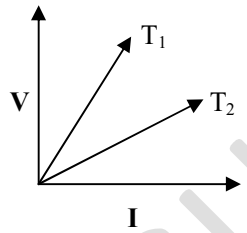
Q.6. Name the physical quantity which is same in all the resistors when they are connected in series.

Q.7. Name the physical quantity whose unit is volt/ampere.

Q.8. A charge of 150 coulomb flows through a wire in one minute. Find the electric current flowing through it.

Q.9. Calculate the number of electrons constituting one coulomb of charge. (charge on 1 electron = 1.6×10^{-19} C)

Q.10. The voltage –current (V-I) graph of a metallic conductor at two different temperatures T_1 and T_2 is shown below. At which temperature is the resistance higher?



Q.11. A given length of a wire is doubled of itself and this process is repeated once again. By what factor does the resistance of the wire changes?

Q.12. 400 J of heat is produced in 4 s in a 4 Ω resistor. Find potential difference across the resistor.

Q.13 State in brief the meaning of a variable resistor. Draw a circuit diagram to illustrate its function specially in the study of variation in current with the potential difference across a resistor.

Q.14. What happens to the resistance of a conductor when its area of cross-section is increased?

Q.15. Through which of the two wires, the electric current will flow more easily?

(i) a thick wire or (ii) a thin wire of the same material, and of the same length when connected to the same source?

Q.16. 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 through it.

Short Answer Type Questions – I

Q.1. Define electric current. Name the particles that constitute electric current flowing through the metallic wires.

Q.2. Define 'I Volt'. State the relation between work, change and potential difference for an electric circuit. Calculate the potential difference between the two terminals of the battery if 100 joules of work is required to transfer 20 coulombs of charge from one terminal of the battery to the other.

Q.3. State the physical quantity which is equal to the ratio of potential difference and current. Define its SI unit.

Q.4. List in a tabular form two differences between a voltmeter and an ammeter.

Q.5. State the factors on which at a given temperature the resistance of a cylindrical conductor depends. State the SI unit of resistivity.

Q.6. Draw a schematic diagram of an electric circuit comprising of 3 cells and an electric bulb, ammeter, plug – key in the ON mode and another with same components but with two bulbs in parallel and a voltmeter across the combination.

Q.7. Mention the condition under which charges can move in a conductor. Name the device which is used to maintain this condition in an electric circuit.

Q.8. Calculate the resistance of a metal wire of length 2 m and area of cross section 1.55×10^{-6} m^2, if the resistivity of the metal be $2.8 \times 10^{-8}\ \Omega m$?

Q.9. A battery of 12 V is connected to a series combination of resistors 3Ω, 4Ω, 5Ω and 12Ω. How much current would flow through the 12 W resistor?

Q.10. Calculate the work done in moving a charge of 2 coulombs across two points having a potential difference of 12 V.

Q.11. (i) Calculate the electrical energy consumed by a 1200 W toaster in 30 minute.

(ii) What will be the cost of using the same for 1 month if one unit of electricity costs ₹ 4?

Q.12. Draw a schematic circuit diagram for a circuit in which three resistors R_1, R_2 and R_3, a plug key under closed condition, an ammeter are joined is series with a 5V battery. Also a voltmeter is connected to measure the potential difference across the resistor R_1.

Short Answer Type Questions – II

Q.1. (i) What is meant by the statement: The potential difference between two points is 1 volt?

(ii) What do the symbols given above represent in a circuit? Write one function of each.

Q.2. Draw symbol of : (i) Rheostat, (ii) Voltmeter, (iii) Electric bulb

Q.3. Name and define S.I. unit of resistance. Calculate the resistance of a resistor if the current flowing through it is 200 mA, when the applied potential difference is 0.8 V.

Q.4. Define resistance. Write the SI unit of resistance. Match the correct range of resistivity with the materials given:

(i) Conductors (a) $10^{-6}\ \Omega m$

(ii) Alloys (b) $10^{12}\ to\ 10^{17} \Omega m$

(iii) Insulators (c) $10^{-6}\ to\ 10^{-8} \Omega m$

Q.5. (a) Nichrome wire of length I and radius 'r' has resistance of 10Ω. How would the resistance of the wire change when:

(i) Only length of the wire is doubled?

(ii) Only diameter of the wire is doubled? Justify your answer.

(b) Why element of electrical heating devices are made up of alloys?

Q.6. A wire of length *l* and area of cross-section A was drawn into a wire of double its length by melting it. If its original resistivity and resistance were ρ and R respectively, what will be its new resistivity and resistance?

Q.7. Derive an expression for electric energy consumed in a device in terms of V, I and t, where V is the potential difference applied to it, I is the current drawn by it and t is the time for which the current flows?

Q.8. The resistance of a wire of 0.01 cm radius is 10Ω. If the resistivity of the material of the wire is 50×10^{-8} ohm meter, find the length of the wire.

Q.9. In an electric field the work done in bringing a 2 coulomb charge from infinity to a point A is 10 joules and in bringing the same charge to some another point B is 20 joules. Find the potential difference between two points A and B. What would be the work done if the same charge is brought directly from A to B?

Q.10. The resistance per metre length of a wire is 10Ω. It the resistivity of the material of the wire is 50×10^{-18} ohm metre, find the area of cross – section of the wire.

Q.11. Three resistors of 5Ω, 10Ω and 15Ω are connected in series and the combination is connected to the battery of 30 V. Ammeter and voltmeter are connected in the circuit. Draw a circuit diagram to connect all the devices in proper correct order. What is the current flowing and potential difference across 10Ω resistance?

Q.12. Draw schematic diagram of a circuit consisting of a battery of five 2V cells, a 5 ohm, a 10 ohm and a 15 ohm resistor and a plug key, all connected in series. Calculate the electric current passing through the above circuit when the key is closed.

Q.13. An electric bulb is rated at 60W, 240V. Calculate its resistance. If the voltage drops to 192V, calculate the power consumed and the current drawn by the bulb. (Assume that the resistance of the bulb remains unchanged).

Long Answer Type Questions

Q.1. What does an electric circuit mean? Name a device that helps to maintain a potential difference across a conductor in a circuit. When do we say that the potential difference across a conductor is 1 volt? Calculate the amount of work done in shifting a charge of 2 coulombs from a point A to B having potentials 110 V and 25 V respectively.

Q.2. (i) Name an instrument that measures electric current in a circuit. Define unit of electric current.

(ii) Draw a closed circuit diagram consisting of 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V and a plug key.

Q.3. (i) Draw a labelled circuit diagram to study a relationship between potential difference (V) across the two ends of a counductor and the current (I) flowing through it. State the formula to show how I in a conductor varies when V across it is increased stepwise. Show this relationship also on a schematic graph.

(ii) Calculate the resistance of a conductor if the current flowing through it is 0.25 A when the applied potential difference is 1.0 V.

Q.4. (a) Two identical resistors each of resistance 10 ohm are connected in: (i) Series, (ii) parallel.
In turn to a battery of 6V. Calculate the ratio of power consumed by the combination of resistor in the two cases.

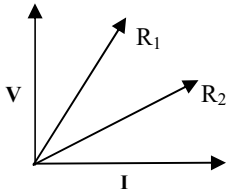
(b) List two factors on which the resistance of a conductor depends.

(c) Write a difference between an ammeter and voltmeter.

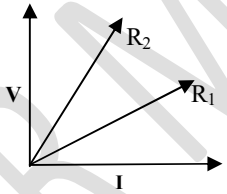
Q.5. How will you convert a given set of resistors so that the equivalent resistance is increased? Give reason for your answer.

Q.6. (a) Two students perform experiments on two given resistors R_1 and R_2 and plot the following V-I graphs.
If $R_1 > R_2$, which of the two diagrams correctly represent the situation on the plotted curves? Justify your answer.

Graph 1



Graph 2



(b) An electric lamp of 24Ω and a conductor of 6Ω are connected in parallel to a 12 V battery Calculate:

(i) Total resistance

(ii) Total current in the circuit

(iii) Potential difference across the conductor.

Q.7. Draw a circuit diagram for a circuit consisting of a battery of five cells of 2 volts each, a 5 Ω resistor, a 10 Ω resistor and a 15 Ω resistor, an ammeter and a plug key; all connected in series. Also connect a voltmeter to record the potential difference across the 15 Ω resistor and calculate:

(i) the electric current passing through the above circuit and

(ii) potential difference across 5 Ω resistor when the key is closed.

Topic - 2

Very Short Answer Type Questions

Q.1. Write SI unit of resistivity.

Q.2. What is commercial unit of energy?

Q.3. On what principle is an electric bulb based?

Q.4. What is electric power? State its SI unit.

Q.5. Name the instrument used for measuring: (i) Potential difference (ii) Current.

Q.6. Mention one reason why tungsten is exclusively used for making filaments of electric lamps.

Q.7. In a circuit if two resistors of 5 Ω and 10 Ω are connected in series. Compare the current passing through the two resistors.

Q.8. How is an ammeter connected in a circuit to measure the current flowing through it?

Q.9. Why are coils of electric toasters and electric irons made of alloy rather than pure metals?

Q.10. What determines the rate at which energy is delivered by a current?

Q.11. Write the relation between resistance (R) of filament of a bulb, its power (P) and a constant voltage V applied across it.

Q.12. Which is having more resistance – a 220 V, 100 W bulb or a 220 V, 60 W bulb.

Q.13. Find the minimum resistance that can be made using five resistors, each of 5Ω.

Short Answer Type Questions – I

Q.1. Define least count with one example.

Q.2. Name the Physical quantity that determines the rate at which energy is delivered by an electric current. State and define the unit of this physical quantity.

Q.3. State the factors on which the heat produced in a current carrying conductor depends. Give one Practical application of this effect. $H = I^2 Rt$

Q.4. (i) Why are electric bulbs filled with chemically inactive nitrogen or organ?

(ii) What is meant by the statement that the rating of a fuse in a circuit is 5A?

Q.5. Explain two disadvantages of series arrangement for household circuit.

Q.6. Give reasons for the following:

(i) Electric bulb are usually filled with chemically inactive gases like nitrogen and argon.

(ii) Fuse wire is placed in series with the device.

Q.7. While experimentally verifying ohm's law a student observed that pointer of the voltmeter coincide with 15^{th} division when the voltmeter has a least count of 0.05. V. Find the observed reading of voltmeter.

Q.8. An electric heater rated 800 W operates 6h/day. Find the cost of energy to operate it for 30 days at ₹ 3.00 per unit.

Q.9. How much current will an electric bulb draw from 220 V source if the resistance of the bulb is 1200 Ω? If in place of a bulb, a heater of resistance 100 Ω is connected to the sources, calculate the current drawn by it.

Q.10. An electric iron takes a current of 5 A and develops 1.5×10^4 J of heat energy in 30s. Calculate the resistance of the electric iron.

Short Answer Type Questions – II

Q.1. What is an electric fuse? What is its in electric circuits? Should it be placed on natural wire or on live wire? Justify your answer.

Q.2. (i) Define electric power. A device of resistance R is connected across a source of V voltage and draws a current I. Derive an expression for power in terms of voltage and resistance.

(ii) An electric bulb is connected to a 220 V generator. The current is 0.5 A. What is the power of the bulb?

Q.3. (i) State one difference between Kilowatt and Kilowatt hour. Express 1 kWh in joules.

(ii) A bulb is rated 5V; 500 mA. Calculate the rated power and resistance of the bulb when it glows.

Q.4. Define electric power. An electric motor is rated at 2kW. Calculate the cost of using it for 2 hours daily for the month of September if each unit costs ₹ 6.00.

Q.5. State Ohm's law. Draw a circuit diagram to verify this law indicating the positive and negative terminals of the battery and the meters. Also show the direction of current in the circuit.

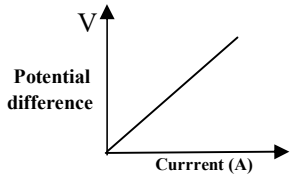
Q.6. Give reason for the following:

(i) Why are copper and aluminium wires used as connecting wires?

(ii) Why is tungsten used for filament of electric lamps?

(iii) Why is lead – tin alloy used for fuse wires?

Q.7. V-I graph for a conductor is as shown in figure.



(i) What do you infer from this graph?

(ii) State the law expressed here.

(iii) Name the physical quantity represented by the slope of this graph and state its SI unit.

Q.8. Show four different ways in which three resistors of 'r' ohm each may be connected in a circuit. In which case is the equivalent resistance of the combination: (i) Maximum (ii) Minimum.

Q.9. Can you run electric geysor with power rating 2 kW; 220 V on a 5 A line? Give reason to justify your answer.

Q.10. Explain the following:

(i) The elements of electric heating devices such as bread-toasters and electric iron are made of an alloy rather than of a pure metal.

(ii) Series arrangement is not used for domestic circuits.

(iii) Copper and aluminium wires are usually employed for electricity transmission.

Q.11. Electrical resistivities of some substances, in ohm – meter, at 20℃ are given as follows:

Silver	1.60×10^{-8}
Copper	1.62×10^{-8}
Tungsten	5.2×10^{-8}
Mercury	94×10^{-8}
Iron	10×10^{-8}
Nichrome	10×10^{-6}

(i) Out of the silver and copper, which is a better conductor of electric current and why?

(ii) Which substance is preferred to be used for electrical transmission lines? Give reason.

(iii) Name the material that you would advise to be used in the heater elements of electric heating device and why?

Q.12. Two devices of rating 44W; 200V and 11W; 220V are connected in series. The combination is connected across a 440V mains. The fuse of which of the two devices is likely to burn when switch is on? Justify your answer.

Q.13. Derive an expression for the combination of two resistances connected in series.

Q.14. Semi – conductors are certain type of metals which allow only partial current to pass through them in one direction only. In a solar cell, the pieces (wafers) of semi – conductors materials containing inpurities are so arranged that potential difference develops between two regions of the semi – conductors when light falls on it. A lead storage battery is connected in the circuit which gets charged and can be used as and when desired.

(i) How does conductivity of semi – conductors increases?

(ii) Name any four materials which act as a semi – conductor.

Q.15. A bulb is rated at 200V – 40W. What is its resistance? 5 such bulbs are lighted for 5 hours. Calculate the electrical energy consumed? Find the cost if the rate is 5.10 per kWh.

Q.16. Three resistors of 10 Ω, 15 Ω and 20 Ω are connected in series in a circuit. If the potential drop across the 15 Ω resistor is 3 V, find the current in the circuit and potential drop across the 10 Ω resistor.

Q.17. A circuit has a line of 5 A. How many lamps of rating 40W, 200V can simultaneously run on this line safely?

Q.18. Calculate the resistance of a 1 km long copper wire of area of cross section 2×10^{-2} cm^2. The resistivity of copper is 1.623×10^{-8} ohm – meter.

Q.19. Calculate the amount of heat generated while transfering 90000 coulombs of charge between the two terminals of a battery of 40V in one hour. Also determine the power expended in the process.

Q.20. An electric heater is used on 220 V supply and takes a current of 5A.What is its power? Calculate the per hour cost of using the heater if 1 unit costs Rs. 6.0.

Q.21. Show how would you connect three resistors each of resistance 6Ω, so that the combination has a resistance of (i) 9Ω and (ii) 4Ω.

Q.22. A hot plate connected to a 220 V line has two resistance coils A and B, each of 22 W resistance. Calculate the amount of electric current flowing when these coil are:

(i) used individually

(ii) connected in series.

(iii) connected in parallel.

Q.23. A torch bulb is rated 5 V and 500 mA. Calculate its (i) Power, (ii) resistance, (iii) energy consumed when it is lighted for 4 hours.

Q.24. A lamp rated 60W and an electric iron rated 800W are used for 6 hours everyday. Calculate the total energy consumed in 30 days.

Q.25. (i) Draw a diagram to show how two resistors R_1 and R_2 are connected in parallel.

(ii) In a circuit if two resistors of 4Ω and 8Ω are connected in parallel, find out the ratio of current passing through the two resistors.

Q.26. A wire of resistance R is cut into five equal parts. These parts are then connected in parallel. If the equivalent resistance of this combination is R'. Calculate the ratio R/R'. Draw a circuit diagram to show two resistors R_1 and R_2 connected in parallel along with a battery, key, ammeter and voltmeter.

Q.27. Amongst iron, silver, nichrome, tungsten, copper, which metal / alloy should be used to make the

(i) Heating element of electric geysers

(ii) Filament of incandescent bulbs.

An electric iron has rating of 750W, 220V. Calculate :

(i) Current required and

(ii) Its resistance when it is in use.

Q.28. Find the equivalent resistance across the two ends A and B of this circuit.

Q.29. Calculate the amount of heat generated when 7200 coulombs of charge is transferred in one hour through a potential difference of 50 V.

Q.30. An electric iron consumes energy at a rate of 840W when heating is at the maximum and 360W, When the heating is at the minimum. The voltage at which it is running is 220V. What are the current and resistance values in each case?

Q.31. Study the circuit shown in which three identical bulbs B_1, B_2 and B_3 are connected in parallel with a battery of 4.5 V.

(i) What will happen to the glow of other two bulbs if the bulb B_3 gets fused?

(ii) If the wattage of each bulb is 1.5 W, how much reading will the ammeter A show when all the three bulbs glow simultaneously.

Q.32. How many resistors of 88 Ω are connected in parallel to carry 10 A current on a 220 V line?

Q.33.(i) What is the total resistance of n resistors each of resistance 'R' connected in: (a) Series, (b) parallel.

(ii) Calculate the resultant resistance of 3 resistors 3 Ω, 4 Ω and 12 Ω are connected in parallel.

Q.34. A 400 W refrigerator operates for 16 h per day. Calculate the cost to operate if for 30 days at ₹ 3.40 kWh.

Q.35. The resistance offered by a wire of unit length and unit cross – sectional area is called resistivity. For a material irrespective of length and area, the resistivity is a constant. It is also called specific resistance of the material. Metals and alloys have low resistivity while insulators have high resistivity. Resistivity of two elements A and B are 1.62×10^{-8} Ωm and 520×10^{-8} Ωm respectively. Out of these two, name the element that can be used to make:

(i) filament of electric bulb.

(ii) wires for electrical transmission lines.

Long Answer Type Questions

Q.1 What is meant by electric current? Name and define S.I. unit. In a conductor electrons are flowing from B to A. What is the direction of conventional current? Give justification for your answer.

A steady current of 1 Ampere flows through a conductor. Calculate the number of electrons that flow through any 5 section of conductor in 1 second. (Charge on electron = 1.6×10^{-1} C)

Q.2. (i) What is meant by potential difference? State its SI unit.

(ii) Name a device that helps to maintain a potential difference across a conductor.

(iii) Calculate: (a) the highest, (b) the lowest resistance that can be obtained by the combination of four coils of resistances 4Ω, 8Ω, 12Ω and 24Ω?

Q.3. Establish a relationship to determine the equivalent resistance R of a combination of three resistors having resistances R_1, R_2 and R_3 connected in series. Calculate the equivalent resistance of the combination of three resistors of 2Ω, 3Ω and 6Ω joined in parallel.

Q.4. (i) Derive an expression for Joule's law of heating.

(ii) Give two examples for applications of heating effect of electric current.

(iii) 100 J of heat is produced each second in a 4Ω resistor. Find the potential difference across the resistor.

Q.5. (i) A wire of resistivity ρ is stretched to double it's length which is it's new resistivity. Giv reason for your answer.

(ii) Draw a schematic diagram of a circuit consisting of a battery of three cells of 2V each, a 5Ω resistor, 8Ω resistor and 12Ω resistor and a plug key all connected in series.

(iii) Two wires, one of copper and other of manganese have equal lengths and equal resistances which is thicker. (Give that resistivity of manganese is lower than that of copper.)

Q.6. (i) Derive an expression for the equivalent resistance of three resistors R_1, R_2 and R_3 connected in series.

(ii) Fuse of 3A, 5A and 10A are available. Calculate and select the fuse for operating electric iron of 1 kW power at 220 V line.

Q.7. (i) What is meant by the statement that the resistance of a wire is 1Ω?

(ii) To identical resistors each of resistance 12 Ω are connected (i) in series (ii) parallel, inturn to a battery of 6 V.

Calculate the ratio of power consumed in the combination of resistors in the two cases.

(iii) What combination is used for connecting the circuit to measure the potential difference across two points?

Q.8. (i) Explain the term: Heating effect of electric current.

(ii) Derive an expression for the heat produced by electric current and state Joule's Law.

(iii) Explain why an inert gas like argon is filled in bulbs.

Q.9. (i) State Ohm's law. Give mathematical relation between potential difference (V), Current (I) and resistance (R) of a conductor. Draw an electric circuit for studying ohm's aw.

(ii) When a 12 V battery is connected across an unknown resistor, 2.5 mA ccurrent flows in the circuit. Find the resistance of the resistor.

Q.10. Draw a labelled circuit diagram to study the relationship between the current (I) flowing through a conductor and the potential difference (V) applied across its two ends. State the formula co – relating the I in a conductor and the V across it. Also show their relationship by drawing a diagram.

What would be the resistance of a resistor if the current flowing through it is 0.15 A when the potential difference across it is 1.05 V?

Q.11. Two conductors A and B of resistances 5 Ω and 10 Ω respectively are first joined in parallel and then in series. In each case the voltage applied is 20 V.

(i) Draw the circuit diagram to show the combination of these conductors in each case.

(ii) In which combination will the voltage across the conductors A and B be the same?

(iii) In which arrangement will the current through A and B be the same ?

(iv) Calculate the equivalent resistance for each arrangement.