GIST OF THE LESSON

1. **Positive and negative charges:** The charge acquired by a glass rod when rubbed with silk is called positive charge and the charge acquired by an ebonite rod when rubbed with wool is called negative charge.

2. **Coulomb:** It is the S.I. unit of charge. One coulomb is defined as that amount of charge which repels an equal and similar charge with a force of 9×10^9 N when placed in vacuum at a distance of 1 meter from it. Charge on an electron = -1.6×10^{-19} coulomb.

3. **Static and current electricities:** Static electricity deals with the electric charges at rest while the current electricity deals with the electric charges in motion.

4. **Conductor:** A substance which allows passage of electric charges through it easily is called a 'conductor'. A conductor offers very low resistance to the flow of current. For example copper, silver, aluminium etc.

5. **Insulator:** A substance that has infinitely high resistance does not allow electric current to flow through it. It is called an 'insulator'. For example rubber, glass, plastic, ebonite etc.

6. **Electric current:** The flow of electric charges across a cross-section of a conductor constitutes an electric current. It is defined as the rate of flow of the electric charge through any section of a conductor. Electric current = Charge/Time or
   $I = Q/t$
   Electric current is a scalar quantity.

7. **Ampere:** It is the S.I. unit of current. If one coulomb of charge flows through any section of a conductor in one second, then current through it is said to be one ampere.
   1 ampere = 1 coulomb/1 second or $1\ A = 1C/1s = 1Cs^{-1}$
   1 milliampere = $1\ mA = 10^{-3}\ A$
   1 microampere = $1\mu A = 10^{-6}\ A$

8. **Electric circuit:** The closed path along which electric current flows is called an 'electric circuit'.

9. **Conventional current:** Conventionally, the direction of motion of positive charges is taken as the direction of current. The direction of conventional current is opposite to that of the negatively charged electrons.

10. **Electric field:** It is the region around a charged body within which its influence can be experienced.

11. **Electrostatic potential:** Electrostatic potential at any point in an electric field is defined as the amount of work done in bringing a unit positive charge from infinity to that point. Its unit is volt. Positive charges move from higher to lower potential regions. Electrons, being negatively charged, move from lower to higher potential regions.

12. **Potential difference between two points:** The Potential difference between two points in an electric field is the amount of work done in bringing a unit positive charge from one to another.
Potential difference = Work done/Charge or V = W/Q

13. **One volt potential difference:** The Potential difference between two points in an electric field is said to one volt if one joule of work has to be done in bringing a positive charge of one coulomb from one point to another. 1 volt = 1 joule/1 coulomb or 1 V = 1J/1C

14. **Galvanometer:** It is device to detect current in an electric circuit.

15. **Ammeter:** It is device to measure current in a circuit. It is always connected in series in a circuit.

16. **Voltmeter:** It is a device to measure potential difference. It is always connected in parallel to the component across which the potential difference is to be measured.

17. **Ohm's law:** This law states that the current passing through a conductor is directly proportional to the potential difference cross its ends, provided the physical conditions like temperature, density etc. remains unchanged.

$$V \alpha I \quad \text{or} \quad V = RI$$

The proportionality constant R is called resistance of conductor.

18. **Resistance:** It is a property of a conductor by virtue of which it opposes the flow of current through it. It is equal to the ratio of the potential difference applied across its ends and the current flowing through it.

Resistance = Potential difference/Current or R = V/I

19. **Ohm:** It is the S.I. unit of resistance. A conductor has a resistance of one ohm if a current of one ampere flows through it on applying a potential difference of one volt across its ends.
1 ohm = 1 volt/1 ampere or $1\Omega = 1V/1A$

20. **Factors on which resistance of a conductor depends:** The resistance R of a conductor depends

    i) Directly on its length L i.e. $R \alpha L$.
    ii) inversely on its area of cross-section A i.e. $R \alpha 1/A$
    iii) on the nature of material of the conductor on.
    On combining the above factors, we get
    $R \alpha L/A$
    $R = \rho * L/A$ The proportionality constant ρ is called resistivity of conductor.

21. **Resistivity:** It is defined as the resistance offered by a cube of a material of side 1 m when current flows perpendicular to its opposite faces. Its S.I. unit is ohm-meter (Ωm).
Resistivity, $\rho = RA/L$

22. Equivalent resistance: If a single resistance can replace the combination of resistances in such a manner that the current in the circuit remains unchanged, then that single resistance is called the equivalent resistance.

23. Laws of resistances in series:

i) Current through each resistance is same.

ii) Total voltage across the combination = Sum of the voltage drops.

$V = V_1 + V_2 + V_3$

iii) Voltage drops across any resistor is proportional to its resistance.

$V_1 = IR_1$, $V_2 = IR_2$, $V_3 = IR_3$

iv) Equivalent resistance = Sum of the individual resistances.

$R_s = R_1 + R_2 + R_3$

v) Equivalent resistance is larger than the largest individual resistance.

24. Laws of resistances in parallel:

i) Voltage across each resistance is same and is equal to the applied voltage.

ii) Total current = Sum of the currents through the individual resistances.

$I = I_1 + I_2 + I_3$

iii) Currents through various resistances are inversely proportional to the individual resistances.

$I_1 = V/R_1$, $I_2 = V/R_2$, $I_3 = V/R_3$

iv) Reciprocal of equivalent resistance = Sum of reciprocals of individual resistances.

$1/R_p = 1/R_1 + 1/R_2 + 1/R_3$

v) Equivalent resistance is less than the smallest individual resistance.

25. Joule's law of heating: It states that the heat produced in a conductor is directly proportional to (i) the square of the current I through it (ii) proportional to its resistances R and (iii) the time t for which current is passed. Mathematically, it can be expressed as

$H = I^2Rt$ joule $= I^2Rt/4.18$ cal

or

$H = VIt$ joule $= VIt/4.18$cal

26. Electric energy: It is the total work done in maintaining an electric current in an electric circuit for given time.

$$\text{Electric energy, } W = VIt = I^2Rt \text{ joule}$$

27. Electrical power: Electrical power is the rate at which electric energy is consumed by an appliance.

$$P = W/t = VI = I^2R = V^2/R$$

28. Watt: It is the S.I. unit of power. The power of an appliance is 1 watt if one ampere of current flows through it on applying a potential differences of 1 volt across its ends.

1 watt = 1 joule/1 second =1 volt x 1 ampere

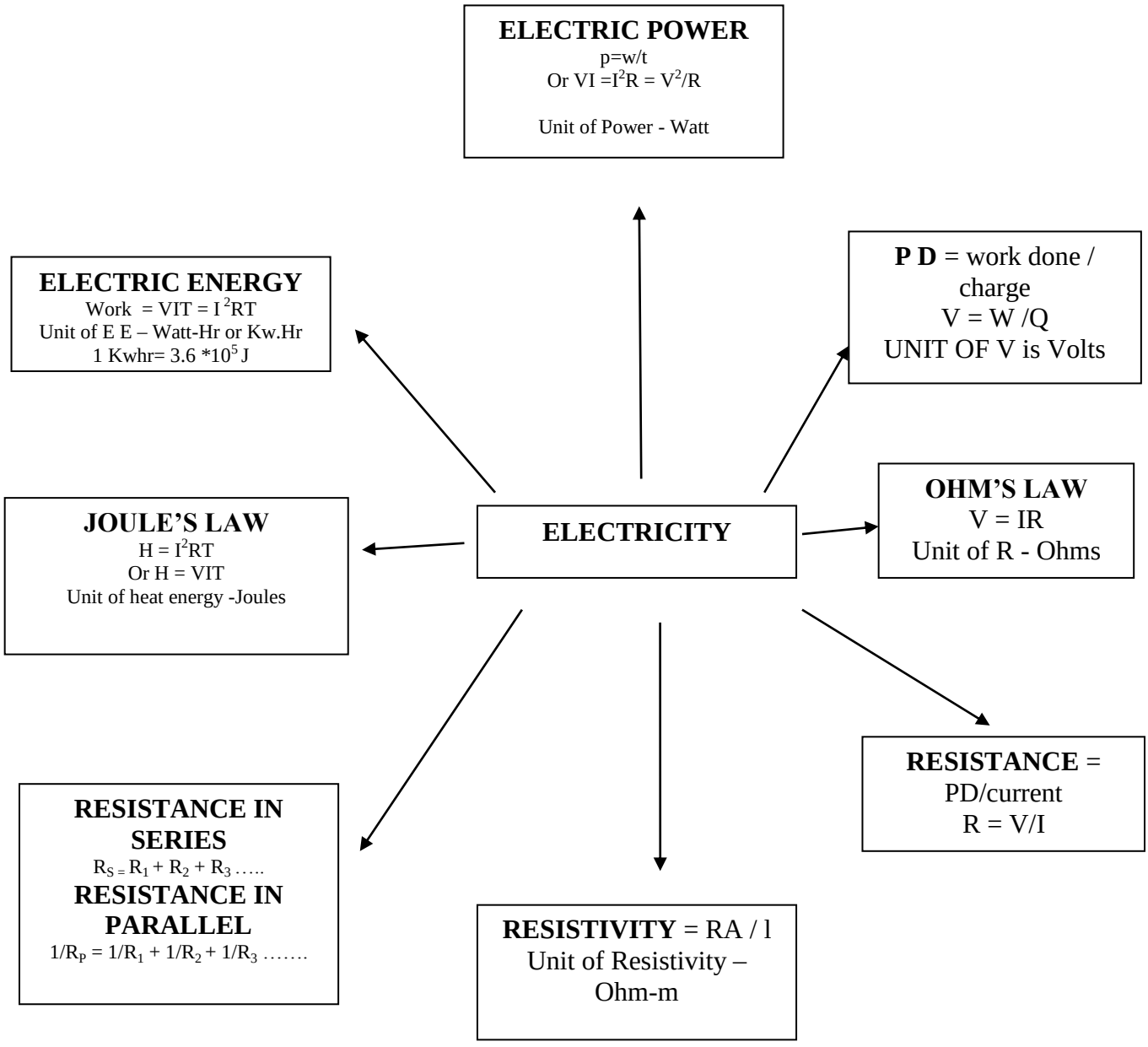
or $1\ W = 1\ Js^{-1} = 1\ VA$

1 kilowatt = 1000 W

29. Kilowatt hour: It is the commercial unit of electrical energy. One kilowatt hour is the electric energy consumed by an appliance of 1000 watts when used for one hour.

1 kilowatt hour (kWh) = 3.6 x 10^6 J

MIND MAP



ELECTRICITY
FORMATIVE ASSESSMENT I
Q. PAPER

MARKS-30 TIME- 70 MINUTES

Instructions:

- Questions : 1 to 5 – 1 Mark each
- Questions : 6 to 9 – 2 Marks each
- Questions : 10 to 13 – 3 Marks each
- Question 14 – 5 Marks

1. Define resistivity of material.

2. What is the power of torch bulb rated at 2.5V and 500mA?

3. Why series arrangement not used for connecting domestic electrical appliances in a circuit?

4. Which has higher resistance – a 50W bulb or a 2.5W bulb and how many times?

5. What is the direction of flow of conventional current?

6. Why is it not advisable to handle electrical appliances with wet hands?

7. Two electric bulbs marked 100W 220V and 200W 200V have tungsten filament of same length. Which of the two bulbs will have thicker filament?

8. How does the resistance of a wire vary with its area of cross section?

9. Draw the following symbols

   i) Battery ii) Switch closed
   iii) Resistor of resistance R iv) Voltmeter

10. A geyser is rated 1500W, 250V. This geyser is connected to 250V mains. Calculate –
    i) The current drawn
    ii) The energy consumed in 50hrs.
    iii) The cost of energy consumed at Rs. 2.20 per kWh.

11. What is the function of an electric fuse? Name the material used for making fuse. In household circuit where is fuse connected?

12. Write one important advantage of using alternative current. How alternating current differ from direct current?

13. What is the difference between short circuiting and overloading?

14. a) Draw diagram showing three resistors R_1, R_2 and R_3 in series.
    b) Two resistors of resistance 4Ω and 12Ω
       i) In parallel
       ii) In series
    Calculate the values of effective resistance in each case.

HOTS QUESTIONS (SOLVED / UNSOLVED)

Q.1. Why is the tungsten metal more coiled in the bulb and not installed in straight parallel wire form?

Ans. The coiled wire of tungsten increases the surface area of the wire in very less space so as to emit more light and helps in glowing with more intensity.

Q.2. Why are fairy decorative lights always connected in parallel?

Ans. When the fairy lights are connected in series the resistance offered will be greater and brightness of the bulbs will be affected. But in parallel connection all the bulbs will glow with same intensity and if any more bulbs gets fused the other bulbs will continue to glow.

Q.3. What will happen when -

a) Voltmeter is connected in series?
b) Ammeter is connected in parallel?

Ans. a) Negligible current will pass through the circuit because the voltmeter has a very high resistance.

b) Ammeter will get damaged due to flow of large amount of current through it, because it has low resistance.

ELECTRICITY
ORAL QUESTIONS (CONVERSATION TYPE)

1. a) Why is electricity more useful than other forms of energy?
   b) How is static electricity different from current electricity?
   c) What are conductors? Give examples.
   d) What are insulators? Give examples.

2. a) What constitutes an electric current?
   b) Name the SI unit of electric charge.
   c) Which is bigger – c coulomb of charge or a charge of an electron?
   d) How much is the charge on an electron? Can a charge less than this value exist?
   e) What is the number of electrons constituting one coulomb of charge?

3. a) Define electric current.
   b) Name the SI unit of current. Define one ampere.
   c) Is electric current a scalar of vector quantity?

4. a) What does an electric circuit mean?
   b) When does the current flow in an electric circuit?
   c) How can the current be kept continuous in a conductor?
   d) Which particles constitute current in a metallic conductor?

5. a) Define potential difference.
   b) Name the SI unit of potential difference.
   c) What is meant by saying that a potential difference between two points in 1volt?
   d) What is the relationship between work done, potential difference and charge moved?