



SUBJECT : SCIENCE (PHY)

**CHAPTER-12:
ELECTRICITY**

TOPIC-2:

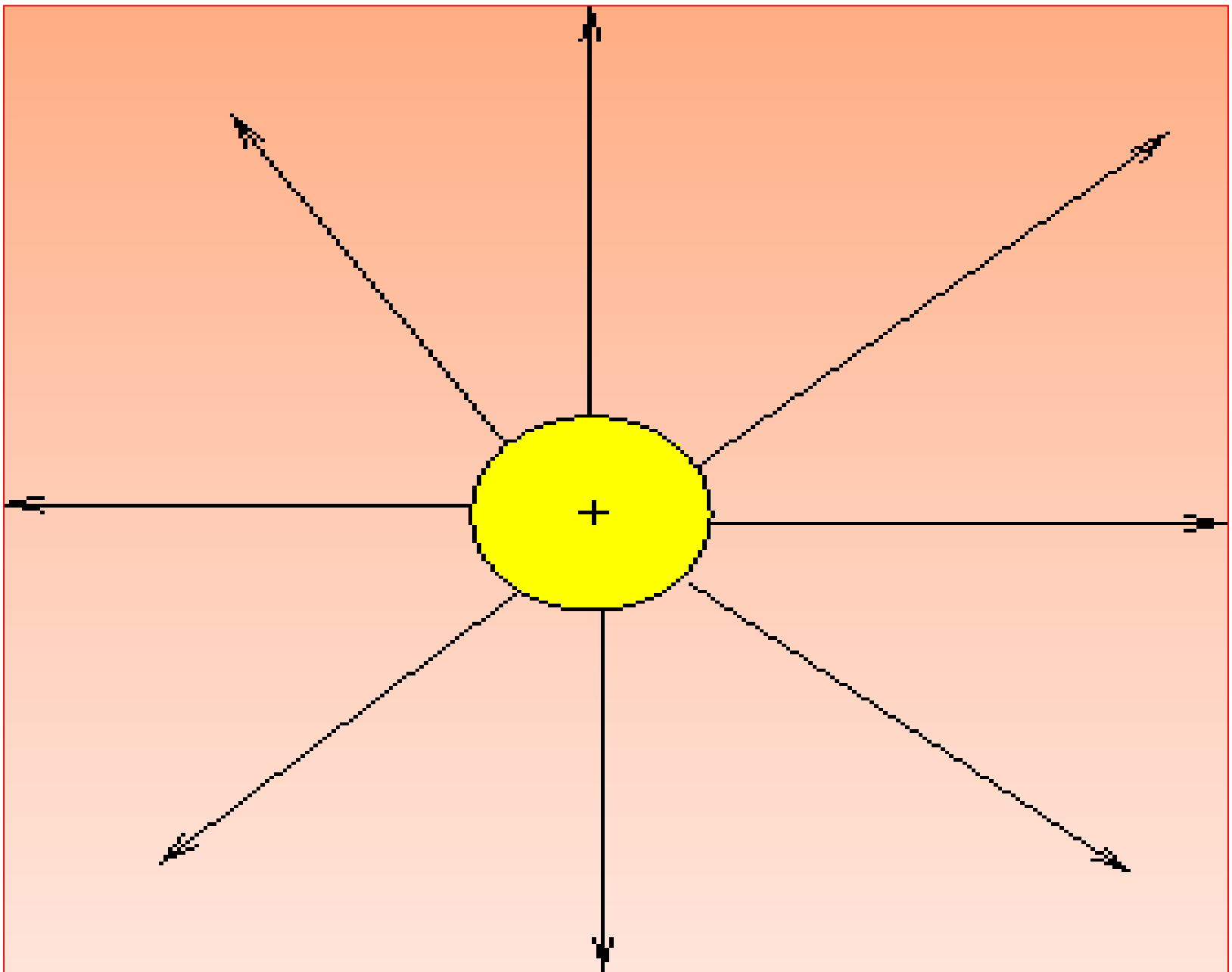
**ELECTRIC POTENTIAL AND POTENTIAL
DIFFERENCE**

OBJECTIVES:

Upon completion of the topic, you will be able to

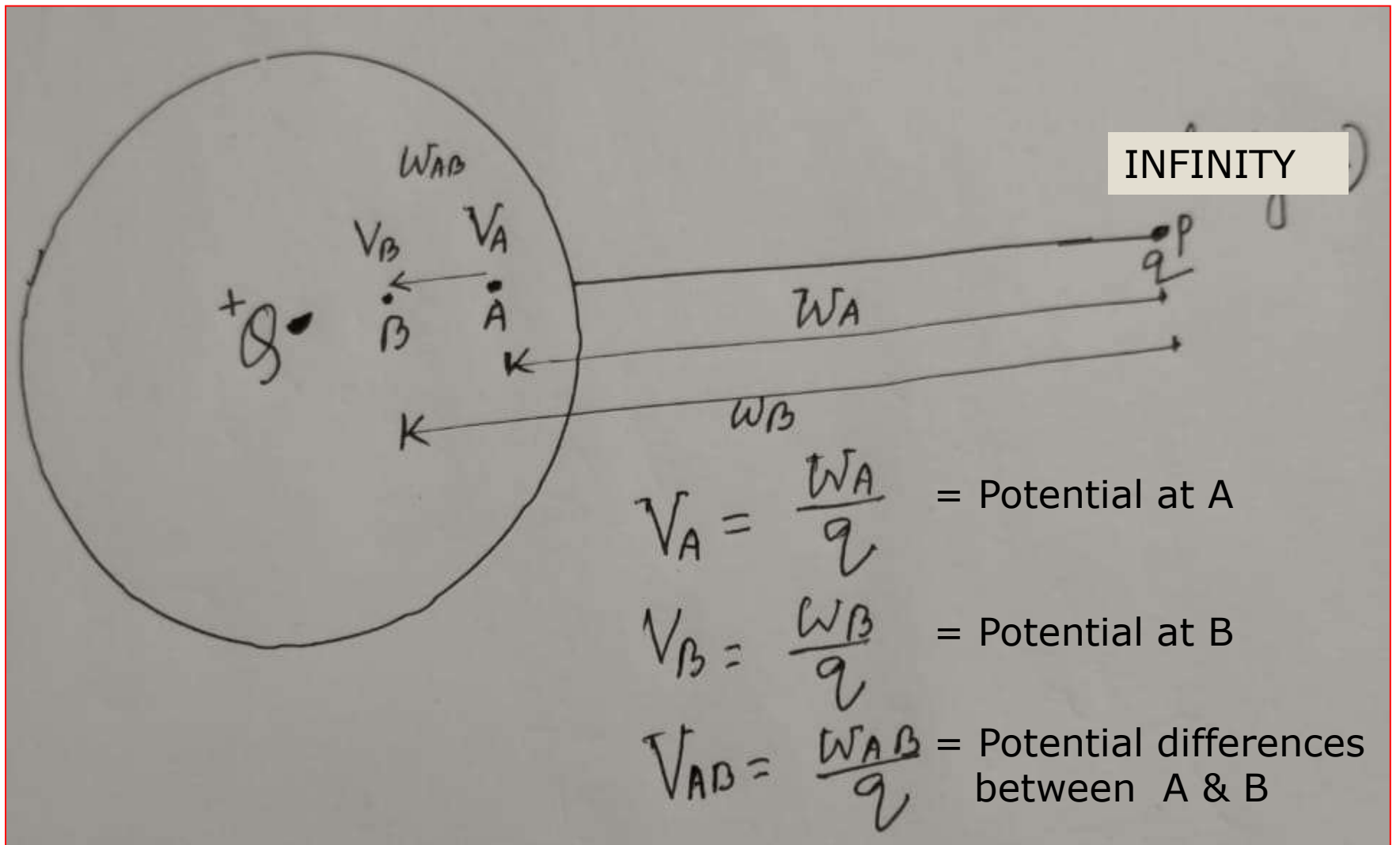
1. DEFINE ELECTRIC FIELD
2. DEFINE ELECTRIC POTENTIAL
3. DEFINE POTENTIAL DIFFERENCE
4. RELATE BETWEEN POTENTIAL, WORK DONE AND CHARGE
5. WRITE UNITS USED TO MEASURE POTENTIAL/POTENTIAL DIFFERENCE
6. DEFINE 1 VOLT
7. EXPLAIN THE ROLE OF POTENTIAL DIFFERENCE IN FLOWING OF ELECTRIC CURRENT THROUGH CONDUCTOR
8. SOLVE NUMERICAL BASED ON POTENTIAL DIFFERENCE
9. EXPLAIN FUNCTION OF AMMETER AND VOLTMETER
10. EXPLAIN POTENTIAL DIFFERENCE IN AN ELECTRIC CELL

ELECTRIC FIELD



Electric field is a space or region around an electric charge in which its effect is felt.

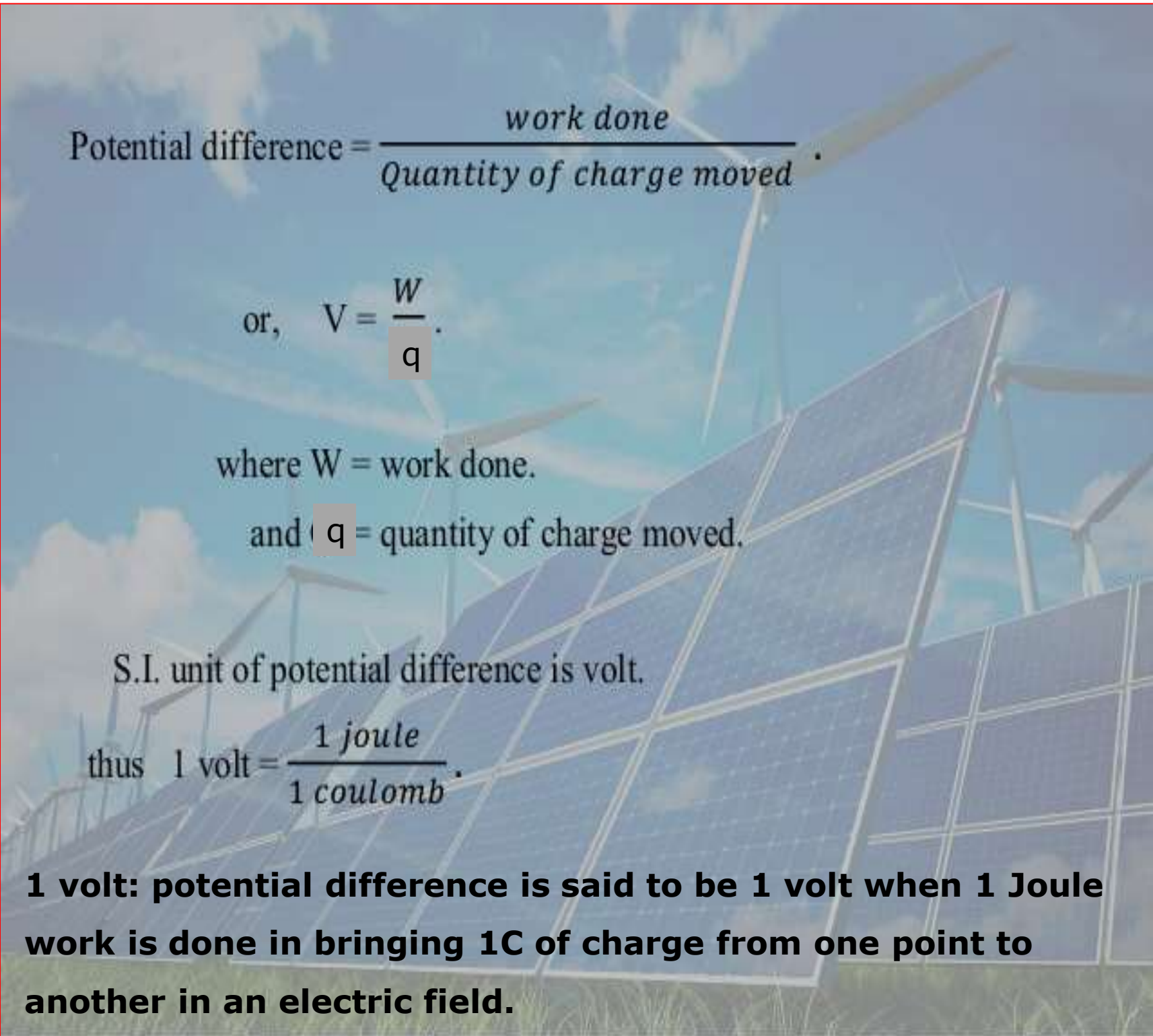
ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE



ELECTRIC POTENTIAL: Electric potential at a point in an electric field is defined as the amount of work done in bringing unit charge from infinity to that point.

POTENTIAL DIFFERENCE: Potential difference between two points in an electric field is defined as the work done in moving unit charge from one point to another point.

UNITS: Volt, milli volt(mV) , micro volt, kilovolt(kV), megavolt(MV)


$$\text{Potential difference} = \frac{\text{work done}}{\text{Quantity of charge moved}} .$$

$$\text{or, } V = \frac{W}{q} .$$

where W = work done.

and q = quantity of charge moved.

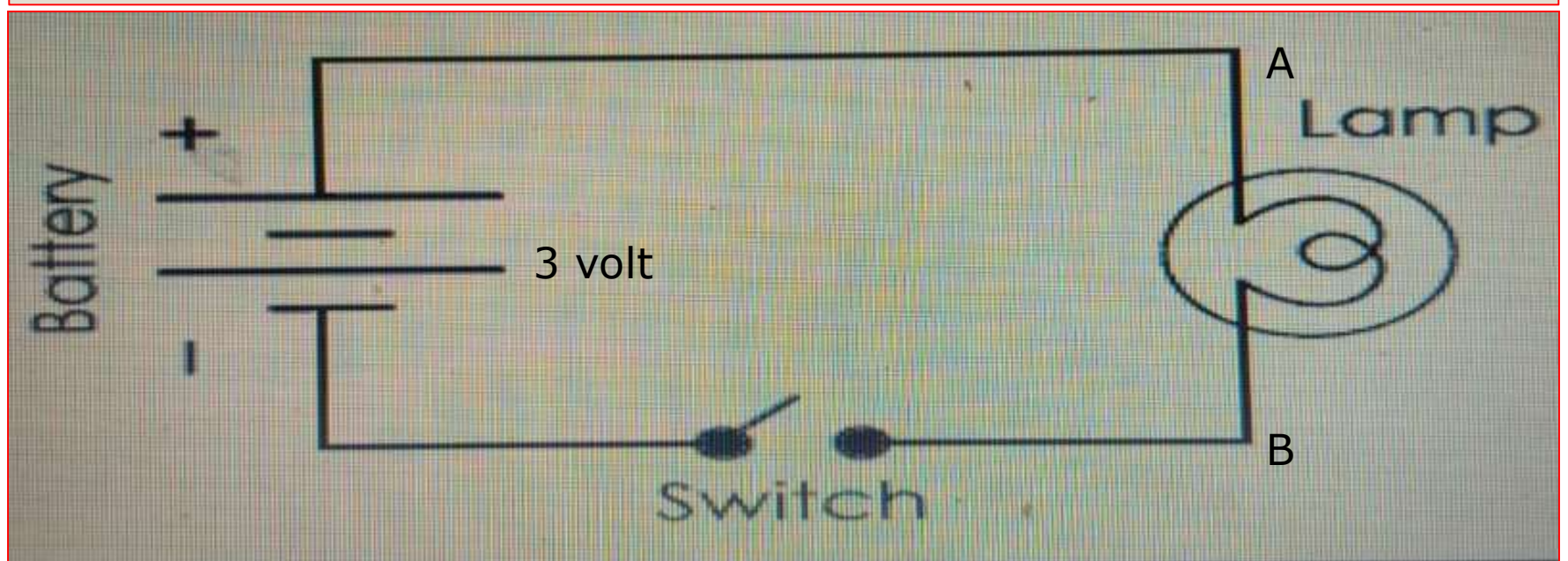
S.I. unit of potential difference is volt.

$$\text{thus } 1 \text{ volt} = \frac{1 \text{ joule}}{1 \text{ coulomb}} .$$

1 volt: potential difference is said to be 1 volt when 1 Joule work is done in bringing 1C of charge from one point to another in an electric field.

IMPORTANT POINTS:

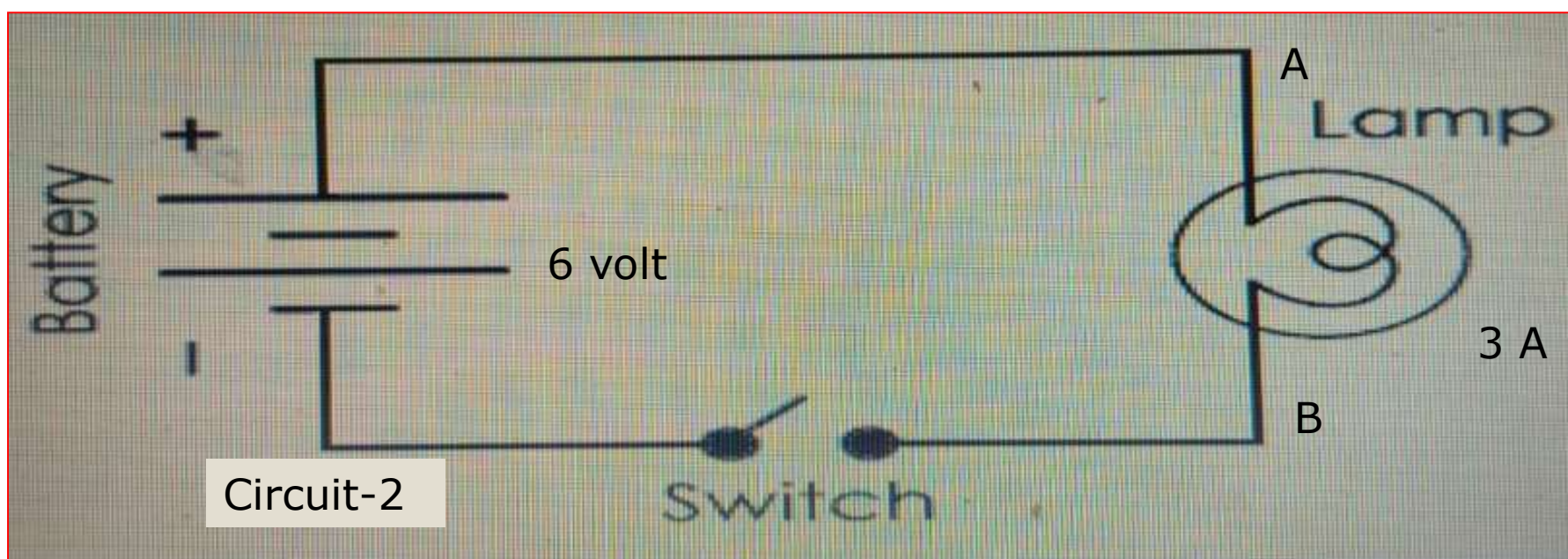
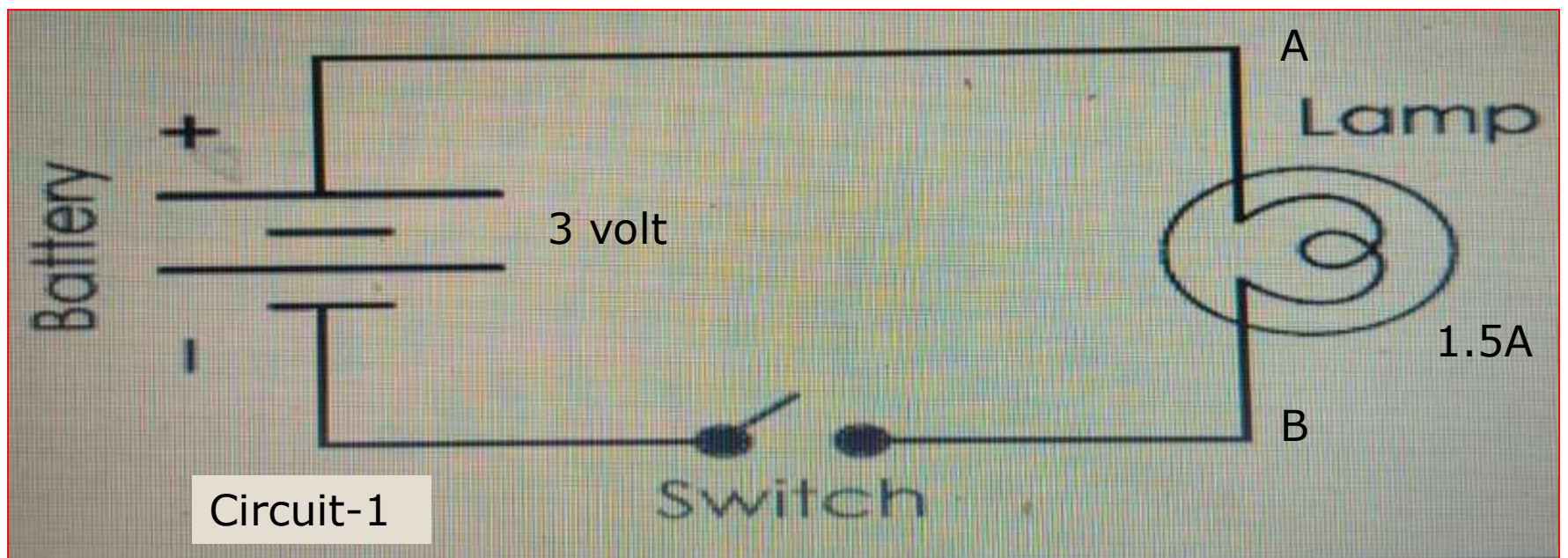
- 1. ELECTRIC POTENTIAL** means work done per unit charge from infinity to any point
- 2. POTENTIAL DIFFERENCE** means work done per unit charge within electric field
- 3. UNIT OF ELECTRIC POTENTIAL:** J/s or Volt (SI unit), mV
- 4. UNIT OF POTENTIAL DIFFERENCE:** J/s or Volt (SI unit), mV
- 5. Electric potential difference implies electric pressure difference on electric charge**
- 6. The cause of flow of electric charge through an electric circuit is the potential difference.**
- 7. The condition for flow of electric current through a conductor (say bulb, fan etc) is electric potential difference between the two ends of the conductor**
- 8. Electric potential & potential difference in an electric cell is developed by chemical action.**



ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE

IMPORTANT POINTS:

8. The voltage of an electric cell is 1.5 volt. It means the potential difference between the two electrodes of the cell is 1.5 volt.
9. More is potential difference applied across a conductor(say bulb), more will be the current passing through it and less is the potential difference applied across a conductor less will be the current passing through it. COMPARE Circuit-1 & Circuit-2. current is different.



Voltmeter

- A **voltmeter** is an instrument used for measuring electrical potential difference between two points in an electric circuit.
- Voltmeter has a high resistance so that it takes negligible current.
 - voltmeter is connected in parallel across load.

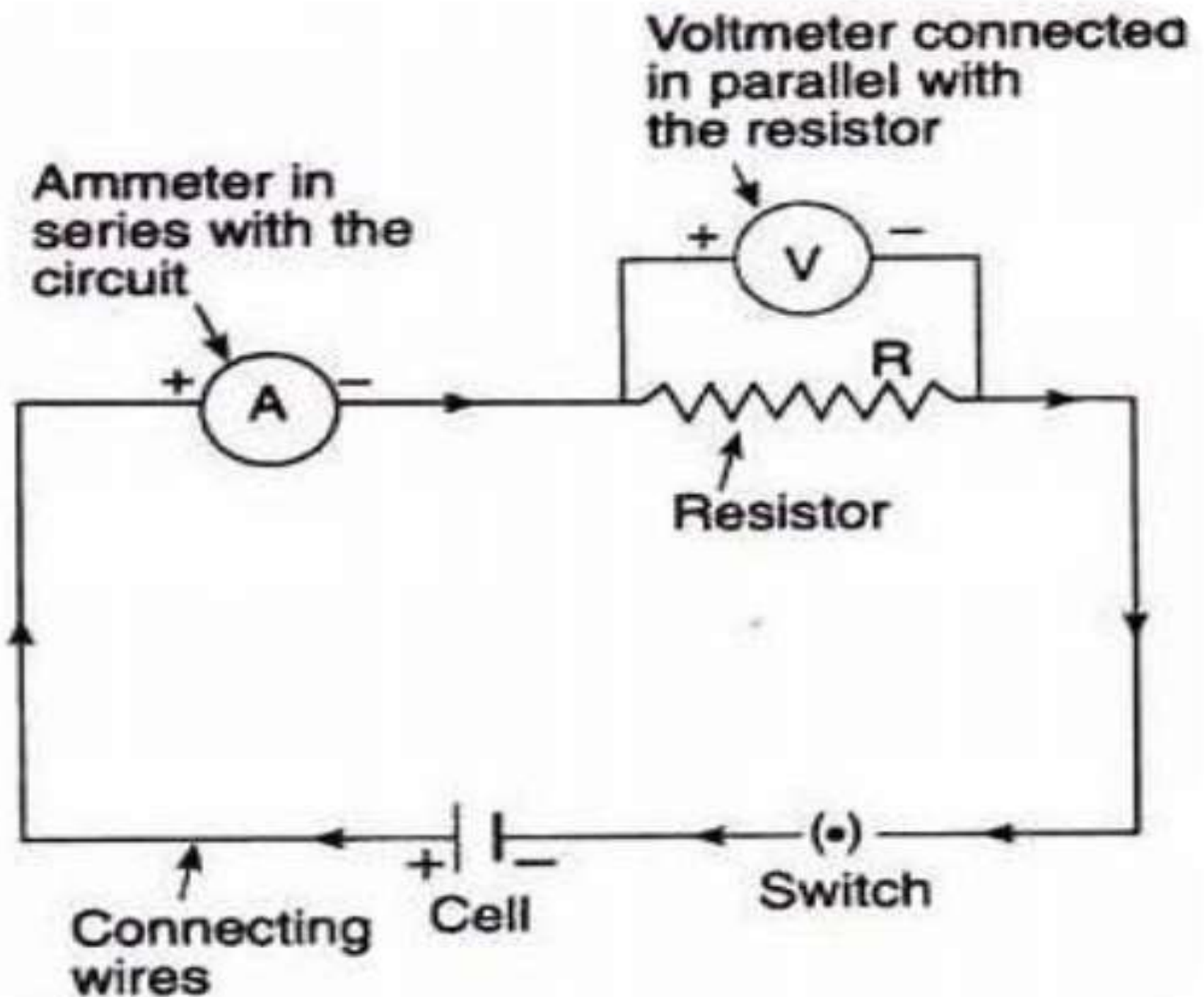


Ammeter

- An **ammeter** is a measuring instrument used to measure the electric current in a circuit. Electric currents are measured in amperes (A), hence the name.
- An ammeter should have a very low resistance so that it may not change the value of current flowing in the circuit.
 - An Ammeter is connected in series with load in circuit.



AMMETER AND VOLTMETER CONNECTION IN CIRCUIT



Note:

1. Resistor = conductor, load, bulb, fan, refrigerator, motor, electric iron etc.
2. Electric cell or battery maintains a potential difference across a conductor.
3. positive terminal of ammeter is connected to positive end of cell and -ve terminal is connected to -ve end of cell. Same is applicable for voltmeter also.

NUMERICALS

1. How much work is done in moving 4 C charge across two point having potential difference 10 v

Solution : We know that $V = W/Q$

$$W = VQ = 10 \times 4 = 40J$$

2. How much energy is given to each coulomb of charge passing through a 9 v battery?

Solution: Energy = Work done(W)

we know, $W = Vq = \text{Potential difference} \times \text{charge}$

Here , Charge, $q = 1 \text{ C}$
Potential difference, $V = 9 \text{ V}$

Work done(Energy), $W = Vq = 9 \times 1 = 9 \text{ Joule.}$

3. 100 J of work is done in moving a charge of 5 C from one terminal of battery to another . What is the potential difference of battery?

Solution: $V = W/Q = 100J/5C = 20 \text{ V}$

4. If 4×10^{-3} J of work is done in moving a particles carrying a charge of 16×10^{-6} C from infinity to point P .What will be the potential at a point?

Solution: We know that potential at a point is:

$$V = W/q$$

$$= (4 \times 10^{-3}) / (16 \times 10^{-6} \text{ C}) = 250 \text{ V}$$

Question 5:

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

Answer 5: A cell, battery, power supply, etc. helps to maintain a potential difference across a conductor.

Question 6:

What is meant by saying that the potential difference between two points is 1 V?

Answer 6: When 1 J of work is required to move a charge of 1 C from one point to another then it is said that the potential difference between the two points is 1 V.

Question 7:

How much energy is required for passing one coulomb of charge through a 6 V battery?

Q8. Name the instrument used for measuring Potential difference and Current

Q9. State the relationship between 1 ampere and 1 coulomb.

Q10. What is meant by potential difference between two points?

Q11. What is meant by potential difference between two points?

Q12. What causes the potential difference between the two terminals of an electric cell?

Q 13. (a) Name the instrument/device used to measure electric current in a circuit.

(b) How is an ammeter connected in a circuit to measure current flowing through it? **[CBSE 2015]**

Q14. How is voltmeter connected in the circuit to measure the potential difference between two points?