1. Details of unit revision and its structure

Subject Name	Physics
Course Name	Physics 03 (Physics Part 1 Class XII)
Title	Revision Unit-02_Study Guide
Pre-requisites	eContent of Unit 02: Current Electricity
Objectives	After going through this study guide, the learners will be able to: • How to consolidate the unit? • How to prepare notes?
Keywords	Electric Current

2. Development Team

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Study Guide Physics 03, Unit 2: Current Electricity

Unit Syllabus: -

Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm's law' electrical resistance, V-I characteristics (linear & non- linear), electrical energy and power, electrical resistivity and conductivity.

Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance

Internal resistance of a cell, potential difference and emf of cell, combination of cells in series and in parallel.

Kirchhoff's laws and simple applications; Wheatstone bridge, Meter bridge.

Potentiometer- principle and its applications to measure potential difference & for comparing emf of two cells; measurement of internal resistance of a cell.

Study list

Use the list and tick against each only when you understand it well. In case you do not get it, please learn again. This is a useful exercise to learn truth fully and gain confidence.

1. Electric current,
2. Flow of electric charges in a metallic conductor,
3. Drift velocity
4. drift velocity and mobility, and their relation with electric current;
5. Ohm's law'
6. Electrical resistance,
7. V-I characteristics (linear & non- linear),
8. Electrical energy
9. Electrical power,
10. Electrical resistivity
11. Electrical conductivity.
12. Carbon resistors,
13. colour code for carbon resistors;
14. Series and parallel combinations of resistors;
15. Temperature dependence of resistance
16. Internal resistance of a cell,
17. Potential difference and emf of cell,
18. Combination of cells in series and in parallel.
19. Kirchhoff's Rules

20. Application of Kirchhoff's rules s to find currents and voltages in simple circuits

21. Wheatstone bridge,

22. Meter bridge and Wheatstone bridge

23. Potentiometer-

24. Potentiometer principle

25. Applications of potentiometer to measure potential difference

26. Applications of potentiometer for comparing emf of two cells;

27. Applications of potentiometer for measurement of internal resistance of a cell.

Derivation list

This list will help you understand the relation between different physical quantities along with the assumptions under which such connection is being made.

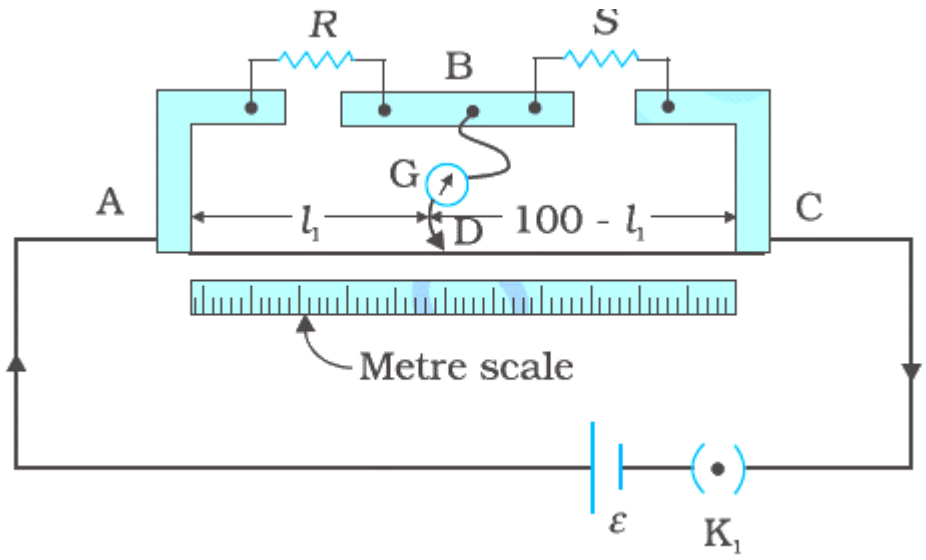
1. Relation between charge flow and current
2. Drift velocity and electrical current
3. **Dependence on drift velocity of length of the conductor in the shape of a wire**
4. **Dependence on drift velocity of area of cross section of the conductor in the shape of a wire**
5. **Dependence on drift velocity of material of the conductor**
6. **Mobility and drift velocity**
7. **Ohm's law**
8. **Resistance and resistivity**
9. **Conductance and conductivity**
10. **Drift velocity and resistivity**
11. **Resistance resistivity and temperature**
12. **Electrical energy and energy dissipated as heat**
13. **Electrical power**
14. **Equivalent resistance for combination of resistances in series and parallel**
15. **Relation between potential difference and emf**
16. **V=E-IR**
17. **Combination of cells in series and parallel (net E ,net r)**
18. **Using Kirchhoff's rules to find the condition for balanced wheat stone bridge**
19. **Resistance using a meter bridge** $R = S\frac{l}{100-l}$
20. **Potentiometer formulae vis potential gradient ,** $\frac{E_1}{E_2} = \frac{l_1}{l_2}$, $r = R\left(\frac{l_1}{l_2} - 1\right)$

Graph list

You should be able to graphically represent the following

1. **Variation of current with potential difference for ohmic conductors and interpret the meaning and slope for V-I and I-V graphs**
2. **Variation of current with potential difference for non-ohmic conductors**
3. **Resistance and length of conductor wire** $R = \rho \frac{l}{A}$
4. **Resistance and area of cross section of conductor wire**
5. **Resistance and diameter of wire**
6. **Resistance and temperature** $R_t = R_0(1 + \alpha t)$
7. **Resistivity and temperature for nichrome, manganin, constantan, semiconductor**
8. **Potential difference and length potential gradient, dependence on temperature, potential difference across the wire, length of the wire, material of the wire**
9. **R-l_1, graph for meter bridge, where R is the unknown resistance and l_1 is the balance length**

Meter Bridge Wire AC is 1 m long. *R* is a resistance to be measured and *S* is a standard resistance.



10. **Electrical power and current**
11. **Electrical power and voltage**
12. **Electrical power and resistance**
13. $V = E - Ir$ **and its applications**

Useful formulae list

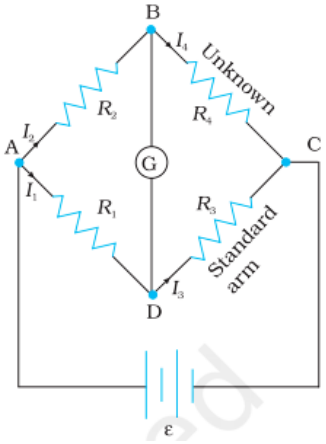
1. $I = \frac{Q}{t}$ and instantaneous current = $\frac{dq}{dt}$
2. $V_d = \frac{e}{m}Et$ e is charge on electron, m is mass of electron E is the electric field applied across a conductor, V_d drift velocity, t is the relaxation time

$$t = \frac{\text{mean displacement between collisions}}{\text{root mean square velocity of electrons between collisions}}$$

3. $I = neAV_d$ n = number of free electrons per m^3, A cross sectional area of the cylindrical wire conductor.
4. $V = I R$
5. Resistance of a wire $R = \rho\frac{l}{A}$, where ρ is resistivity of the material of wire of length l and area of cross section A and resistance R
6. $\rho = \frac{m}{ne^2t}$
7. $resistance\ R = \frac{ml}{ne^2At}$
8. Electrical energy consumed = $I^2Rt = \frac{V^2}{Rt}$ here t is time for which current is passing through a conductor of resistance R
9. Power W = VA = $I^2R = \frac{V^2}{R}$
10. Conductance $G = \frac{1}{R}$
11. Conductivity $\sigma = \frac{1}{\rho}$
12. Conductance $G = \sigma\frac{A}{l}$
13. $net\ resistance\ in\ series\ R_{net} = R_1 + R_2 + \cdots + R_n$
14. $net\ resistance\ in\ parallel\ \frac{1}{R_{net}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$
15. $resistance\ at\ temperature\ t\ R_t = R_0(1 + \alpha t)$
16. $\alpha = \frac{R_2 - R_1}{R_1(t_2 - t_1)}\ per\ ℃\ or\ k$
17. E = V + Ir for potential difference emf and internal resistance.
18. When n identical cells are connected in series

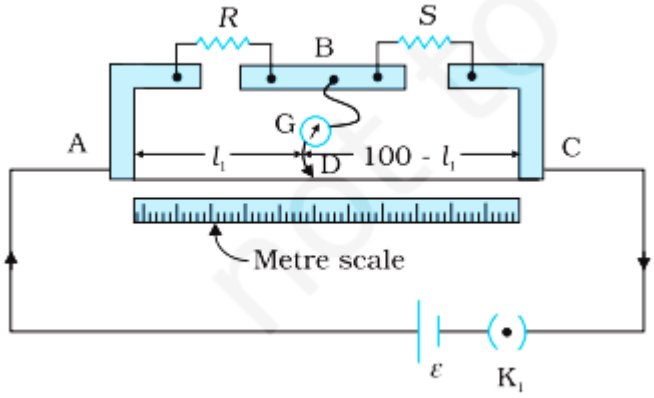
    Current I = $\frac{nE}{R+nr}$ when R >> net internal resistance
19. When n identical cells are connected in parallel

    Current I = $\frac{E_{net}}{R_{ext}+R_{internal}} = \frac{E}{R+\frac{r}{n}}$ if R < r/n
20. Balanced wheat stone bridge



$$\frac{P}{Q} = \frac{R}{S}$$

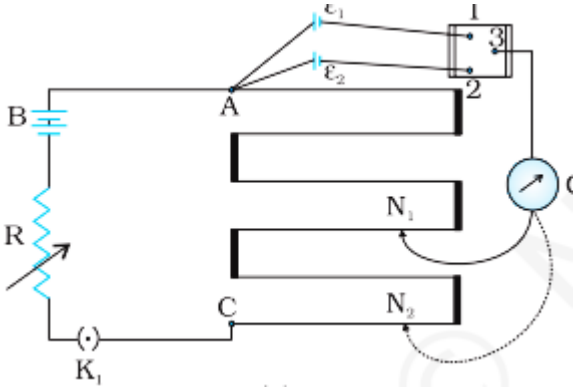
21. meter bridge



$$\frac{R}{S} = \frac{l}{100 - l}$$

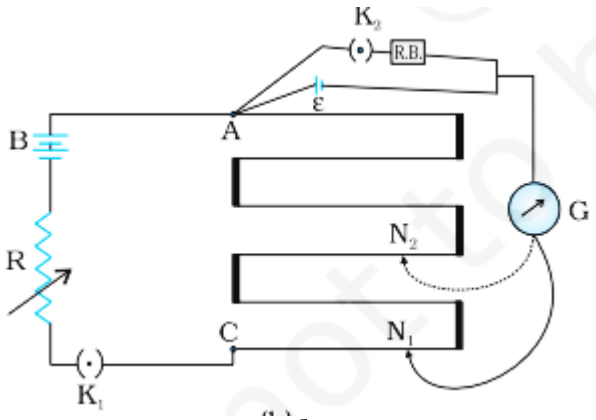
22. Potentiometer

Potential gradient = potential across the wire /length of wire



$$\frac{e_1}{e_2} = \frac{l_1}{l_2}$$

23. For internal resistance of a cell



$$r = R\left(\frac{l_1}{l_2} - 1\right)$$

Good luck!!