NCERT – GRADE 10 CHEAT SHEET

ELECTRICITY

Part B – Resistance, Heating Effect and Electric Power

Pumpa

Resistance of a System of Resistors

- The equivalent resistance (R) of a combination of resistors is the single resistor that can replace the given combination.
- It depends on how the resistors are connected.

For two resistors in series or parallel:

$$R = \frac{V}{I}$$

R = equivalent resistance (Ω)
V = potential difference (V)
I = current (A)

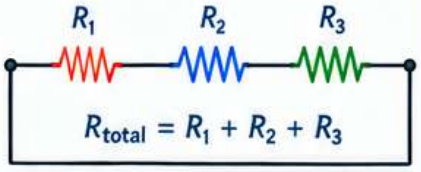
Key points:

✔ **Series:** $R_{series} = R_1 + R_2 + \dots$

✔ **Parallel:** $\frac{1}{R_{parallal}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$

Resistors in Series

- In a series combination, the same current flows through all the resistors.
- The total resistance is the sum of individual resistances.

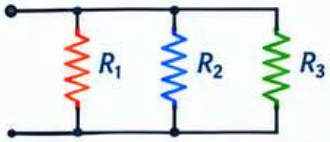


Example:
If $R_1 = 2\ \Omega$, $R_2 = 3\ \Omega$ and $R_3 = 5\ \Omega$,
$R_{total} = 2 + 3 + 5 = 10\ \Omega$

In series, if one resistor is removed, the circuit breaks.

Resistors in Parallel

- In a parallel combination, the same potential difference is across each resistor.
- The total resistance is less than the smallest resistor.



$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Example:
If $R_1 = 6\ \Omega$, $R_2 = 3\ \Omega$ and $R_3 = 2\ \Omega$,
$\frac{1}{R_{total}} = \frac{1}{6} + \frac{1}{3} + \frac{1}{2} = 1 \rightarrow R_{total} = 1\ \Omega$

In parallel, if one branch is removed, other branches still work.

Heating Effect of Electric Current

- When current flows through a conductor, it produces **heat** due to the resistance of the conductor.
- This is called the heating effect of electric current.

$$H = I^2Rt$$

H = heat produced (J)
I = current (A)
R = resistance (Ω)
t = time (s)



Electrical energy → Heat energy

Example:
If $I = 2$ A, $R = 5\ \Omega$, $t = 10$ s,
$H = 2^2 \times 5 \times 10 = 200$ J

Practical Applications of Heating Effect of Electric Current

The heating effect is useful in many devices:


Electric heater (space heating)


Electric iron (clothes)


Incandescent bulb (heat + light)


Toaster (bread)


Electric kettle (water heating)


Electric storage water heater (hot water)

These devices convert electrical energy into heat energy.

Electric Power

- Electric power is the rate at which **electrical energy** is consumed.
- It tells us how much energy is used per second.

$$P = VI = I^2R = \frac{V^2}{R}$$

P = power (W)
V = potential difference (V)
I = current (A)
R = resistance (Ω)

Example:
If V = 12 V and I = 2 A,
$P = VI = 12 \times 2 = 24$ W

Higher power means greater energy consumption per second.

Common Mistakes

- ✗ Adding resistances in parallel (instead of using $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$).
- ✗ Confusing series and parallel connection.
- ✗ Forgetting to use square (I^2) in $H = I^2Rt$.
- ✗ Mixing up power formulae ($P = VI$, $P = I^2R$, $P = V^2/R$).
- ✗ Thinking power and energy are the same (power is the rate, energy is the total).

KEY TAKEAWAY

- ✔ Equivalent resistance depends on the combination (series/parallel).
- ✔ In series: $R_{total} = R_1 + R_2 + \dots$
- ✔ In parallel: $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$
- ✔ Heating effect: $H = I^2Rt$.
- ✔ Electric power: $P = VI = I^2R = V^2/R$.
- ✔ Used in many daily life applications.

More Current, More Power, More Possibilities!

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