NCERT – GRADE 10 CHEAT SHEET

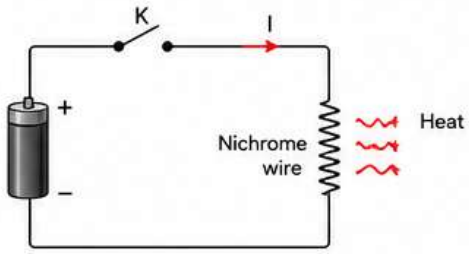
ELECTRICITY

HEATING EFFECT OF ELECTRIC CURRENT

Key Concepts, Formulas & Diagrams at a Glance

1. HEATING EFFECT OF ELECTRIC CURRENT

- When electric current passes through a conductor, electrical energy is converted into heat energy.
- Many electrical appliances work on this principle.



Key Points

- More current (I) → More heat.
- More resistance (R) → More heat.
- More time (t) → More heat.

2. JOULE'S LAW OF HEATING

The heat produced in a conductor is:

- directly proportional to the square of current (I^2),
- directly proportional to the resistance (R),
- directly proportional to the time (t) of flow of current.

Main Formula

$$H = I^2 R t$$

Other Forms

$$H = V I t \qquad H = \frac{V^2 t}{R}$$

Where,

H = Heat produced (joule, J)
I = Current (ampere, A)
R = Resistance (ohm, Ω)
t = Time (second, s)
V = Potential difference (volt, V)

Effect on Heat (H)

Current (I)	Resistance (R)	Time (t)
↑	↑	↑
Heat ↑	Heat ↑	Heat ↑

3. APPLICATIONS OF HEATING EFFECT

Household Appliances

Electric Iron | Room Heater | Electric Kettle

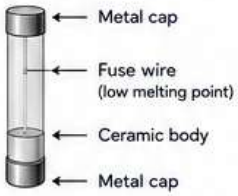
Toaster | Geyser | Incandescent Bulb

- In all these appliances, electrical energy is converted into heat energy.
- In an incandessent bulb, most of the electrical energy is converted into heat and only a small part into light.

4. ELECTRIC FUSE

- A fuse is a safety device that protects the circuit and appliances from damage due to excessive current.
- It works on the heating effect of electric current.

Construction



Characteristics

- Made of an alloy of tin and lead.
- Low melting point.
- High resistance.

Working

Normal current
↓
Fuse remains intact
↓
Excess current
↓
Fuse wire melts
↓
Circuit breaks
↓
Appliance protected

5. ELECTRIC POWER

Electric power is the rate at which electrical energy is consumed or work is done.

Main Formula

$$P = V I$$

Other Forms

$$P = I^2 R \quad \text{and} \quad P = \frac{V^2}{R}$$

Where,

P = Power (watt, W)
V = Potential difference (volt, V)
I = Current (ampere, A)
R = Resistance (ohm, Ω)

SI Unit

Watt (W) | 1 kW = 1000 W

Examples

60 W bulb | 100 W bulb

☆ Higher power appliance consumes more energy per second.

6. ELECTRICAL ENERGY

Electrical energy is the electrical work done in a given time.

Main Formula

$$E = P t$$

Other Form

$$E = V I t$$

Where,

E = Electrical energy (joule, J)
P = Power (watt, W)
t = Time (second, s)

Commercial Unit

Kilowatt-hour (kWh)

1 kWh = 3.6×10^6 J

Electricity Meter (measures in kWh) → Electricity Bill (Pay for units used)

QUICK FORMULA BOX

- $H = I^2 R t$
- $H = V I t$
- $P = V I$
- $P = I^2 R$
- $P = \frac{V^2}{R}$
- $E = P t$
- $E = V I t$

TIPS / QUICK FACTS

- ✓ Heat produced ∝ $I^2 R t$
- ✓ Joule's law is valid only when temperature remains constant.
- ✓ Fuse wire has low melting point and high resistance.
- ✓ Power tells how fast energy is used.
- ✓ Energy measured in kWh by electricity boards.

COMMON MISTAKES

- ✗ Confusing power with electrical energy.
- ✗ Writing kW instead of kWh for energy.
- ✗ Forgetting square of current (I^2) in Joule's law.
- ✗ Writing power unit as Joule.
- ✗ Not converting kWh into Joules.

COMMON TERMS & UNITS

Heat (H)	:	Joule (J)
Current (I)	:	Ampere (A)
Resistance (R)	:	Ohm (Ω)
Potential Difference (V)	:	Volt (V)
Power (P)	:	Watt (W)
Energy (E)	:	Joule (J), Kilowatt-hour (kWh)
Time (t)	:	Second (s)

KEY TAKEAWAY: Electric current produces heat in a conductor. This heating effect is used in many appliances and safety devices. Electrical power is the rate of energy use, while electrical energy is measured in kilowatt-hour (kWh).