Grade: 8 CBSE

Subject: Physics

Chapter: Electricity: Magnetic and Heating Effects

SECTION A — MCQs (5 Questions × 1 Mark = 5 Marks)

1. An electric safety fuse functions on which physical principle of electric current? [1]

(A) Chemical effect

(B) Magnetic effect

(C) Heating effect (Joule heating)

(D) Optical effect

2. The material used to make an electric fuse wire must have: [1]

(A) High melting point and low resistance

(B) Low melting point and high resistance

(C) Low melting point and high conductivity

(D) Infinite melting point and zero resistance

3. What catastrophic event occurs when the live wire and neutral wire come into direct physical contact due to worn-out or cracked plastic insulation? [1]

(A) Complete open-circuiting

(B) Short-circuiting

(C) Reversal of magnetic polarity

(D) Chemical electrolysis

4. Which modern safety device has widely replaced traditional rewireable cartridge fuses in domestic distribution boards because it can be easily reset by flipping a lever? [1]

(A) Galvanometer

(B) Miniature Circuit Breaker (MCB)

(C) Step-up Transformer

(D) Rheostat

5. Assertion (A): A blown fuse wire must NEVER be replaced with an ordinary thick copper wire or iron nail.

Reason (R): Thick copper wire has very low resistance and an exceptionally high melting point (1085 °C); it will fail to melt during an overcurrent fault, leading to catastrophic building fires. [1]

(A) Both (A) and (R) are true, and (R) is the correct explanation of (A).

(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

(C) (A) is true, but (R) is false.

(D) (A) is false, but (R) is true.

SECTION B — VERY SHORT / SHORT ANSWERS (5 Questions × 2 Marks = 10 Marks)

6. Differentiate between "Short-Circuiting" and "Overloading" in domestic electrical circuits. [2]

7. Explain how an electric fuse prevents domestic appliances from getting damaged during a sudden voltage spike. [2]

8. What is the significance of the "Current Rating" (e.g., 5 A vs 15 A) of an electric fuse? [2]

9. Name the three wires in a standard domestic 3-pin cable, state their international color codes, and state the safety function of the Earth wire. [2]

10. State two distinct operational advantages of an MCB over a conventional rewireable fuse. [2]

SECTION C — APPLICATION & LOGICAL THINKING (2 Questions × 5 Marks = 10 Marks)

11. (a) A homeowner connects a 1000 W electric iron, a 1500 W room heater, and a 2000 W geyser simultaneously into a single multi-socket adapter connected to a 220 V power socket rated for a maximum of 15 A:

(i) Calculate the total electric power consumed by all three appliances operating together. [1]

(ii) Calculate the total current drawn from the 220 V mains. [2]

(iii) Determine whether the 15 A fuse or MCB will trip, and identify the specific electrical hazard taking place. [1]

(b) Suggest two preventive measures to eliminate this electrical hazard in household wiring. [1]

12. (a) A microwave oven with a metallic chassis develops an insulation fault where an exposed live wire touches the metal outer body:

(i) Explain what happens to a person who touches the microwave oven if the appliance is NOT connected to an Earth wire. [2]

(ii) Explain how connecting the metal casing to a properly grounded Earth wire protects the user from lethal electric shock. [2]

(b) Why is the earth pin in a 3-pin plug made thicker and longer than the live and neutral pins? [1]

SECTION D — CASE STUDY & VISUAL ANALYSIS (1 Question × 5 Marks = 5 Marks)

13. Case Study & Electrical Safety Engineering:

Carefully examine Figure 4.2. Part A illustrates a cartridge fuse under normal operation versus its blown state where excessive Joule heating causes the alloy wire to melt and open the circuit. Part B contrasts the physics of short-circuiting (zero resistance surge) with overloading (excessive parallel load).

(a) In Figure 4.2 Part A, why is the fuse always connected in series with the Live wire rather than the Neutral wire? [1]

(b) In Figure 4.2 Part B, by what mathematical relationship does the current surge when circuit resistance drops to near zero during a short-circuit? [1]

(c) In Figure 4.2 Part B, explain why the total resistance of a household circuit decreases as more appliances are plugged into parallel sockets. [1]

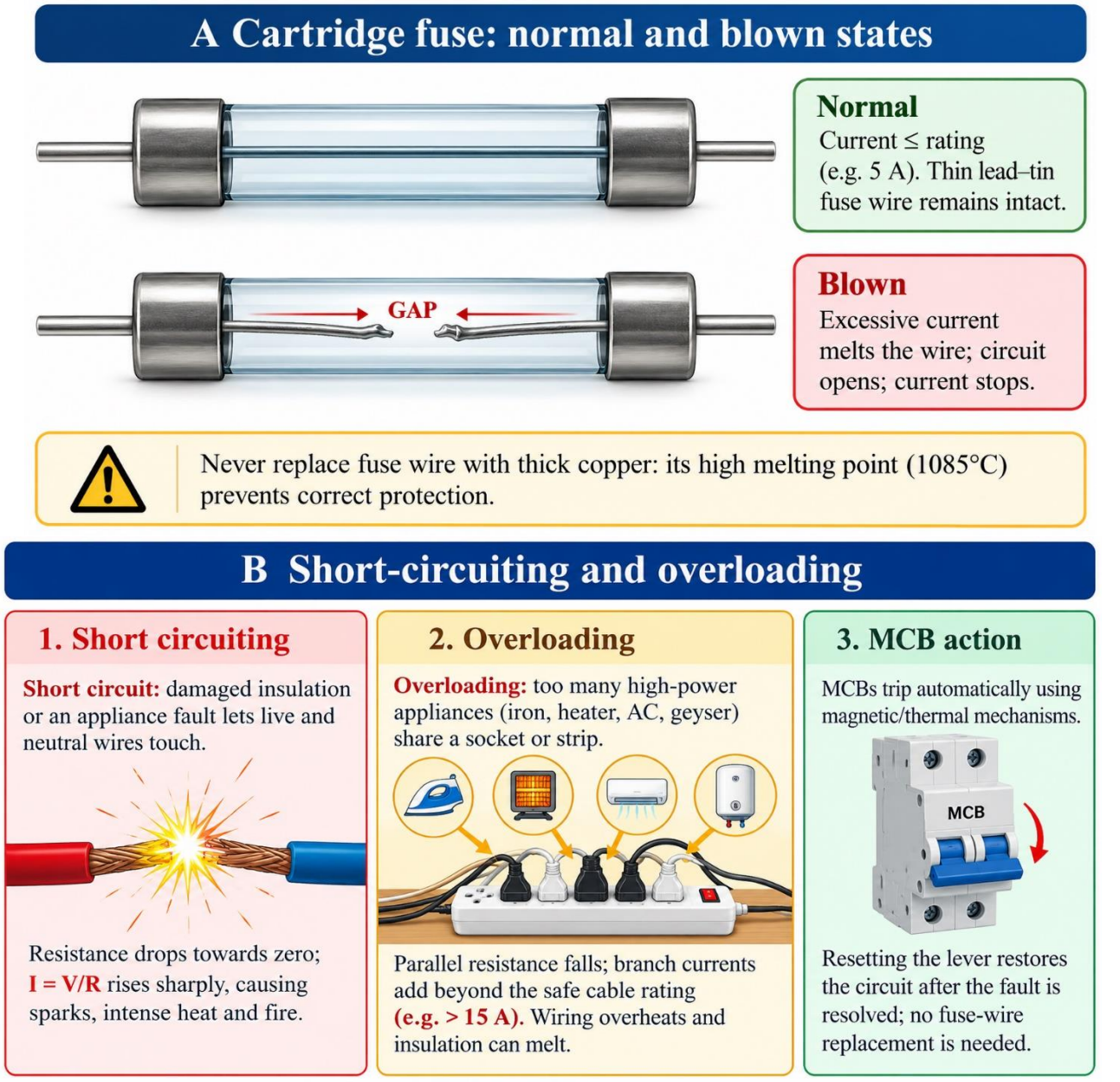


Figure 4.2: *(Part A) Structure and Function of an Electric Fuse (Intact vs Blown State). (Part B) Origins of Hazardous Overcurrent (Short-Circuit vs Overloading).*

(d) Applied Sizing Calculation:

An electric geyser of power rating 2200 W operates on a 220 V AC mains supply. Available fuses in the market have ratings of 5 A, 10 A, 12 A, and 16 A.

(i) Calculate the normal operating current of the geyser.

(ii) Which fuse rating must be selected for this geyser? Justify why choosing a 5 A fuse or a 30 A fuse would be disastrous. [2]