ACTIVITY

AIM

To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse, and a power source.

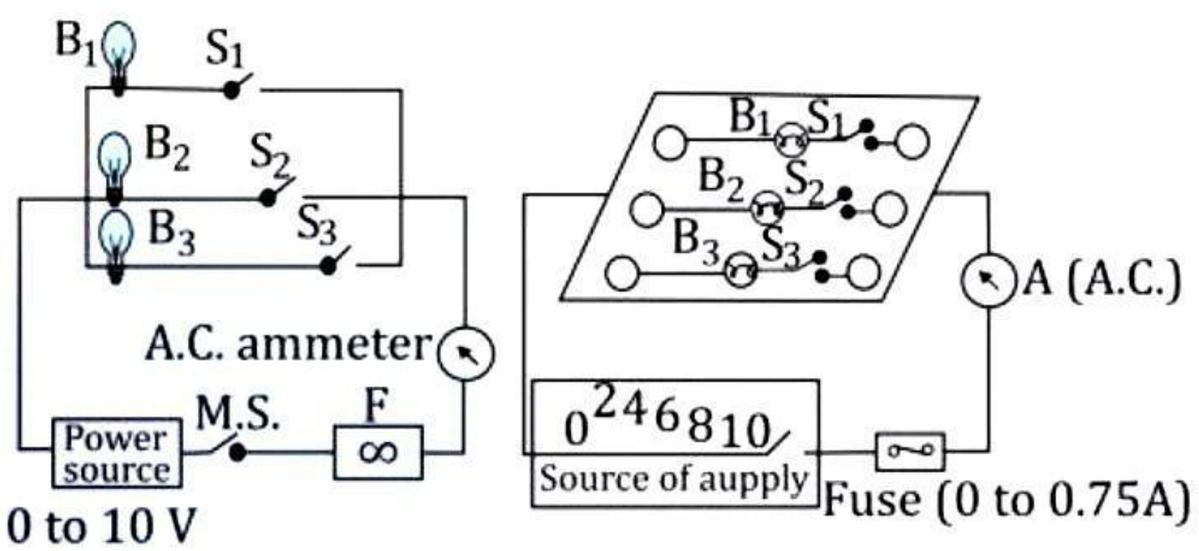
MATERIAL REQUIRED

Apparatus: No apparatus is required in assembling a circuit.

Material: Three bulbs (6V, 1W) each, the fuse of 0.6 A, the main switch a power supply (battery eliminator), three (on/off) switches flexible connecting wire with red and black plastic covering, a fuse wire.

Supplementary: Main electric board with a two-pin socket and main switch.

DIAGRAM



(a) Circuit Diagram (b) Actual layout

THEORY

1. Electricity supplied to us for domestic purposes is 220 V A.C. and 50 Hz. In the household circuit, all appliances are connected in "parallel" with the mains. The switches are connected in series with each appliance in the live wire. 5 A Switches are required for normal appliances like bulbs, fluorescent tube fans, etc. 15 A sockets and switches are required for heavy-load appliances like, refrigerators, air conditioners, geysers, hot plates, etc. All appliances must have three wires called live, neutral, and earth. Total power consumption ' P ' at a time

$$P = P_1 + P_2 + P_3 + \ldots\ldots\ldots\ldots$$

Where P_1, P_2, P_3 are the powers drawn by appliances?

2. To protect the appliances from damage when unduly high currents are drawn fuse of a little higher rating, 10 to 20% higher than the current normally drawn by all appliances. For further safety, a suitable value mains fuse like rating 32 A is connected in series with the supply source.

3. The current, I drawn by the appliances from the mains presently is,

$$\boxed{I = \frac{P}{V}}$$

PROCEDURE

1. Connect the bulbs B_1, B_2 and B_3 in series with switches S_1, S_2 and S_3 respectively and connect each set of B-S in parallel with each other.

2. Connect the main supply to a step-down transformer (battery eliminator) to get the required voltage from 0 to 10 V(0, 2, 4, 6, 8 and 10 V)
3. Connect the main fuse M.S. in series with the power supply (battery eliminator).
4. Connect an A.C. ammeter in series with the B-S set.
5. Connect one end of the power supply to one end of the B-S set.
6. Check the circuit once again to ensure that the household circuit is complete.
7. Gradually increase the current to 0.75 A, the fuse must bum off at about 0.6 A.

RESULT

1. When the switches S_1, S_2, S_3 are switched on in steps the bulbs B_1, B_2 and B_3, glow. The bulbs stop glowing when the switch is put off.
2. Bulbs B_1, B_2 and B_3 illuminate sequentially as switches S_1, S_2, S_3 are successively turned on. The bulbs cease to glow when the switch is turned off.

PRECAUTIONS

1. All the components must be connected to the power supply as given in the circuit diagram.
2. Insulated copper/aluminum wires of standard colour code should be used for connections.
3. Switches and fuse must always be placed on the live wire.
4. Keep all the connections tight and insulation intact.
5. Be extra careful not to touch any exposed part of this circuit.

VIVA- VOCE

Q 1. Name the wires used in household circuits. Give their colours also.

Ans. Live wire, a neutral wire, and earth wire. Their colours are red, black and green respectively.

Q 2. What is the function of fuse wire?

Ans. Fuse wire melts away when the current through it exceeds the safe limits. It breaks the circuit and saves the rest of the circuit.

Q 3. Give two examples of each of the appliances connected in the circuit of (a) 5 *A* rating, (b) 15 *A* rating.

Ans. (a) Electric bulb, fan
(b) Geyser, electric iron

Q 4. How does the current rating of the fuse vary with its (a) length, and (b) area of cross-section?

Ans. (a) The current rating is independent of the length of the fuse wire.
(b) Current rating varies directly as (radius of wire) $^{3/2}$

Q 5. How is the fuse wire connected to the household circuit?

Ans. It is connected in series in the live wire.

Q 6. Why can't tungsten be used to make fuse wire?

Ans. Fuse wire should have a low melting point while tungsten has a high melting point, though it has high resistivity (which is required by fuse wire).

Q 7. What is the value of supply voltage in India?

Ans. 220 *V*