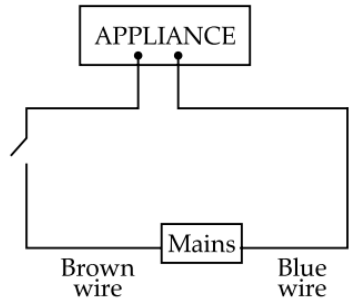
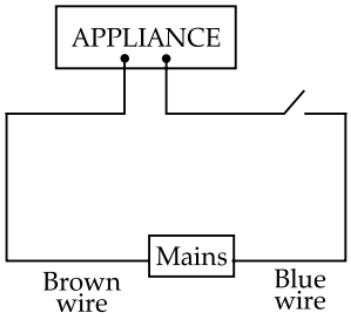
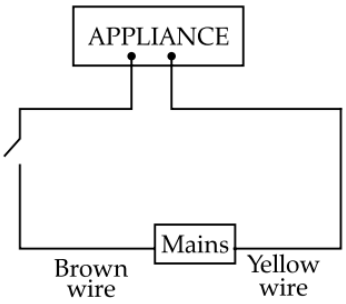
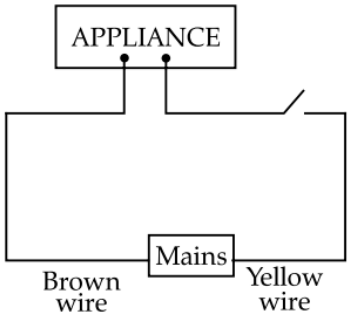
PREVIOUS YEAR QUESTIONS
(Chapterwise)

CHAPTER NAME: HOUSEHOLD CIRCUITS

SUMMARY POINTS

Concept	Key Points & Formulae	SI Units
Electrical Energy	Energy produced when current I flows through resistance R for time t: $E = I^2Rt$.	Joules (J)
Relation of e.m.f. (ε) & Voltage (V)	- $V \leq \varepsilon$ (when cell is in use). - $\varepsilon = V + \text{Losses}$ (real cells).	Volts (V)
Specific Resistance (Resistivity)	- Resistance of a unit length and cross-sectional area. - Formula: $\rho = R \cdot A/L$.	Ohm-meter ($\Omega \cdot m$)
Ohm's Law	Voltage across a conductor: $V = IR$.	Voltage (V)
Power in Electrical Circuits	- $P = IV$ - Alternate forms: $P = I^2R$, $P = V^2/R$.	Watts (W)
Kilowatt-Hour (kWh)	Energy consumed by a 1 kW appliance in 1 hour: $1\ \text{kWh} = 3.6 \times 10^6\ \text{J}$.	Kilowatt-hour (kWh)
Current in a Circuit	Current drawn: $I = V/R_{\text{total}}$.	Amperes (A)
Heat Produced in Resistor	Heat produced: $H = I^2Rt$.	Joules (J)
Superconductors	Materials with zero resistance below a critical temperature.	-
Effect of Temperature on Resistance	- Metals: Resistance increases with temperature. - Semiconductors: Resistance decreases with temperature.	-

Q.NO.: 1	**Identify the option that displays the correct wiring with correct colour code**	YEAR [2024]
	(a)  (c)  (b)  (d) 	
ANS.:		
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Q.NO.: 2	**5 bulbs are connected in series in a room. One bulb is fused. It is removed and remaining 4 bulbs are again connected in series to the same circuit. What will be the effect on the following physical quantities? (Increases, Decreases, Remain Same) (a) Resistance (b) Intensity of light**	YEAR [2024]
ANS.:	**(a) Resistance:** The **total resistance of the circuit will decrease**. When bulbs are connected in series, their resistances add up. Removing one bulb reduces the number of resistors, and therefore reduces the total resistance of the circuit. **(b) Intensity of light:** The **intensity of light will increase**. The intensity of light depends on the power consumed by the bulbs. • With a lower total resistance after removing one bulb, the current in the circuit will increase (assuming a constant voltage supply), according to Ohm's law. • The power consumed is directly proportional to the square of the current **($P=I^2R$)**, so an increase in current leads to an increase in power and the intensity of light of the bulbs will also increase.	

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Q.NO.: 3	**A fuse is rated 5 A. Can it be used with a geyser rated 1540 W, 220 V. Write Yes or No. Give supporting calculations to justify your answer.**	YEAR [2024]
ANS.:	No, a 5A fuse cannot be used with a geyser rated 1540W, 220V. The geyser will draw 7 Amperes of current, which exceeds the fuse's rating of 5A. A fuse is designed to melt when the current exceeds its rating to protect the appliance from damage. If a 5A fuse was used, it would likely melt or blow due to the excessive current.	
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Q.NO.: 4	**(a) Which electrical component protects the electric circuit in case of excess current and which can also be used as a switch?** **(b) Name the wire to which this electrical component is connected in an electric circuit.**	YEAR [2023]
ANS.:	(a) A **Miniature Circuit Breaker (MCB)** protects the circuit from excess current and can also be used as a switch. (b) It is connected in **series with the live wire** in the household circuit2. **Explanation**: MCBs are now used in place of fuses as they can also function as switches and are safer and easier to use.	
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Q.NO.: 5	**A main switch in the main distribution board is present in :** **a. a live wire** **b. a neutral wire** **c. a live as well as neutral wire** **d. an earth wire**	YEAR [2022]
ANS.:	(c) a live as well as neutral wire **Explanation:** The main switch in the distribution board is connected to both the live and neutral wires to control the entire circuit.	
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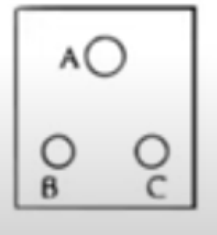
Q.NO.: 6	**Three wires with proper colour coding are connected to the three terminals of a three-pin socket. Match the colour of the wire with the proper terminals A, B and C of the socket.**  **(a) Brown** **(b) Green** **(c) Light blue**	**YEAR** **[2022]**
ANS.:	A: **Green** (Earth wire) B: **Light Blue** (Neutral wire) C: **Brown** (Live wire) **Explanation**: This specifies the standard color coding for wires in a three-pin socket.	
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Q.NO.: 7	**Why it is not advisable to use a piece of copper wire as fuse wire in an electric circuit?**	**YEAR** **[2020]**
ANS.:	Copper has low resistivity and a high melting point, whereas a fuse wire should have high resistivity and a low melting point. **Explanation**: Fuse wires need to melt easily to break the circuit in case of excess current and hence need the opposite properties of copper.	
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Q.NO.: 8	**(i) Write one advantage of connecting electrical appliances in parallel combination.** **(ii) What characteristics should a fuse wire have?** **(iii) Which wire in a power circuit is connected to the metallic body of the appliance?**	**YEAR** **[2019]**
ANS.:	(i) Each appliance works at the same potential. **Explanation**: Parallel circuits ensure each appliance receives the same voltage.	

	(ii) High resistivity and low melting point. **Explanation:** This ensures the fuse wire melts and breaks the circuit with excess current. (iii) Earth wire. **Explanation**: This protects against electric shocks by providing a path to the ground for excess current.	
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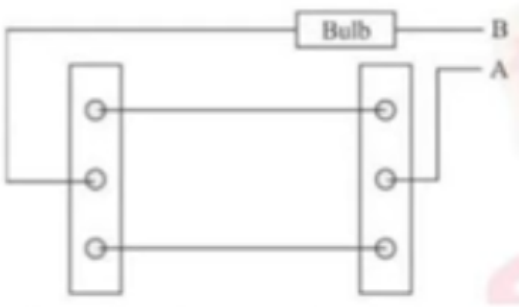
Q.NO.: 9	**The diagram below shows a dual control switch circuit connected to a bulb:**  **(i) Copy the diagram and complete it so that the bulb is switched on.** **(ii) Out of A and B which one is a live wire and which one is a neutral wire.**	**YEAR [2019]**
ANS.:	(i) The diagram can be completed by connecting either the top two or the bottom two terminals on both sides. (ii) A is the **live wire**, and B is the **neutral wire**. **Explanation**: This demonstrates the completion of a circuit for a dual control switch.	
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Q.NO.: 10	**Identify the following wire used in a household circuit** **(i) The wire is also called as the phase wire** **(ii) The wire is connected to the top terminal of a 3 pin socket.**	**YEAR [2018]**
ANS.:	(i) This is the **live wire** (ii) This is the **earth wire**	
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Q.NO.: 11	**An electric iron is rated 220 V, 2 kW.** **(i) If the iron is used for 2h daily while the cost of running it for one week if it cost Rs.4.25 per kWh.** **(ii) Why is the fuse absolutely necessary in a power circuit?**	**YEAR** **[2018]**
ANS.:	(i) Total energy consumed in one week = 2 kW * 2 hours/day * 7 days = 28 kWh. Total cost = 28 kWh * ₹4.25/kWh = ₹119. **Explanation**: This is a calculation of energy consumption and cost. (ii) A fuse melts and stops the current flow in case of excess current, protecting appliances from damage. **Explanation**: Fuses are crucial safety devices in a circuit.	
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Q.NO.: 12	**A fuse is rated 8A. Can it be used with an electrical appliance rated 5 K W, 200 V? Give a reason.**	**YEAR** **[2018]**
ANS.:	No, an **8A fuse cannot be used** with a 5kW, 200V appliance. The appliance will draw 25A of current, which exceeds the fuse's rating of 8A. A fuse is designed to melt when the current exceeds its rating to protect the appliance. If an 8A fuse was used, it would likely melt or blow due to the excessive current and the appliance will not function .	
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Q.NO.: 13	**(i) Name the colour code of the wire which is connected to the metallic body of an appliance** **(ii) Draw diagram of a dual control appliance is switched 'ON'.**	**YEAR** **[2017]**
ANS.:	**(i) Green or Yellow**. **Explanation**: Standard color coding for earth wires. (ii) The diagram is similar to the one described in the **2019 question** with either the top or the bottom two terminals connected on each side. The bulb can be replaced with a load. **Explanation**: This is the correct way to draw the schematic of a dual switch circuit in the "on" position.	
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Q.NO.: 14	**(i) Which particles are responsible for current in conductors** **(ii) To which wire of a cable in a power circuit should the metal case of a geezer be connected ?** **(iii) To which wire should the fuse be connected?**	YEAR [2017]
ANS.:	(i) **Electrons** **Explanation**: Electrons are the charge carriers in metal conductors. (ii) **Earth wire**. **Explanation**: Earthing prevents electric shock from the metal casing of appliances (iii) **Live wire**. **Explanation:** Fuses must be connected in series with the live wire to stop the current flow.	
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Q.NO.: 15	**(i) Explain the meaning of the statement 'current rating of a fuse is 5A'** **(ii) In the transmission of power the voltage of power generated at the generating station is stepped up from 11 kV to 132 kV before it is transmitted why?**	YEAR [2017]
ANS.:	(i) The fuse can handle a maximum current of 5 amperes. If the current exceeds 5 amperes, the fuse will blow or melt. **Explanation**: This means the circuit is designed to operate at 5A and will break if it exceeds that value. (ii) To reduce current and minimize energy loss due to heat during transmission. **Explanation**: High voltage means lower current and therefore less energy loss due to heat.	
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Q.NO.: 16	**State the characteristics required in a material to be used as an effective fuse wire.**	YEAR [2016]
ANS.:	**High resistivity** and **low melting point**. **Explanation**: Same answer as in 2019 and earlier questions	
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Q.NO.: 17	**(i) Which particles are responsible for current in conductors ?** **(ii) To which wire of a cable in a power circuit should the metal case of a geyser be connected?** **(iii) To which wire should the fuse be connected?**	**YEAR** **[2016]**
ANS.:	**(i) Electrons** are the particles responsible for current in conductors. (ii) The metal case of a geyser should be connected to the **earth wire.** (iii) The fuse should be connected to the **live wire**.	
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Q.NO.: 18	**(i) Name the transformer used in the power transmitting station of a power plant.** **(ii) What type of current is transmitted from the power station?** **(iii) At what voltage is this current available to our household?**	**YEAR** **[2016]**
ANS.:	(i) **Step-up transformer**. **Explanation:** A step-up transformer increases voltage for transmission. (ii) **Alternating Current (AC)**. **Explanation**: AC is the type of current used for power transmission. (iii) **220 volts**. **Explanation**: Standard household voltage supply.	
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Q.NO.: 19	**(a)** **(i) Name the device used to increase the voltage at a generating station.** **(ii) At what frequency is A.C. supplied to residential houses?** **(iii) Name the wire in a household electrical circuit to which the switch is connected?**	**YEAR** **[2015]**
ANS.:	(i) **Step-up transformer** **(ii) 50 Hertz.** **Explanation: Standard frequency of AC power supply.** **(iii) Live wire.** **Explanation: Switches are always connected to the live wire to control the circuit.**	

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Q.NO.: 20	**What is consumed using different electrical appliances, for which electricity bills are paid?**	YEAR [2014]
ANS.:	Electrical energy	
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Q.NO.: 21	**(i) Two sets A and B, of the three bulbs each, are glowing in two separate rooms. When one of the bulbs in set A is fused, the other two bulbs also cease to glow. But in set B, when one bulb fuses, the other two bulbs continue to glow. Explain why this phenomenon occurs.** **(ii) Why do we prefer arrangements of Set B for house circuiting?**	YEAR [2014]
ANS.:	(i) Bulbs in set A are connected in **series**14, and in set B are connected in **parallel**. **Explanation**: Series circuits break when one element fails, parallel circuits do not. (ii) Because household equipment have different current ratings, and parallel circuits ensure each appliance draws the current it needs and if one device is damaged the others are unaffected. **Explanation**: This explains why parallel circuits are preferred in household wiring.	
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