PREVIOUS YEAR QUESTIONS
(Chapterwise)

CHAPTER NAME: CURRENT ELECTRICITY

SUMMARY POINTS

Concept	Key Points & Formulae	SI Units
Electric Current (I)	- Rate of flow of charge: $I = \frac{Q}{t}$, where Q is charge and t is time.	- Ampere (A)
Ohm's Law	- $V = IR$, where V is voltage, I is current, and R is resistance.	- Volt (V), Ohm (Ω)
Resistance (R)	- $R = \frac{\rho L}{A}$, where ρ = resistivity, L = length, A = cross-sectional area.	- Ohm (Ω)
Resistivity (ρ)	- $\rho = R\frac{A}{L}$.	- Ohm-meter (Ω·m)
Conductance (G)	- Reciprocal of resistance: $G = \frac{1}{R}$.	- Siemens (S)
Series Combination of Resistors	- Total resistance: $R_{\text{total}} = R_1 + R_2 + \ldots + R_n$.	- Ohm (Ω)
Parallel Combination of Resistors	- Total resistance: $\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_n}$.	- Ohm (Ω)
Power (P)	- Rate of energy consumption: $P = VI = I^2R = \frac{V^2}{R}$.	- Watt (W)
Energy (E)	- $E = Pt = VIt$, where t = time.	- Joule (J)

Key Formulas and Notes:

Formulas

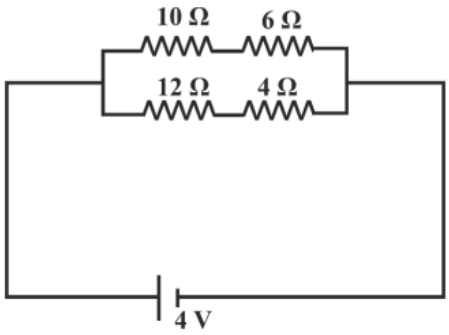
1. **Current**:
$$I = \frac{Q}{t}$$
2. **Ohm's Law**:
$$V = IR$$
3. **Resistance**:
$$R = \frac{\rho L}{A}$$
4. **Series Combination**:
$$R_{\text{total}} = R_1 + R_2 + \ldots + R_n$$
5. **Parallel Combination**:
$$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_n}$$
6. **Power**:
$$P = VI = I^2R = \frac{V^2}{R}$$
7. **Energy**:
$$E = Pt = VIt$$

Key Notes:

- **Ohm's Law**: Voltage is directly proportional to current for a constant resistance.
- **Factors affecting resistance**:
  - Length of conductor: $R \propto L$.
  - Area of cross-section: $R \propto \frac{1}{A}$.
  - Material: $R \propto \rho$, where ρ is resistivity.
- **Resistivity** depends only on material and temperature.
- **Power in Circuits**: Higher resistance reduces current and hence decreases power consumption.

Q.NO.: 1	The specific resistance of a conductor depends on its: (a) length (b) material (c) area of cross section (d) radius	YEAR [2024]
ANS.:	(b) material	
TOPIC:	Page No.:	Ref. Link

Q.NO.: 2	The potential difference between terminals of a cell in a closed electric circuit is: (a) terminal voltage (b) electro motive force (c) voltage drop (d) none of these	YEAR [2024]
ANS.:	(a) terminal voltage.	
TOPIC:	Page No.:	Ref. Link

Q.NO.: 3	**Study the diagram:**  **(a) Calculate the total resistance of the circuit.** **(b) Calculate the current drawn from the cell.** **(c) State whether the current through 10 Ω resistor is greater than, less than or equal to the current through the 12 Ω resistor.**	**YEAR** **[2024]**
ANS.:		
TOPIC: **Page No.:**		Ref. Link

Q.NO.: 4	**When a current I flows through a wire of resistance R for time t then the electrical energy produced is given by:** **a. F^2Rt** **b. I^2Rt** **c. IRt** **d. IRt^2**	**YEAR** **[2023]**
ANS.:	The electrical energy produced is given by **I^2Rt.** ***Explanation:*** This formula is also used for heat energy and is a standard relationship in current electricity.	
TOPIC: **Page No.:**		Ref. Link

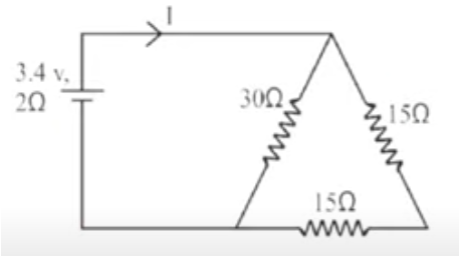
Q.NO.: 5	**Choose the correct relation for e.m.f.(e) and terminal voltage V:** **a. ε = V [always]** **c. V < ε [when the cell is in use]** **b. V > = ε [always]** **d. None of these**	**YEAR** **[2023]**

ANS.:	Terminal voltage is less than EMF when the cell is in use {V > = ε [always]}. ***Explanation:*** When a cell is in use, there is a voltage drop due to internal resistance, thus the terminal voltage is less than the EMF of the cell.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 6	**'A geyser is rated 240 W - 220 V'. Explain the meaning of this statement.**	**YEAR [2023]**
ANS.:	It means that when the geyser is operated on a 220V supply, it consumes 240 W of electric power, or it consumes 240 Joules of electrical energy in one second. ***Explanation:*** This describes the power rating of the geyser under standard operating conditions.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 7	**(a) Define specific resistance.** **(b) What happens to the specific resistance of a conductor if its length is doubled?** **(c) Name a substance whose specific resistance remains almost unchanged with the increase in its temperature.**	**YEAR [2023]**
ANS.:	(a) **Specific resistance** (also known as resistivity) is the resistance of a material with a **unit length and a unit cross-sectional area**. It is a measure of how strongly a material opposes the flow of electric current. The specific resistance of a material is the resistance of a wire of that material with unit length and unit area of cross section. (b) • If the length of a conductor is doubled, its **specific resistance remains unchanged**. • Specific resistance **does not depend on the dimensions** of the wire (like length or cross-sectional area). It is an intrinsic property of the material. (c) **Manganin** is a substance whose specific resistance remains almost unchanged with an increase in its temperature.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 8	**Find the value of current I drawn from the cell.** **(a) Calculate the current I.** **(b) Calculate the terminal voltage.**	**YEAR [2023]**



ANS.:

(a) To calculate the current, you need the total electromotive force (EMF) and the total resistance of the circuit.
• The **EMF** of the cell is given as **3.4 volts**.
• The circuit contains a **2-ohm** resistor that is part of the cell and a combination of resistors arranged in a triangle.
• The triangle consists of two **15-ohm** resistors in series and a **30-ohm** resistor.

◦ The two 15-ohm resistors in series are equivalent to a 30-ohm resistance (15 + 15 = 30).
◦ The 30-ohm resistor and the equivalent 30-ohm from the series pair are in parallel, which gives an effective resistance of 15 ohms.This is calculated using the formula 1/Rp = 1/30 + 1/30, resulting in Rp = 15.
◦ The total resistance of the circuit is the parallel resistance plus the internal resistance of the battery:
15 ohms + 2 ohms = 17 ohms.

• Using Ohm's Law (**I = EMF / Total Resistance**), the current is calculated as:
I = 3.4 V / 17 ohms = 0.2 A

(b) Calculating the Terminal Voltage

• Terminal voltage is the potential difference across the terminals of the cell.
• To calculate the terminal voltage, only the external resistance is considered and not the internal resistance of the battery.
• The external resistance in this case is the equivalent resistance of the resistor combination, which is 15 ohms.
• Using Ohm's Law again, the terminal voltage (V) is calculated as: **V = I * R**.
• The current I is 0.2 amperes and external resistance R is 15 ohms.
• Therefore, the terminal voltage **V = 0.2 A * 15 ohms = 3 volts**

TOPIC: **Page No.:** Ref. Link

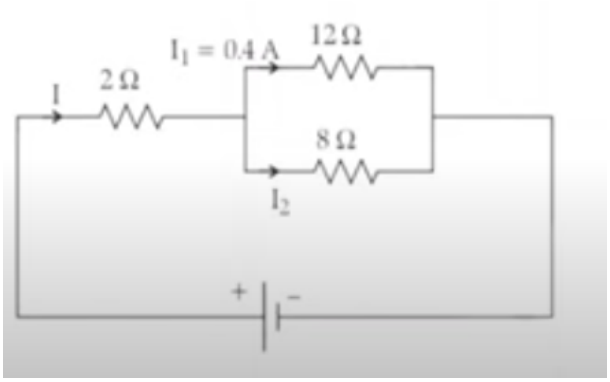
Q.NO.: 9

The graph plotted for potential difference (V) against current (I) for ohmic resistors is:

a. A curve passing through the origin.
b. A straight line not passing through origin.
c. A straight line passing through the origin.

YEAR
[2022]

	d. A circle centred at the origin.	
ANS.:	(c) A straight line passing through the origin. ***Explanation:*** This is a characteristic of ohmic resistors, where the voltage and current are directly proportional.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 10	**In the below circuit diagram, calculate:** **(a) the external resistance of the circuit.** **(b) the current 12-** **(c) the current I.**  	**YEAR** **[2022]**
ANS.:	(a) External resistance: 6.8 Ω. The resistors are connected in parallel, and the result of that is then added to the remaining resistance in series. (b) **Current i^2:** 0.6 A. Ohm's law and the principle that voltage is the same across parallel branches was used to calculate the current i^2. (c) **Total current i:** 1 A. Total current was found by adding the currents in the parallel paths. ***Explanation:*** This problem uses series and parallel resistance rules and Ohm's law to solve.	
TOPIC:	**Page No.:**	Ref. Link

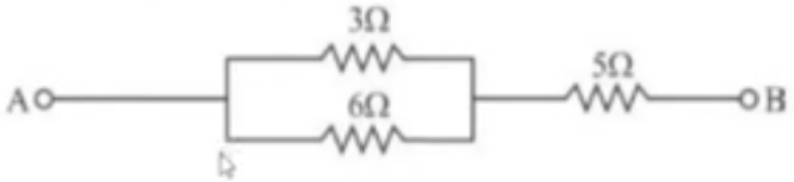
Q.NO.: 11	**An appliance rated 440 W, 220V is connected across 220V supply.** **(a) Calculate the maximum current that the appliance can draw.** **(b) Calculate the resistance of the appliance.**	**YEAR** **[2022]**

ANS.:	(a) Maximum Current: 2 A. Calculated by dividing power by voltage (I = P/V). (b) Resistance: 110 Ω. Calculated using ($R = V^2/P$) or Ohm's law. ***Explanation:*** Power and voltage ratings are used to calculate current and resistance.	
TOPIC:	**Page No.:**	Ref. Link

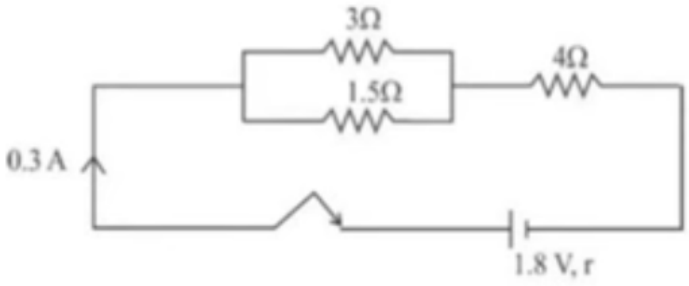
Q.NO.: 12	**If a wire of resistance 25 gets stretched to thrice its original length:** **(a) Calculate the new resistance of the wire.** **(b) What happens to the specific resistance of the wire?**	**YEAR [2022]**
ANS.:	(a) New resistance: 18 Ω. The calculation accounts for the increase in length and corresponding decrease in area. (b) Specific resistance: Remains unchanged8. Specific resistance depends only on the material, not dimensions. ***Explanation:*** This problem shows the effect of changing dimensions on resistance while remembering that specific resistance is an intrinsic property.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 13	**Define a kilowatt hour. How is it related to joule?**	**YEAR [2020]**
ANS.:	A kilowatt-hour is the energy spent or work done by a source of 1kW power in 1 hour. 1 kWh = 3.6×10^6 J. ***Explanation:*** This defines a unit of energy used in electrical contexts and gives the conversion to Joules.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 14	**Calculate the total resistance across AB.**	**YEAR [2020]**

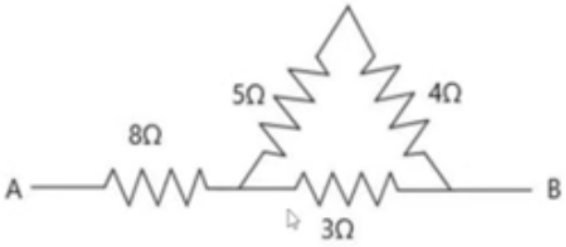
		
ANS.:	7 Ω. Series and parallel combinations of resistors are used to find the total resistance. ***Explanation:*** This involves combining parallel resistances and then adding them to series resistances.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 15	**(i) What are superconductors?** **(ii) Calculate the current drawn by an appliance rated 110 W, 220 V when connected across 220 V supply.** **(iii) Name a substance whose resistance decreases with the increase in temperature.**	**YEAR** **[2020]**
ANS.:	(i) Superconductors are materials with zero resistance at very low temperatures. (ii) 0.5 A. Calculated using I = P / V (iii) Carbon or Silicon ***Explanation:*** This question covers superconductors, current calculation, and materials with a negative temperature coefficient of resistance.	
TOPIC:	**Page No.:**	Ref. Link

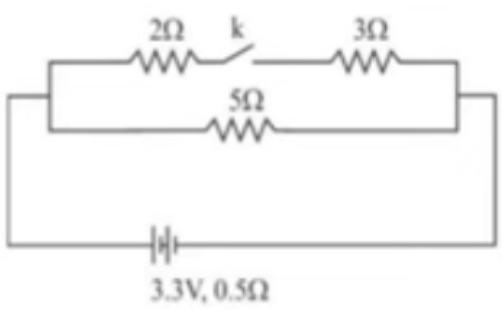
Q.NO.: 16	 **The diagram above shows three resistors connected across a cell of e.m.f. 1.8 V** **and internal resistance r.**	**YEAR** **[2020]**

	Calculate: **(i) Current through 3Ω resistor.** **(ii) The internal resistance r.**	
ANS.:	(i) Current through 3Ω resistor: 0.1 A. The potential across the parallel combination is used and Ohm's law then gives the current. (ii) Internal resistance: 1 Ω. The formula **E = I(R + r)** was used to calculate the internal resistance. ***Explanation:*** This involves using Ohm's law and internal resistance to solve.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 17	**How does an increase in the temperature affect the specific resistance of** **(i) Metal and** **(ii) Semiconductor?**	**YEAR** **[2019]**
ANS.:	(i) Metal: Specific resistance increases; (ii) Semiconductor: Specific resistance decreases. ***Explanation:*** This describes the temperature dependence of resistivity for different materials.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 18	**Calculate the effective resistance across AB:-**  	**YEAR** **[2019]**
ANS.:	10.25 Ω. Series and parallel combinations are used to get the total resistance. ***Explanation:*** Series and parallel resistor combinations are key to solving this problem.	

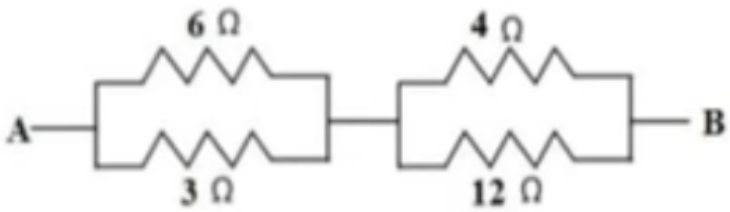
TOPIC:	Page No.:	Ref. Link

Q.NO.: 19	 **The diagram above shows a circuit with the key k open.** **Calculate:** **(i) the resistance of the circuit when the key k is open.** **(ii) the current drawn from the cell when the key k is open.** **(iii) the resistance of the circuit when the key k is closed.** **(iv) the current drawn from the cell when the key k is closed.**	YEAR [2019]
ANS.:	(i) Resistance when k is open: 5.5 Ω (ii) Current when k is open: 0.6 A (iii) Resistance when k is closed: 3 Ω (iv) Current when k is closed: 1.1 A ***Explanation:*** This problem focuses on circuit behavior under different conditions (open and closed key), involving series and parallel circuit analysis.	

TOPIC:	Page No.:	Ref. Link

Q.NO.: 20	**You have three resistors of values 2Ω, 3Ω and 5Ω. How will you join them so that the total resistance is more than 7Ω?** **(i) Draw a diagram for the arrangement.** **(ii) Calculate the equivalent resistance.**	YEAR [2018]
ANS.:	(i) The resistors are joined in series. (ii) The equivalent resistance is 10 Ω.	

	Explanation: To obtain the maximum equivalent resistance, the resistors are connected in series.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.:21	**Find the equivalent resistance between A and B.**  	**YEAR [2018]**
ANS.:	5 Ω ***Explanation:*** This involves calculating the resistance of two parallel sets of resistors and then adding them in series.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 22	**An electric iron is rated 220V, 2kW. If the iron is used for 2h daily find the cost of running it for one week if it costs 4.25 per kWh.**	**YEAR [2018]**
ANS.:	The total energy consumed is 28 kWh, and the cost is ₹119. ***Explanation:*** The problem combines power consumption, time, and cost calculations.	
TOPIC:	**Page No.:**	Ref. Link

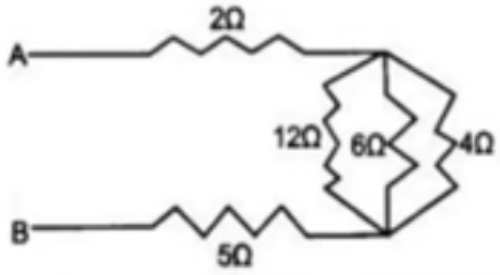
Q.NO.: 23	**An electric bulb of resistance 500S, draws a current of 0.4A. Calculate the power of the bulb and the potential difference at its end.**	**YEAR [2017]**
ANS.:	Power is 80 W and potential difference is 200 V. ***Explanation:*** Ohm's law and power relationships are used to solve.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 24	**A music system draws a current of 400 mA when connected to a 12 V battery.** **(i) What is the resistance of the music system?** **(ii) The music system is left playing for several hours and finally the battery**	**YEAR** **[2016]**
ANS.:	(i) Resistance: 30 Ω (ii) Voltage: 9.6 V ***Explanation:*** The same resistance value is used to find the voltage with the new current.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 25	**Calculate the quantity of heat produced in a 2Ω resistor carrying 2.5A current in 5 minutes.**	**YEAR** **[2016]**
ANS.:	37500 J. ***Explanation:*** This uses the formula for heat **($H = I^2Rt$)**.	
TOPIC:	**Page No.:**	Ref. Link

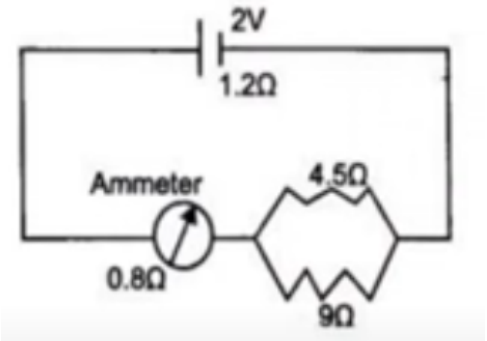
Q.NO.: 26	**What happens to the resistivity of semi-conductors with the increase of temperature?**	**YEAR** **[2015]**
ANS.:	The resistivity decreases. ***Explanation:*** This discusses the behavior of semiconductors with respect to temperature.	
TOPIC:	**Page No.:**	Ref. Link

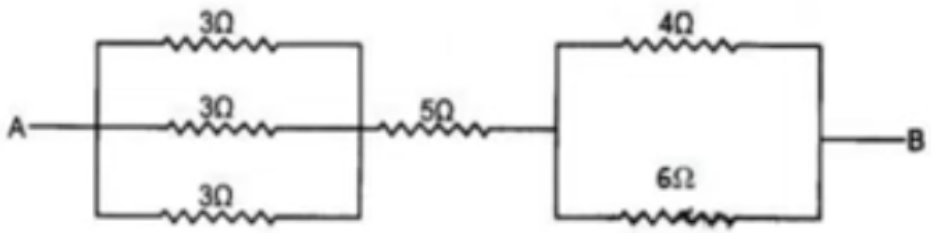
Q.NO.: 27	**Find the equivalent resistance between points A and B.**	**YEAR** **[2015]**

		
ANS.:	9 Ω. ***Explanation:*** This involves series and parallel combinations of resistors.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 28	**The relationship between the potential difference and the current in a conductor is stated in the form of a law.** **(i) Name the law.** **(ii) What does the slope of V-I graph for a conductor represent?** **(iii) Name the material used for making the connecting wire.**	**YEAR** **[2015]**
ANS.:	(i) Ohm's law (ii) Resistance (iii) Copper	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 29	**A cell of e.m.f. 2 V and internal resistance 1.2 Ω is connected with an ammeter of resistance 0.8 Ω and two resistors of 4.5 Ω and 9 Ω as shown in the diagram below**	**YEAR** **[2015]**

	 **(i) What would be the reading on the Ammeter?** **(ii) What is the potential difference across the terminals of the cell?**	
ANS.:	(i) Ammeter Reading: 0.4 A (ii) Terminal Voltage: 1.52 V ***Explanation:*** This problem focuses on the use of Ohm's law and understanding of internal resistance and terminal voltage.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 30	**Find the equivalent resistance between points A and B.** 	**YEAR** **[2014]**
ANS.:	8.4 Ω. ***Explanation:*** Series and parallel resistor combinations are used to solve the problem.	
TOPIC:	**Page No.:**	Ref. Link

Q.NO.: 31	**(a) Two resistors of 4Ω and 6Ω are connected in parallel to a cell to draw 0.5 A current from the cell.**	**YEAR** **[2014]**

	(i) Draw a labelled circuit diagram showing the above arrangement. **(ii) Calculate the current in each resistor.** **(b)** **(i) What is an Ohmic resistor?** **(ii) Two copper wires are of the same length, but one is thicker than the other.** **(1) Which wire will have more resistance?** **(2) Which wire will have more specific resistance?**	
ANS.:	(a) (ii) Current in 4Ω resistor: 0.3 A Current in 6Ω resistor: 0.2 A ***Explanation:*** This problem combines circuit drawing with current distribution in a parallel circuit. (b) (i) A resistor that obeys Ohm's law. (ii) (1) Thin wire has more resistance (2) Specific resistance is the same for both. ***Explanation:*** This describes the properties of ohmic resistors and resistance relative to dimensions and material.	
TOPIC:	**Page No.:**	Ref. Link