CBSE CLASS X

Science (086)

QUESTION PAPER

AI-generated question paper

Code: P8HPB7 **Questions: 51** **Maximum Marks: 148** **Generated: 2026-06-25 17:52**

SELECTIONS USED

Subject	Science
Lessons	11 Electricity
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 4 straightforward · 28 medium · 19 deep | Types: 36 Short · 8 Long · 5 Very short · 2 MCQ

Q1. medium · thorough-understanding · § Chapter Introduction **[3]**

A switch in a torch circuit is opened (turned off). Explain, in terms of what happens to the electric charges, why the bulb stops glowing.

◆ **Electricity**

Q2. medium · thorough-understanding · § 11.1 ELECTRIC CURRENT AND CIRCUIT **[3]**

In a metallic wire, electrons are the actual charge carriers, yet the conventional direction of electric current is taken as opposite to the direction of electron flow. Why was this convention established, and what practical consequence does it have when analysing a circuit?

◆ **Electricity**

Q3. medium · thorough-understanding · § 11.1 ELECTRIC CURRENT AND CIRCUIT **[1]**

A charge of 180 C flows through a conductor in 2 minutes. (i) Calculate the electric current through the conductor. (ii) If the potential difference across the conductor is 12 V, find its resistance. State the law you used in part (ii).

◆ **Electricity**

Q4. deep · thorough-understanding · § 11.1 ELECTRIC CURRENT AND CIRCUIT **[3]**

An ammeter of very low resistance (nearly zero) is accidentally connected in parallel with a resistor of 10 Ω in a circuit supplied by a 6 V cell. (i) What current will flow through the ammeter branch? (ii) What effect will this have on the circuit, and why is this connection incorrect for measuring current?

◆ **Electricity**

Q5. medium · thorough-understanding · § 11.2 ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE **[3]**

A cell maintains a fixed potential difference across its terminals even when no current is drawn from it. (a) When the cell is connected to a resistor, explain the role this potential difference plays in driving current through the circuit. (b) What energy transformation occurs inside the cell to sustain this current, and why does the potential difference across the external resistor fall if the internal resistance of the cell is taken into account?

◆ **Electricity**

Q6. deep | thorough-understanding | § 11.2 ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE **[3]**

A voltmeter connected across a resistor in a circuit reads 9 V, while an ammeter in series reads 3 A. (a) Calculate (i) the resistance of the resistor, and (ii) the work done in moving 6 C of charge through it. (b) A student claims that the potential difference across a resistor is a fixed property of the resistor alone, and will remain 9 V regardless of what else changes in the circuit. Evaluate this claim, explaining what factors in the circuit actually determine the potential difference across a given resistor.

◆ **Electricity**

Q7. straightforward | thorough-understanding | § 11.4 OHM'S LAW **[1]**

State Ohm's law. Under what conditions does a metallic conductor obey it?

◆ **Electricity**

Q8. medium | thorough-understanding | § 11.4 OHM'S LAW **[2]**

The V–I graph of a nichrome wire is found to be a straight line passing through the origin. What two conclusions can you draw about the electrical nature of the conductor from this observation?

◆ **Electricity**

Q9. medium | thorough-understanding | § 11.4 OHM'S LAW **[2]**

A student connects a resistor to a 4 V source and measures a current of 0.5 A. She then doubles the potential difference across the same resistor. Predict the new current and justify your answer using Ohm's law.

◆ **Electricity**

Q10. medium | thorough-understanding | § 11.4 OHM'S LAW **[2]**

Ohm's law holds true for a metallic wire only under a specific condition. What is that condition, and why is it necessary?

◆ **Electricity**

Q11. medium | thorough-understanding | § 11.4 OHM'S LAW **[3]**

Explain how a rheostat controls the current in a circuit without changing the voltage of the source. In your answer, relate its working to the relevant physical property of the conductor.

◆ **Electricity**

Q12. deep | thorough-understanding | § 11.4 OHM'S LAW **[3]**

Two resistors P and Q are made of the same material and have the same length, but Q has twice the cross-sectional area of P. When both are connected one at a time to the same battery, compare the currents flowing through them. Show your reasoning clearly.

◆ **Electricity**

Q13. deep | thorough-understanding | § 11.4 OHM'S LAW **[5]**

(a) A student claims: 'If the resistance of a conductor is high, no current can flow through it at all.' Critically evaluate this statement using Ohm's law, giving a suitable example to support your answer.
(b) An electric heater coil (R = 50 Ω) and an electric bulb filament (R = 1000 Ω) are connected separately to the same 200 V supply. Calculate the current drawn by each. Which draws more current, and by what factor? Explain why heating appliances are designed to have lower resistance than lighting appliances.

◆ **Electricity**

Q14. deep | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

A nichrome wire of length l and cross-sectional area A has a resistance R. If you stretch the same wire so that its length becomes 2l (assume the volume remains constant, so the area becomes A/2), what will be the new resistance? Show your reasoning.

◆ **Electricity**

Q15. deep | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

Two wires P and Q are made of the same material. Wire P has twice the length and twice the diameter of wire Q. What is the ratio of resistance of P to resistance of Q?

◆ **Electricity**

Q16. medium | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

Why does doubling the length of a conducting wire double its resistance, while doubling its cross-sectional area halves its resistance? Explain with reference to the factors that govern resistance in a conductor.

◆ **Electricity**

Q17. medium | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[1]**

Which of the following changes to a copper wire will reduce its resistance to one-quarter of its original value?
(A) Halving its length and doubling its cross-sectional area
(B) Doubling its length and halving its cross-sectional area
(C) Halving both its length and cross-sectional area
(D) Doubling both its length and cross-sectional area

A Halving its length and doubling its cross-sectional area
B Doubling its length and halving its cross-sectional area
C Halving both its length and cross-sectional area
D Doubling both its length and cross-sectional area

◆ **Electricity**

Q18. medium | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

Nichrome has a much higher resistivity than copper, yet nichrome — not copper — is used as the heating element in electric toasters. Justify this choice by comparing the relevant properties of the two materials.

◆ **Electricity**

Q19. medium | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[2]**

A student claims: 'If I replace the wire in a circuit with one made of a different material but keep the length and thickness exactly the same, the current will not change.' Is this claim correct? Explain.

◆ **Electricity**

Q20. medium | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[2]**

Define electrical resistivity of a material. A copper wire and a nichrome wire have exactly the same dimensions. Can you use the resistance of these wires alone (without knowing the material) to compare the materials? Explain why resistivity is a more suitable property for this comparison.

◆ **Electricity**

Q21. medium | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

Wire X is made of copper and wire Y is made of manganin. Both wires have identical dimensions. In which wire will electrons experience greater opposition to their flow? Given that the resistivity of manganin is approximately 2700 times that of copper, by what factor is the resistance of wire Y greater than that of wire X?

◆ **Electricity**

Q22. deep | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

Resistivity of a conductor changes with temperature. If the resistivity of a nichrome wire increases when it is heated, what happens to the current through it if it is connected to the same voltage source before and after heating? Justify your answer using relevant relationships.

◆ **Electricity**

Q23. deep | thorough-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

A wire of resistance 12 Ω is bent into a closed square loop. What is the resistance measured between two diagonally opposite corners of the square?

◆ **Electricity**

Q24. deep | thorough-understanding | § 11.6 RESISTANCE OF A SYSTEM OF RESISTORS **[5]**

A student connects three identical resistors, each of resistance 6 Ω, first in series and then in parallel across the same 12 V battery.
(i) Calculate the equivalent resistance and total current drawn from the battery in each case.
(ii) Using your calculated values, find the ratio of currents drawn in the parallel and series combinations. Explain, in terms of how equivalent resistance changes with configuration, why such a large difference in current arises.
(iii) In a household, electrical appliances are connected in parallel rather than in series. Using your findings above, give TWO distinct reasons why parallel connection is preferred.

◆ **Electricity**

Q25. straightforward | thorough-understanding | § 11.6.1 Resistors in Series **[1]**

[very_short_answer] Three resistors of 4 Ω, 6 Ω, and 10 Ω are connected in series to a 20 V battery. Calculate the potential difference across the 6 Ω resistor.

◆ **Electricity**

Q26. straightforward | thorough-understanding | § 11.6.1 Resistors in Series **[1]**

In a series circuit, an ammeter placed before the first resistor shows a reading of 0.3 A. Without any calculation, what will the ammeter read if it is moved to a position between the second and third resistors? Justify your answer.

◆ **Electricity**

Q27. medium | thorough-understanding | § 11.6.1 Resistors in Series **[3]**

When resistors are connected in series, the equivalent resistance is always greater than any individual resistance in the combination. Explain why this must be true, using the physics of what resistance represents.

◆ **Electricity**

Q28. medium | thorough-understanding | § 11.6.1 Resistors in Series **[5]**

[long_answer] Three resistors of 5 Ω, 10 Ω, and 15 Ω are connected in series across a 30 V supply. (a) Calculate the current through the circuit and the potential difference across each resistor. (b) Which resistor dissipates the most power? Justify using an appropriate formula. (c) If the 15 Ω resistor is now removed and the remaining two resistors stay connected in series to the same 30 V supply, how does the power dissipated in the 5 Ω resistor change? Support your answer with calculations.

◆ **Electricity**

Q29. deep | thorough-understanding | § 11.6.1 Resistors in Series **[3]**

A torch uses two identical cells, each of 1.5 V, and the bulb has a resistance of 5 Ω. A fault develops so that one cell is inserted in reverse (opposing the other). Explain what happens to the current through the bulb, and why this is consistent with the series-circuit principles you have studied.

◆ **Electricity**

Q30. deep | thorough-understanding | § 11.6.1 Resistors in Series **[3]**

[short_answer] Explain, with reference to how current and potential difference behave in a series circuit, why a series arrangement is NOT suitable for connecting domestic electrical appliances such as a refrigerator and a ceiling fan.

◆ **Electricity**

Q31. straightforward | thorough-understanding | § 11.6.2 Resistors in Parallel **[1]**

Three resistors of 6 Ω, 12 Ω, and 4 Ω are connected in parallel across a 12 V battery. (i) Calculate the equivalent resistance of the combination. (ii) What total current does the battery supply? Comment on how the equivalent resistance compares with the smallest individual resistor.

◆ **Electricity**

Q32. medium | thorough-understanding | § 11.6.2 Resistors in Parallel **[2]**

In a parallel combination of resistors, the potential difference across each resistor is the same, yet the current through each resistor is different. Explain why this is so.

◆ **Electricity**

Q33. medium | thorough-understanding | § 11.6.2 Resistors in Parallel **[3]**

Two resistors, P (10 Ω) and Q (40 Ω), are connected in parallel to a 20 V supply. A student claims that more current flows through Q because it is connected to the same voltage as P. Is the student correct? Justify your answer with a calculation.

◆ **Electricity**

Q34. medium | thorough-understanding | § 11.6.2 Resistors in Parallel **[3]**

When resistors are connected in parallel, the equivalent resistance of the combination is always less than the smallest individual resistance. Explain why this must be so, and verify your reasoning with a numerical example using two resistors of your choice.

◆ **Electricity**

Q35. medium | thorough-understanding | § 11.6.2 Resistors in Parallel **[3]**

An electric lamp (100 Ω), a toaster (50 Ω), and a water filter (500 Ω) are connected in parallel to a 220 V source. A fourth appliance — an electric iron — is then connected in parallel to the same source and draws the same total current as all three original appliances combined. Calculate the resistance of the electric iron.

◆ **Electricity**

Q36. medium | thorough-understanding | § 11.6.2 Resistors in Parallel **[3]**

Household electrical appliances such as lights, fans, and refrigerators are always wired in parallel rather than in series. Give TWO distinct reasons to justify this practice.

◆ **Electricity**

Q37. deep | thorough-understanding | § 11.6.2 Resistors in Parallel **[5]**

A battery of EMF 24 V has an internal resistance of 2 Ω. Three resistors of 10 Ω, 15 Ω, and 30 Ω are connected in parallel and this parallel combination is then connected in series with the battery's internal resistance. (a) Find the equivalent resistance of the parallel combination. (b) Find the total current drawn from the battery. (c) Find the potential difference actually available across the parallel combination. (d) Hence, determine the current through the 30 Ω resistor. Show your reasoning at each step.

◆ **Electricity**

Q38. medium | thorough-understanding | § 11.7 HEATING EFFECT OF ELECTRIC CURRENT **[2]**

An electric heater and the connecting cord supplying it are both carrying the same current. The heating element glows red-hot, but the cord remains cool. Explain why, using the relevant physical law.

◆ **Electricity**

Q39. medium | thorough-understanding | § 11.7 HEATING EFFECT OF ELECTRIC CURRENT **[3]**

A fuse wire must melt quickly when an excessive current flows, yet it must not melt during normal operation. Explain how the choice of material and design of a fuse wire allows it to fulfil both these requirements.

◆ **Electricity**

Q40. deep | thorough-understanding | § 11.7 HEATING EFFECT OF ELECTRIC CURRENT **[5]**

Two resistors P (2 Ω) and Q (8 Ω) are connected in series to a battery. A student claims that Q will produce more heat per second than P. Is the student correct? Justify your answer with a calculation. How would the ratio of heat produced per second in P and Q change if the two resistors were instead connected in parallel to the same battery? Support your answer with a calculation.

◆ **Electricity**

Q41. deep | thorough-understanding | § 11.7 HEATING EFFECT OF ELECTRIC CURRENT **[3]**

Tungsten is used for electric bulb filaments while aluminium or copper is used for transmission lines. Both situations involve current flowing through a metal conductor. What property of tungsten makes it suitable for a bulb filament but unsuitable for transmission lines, and what property of copper/aluminium makes them preferable for transmission?

◆ **Electricity**

Q42. medium | thorough-understanding | § 11.7.1 Practical Applications of Heating Effect of Electric Current **[3]**

An electric fuse is rated 5 A. An electric iron rated 1.5 kW operates on a 220 V supply. Will this fuse protect the electric iron safely? Justify your answer with a calculation.

◆ **Electricity**

Q43. deep | thorough-understanding | § 11.7.1 Practical Applications of Heating Effect of Electric Current **[5]**

[long_answer] Tungsten is used as the filament in electric bulbs, while alloys such as nichrome are preferred for the heating coils of devices like toasters and electric irons. Both applications exploit the heating effect of electric current. (i) Explain why tungsten is chosen for a bulb filament rather than for a heating coil. (ii) Why is an alloy preferred over a pure metal for the heating element of a toaster or electric iron?

◆ **Electricity**

Q44. medium | thorough-understanding | § 11.8 ELECTRIC POWER **[3]**

An electric kettle is rated 2 kW at 240 V. Assuming the resistance of the heating element remains constant, calculate the power consumed when it is connected to a 120 V supply. A student argues that halving the voltage will halve the power. Is the student correct? Justify your answer with the appropriate formula.

◆ **Electricity**

Q45. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

A student connects three identical bulbs first in series and then in parallel across the same battery. In which arrangement do the bulbs glow brighter, and why? Your answer must refer to both current distribution and equivalent resistance.

◆ **Electricity**

Q46. medium | thorough-understanding | § (whole-chapter synthesis) **[1]**

Assertion (A): Connecting several household appliances in parallel across the mains is preferred over connecting them in series.
Reason (R): In a parallel combination, the equivalent resistance decreases, allowing each appliance to receive the full supply voltage and draw the current it requires independently.

Choose the correct option:
(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.

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.

◆ **Electricity**

Q47. medium | thorough-understanding | § (whole-chapter synthesis) **[3]**

Two resistors, P (nichrome, length l, cross-sectional area A) and Q (copper, same length l, same cross-sectional area A), are connected in series across a battery. Even though the same current flows through both, the heat generated per second in P is much greater than in Q. (i) Name the physical property of the material responsible for this difference, and state how it differs between nichrome and copper. (ii) Using the expression for electrical power dissipated in a resistor, explain why P generates more heat per second than Q despite carrying the same current.

◆ **Electricity**

Q48. deep | thorough-understanding | § (whole-chapter synthesis) **[5]**

A fuse wire, the heating element of a toaster, and the connecting copper wires in a household circuit all carry the same current simultaneously. (i) Using the relationship $R = \rho l/A$ and $P = I^2R$, explain why the heating element becomes very hot while the copper connecting wires remain cool during normal operation. (ii) The fuse wire does not melt during normal operation but melts during a fault (when current exceeds the rated value). Explain what property of the fuse wire material and its design makes this possible. (iii) Why is copper preferred for connecting wires despite all three conductors carrying the same current?

◆ **Electricity**

Q49. deep thorough-understanding § (whole-chapter synthesis) **[3]**

A resistor is connected across a potential difference V and carries current I. (i) If the potential difference is tripled while the resistance remains fixed, what happens to the current? (ii) The resistor is replaced by one made of the same material but with double the length and half the cross-sectional area. By what factor does the resistance change? Show your working. (iii) With this new resistor connected across the tripled potential difference, calculate the ratio of the new current to the original current I.

◆ **Electricity**

Q50. deep thorough-understanding § (whole-chapter synthesis) **[3]**

An electric circuit has a battery, a resistor of resistance R, and a fuse, all in series. The battery maintains a constant potential difference V. (i) Write an expression for the power dissipated in the resistor. (ii) If R is halved (by replacing it with a shorter wire of the same material and cross-section), what happens to the power dissipated? (iii) Explain why this change could cause the fuse to melt.

◆ **Electricity**

Q51. deep thorough-understanding § (whole-chapter synthesis) **[5]**

A 220 V electric iron rated 1000 W and a 220 V electric bulb rated 100 W are connected in parallel across a 220 V supply. (i) Calculate the resistance of each device. (ii) Calculate the total current drawn from the supply. (iii) If both devices are instead connected in series across the same 220 V supply, calculate the current through the circuit and explain why this series arrangement is unsuitable for practical household use, giving at least two distinct reasons.

◆ **Electricity**

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