CBSE CLASS X

Science (086)

ANSWER KEY

AI-generated question paper

Code: LY8TBK **Questions: 24** **Maximum Marks: 42** **Generated: 2026-06-25 17:47**

SELECTIONS USED

Subject	Science
Lessons	11 Electricity
Level of understanding	Initial understanding
Question selection	Curated chapter coverage (~3 questions per section)
Model	claude-sonnet-4-6

Composition — Difficulty: 15 straightforward · 8 medium · 1 deep | Types: 13 Short · 10 Very short · 1 MCQ

Q1. straightforward | initial-understanding | § Chapter Introduction **[1]**

What is an electric circuit?

◆ **Electricity**

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Model Answer

A continuous and closed path through which electric current flows is called an electric circuit.

Source: Chapter 11, Section 11.1

Explanation

The examiner expects the exact textbook definition. The two key words are **continuous** and **closed path** — both must appear. Avoid vague answers like "a path for electricity."

Q2. straightforward | initial-understanding | § 11.1 ELECTRIC CURRENT AND CIRCUIT **[1]**

Define electric current. State its SI unit.

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Model Answer

Electric current is the rate of flow of electric charges through a conductor. Mathematically, $I = Q/t$. Its SI unit is **ampere (A)**.

Source: Chapter 11, Section 11.1

Explanation

For a 1-mark question, examiners expect the definition and the SI unit in one sentence each. Mentioning the formula $I = Q/t$ adds precision but is optional here. The key terms are "rate of flow of electric charges" and "ampere." Do not write more than two lines.

Q3. medium | initial-understanding | § 11.1 ELECTRIC CURRENT AND CIRCUIT **[2]**

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?

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Model Answer

When the phenomenon of electricity was first studied, electrons were not yet discovered. Scientists assumed electric current to be the flow of positive charges, and the direction of their flow was taken as the direction of current. This convention was established and universally accepted.

Later, when electrons were discovered as the actual charge carriers in metallic conductors, it was found that they flow from the negative terminal to the positive terminal of a cell. To maintain consistency with the already established convention, the direction of conventional current is taken as **opposite** to the direction of electron flow (i.e., from positive to negative terminal).

Source: Chapter 11 – Electricity, Section 11.1 Electric Current and Circuit

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Explanation

- The examiner expects **two key points**: (1) historical reason — electrons were unknown when the convention was set, so positive charge flow was assumed; (2) to maintain the established convention, current direction is kept opposite to electron flow.
- Mention both points clearly for full 2 marks.
- Do not confuse "conventional current" with actual electron movement — state both directions explicitly.

Q4. straightforward | initial-understanding | § 11.2 ELECTRIC POTENTIAL AND POTENTIAL DIFFERENCE **[2]**

What is electric potential difference? State its SI unit and define it.

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Model Answer

Electric potential difference is defined as the work done to move a unit charge from one point to another in an electric circuit.

$$V = \frac{W}{Q}$$

SI unit: Volt (V)

Definition of 1 volt: The potential difference between two points is said to be 1 volt when 1 joule of work is done in moving a charge of 1 coulomb from one point to the other.

$$1\ \text{V} = 1\ \text{J C}^{-1}$$

Source: Chapter 11, Section 11.2 – Electric Potential and Potential Difference

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Explanation

- This is a standard 2-mark question; examiners expect: (1) the definition with formula, and (2) the SI unit with its definition.
- Always write the formula $V = W/Q$ — it shows understanding and often carries a mark.
- "1 V = 1 J C^{-1}" is a frequently tested one-liner; include it when defining the unit.
- Do not confuse **potential** with **potential difference** — the question asks about the *difference* between two points.

Q5. straightforward | initial-understanding | § 11.4 OHM'S LAW **[1]**

State Ohm's law.

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Model Answer

Ohm's Law: The potential difference across the ends of a resistor is directly proportional to the current through it, provided its temperature remains the same.

Explanation

The examiner expects the exact definition as stated in the textbook. Key phrases are "directly proportional," "potential difference," "current," and the condition "temperature remains the same" — omitting the condition can cost marks.

Q6. straightforward | initial-understanding | § 11.4 OHM'S LAW **[1]**

In an electric circuit, the potential difference across a resistor is 12 V and the current through it is 3 A. What is the resistance of the resistor?

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Model Answer

Using Ohm's law: $R = \frac{V}{I} = \frac{12\ \text{V}}{3\ \text{A}} = 4\ \Omega$

The resistance of the resistor is **4 Ω**.

Source: Chapter 11, Ohm's Law

Explanation

This is a direct application of Ohm's law: $V = IR$, so $R = V/I$. Always write the formula, substitute values with units, and state the final answer with the correct SI unit (Ω). Examiners award the mark for the correct substitution and answer.

Q7. medium | initial-understanding | § 11.4 OHM'S LAW **[2]**

The resistance of a conductor is kept constant. If the potential difference across it is doubled, what happens to the current through it? Justify your answer.

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Model Answer

According to Ohm's law, $I = \frac{V}{R}$.

Since resistance R is constant, current I is directly proportional to potential difference V.

If V is doubled, the current through the conductor will also **double**.

Justification: $I = \frac{V}{R}$. If V becomes 2V (and R is unchanged), then new current $I' = \frac{2V}{R} = 2I$.

Source: Chapter 11 (Electricity), Section 11.4 – Ohm's Law

Explanation

- Examiners expect you to state Ohm's law (or its formula), identify the proportional relationship between V and I (with R constant), and show the doubling effect — either in words or with a brief calculation.
- Writing $I' = 2V/R = 2I$ earns full marks efficiently.
- Don't forget the condition: resistance (and temperature) must remain constant for Ohm's law to apply.

Q8. medium | initial-understanding | § 11.4 OHM'S LAW **[3]**

When the potential difference V across a conductor is plotted against the current I through it, a straight line passing through the origin is obtained. What does the slope of this V–I graph represent?

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Model Answer

The slope of the V–I graph represents the **resistance (R)** of the conductor.

According to Ohm's law, $V \propto I$ (at constant temperature), which gives:

$$\frac{V}{I} = R = \text{constant}$$

Since the graph is a straight line through the origin, its slope = $\frac{V}{I}$ = R.
Thus, the slope gives the resistance of the conductor, measured in **ohms (Ω)**. A steeper slope means higher resistance, meaning the conductor opposes the flow of current more strongly.

Source: Chapter 11, Section 11.4 — Ohm's Law

Explanation

- The examiner expects you to clearly name **resistance** as what the slope represents.
- State Ohm's law ($V = IR$) and rearrange to show slope = $V/I = R$.
- Mention the SI unit **ohm (Ω)** — this is often a separate mark.
- Optionally link slope steepness to higher resistance for a complete answer in a 3-mark question.
- Never say "the slope is Ohm's law" — say the slope **represents resistance**.

Q9. straightforward | initial-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[1]**

State the factors on which the resistance of a uniform metallic conductor depends.

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Model Answer

The resistance of a uniform metallic conductor depends on: (i) its length — directly proportional, (ii) its area of cross-section — inversely proportional, and (iii) the nature (material) of the conductor.

Source: Chapter 11, Section 11.5

Explanation

The examiner expects all **three factors** to be named clearly. Just listing them is enough for 1 mark — no need for formulas or elaboration. Writing the proportionality relationships (directly/inversely) shows precision and is good practice even in a 1-mark answer.

Q10. straightforward | initial-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[2]**

A nichrome wire of length l has a resistance R. It is replaced by another nichrome wire of the same cross-sectional area but of length 2l. What will be the new resistance? Give a reason for your answer.

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Model Answer

The new resistance will be **2R**.

Reason: Resistance is directly proportional to the length of the conductor, i.e., $R \propto l$. When the length is doubled (from l to $2l$) while the cross-sectional area remains the same, the resistance also doubles. Therefore, new resistance = 2R.

Source: Chapter 11, Section 11.5 – Factors on which the resistance of a conductor depends.

Explanation

- The key formula is $R = \rho\frac{l}{A}$. Since ρ (resistivity, same material) and A (same cross-section) are unchanged, $R \propto l$.
- Examiners expect: the answer (2R) **and** a reason citing the direct proportionality between resistance and length. Both parts are needed for full 2 marks.
- Do not simply state the formula — briefly explain what it means in context.

Q11. medium | initial-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[2]**

Two wires are made of the same material and have the same length, but one is thicker than the other. Which wire has greater resistance, and why?

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Model Answer

The **thinner wire** has greater resistance.

According to the formula $R = \rho\frac{l}{A}$, resistance is **inversely proportional to the area of cross-section** (A). A thicker wire has a larger cross-sectional area, so its resistance is lower. The thinner wire has a smaller area, giving it greater resistance, even though both wires have the same length and material.

Source: Chapter 11, Section 11.5 – Factors on which the resistance of a conductor depends

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Explanation

- Examiners expect you to state **which** wire clearly, then justify using the formula $R = \rho l/A$.
- Key point: same material → same ρ; same length → l is equal; only A differs. So resistance depends solely on cross-section here.
- "Thicker" means larger diameter → larger A → smaller R. Don't confuse thicker with higher resistance.
- Always write the formula and link it to the concept for full 2-mark credit.

Q12. deep | initial-understanding | § 11.5 FACTORS ON WHICH THE RESISTANCE OF A CONDUCTOR DEPENDS **[3]**

A student needs a wire with very high resistance for use in an electric heating device. She has two wires of identical dimensions — one made of copper and one made of nichrome. (a) Which wire should she choose, and why? (b) State one property of nichrome, other than high resistivity, that makes it suitable for use in heating devices.

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Model Answer

(a) She should choose the **nichrome wire**. Nichrome has a very high resistivity (100×10^{-6} Ω m), much greater than copper (1.62×10^{-8} Ω m). Since resistance $R = \rho\, l / A$ and both wires have identical dimensions, the nichrome wire will have far greater resistance, producing more heat.

(b) Nichrome (an alloy) **does not oxidise (burn) readily at high temperatures**, which makes it durable and long-lasting in heating devices.

Source: Chapter 11, Section 11.5 – Factors on which resistance depends

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Explanation

- Part (a) is worth 2 marks: name the correct wire **and** justify using resistivity values/formula. Examiners expect both.
- Part (b) is worth 1 mark: the key phrase from the textbook is "alloys do not oxidise readily at high temperatures." Write it clearly. Do not repeat resistivity (the question says "other than high resistivity").
- Quoting the actual resistivity values (or at least saying nichrome's is much higher) strengthens part (a).

Q13. medium | initial-understanding | § 11.6 RESISTANCE OF A SYSTEM OF RESISTORS **[2]**

Three resistors of 4 Ω, 6 Ω, and 12 Ω are connected in parallel. Explain why the equivalent resistance of this combination is less than 4 Ω.

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Model Answer

In a parallel combination, the reciprocal of equivalent resistance is:

$$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{6} + \frac{1}{12} = \frac{3+2+1}{12} = \frac{6}{12} = \frac{1}{2}$$

So, $R_p = 2\ \Omega$.

This is less than the smallest individual resistance (4 Ω) because adding more parallel paths provides additional routes for current, increasing total current flow. As per the formula $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$, each extra resistor increases $\frac{1}{R_p}$, thereby **decreasing** R_p below any individual resistance.

Source: Chapter 11, Section 11.6.2 – Resistors in Parallel

Explanation

- Examiners expect the formula, the calculation showing $R_p = 2\ \Omega$, and a one-line conceptual reason (additional current paths → lower equivalent resistance).
- The key phrase to remember: *"reciprocal of equivalent resistance equals sum of reciprocals"* — each added branch always makes $\frac{1}{R_p}$ larger, so R_p is always smaller than the smallest individual resistor.
- Don't just state the result — show the arithmetic to earn full marks.

Q14. straightforward | initial-understanding | § 11.6.1 Resistors in Series **[2]**

An ammeter is connected at three different positions in a series circuit with three resistors: before the first resistor, between the first and second, and after the third. What would the three ammeter readings be? What conclusion can you draw about current in a series combination?

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Model Answer

All three ammeter readings will be **the same**.

Whether the ammeter is placed before the first resistor, between any two resistors, or after the third, it shows the same value of current.

Conclusion: In a series combination of resistors, the current is the same in every part of the circuit, i.e., the same current flows through each resistor.

Source: Chapter 11, Section 11.6.1 – Resistors in Series

Explanation

- The examiner expects you to state the reading (equal/same) and give the conclusion as a clear statement — both parts carry marks.
- The key phrase to use is *"current is the same in every part of the circuit"* — this is the exact language from the textbook (Activity 11.4).
- Do not confuse this with voltage, which is *different* across each resistor in series.

Q15. straightforward | initial-understanding | § 11.6.1 Resistors in Series **[1]**

Three resistors of 4 Ω, 6 Ω, and 10 Ω are connected in series. What is the equivalent resistance of the combination?

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Model Answer

For resistors in series: $R_s = R_1 + R_2 + R_3 = 4 + 6 + 10 = \mathbf{20\ \Omega}$

Source: Chapter 11, Section 11.6.1

Explanation

For a series combination, equivalent resistance is simply the sum of all individual resistances. Examiners expect the formula, substitution, and final answer with the correct unit (Ω) — all in one line for 1 mark.

Q16. medium | initial-understanding | § 11.6.1 Resistors in Series **[3]**

A student connects a 2 Ω and an 8 Ω resistor in series to a 10 V battery. (a) Calculate the total resistance of the circuit. (b) Find the current flowing through the circuit. (c) Find the potential difference across the 8 Ω resistor.

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Model Answer

(a) Total resistance:

Since the resistors are in series:

$$R_s = R_1 + R_2 = 2\,\Omega + 8\,\Omega = 10\,\Omega$$

(b) Current through the circuit:

By Ohm's law:

$$I = \frac{V}{R_s} = \frac{10\,\text{V}}{10\,\Omega} = 1\,\text{A}$$

(c) Potential difference across the 8 Ω resistor:

Applying Ohm's law to the 8 Ω resistor:

$$V_2 = I \times R_2 = 1\,\text{A} \times 8\,\Omega = 8\,\text{V}$$

Source: Chapter 11, Section 11.6.1 — Resistors in Series

Explanation

- **Examiner focus:** Each sub-part carries 1 mark. Show the formula, substitution, and result clearly — don't just write the answer.
- For series circuits: $R_s = R_1 + R_2$ (resistances add up).
- Current is the same throughout a series circuit, so the same $I = 1$ A flows through both resistors.
- For the voltage across one resistor, apply Ohm's law to that resistor alone: $V = IR$.
- Note that $V_1 + V_2 = 2\,\text{V} + 8\,\text{V} = 10\,\text{V}$ = battery voltage ✓ (good self-check).

Q17. straightforward initial-understanding § 11.6.2 Resistors in Parallel **[1]**

[very_short_answer] Three resistors are connected in parallel across a battery of potential difference V. What is the potential difference across each individual resistor?

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Model Answer

The potential difference across each individual resistor is the same and equals **V** (the battery's potential difference).

Source: Chapter 11, Section 11.6.2 – Resistors in Parallel

Explanation

In a parallel combination, all resistors share the same two endpoints, so the same potential difference V appears across each one. Examiners expect the student to state clearly that each resistor has potential difference equal to V (the battery voltage), not just that they are "equal." One crisp line with the key term is sufficient for 1 mark.

Q18. straightforward initial-understanding § 11.6.2 Resistors in Parallel **[1]**

Three resistors of resistances R_1, R_2, and R_3 are connected in parallel. Write the expression for their equivalent resistance R_p.

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Model Answer

For three resistors connected in parallel, the equivalent resistance R_p is given by:

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Source: Chapter 11, Section 11.6.2 Resistors in Parallel, Eq. (11.18)

Explanation

Write the formula in reciprocal form — examiners expect exactly this expression. Do **not** write $R_p = R_1 + R_2 + R_3$ (that is the series formula). The key idea: in parallel, reciprocals of resistances add up.

Q19. medium | initial-understanding | § 11.6.2 Resistors in Parallel **[3]**

[short_answer] Three resistors carrying currents I_1, I_2, and I_3 are connected in parallel across a battery. Write the expression relating the total current I drawn from the battery to I_1, I_2, and I_3.

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Model Answer

When three resistors are connected in parallel across a battery, the potential difference across each resistor is the same (equal to the terminal voltage of the battery). However, the current through each resistor is different.

The total current **I** drawn from the battery is equal to the sum of the currents through each individual branch:

$$\boxed{I = I_1 + I_2 + I_3}$$

where I_1, I_2, and I_3 are the currents through resistors R_1, R_2, and R_3 respectively.

This is because, at each junction, charge is conserved — the total charge flowing in per second equals the total charge flowing out. Hence, the total current splits among the parallel branches and recombines to give I.

Source: Chapter 11, Section 11.6.2 — Resistors in Parallel

Explanation

- The key relation examiners want is **$I = I_1 + I_2 + I_3$** (Eq. 11.15 from the textbook). Always write it as a numbered/boxed expression.
- Briefly state *why* (conservation of charge / current splits at junction) — this earns the reasoning mark in a 3-mark question.
- Mention that the **potential difference** across each parallel branch is the **same** — this is the defining feature of parallel combination and often fetches 1 mark.
- Don't confuse this with the series rule ($V = V_1 + V_2 + V_3$); parallel → currents add, series → voltages add.

Q20. medium | initial-understanding | § 11.6.2 Resistors in Parallel **[2]**

State TWO practical advantages of connecting electrical appliances in parallel rather than in series in a domestic circuit.

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Model Answer

Two practical advantages of parallel connection in domestic circuits:

1. **Each appliance operates at the same voltage** (the supply voltage), so every device works at its rated voltage and functions properly.
2. **Each appliance can be switched ON or OFF independently** — if one appliance fails or is turned off, the others continue to work without any interruption.

Source: Chapter 11 – Electricity, Exercise Q.18(c)

Explanation

Examiners expect exactly these two points: (i) equal (full) voltage across each appliance, and (ii) independent operation. Exercise 18(c) asks why series is NOT used for domestic circuits — the flip side of that gives the parallel advantages. Avoid vague answers; name the specific benefit clearly. One point = 1 mark each.

Q21. straightforward | initial-understanding | § 11.7 HEATING EFFECT OF ELECTRIC CURRENT **[3]**

State Joule's law of heating. Write the mathematical expression for heat produced in a resistor and explain what each symbol represents.

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Model Answer

Joule's Law of Heating: The heat produced in a resistor is directly proportional to (i) the square of the current, (ii) the resistance, and (iii) the time for which current flows.

Mathematical Expression:

$$H = I^2 Rt$$

Where:

- H = Heat produced (in joules, J)
- I = Current flowing through the resistor (in amperes, A)
- R = Resistance of the resistor (in ohms, Ω)
- t = Time for which current flows (in seconds, s)

Source: Chapter 11 – Electricity, Section 11.7 Heating Effect of Electric Current

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Explanation

Examiners expect three things here: the **statement** of the law (mentioning all three proportionalities), the **formula**, and **symbol definitions**. Missing any one costs marks. Note that the law is derived by applying Ohm's law ($V = IR$) to the energy equation $H = VIt$, giving $H = I^2 Rt$. Write the symbols neatly in a list — examiners award a mark specifically for correct identification of each symbol.

Q22. straightforward | initial-understanding | § 11.7 HEATING EFFECT OF ELECTRIC CURRENT **[1]**

Tungsten is preferred over most other metals for making the filament of an electric bulb. Which two properties of tungsten make it most suitable for this purpose?

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Model Answer

Tungsten has a **very high melting point (3380°C)** and is a **strong metal**, so it can get extremely hot to emit light without melting.

Source: Chapter 11, Section 11.7.1

Explanation

The passage explicitly states both properties: high melting point (3380°C) and being a strong metal. Examiners expect both properties named clearly. Avoid vague terms like "good conductor" — the key traits are mechanical strength and high melting point, not conductivity.

Q23. straightforward | initial-understanding | § 11.7.1 Practical Applications of Heating Effect of Electric Current **[1]**

Why is tungsten preferred over other metals for making the filaments of electric bulbs?

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Model Answer

Tungsten has a very high melting point (3380°C), so it can get extremely hot to emit light without melting, making it ideal for bulb filaments.

Source: Chapter 11, Section 11.7.1

Explanation

The examiner expects two linked points: high melting point (with the value as a bonus) → can withstand high temperature without melting → emits light. Keep it to one sentence for 1 mark.

Q24. straightforward | initial-understanding | § 11.8 ELECTRIC POWER **[1]**

Which of the following expressions correctly represents the electric power consumed in a circuit?
(A) $P = VI$
(B) $P = V^2/R$
(C) $P = I^2R$
(D) $P = IR^2$

- A VI
- B I^2R
- C IR^2
- D V^2/R

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Model Answer

The expressions that correctly represent electric power consumed in a circuit are $\mathbf{P = VI}$, $\mathbf{P = I^2R}$, and $\mathbf{P = V^2/R}$.

Therefore, the option that does **not** represent electrical power is **(D)** $\mathbf{P = IR^2}$.

Since the question asks which **correctly** represents electric power, options **(A)** $\mathbf{P = VI}$, **(B)** $\mathbf{P = I^2R}$, and **(D)** $\mathbf{P = V^2/R}$ are all correct. $\mathbf{IR^2}$ is incorrect.

The correct answer is **(D)** $\mathbf{IR^2}$ does **not** represent power; thus among the given options, **A (VI), B ($\mathbf{I^2R}$), and D ($\mathbf{V^2/R}$)** are valid expressions.

▶ **Best single answer: (D)** $\mathbf{IR^2}$ is the odd one out; all others are correct power formulae.

Source: Chapter 11, Section 11.8 Electric Power

Explanation

The textbook (Section 11.8) states $P = VI = I^2R = V^2/R$ as valid expressions for electric power. The term $\mathbf{IR^2}$ has no physical basis — resistance is squared instead of current, so it does not give power. This mirrors Exercise Q2 which asks which term does **not** represent electrical power, with IR^2 as the answer. In the MCQ framing here, IR^2 is the incorrect/false expression, so if the question asks which **correctly** represents power, avoid IR^2.

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