Topic 4.2 Electricity Revision Booklet

AQA GCSE Physics 8463 · Foundation & Higher



Name _____ Class _____ Target grade _____

4.2
Electricity

Work through a topic, then come back to it on the dates in your planner. Little and often beats one long cram.

Revise like a scientist

This booklet uses six revision techniques that research shows work best. Every activity is labelled with the technique it uses and the grade it targets.

Retrieval practice

Pulling ideas out of your memory makes them stick far better than re-reading. Brain dumps, quizzes and cover-and-recall tasks.

Spaced practice

Revisit each topic after 2 days, 1 week and 3 weeks. Forgetting a little, then remembering again, strengthens memory.

Interleaving

Mixed-topic questions train you to spot which idea a question needs, just like the real exam.

Dual coding

Words plus diagrams: graphs, ray diagrams and labelled apparatus give your memory two routes in.

Elaboration

Asking 'why?' and 'how?' and linking ideas together turns facts into understanding.

Worked examples

I do → We do → You do: study a full solution, finish a half-done one, then do one alone.

KEY

Grade pathways

GRADE 4

Secure the basics: recall definitions and units, pick the right equation from the equation sheet, and do one-step calculations.

GRADE 5

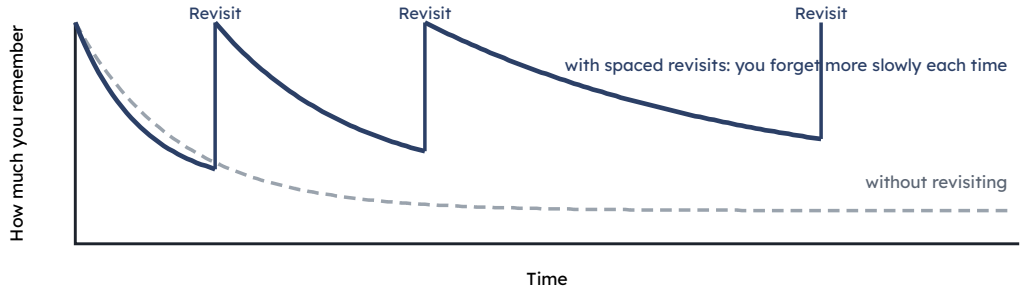
Rearrange equations, convert units, describe practicals and explain in two linked steps.

GRADE 7+

Multi-step calculations, evaluate methods and data, and write logical 6-mark answers.

SPACED PRACTICE DUAL CODING

Why spacing works



SPACED PRACTICE

My spaced revision planner

Write the date you'll do each session. Tick it off when it's done.

Topic	First go	+2 days	+1 week	+3 weeks	Before the mock
4.2 Electricity					
Final review					

What's inside

Topic 2 · Electricity (4.2)

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Final review

Final review: mixed questions	18

ROUTINE

The routine for every page

1. Try it cold. Answer from memory first, without notes. Struggling a bit is good: it's what makes learning stick.

2. Check and correct. Mark it with the answer booklet in a different colour pen. Fix every mistake.

3. Come back later. Redo anything you got wrong on your next spaced session.

ONLINE

Use it with mrsullyphysics.com

Flashcards for retrieval practice: cards you get wrong come back until you get them right.

Quizzes and Aim higher for extra Grade 5+ and 7+ questions with mark schemes.

Animations to see the physics move (dual coding).

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 Describe how the resistance of a thermistor changes with temperature and give one use. [2]

2 Grade 5 A 9 V battery is connected in series with a 3 Ω and a 6 Ω resistor. Calculate the current. [3]

3 Grade 5 A 4 Ω and an 8 Ω resistor are in series with a 6 V battery. Calculate the current and the potential difference across the 8 Ω resistor. [3]

Brain dump and checklist

RETRIEVAL PRACTICE · GRADE 4 · GRADE 5 · GRADE 7

Brain dump

Set a timer for 5 minutes. Write or draw everything you remember about electricity. No notes! Afterwards, add anything you missed in a different colour.

Prompts if you get stuck: circuit symbols? · Q = It? · V = IR? · series vs parallel? · I–V graphs? · thermistor and LDR? · a.c. and d.c.? · plug wires? · National Grid? · static?

METACOGNITION

How confident am I?

Rate each statement now (before) by shading R, A or G. Rate again at the end of the topic (after).

I can...	Before			After		
	R	A	G	R	A	G
Draw and recognise circuit symbols	○	○	○	○	○	○
Use Q = It and define current as the rate of flow of charge	○	○	○	○	○	○
Use V = IR and describe the resistance practical (RP3)	○	○	○	○	○	○
Sketch and explain I–V graphs for a resistor, filament lamp and diode (RP4)	○	○	○	○	○	○
Describe how thermistors and LDRs respond to temperature and light	○	○	○	○	○	○
State the rules for current, p.d. and resistance in series and parallel	○	○	○	○	○	○
Describe a.c. and d.c. and UK mains (230 V, 50 Hz)	○	○	○	○	○	○
Name the three wires in a plug and explain why the live wire is dangerous	○	○	○	○	○	○
Use P = VI, P = I^2R, E = Pt and E = QV	○	○	○	○	○	○
Explain how the National Grid uses transformers to reduce the energy wasted in the cables	○	○	○	○	○	○
Explain static charge and electric fields (Physics only)	○	○	○	○	○	○

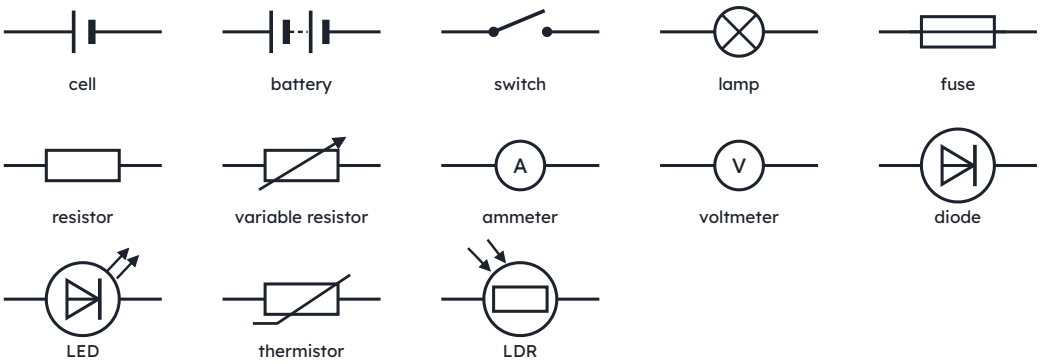
Extra practice

Retrieval · answers in the answer booklet

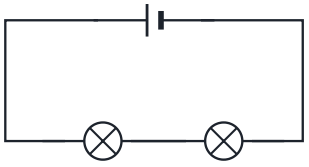
1 Fill the gap: The _____ wire is green and yellow. [1]

DUAL CODING | GRADE 4 | GRADE 5 | GRADE 7

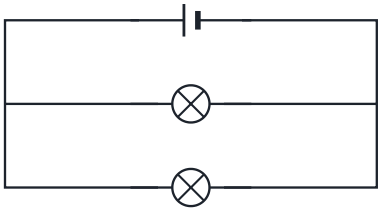
CIRCUIT SYMBOLS



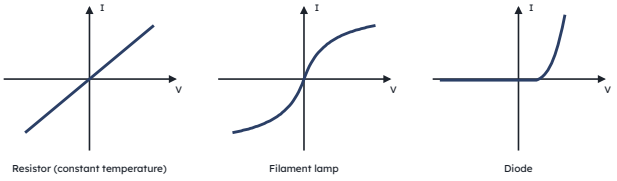
SERIES AND PARALLEL · I–V GRAPHS



Series: one loop
same current everywhere
p.d. shared; R total = $R_1 + R_2$



Parallel: separate branches
same p.d. across each branch; currents add
total R less than the smallest resistor



Resistor (constant temperature) | Filament lamp | Diode

KEY EQUATIONS: ALL GIVEN ON THE PHYSICS EQUATIONS SHEET IN THE EXAM

Equation	Quantities and units	Watch out
Q = I t	charge flow (C), current (A), time (s)	Time in seconds
V = I R	potential difference (V), current (A), resistance (Ω)	Rearrange: R = V ÷ I
P = V I	power (W), potential difference (V), current (A)	Mains p.d. ≈ 230 V
P = I^2 R	power (W), current (A), resistance (Ω)	Square the current first
E = P t	energy transferred (J), power (W), time (s)	kW → W, minutes → s
E = Q V	energy transferred (J), charge flow (C), potential difference (V)	p.d. = energy per unit charge

SERIES AND PARALLEL RULES

Series: same current everywhere; p.d. is shared; $R_{total} = R_1 + R_2$.

Parallel: same p.d. across each branch; branch currents add up to the total; total resistance is less than the smallest resistor.

MAINS ELECTRICITY

UK mains is a.c. at 230 V, 50 Hz.
Live (brown) 230 V · **neutral** (blue) about 0 V · **earth** (green and yellow stripes) safety wire, only carries current if there is a fault.

TURN OVER

Key words, misconceptions, required practicals and Grade 7+ links are on the next page.

Knowledge organiser: key words, misconceptions, practicals

ELABORATION GRADE 4 GRADE 5 GRADE 7

KEY WORDS: LEARN THESE WORD FOR WORD (SAME AS SIDE 2 OF YOUR KNOWLEDGE ORGANISER)

Current: the rate of flow of electrical charge. Same at every point in a single closed loop.
Potential difference: the energy transferred per unit charge passed (E = QV).
Resistance: the greater it is, the smaller the current for a given p.d.
Ohmic conductor: current is directly proportional to p.d. at constant temperature.
Thermistor: resistance decreases as temperature increases.
LDR: resistance decreases as light intensity increases.
Direct current (d.c.): flows in one direction only (cells and batteries).
Alternating current (a.c.): keeps changing direction; UK mains is 230 V, 50 Hz.

MISCONCEPTIONS: SPOT THE MISTAKE

× Common mistake	✓ What's actually true
× Current gets used up round a circuit.	✓ Current is the same at every point in a series loop; energy is transferred, not charge.
× Adding resistors in parallel increases resistance.	✓ It decreases the total resistance: more paths for the charge.
× The fuse is in the neutral wire.	✓ The fuse is in the live wire, so a fault disconnects the dangerous supply.

RP3: RESISTANCE

Aim: Investigate how wire length affects resistance, and how resistors combine in series and parallel.
Change: Length of wire · **Measure:** Resistance (from V and I) · **Control:** Material and thickness of wire, temperature, current
Must include: Draw and use a correct circuit diagram; Test resistors in series and in parallel and compare total resistance; Ammeter in series, voltmeter in parallel; Calculate R = V ÷ I.
Common mistake: Connecting the voltmeter in series or the ammeter in parallel.

RP4: I–V CHARACTERISTICS

Aim: Plot I–V graphs for a filament lamp, a resistor at constant temperature and a diode.
Change: Potential difference · **Measure:** Current · **Control:** Component being tested, temperature (for the resistor)
Must include: Correct circuit with a variable resistor; Record pairs of V and I readings; Reverse the connections for negative values; Plot I against V for each component.
Common mistake: Plotting the axes the wrong way round (AQA uses current on the y-axis).

AIM FOR GRADE 7+

- Two-step calculations: I = P ÷ V, then R = V ÷ I.
- Explain the filament lamp's I–V curve using temperature and resistance.
- Explain why the National Grid uses high p.d.: P = I^2R, so a lower current wastes less power.

Extra practice

Retrieval · answers in the answer booklet

1 Grade 7+ A current of 50 A flows through a cable with a resistance of 0.4 Ω. Calculate the power wasted, then explain what happens to this if the current is halved. [3]

RETRIEVAL PRACTICE | SPACED PRACTICE | GRADE 4 | GRADE 5

Equation sheet skills: which equation, which unit?

Every equation is on the Physics Equations Sheet, but it won't tell you which one a question needs or what unit the answer has. Cover the knowledge organiser and fill in the table. Redo it on another day.

Situation	Which equation?	Unit of the answer	Redo 1 ✓/×	Redo 2 ✓/×
Current through a phone charger cable over an hour → charge				
Resistance of a component from a voltmeter and ammeter reading				
Power of a hairdryer from mains p.d. and current				
Energy used by a fridge running all day				
Energy given to each coulomb by a battery				
Heating in a resistor from current and resistance				

RETRIEVAL PRACTICE | GRADE 4 | GRADE 5

Fill the gaps

Use the AQA key words. No word bank: that's the point.

1. The potential difference across a component is measured with a _____ connected in parallel.
2. For an ohmic conductor at constant temperature, current is directly _____ to p.d.
3. The resistance of an LDR decreases as light _____ increases.
4. Mains electricity in the UK is an _____ current supply.
5. The National Grid uses step-down _____ to reduce the p.d. for safe use in homes.

ELABORATION | GRADE 5

Odd one out

Circle the odd one out in each row and explain why.

1. ammeter · voltmeter · fuse · cell

2. 230 V · 50 Hz · d.c. · live wire

3. V = IR · P = VI · E = Pt · Ep = mgh

Extra practice

Retrieval · answers in the answer booklet

1 True or false? The current through a diode can flow in both directions equally. Explain. [2]

ELABORATION GRADE 5 GRADE 7

A thermistor in a potential divider

A thermistor and a fixed resistor are connected in series to a 6 V battery.

a The thermistor gets warmer. What happens to its resistance? [1]

b What happens to the p.d. across the fixed resistor? Explain. [3]

c Suggest a use for this circuit. [1]

DUAL CODING GRADE 4

Circuit symbols

Draw the circuit symbol for each component.

Component	Symbol
Diode	
LED	
LDR	
Variable resistor	



a What is the difference between the arrows on an LED and an LDR symbol? [2]

Extra practice

Retrieval · answers in the answer booklet

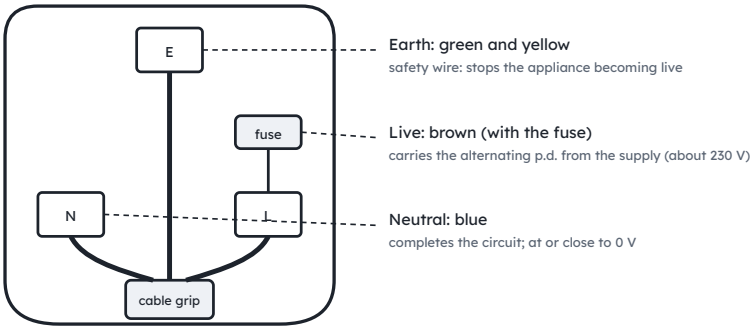
1 Grade 7+ A phone battery has a p.d. of 3.7 V and supplies a current of 0.5 A for 2 hours. Calculate the charge that flows and the energy transferred. [4]

2 Define **parallel circuit rules**. [1]

Picture it (continued)

DUAL CODING GRADE 4 GRADE 5 GRADE 7

Plug safety



a What is the p.d. between the earth wire and the neutral wire? [1]

b Explain how the fuse and the earth wire protect someone if the live wire touches a metal case. [4]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 Explain why the lights in a house are connected in parallel rather than in series. [3]

2 Grade 7+ A 12 V battery is connected to a 4 Ω and an 8 Ω resistor in series. Calculate the potential difference across the 8 Ω resistor. [4]

3 Grade 5 A charge of 120 C flows through a wire in 60 s. Calculate the current. [2]

I do, we do, you do

WORKED EXAMPLES | GRADE 4 | GRADE 5

Resistance in series

I do (worked example)

Resistors of 3 Ω, 5 Ω and 12 Ω are in series. Total R?

1. R total = $R_1 + R_2 + R_3$
2. = 3 + 5 + 12
3. **= 20 Ω**

We do (finish it)

15 Ω and 25 Ω in series with a 10 V cell. Calculate I.

1. R total = ___ Ω
2. I = V ÷ R = 10 ÷ ___
3. I = ___ A

You do

2 kΩ and 3 kΩ in series with 9 V.

WORKED EXAMPLES | GRADE 4 | GRADE 5

Charge and time

I do (worked example)

12 C flows when the current is 0.3 A. How long?

1. Q = I t, so t = Q ÷ I
2. t = 12 ÷ 0.3
3. **t = 40 s**

We do (finish it)

A 2 A current for 5 minutes.

1. t = ___ s
2. Q = 2 × ___
3. Q = ___ C

You do

300 C flows in 1 minute. Calculate I.

WORKED EXAMPLES | GRADE 7

Parallel branches (Grade 7+)

1 A 12 V battery is connected to a 4 Ω resistor and a 6 Ω resistor in parallel. Calculate the current in each branch and the total current from the battery. [4]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 Explain how the earth wire protects you if the live wire touches the metal casing of a kettle. [3]

I do, we do, you do (continued)

WORKED EXAMPLES | GRADE 4 | GRADE 5

Cost of running an appliance

I do (worked example)

A 2.5 kW oven runs for 2 hours. Energy in J?

1. P = 2500 W, t = 7200 s
2. E = P t = 2500 × 7200
3. **E = 18 000 000 J**

We do (finish it)

A 100 W TV on for 3 hours.

1. t = ___ s
2. E = 100 × ___
3. E = ___ J

You do

An 800 W microwave, 90 s.

WORKED EXAMPLES | GRADE 7

Rearranging P = I²R

I do (worked example)

A 20 Ω resistor dissipates 80 W. Calculate I.

1. $I^2 = P \div R = 80 \div 20 = 4$
2. $I = \sqrt{4}$
3. **I = 2 A**

We do (finish it)

3 A through a resistor dissipates 45 W. Calculate R.

1. $R = P \div I^2$
2. R = 45 ÷ ___
3. R = ___ Ω

You do

A 10 Ω resistor dissipates 250 W. Calculate I.

ELABORATION | GRADE 5

Spot the mistake

Each student has made one mistake. Find it and correct it.

1 Jo: "5 Ω and 10 Ω in parallel give 15 Ω in total." [1]

2 Kai: "E = Pt = 60 × 2 = 120 J for a 60 W lamp on for 2 hours." [2]

3 Lia: "A voltmeter goes in series with the lamp." [1]

Extra practice

Retrieval · answers in the answer booklet

1 There is 12 V across a 4 Ω resistor. What is the current? [1]

A 48 A **B** 3 A **C** 0.33 A **D** 16 A

Why? How? Explaining electricity

ELABORATION GRADE 4 GRADE 5 GRADE 7

Build an explanation

Answer each question in two steps. Use the starter, then push yourself with the Grade 7+ extension.

1 Explain why the current is the same at every point in a series circuit.

Grade 4–5 starter: "There is only one path, so…"

Grade 7+ extension: "Link to charge:…"

2 Explain why a thin wire gets hotter than a thick wire carrying the same current.

Grade 4–5 starter: "The thin wire has a higher resistance, so…"

Grade 7+ extension: "Use $P = I^2R$:…"

3 Explain why touching a charged object can give you a small shock. (Physics only)

Grade 4–5 starter: "The object has gained extra electrons, so…"

Grade 7+ extension: "Link to the p.d. and the spark:…"

ELABORATION GRADE 5

True or false? Justify it.

Saying why is worth more marks than saying true or false.

4 "A fuse is there to stop the appliance using too much energy." [2]

5 "Adding resistors in parallel increases the total resistance." [1]

WORKED EXAMPLES | ELABORATION | GRADE 4 | GRADE 5 | GRADE 7

RP3: resistors in series and parallel

A student measures the total resistance of combinations of identical 10 Ω resistors.

Combination	p.d. (V)	Current (A)	Total R (Ω)
One resistor	3.0	0.30	
Two in series	3.0	0.15	
Three in series	3.0	0.10	
Two in parallel	3.0	0.60	
Three in parallel	3.0	0.90	

a Complete the table using R = V ÷ I. [3]

b Describe the pattern for resistors in series. [1]

c Describe the pattern for resistors in parallel. [2]

d Why should the circuit be switched off between readings? [1]

e Predict the total resistance of four 10 Ω resistors in parallel. [1]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 A toaster is connected to the 230 V mains and draws a current of 4 A. Calculate its power. [2]

2 Grade 7+ A balloon rubbed on a jumper becomes negatively charged. Explain, in terms of electrons, what happens to both the balloon and the jumper. [3]

3 Define **live wire**. [1]

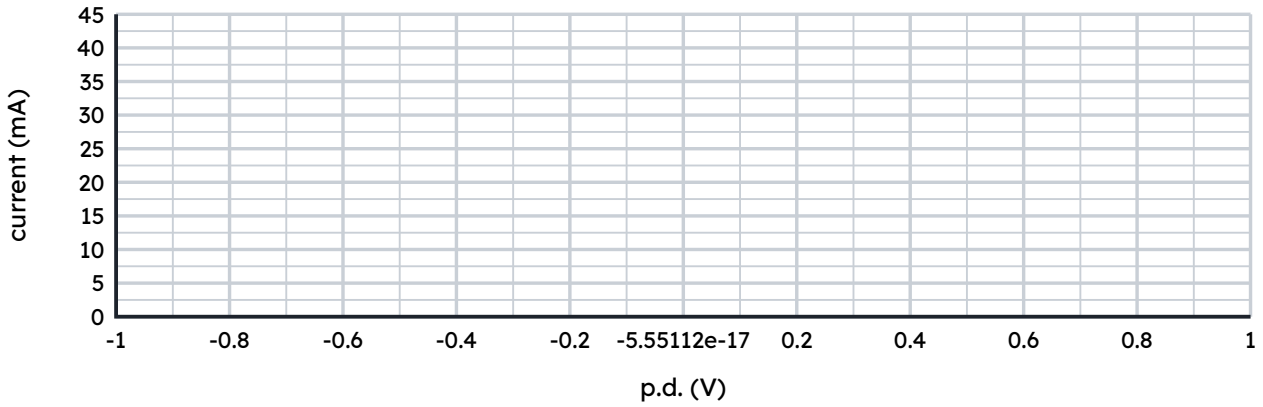
RP4: diode

DUAL CODING | WORKED EXAMPLES | GRADE 5 | GRADE 7

RP4: I–V characteristic of a diode

A student records the current through a diode for different p.d.s.

p.d. (V)	−1.0	−0.5	0	0.2	0.4	0.6	0.7	0.8
Current (mA)	0	0	0	0	1	6	18	40



a Plot the graph and draw a smooth curve. [3]

b Describe what the graph shows about the resistance of the diode in reverse. [2]

c Calculate the resistance at 0.8 V. [2]

d Why is a protective resistor included in series with the diode? [1]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 A resistor has a potential difference of 6.0 V across it and a current of 0.25 A through it. Calculate its resistance. [2]

2 Grade 5 50 C of charge flows through a mains heater (230 V). Calculate the energy transferred. [2]

Exam practice

GRADE RADE 4

Secure the basics

1 What does an ammeter measure? [1]

2 Name the colour of the earth wire. [1]

3 Give the unit of potential difference. [1]

4 Which component lets current flow in one direction only? [1]

5 A current of 0.5 A flows for 60 s. Calculate the charge. [2]

GRADE RADE 5

Apply and rearrange

6 A lamp has a resistance of 12 Ω and a current of 0.5 A. Calculate the p.d. across it. [2]

7 Describe the difference between a.c. and d.c. [2]

8 Explain why the resistance of an LDR is useful in an automatic night light. [3]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 7+ Explain the shape of the I–V graph for a filament lamp. [4]

GRADE RADE 7+

Stretch

9 A 230 V kettle has a power of 2.3 kW. Calculate the current and explain whether a 3 A or 13 A fuse should be used. [4]

10 Describe how to obtain the I–V characteristic of a filament lamp and explain the shape of the graph. [6]

Total: _____ / 23

RETRIEVAL PRACTICE SPACED PRACTICE GRADE 4

Quick-fire retrieval: Electricity

Cover everything. Answer in under 3 minutes. Redo it on your next spaced session.

1 Unit of current?

2 Ammeter in series or parallel?

3 Brown wire?

4 LDR resistance in bright light?

5 UK mains frequency?

6 What melts in a fuse?

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 A lamp has a potential difference of 6 V across it and a current of 0.5 A through it. Calculate its resistance. [2]

Reflect and plan

METACOGNITION

Re-rate yourself

Go back to the checklist at the start of this topic and fill in the 'After' column.

METACOGNITION GRADE 4 GRADE 5 GRADE 7

Exam wrapper: why did I drop marks?

After marking the exam practice, write the question numbers you got wrong in the right row.

Reason I lost marks	Question numbers	What to do next
I didn't know or remember it (knowledge gap)		Flashcards and brain dumps
I knew it but misread the question or command word		Underline command words
Maths slip: units, rearranging, standard form		Redo the "we do / you do" pages
I ran out of time or didn't finish		Timed practice: 1 mark per minute

METACOGNITION

Two things I'm now confident about

METACOGNITION

One thing I still need to work on, and how I'll fix it

e.g. 'Rearranging equations → redo the Grade 7+ questions and use the website's Aim higher section.'

SPACED PRACTICE

Book my next spaced sessions

Write the dates in the planner at the front: +2 days, +1 week, +3 weeks.

Extra practice

Retrieval · answers in the answer booklet

1 Define **voltmeter**. [1]

RETRIEVAL PRACTICE | SPACED PRACTICE | GRADE 4 | GRADE 5 | GRADE 7

Final review: test yourself on the whole topic

Do these without your notes, a week after finishing the booklet. Mark them with the answer booklet and add any you got wrong to your 'still to learn' list on the reflect page.

Each question shows its target grade. Aim to get every Grade 4 and 5 question right before moving on to Grade 7+.

Extra practice

Retrieval · answers in the answer booklet

1 Grade 7+ A 2.5 kW heater runs on 230 V mains. Calculate the current and choose a suitable fuse from 3 A, 5 A and 13 A. [3]

2 Grade 7+ Describe and explain the shape of the I–V graph for a filament lamp. [4]

3 Grade 7+ A 2.8 kW kettle is connected to the 230 V mains. Calculate the current and the resistance of its heating element. [3]

4 Grade 5 Describe how to connect an ammeter and a voltmeter to find the resistance of a resistor. [3]

5 A 2 kW kettle runs for 120 s. How much energy does it transfer? [2]

6 Define **non-ohmic components**. [1]