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Isaac Physics 11-14

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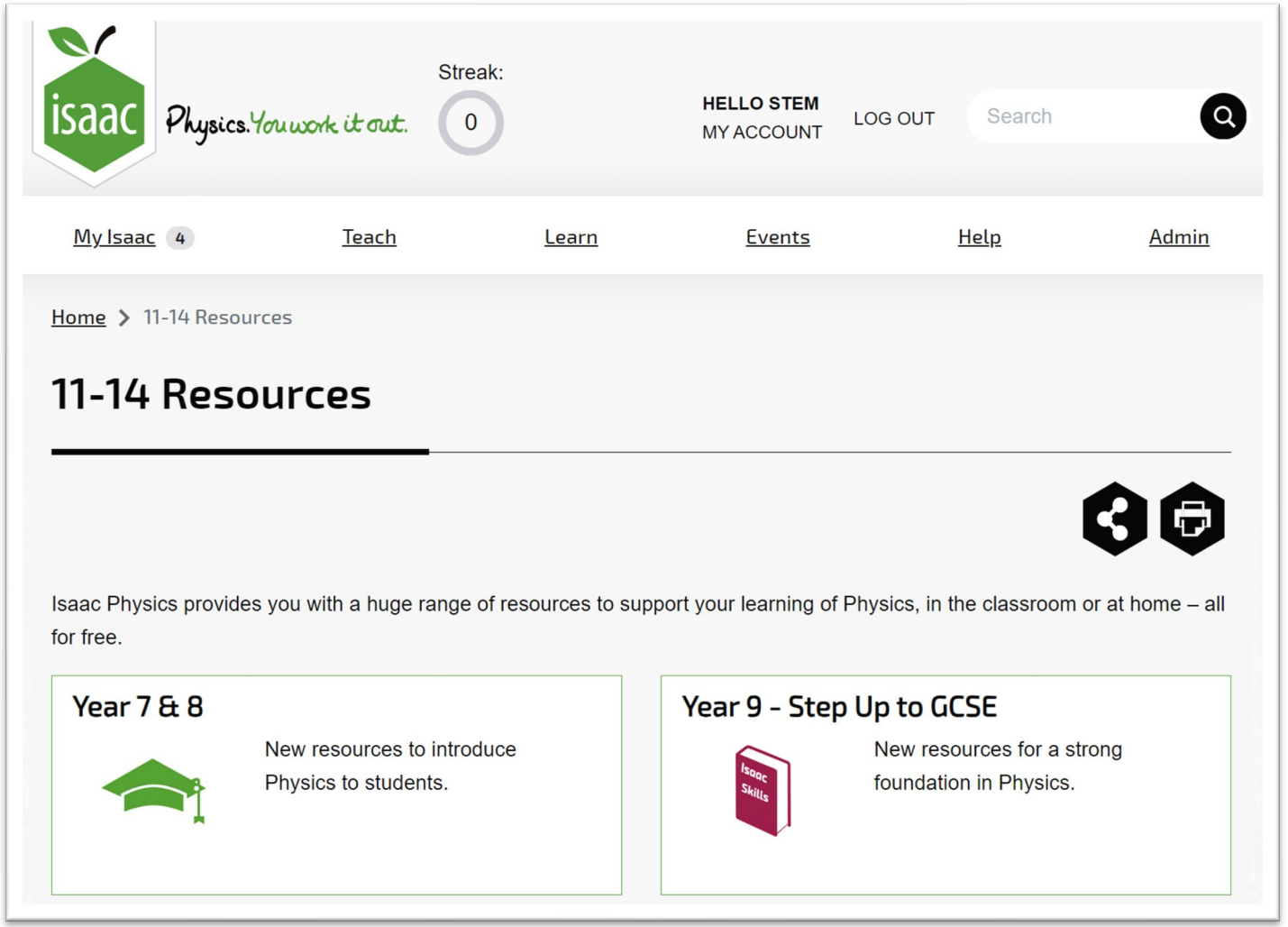
INTRODUCTION & CONTEXT

Dr Lisa Jardine-Wright



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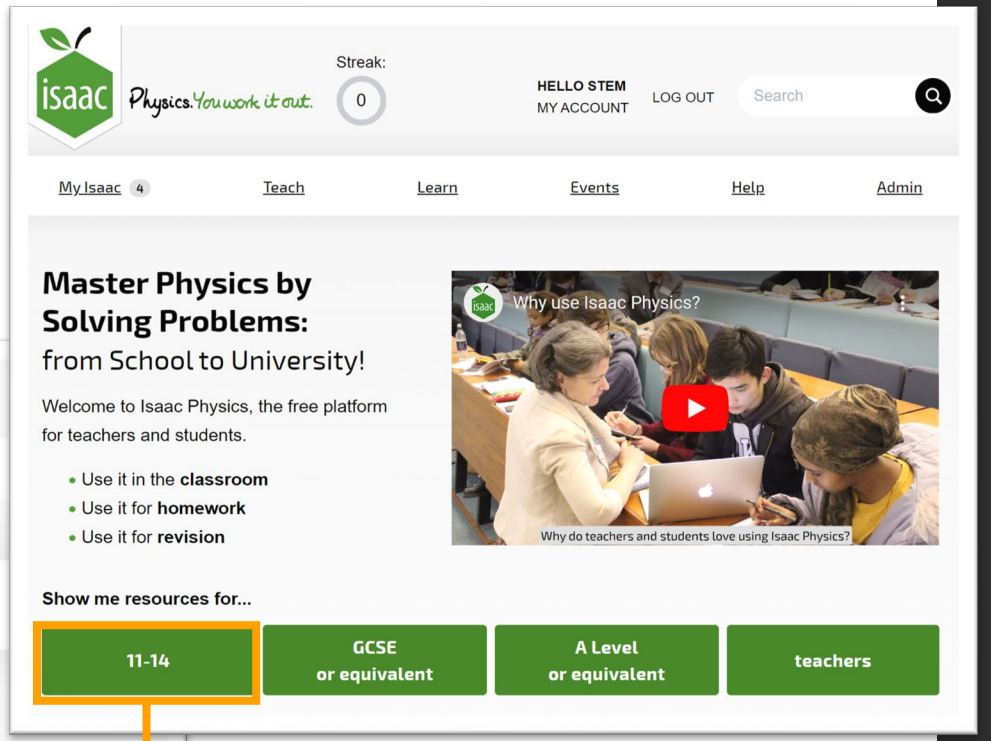
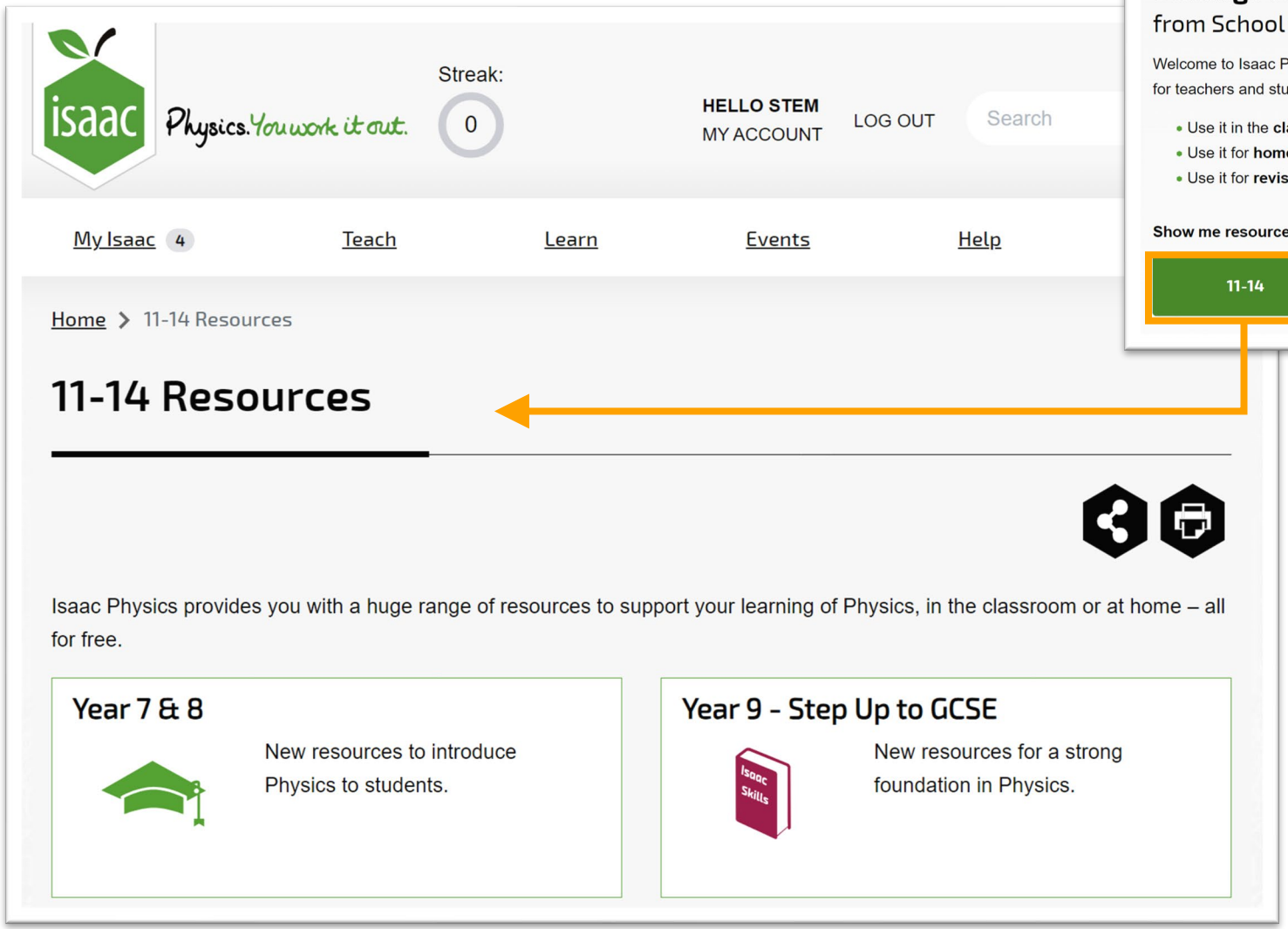
11-14 Resources (KS3)





- Separate resources suitable for
  - Year 7 & 8
  - Year 9 (& 10)

Year 7 & 8:

- These are our newest resources on Isaac Physics and new topics continue to be developed.
- They were published in 2022 and piloted with our outreach events and at the teacher symposium in 2023.
- Using our observations and feedback from the 2023 events further developments have been made in 2024.
- **Our revised key stage 3 resources have been used very successfully in our outreach events with ~ 300 students mostly in year 7 but some in year 8.**

Thank you for putting on the session yesterday for so many of our year 8s. The students (and staff) really enjoyed it - I've had several e-mails from parents thanking us for the great time their children had. It was incredibly well organised, and the programme structure worked really well for year 8 students.

- **Teacher attending our KS3 Jamboree**

DfE Science programmes of study: Key stage 3

Year 7 & 8 – Our aims:

- Build skills and confidence in:
  - Numeracy
  - Creativity
  - Curiosity
  - Problem-solving
- Embed numeracy (mathematics) within the development of conceptual understanding
- Support teachers with reference materials to teach the lessons and tailored CPD.

Key stage 3

Working scientifically

Through the content across all three disciplines, pupils should be taught to:

Scientific attitudes

- pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
- understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
- evaluate risks.

Experimental skills and investigations

- ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- make predictions using scientific knowledge and understanding
- select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate
- use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements
- apply sampling techniques.

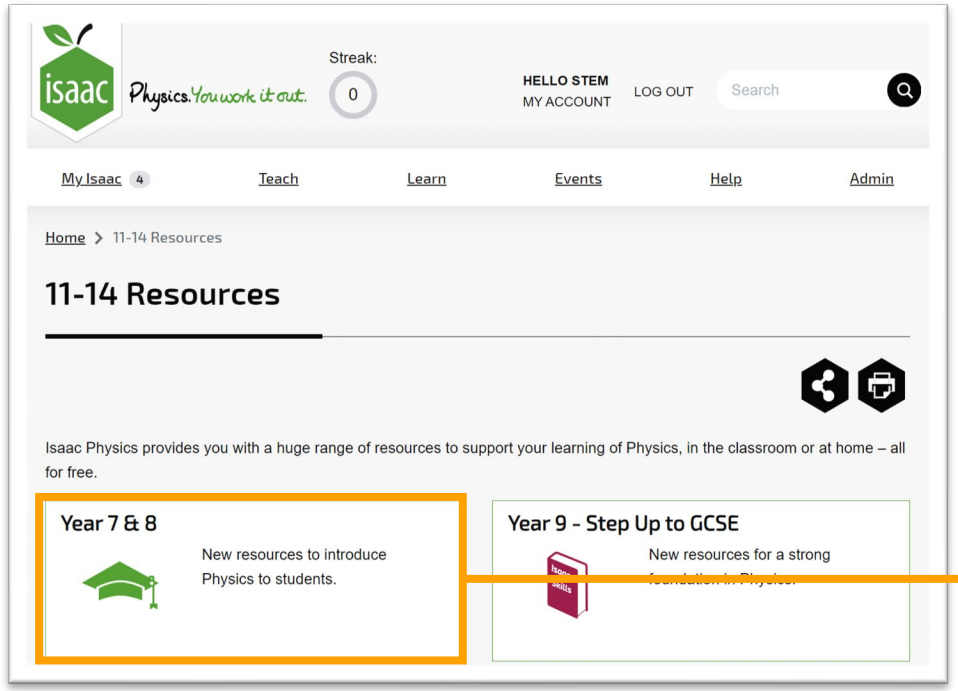
Analysis and evaluation

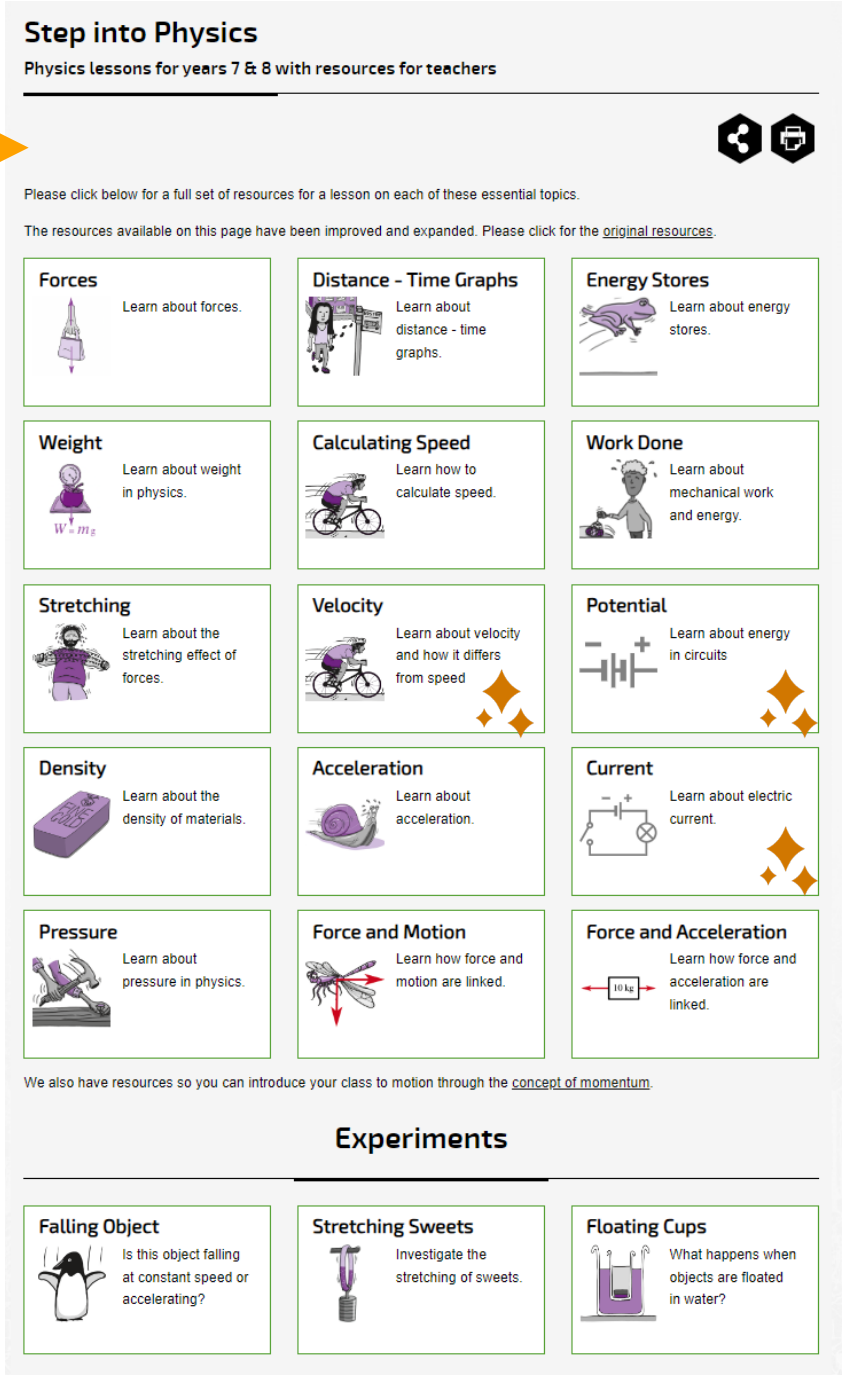
- apply mathematical concepts and calculate results
- present observations and data using appropriate methods, including tables and graphs
- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- present reasoned explanations, including explaining data in relation to predictions and hypotheses
- evaluate data, showing awareness of potential sources of random and systematic error
- identify further questions arising from their results.

Measurement

- understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature
- use and derive simple equations and carry out appropriate calculations
- undertake basic data analysis including simple statistical techniques.

Step into Physics (Y7 & 8)





isaacphysics.org/pages/itsp_resources

Year 7 & 8 – Our approach:

Force and Motion

All you need for your KS3 lesson on the link between force and motion.

Key Points – Questions to summarise learning

Teacher Notes – Your classroom assistant for the lesson

Class Gentle – Online questions with a gentle progression

Class Steeper – Online questions with a steeper progression

Homework Gentle – Online questions with a gentle progression

Homework Steeper – Online questions with a steeper progression

Class Worksheet – Full text class worksheet PDF

Class Cloze – Cloze text class worksheet PDF

Homework Worksheet – Full text homework worksheet PDF

Homework Cloze – Cloze text homework worksheet PDF

Step into Physics

Physics lessons for years 7 & 8 with resources for teachers

Please click below for a full set of resources for a lesson on each of these essential topics.

The resources available on this page have been improved and expanded. Please click for the original resources.

Forces – Learn about forces.

Distance - Time Graphs – Learn about distance - time graphs.

Energy Stores – Learn about energy stores.

Weight – Learn about weight in physics.

Calculating Speed – Learn how to calculate speed.

Work Done – Learn about mechanical work and energy.

Stretching – Learn about the stretching effect of forces.

Velocity – Learn about velocity and how it differs from speed

Potential – Learn about energy in circuits

Density – Learn about the density of materials.

Acceleration – Learn about acceleration.

Current – Learn about electric current.

Pressure – Learn about pressure in physics.

Force and Motion – Learn how force and motion are linked.

Force and Acceleration – Learn how force and acceleration are linked.

We also have resources so you can introduce your class to motion through the concept of momentum.

Experiments

Falling Object – Is this object falling at constant speed or accelerating?

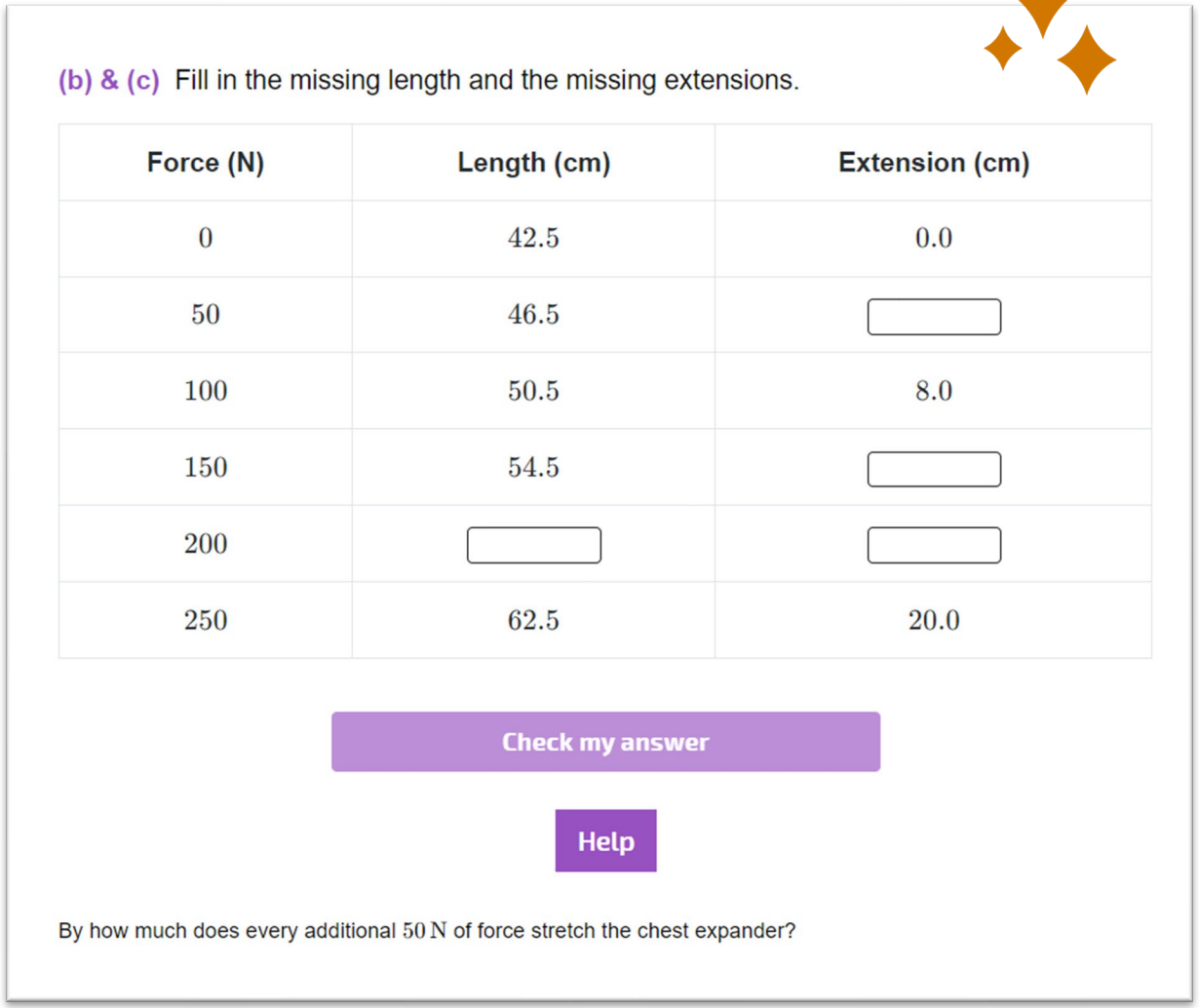
Stretching Sweets – Investigate the stretching of sweets.

Floating Cups – What happens when objects are floated in water?

isaacphysics.org/pages/itsp_resources

Year 7 & 8 – Summary of our approach:

- Scientific study is about spotting patterns, suggesting a connection (law or theory) and then testing them by making a prediction.
  - Our approach to formulae or laws of physics is to look at number patterns and scaffold a common-sense deduction rather than memorising formulae.



(b) & (c) Fill in the missing length and the missing extensions.

Force (N)	Length (cm)	Extension (cm)
0	42.5	0.0
50	46.5	
100	50.5	8.0
150	54.5	
200		
250	62.5	20.0

Check my answer

Help

By how much does every additional 50 N of force stretch the chest expander?

Year 7 & 8 – Summary of our approach:

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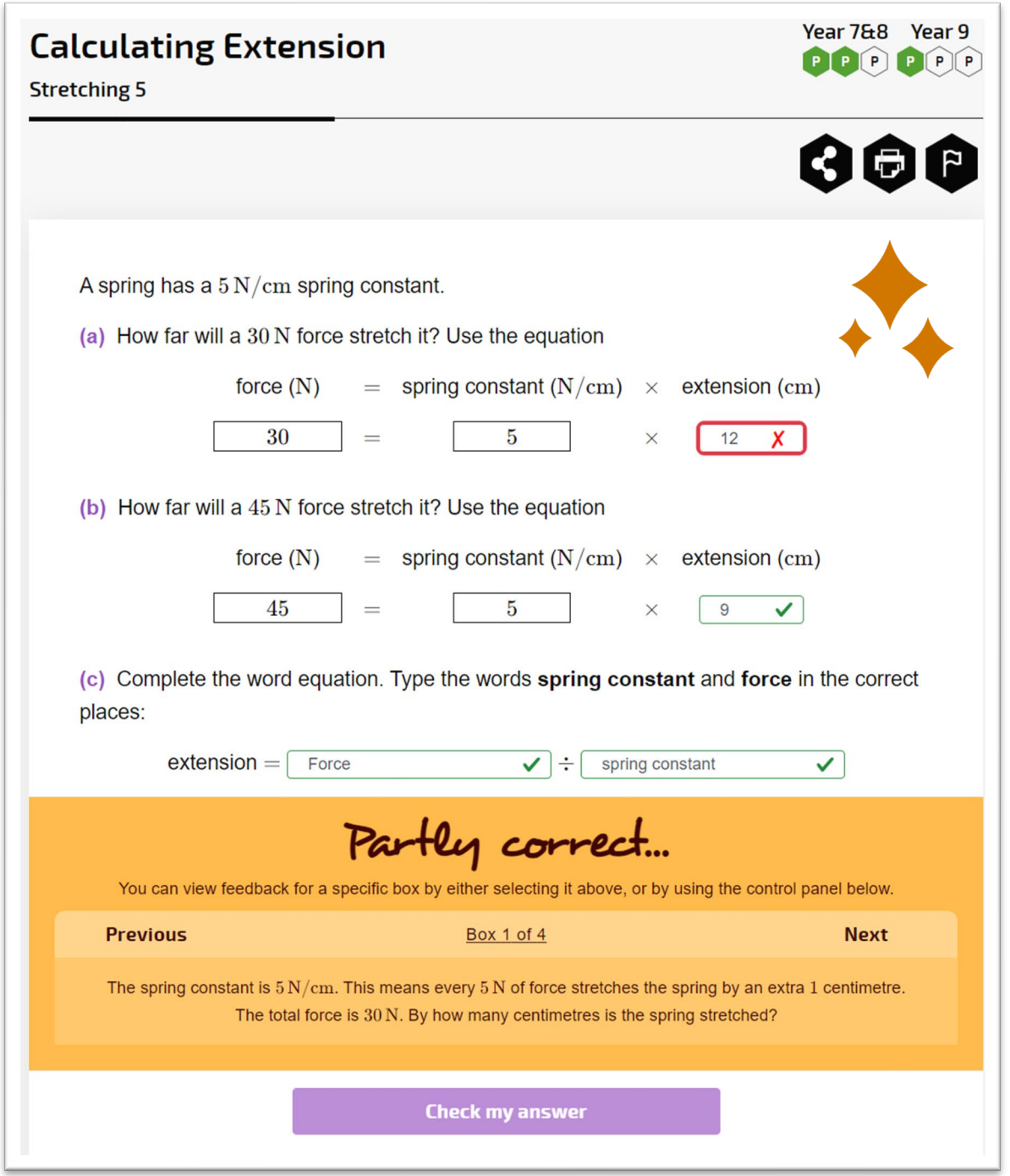
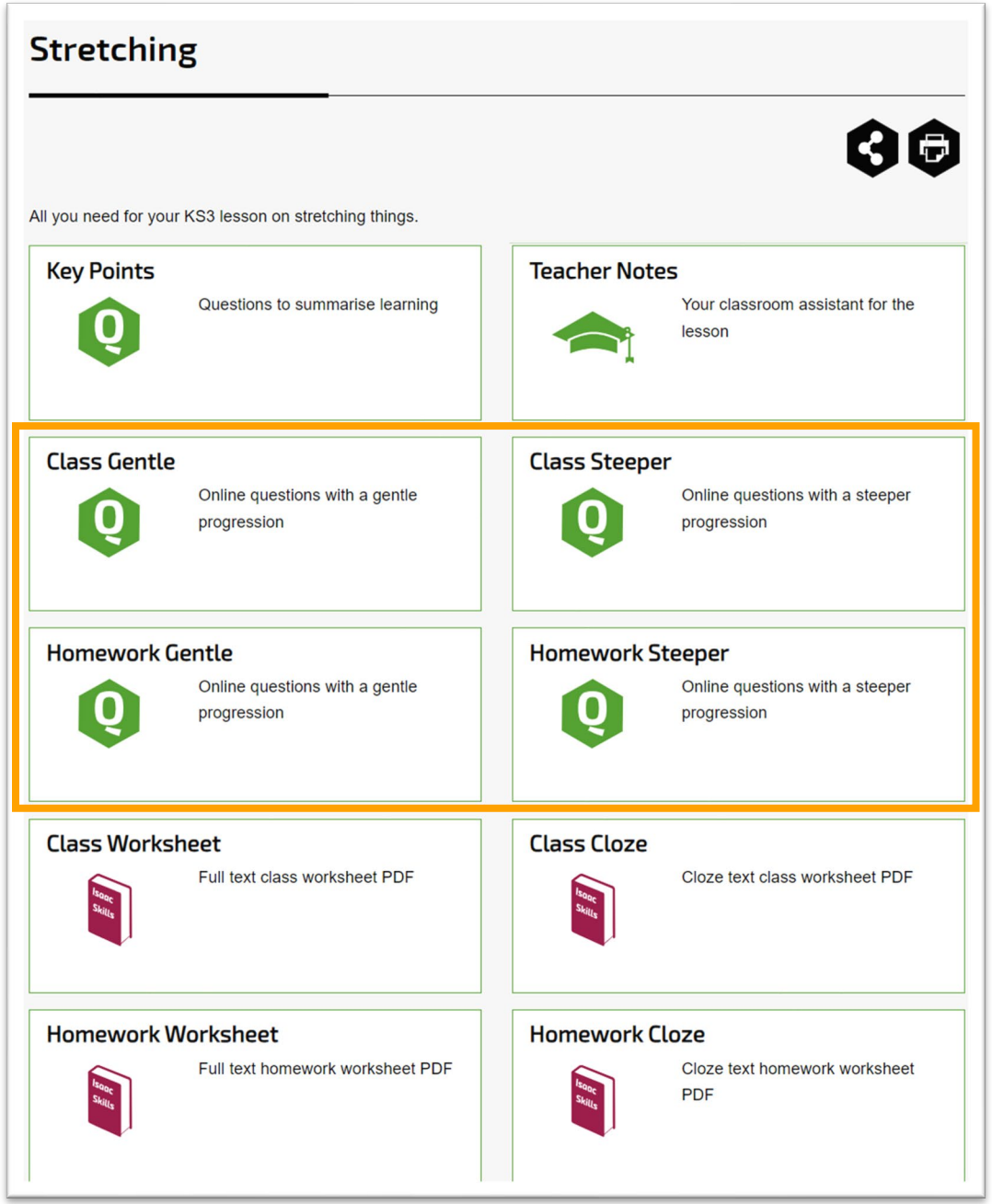


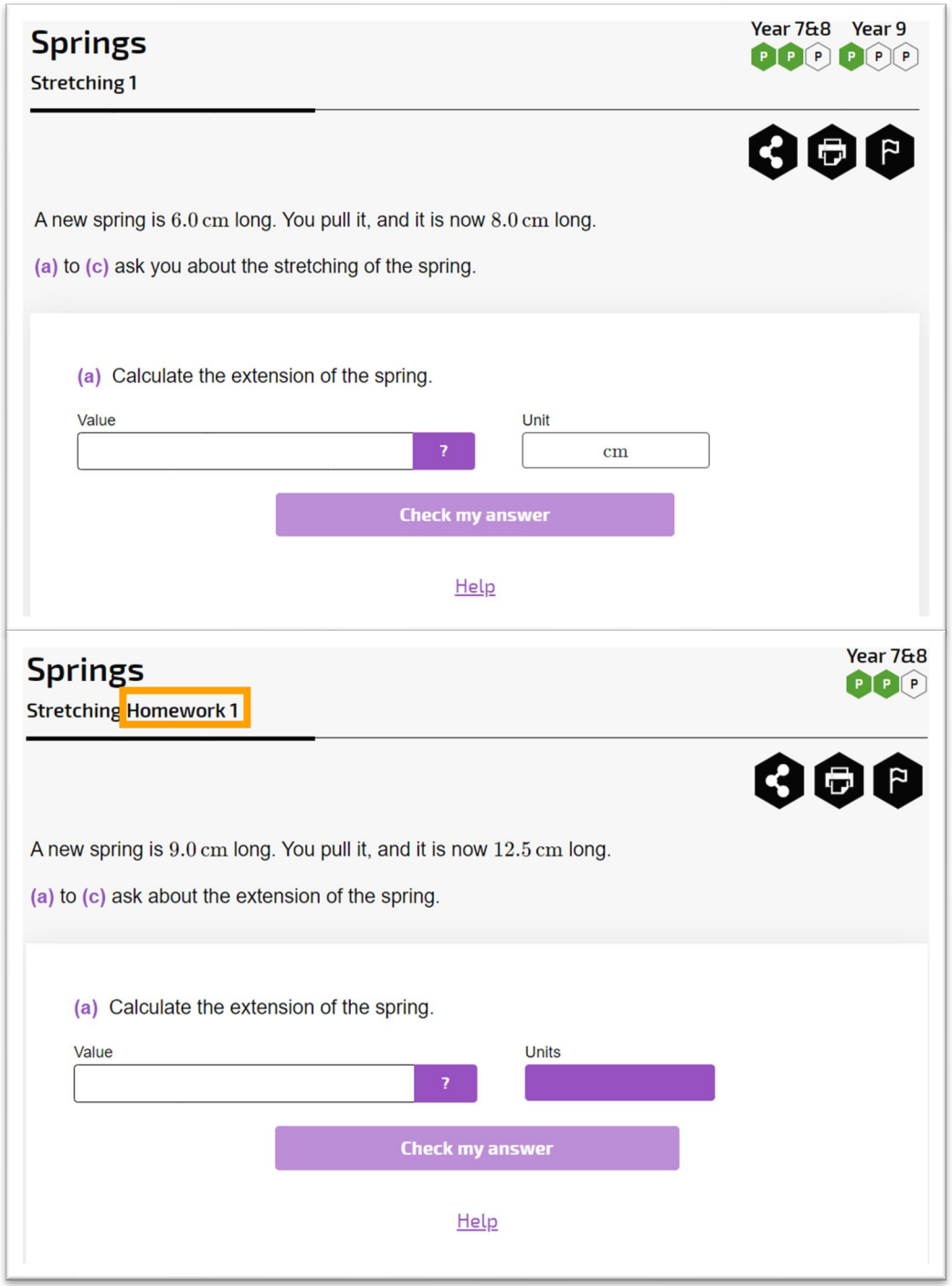
Year 7 & 8 – Summary of our approach:

- Students learn/embed understanding at different rates
  - Shallow and steep question sets for class work and homework
  - Significant overlap between shallow and steep to minimise teacher's work and to build confidence in all students.



Year 7 & 8 – Summary of our approach:

- Dovetailed class and homework question sets
  - Spaced repetition of the ideas and the calculations in the class sheets to consolidate the work done in class – with a little challenge.
  - Option for teachers to use the "classwork" for homework and then the homework for class work.



isaacphysics.org/questions/itsp24_stretch_class_q1

isaacphysics.org/questions/itsp24_stretch_hw_q1

Year 7 & 8 – Summary of our approach:

- Students can learn by working through the resources themselves.
  - After a very brief intro, our experience is that students can make their own way through the sheets without extensive explanations – they learn by doing.

Stretching

When you pull a spring, it gets longer.

The extra length is called extension and is measured in cm or m.

If it goes back to its original length when you let it go, it is elastic.

1 A new spring is 6.0 cm long. You pull it, and it is now 8.0 cm long.

(a) Calculate the extension.

(b) You now pull it harder, and make it 10.0 cm long. What is the extension now?

(c) When you let it go, it is now 6.4 cm long. Was the stretch elastic?

2 An athlete trains using a chest expander.
The table shows the force needed to stretch it.

Force (N)	0	50	100	150	200	250
Length (cm)	42.5	46.5	50.5	54.5		62.5
Extension (cm)	0.0		8.0			20.0

(a) How long was the chest expander before they stretched it?

(b) Fill in the missing length.

(c) Fill in the row with the extensions.

(d) How much longer does an extra force of 100 N make it?

(e) How much extra force is needed to make it 1 cm longer?

3 A spring gets 1 cm longer each time the force is made 4 N larger.

(a) Complete the equation: force (in newtons) = ☐ × extension (in cm).

(b) Use your equation to calculate the force needed to make the spring 7 cm longer.

(c) Use your equation to calculate the force needed to make the spring 10 cm longer.

cdn.isaacphysics.org/isaac/itsp/itsp_stretching_class_full.pdf

cdn.isaacphysics.org/isaac/itsp/itsp_forcemot_teachguide.pdf

Year 7 & 8 – Summary of our approach:

- Teacher support:
  - Guidance notes,

11-14 Force and Motion

Prerequisites:

Students should have already completed the **Forces** and the **Weight** sheets

The Main Points

The summary points are given at the top of the front and back side of the class work sheet.

- Balanced forces (2N upwards and also 2N downwards) cancel out as far as the object's motion is concerned. (They might stretch the object, but we don't worry about that here.)
  - Where there are more than two forces, we add up the total forces to the left, and compare the total force to the right. If these are equal, we have balanced forces.
  - If the forces are balanced, and cancel out, we say that there is **zero resultant force** (nothing left over).
  - A stationary object stays still if the forces are balanced.
  - A moving object carries on moving at a steady speed in a straight line if the forces are balanced. To give an example, if when cycling, you pedal with a force exactly equal to the friction and drag, your bike carries on at the same speed. If your driving force is bigger than the friction & drag (even if only a bit), the cycle will speed up.
- If the forces are not balanced, we calculate the resultant force (the force left over once we have cancelled out as much as we can).
  - If the total force pulling to the right is 5N, and the total force pulling to the left is 4N, the resultant force is 5N - 4N = 1N to the right.
  - Some students might actually find it easier to add the forces using negative numbers for the forces pointing one way, and positive numbers for forces pointing the other way. The sign (+ or -) of the final total gives the direction of the resultant force.
  - An unbalanced force in the direction of motion causes an object to speed up
  - An unbalanced force opposing motion slows the object down. If you are cycling and stop pedalling, the driving force has stopped, but the friction and drag still point backwards. This backwards force slows the bike down, but does not stop it instantly.
  - An unbalanced force to the side turns an object.

The most likely sticking point

- The students will find this point hard: if a ball is moving upwards, there must have been an upwards force on it at some stage, **but there might not be an upwards force on it now**.
- **It takes a net (or resultant) force to start something moving, but does not take a force to keep something moving**. This is very counterintuitive for students as we live in a world where there are always forces resisting motion, and so as soon as you take the driving force away, things slow down. However, the driving force needed for a bus to go at 30mph is exactly equal to the resistance force (to cancel it out) - you don't need any surplus. If you do give extra force, the bus gets faster.
- Some students find it helpful if you point out that when you turn the engine off, a vehicle does stop, but it doesn't stop immediately. So in that time while it is slowing down, it is definitely moving forward without a forward force on it. Others find it helpful if you ask students to picture a vehicle where there was a on/off key for the friction as well as for the engine, and ask them what would happen if you set the engine to keep the vehicle at a steady speed, and then turn the engine off and leave the friction on (slow down), next friction off with engine on (speed up), and finally both off.
- Students will accordingly struggle with the last part of class Q4 and homework Q8b: after a ball has been thrown upwards and let go, there is no upwards force on it at all (apart from a little upthrust due to buoyancy which we neglect here), and yet still it rises (albeing while slowing down)!

cdn.isaacphysics.org/isaac/itsp/itsp_forcemot_teachguide.pdf

Year 7 & 8 – Summary of our approach:

- Teacher support:
  - Guidance notes,

Teacher Quarter Briefing

- Introduction: https://youtu.be/Ev8dhWZcbUU
- Practice: https://isaacphysics.org/gameboards#itsp_teach_forcemot
- Review: https://youtu.be/IBA7YH3eYe0
- If you want to go deeper, please see the 'Force and Acceleration' materials

Class Question Notes

The worksheet can be printed either in full, or in cloze text form (where the red text is missing, and students can complete these blank spaces after class discussion). The online version of the notes requires the appropriate text to be dragged to the right place in the sentences.

Shallow learning gradient online assignment - q1,2,4,5,6,8
Steeper learning gradient online assignment - q1,2,3,4,5,6,7,8,9

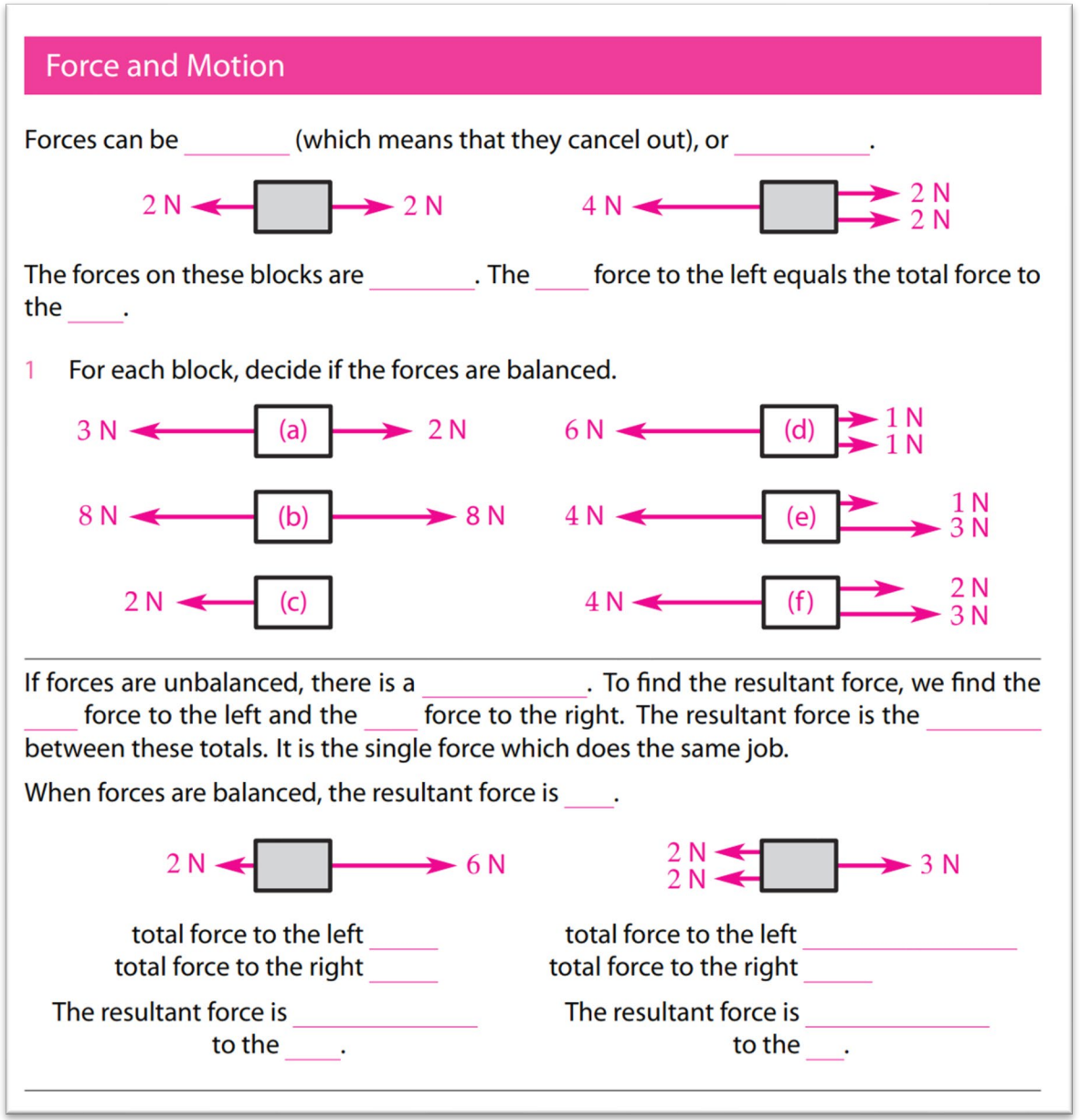
1. In this question, students decide for each diagram whether the forces are balanced or not.
2. Here students calculate the resultant force (and say 'zero' if the forces are balanced). To give an example, for (g) total force to the right is 7N, force to the left is 5N, so resultant is 2N to the right.
3. Here students add one force to each example in Q1 to make the forces balance. For 2(g) they would add 2N to the left to cancel out the resultant force worked out in Q1(g).
4. Students add a 3mN upwards force and a 1mN left force to balance the forces given.
5. Students draw the direction of the extra force needed to speed up a falling penguin or slow it down.
6. In this question, students match up a description of what a force does with the direction it points.
7. Here students apply the notes at the top of the sheet and choose whether the object will speed up, slow down, stay still, go at a steady speed or turn. This is a more detailed version of q6. In (c) the gravity force is at right angles to the motion and causes the planet to turn (change direction) so it can keep moving on its circular orbit. The force does not speed up or slow the planet down. Planets in elliptical orbits do speed up (slow down) when they get nearer to (further from) the star. In (g) point out that although the ball is going upwards, the resultant force is downwards. There is no upwards force on the ball simply because it is moving that way. There was once an upwards force to make it move upwards (from the person), but once the person let go, that force stopped acting.
8. The aim here is for students to draw the driving force as larger than drag when speeding up, and smaller when slowing down. Bonus mark for the student who shows the two forces equal in strength for the steady speed situation.
9. Here we have a downwards weight force and upwards drag on a leaf falling from a tree. In (b) the drag is less than weight, so the leaf gets faster, but in (c) forces are balanced and the leaf falls at a steady speed (later, students will learn this is called **terminal velocity**).

Homework Question Notes

These questions have a very similar form to the questions in the class task, so students can refer back to their earlier answers to help •••

Year 7 & 8 – Summary of our approach:

- Teacher support:
  - Guidance notes,
  - cloze text sheets for projection in class,



Force and Motion

Forces can be _____ (which means that they cancel out), or _____.

2 N ← → 2 N 4 N ← → 2 N, 2 N

The forces on these blocks are _____. The ____ force to the left equals the total force to the ____.

1 For each block, decide if the forces are balanced.

3 N ← (a) → 2 N 6 N ← (d) → 1 N, 1 N

8 N ← (b) → 8 N 4 N ← (e) → 1 N, 3 N

2 N ← (c) 4 N ← (f) → 2 N, 3 N

If forces are unbalanced, there is a _____. To find the resultant force, we find the ____ force to the left and the ____ force to the right. The resultant force is the _____ between these totals. It is the single force which does the same job.

When forces are balanced, the resultant force is ____.

2 N ← → 6 N

total force to the left _____
total force to the right _____

The resultant force is _____ to the ____.

2 N, 2 N ← → 3 N

total force to the left _____
total force to the right _____

The resultant force is _____ to the ____.

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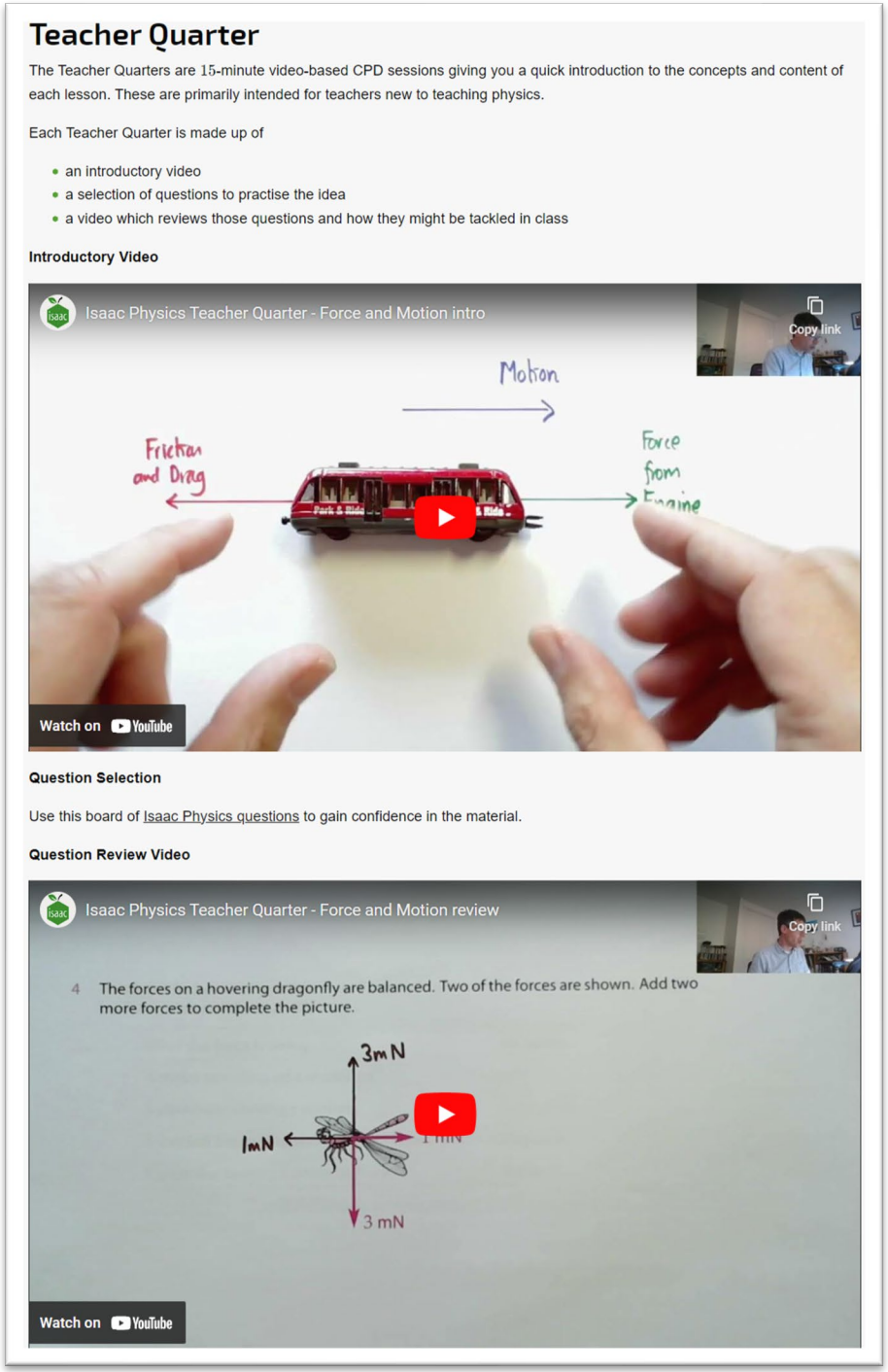
Year 7 & 8 – Summary of our approach:

- Teacher support:
  - Guidance notes,
  - cloze text sheets for projection in class,
  - teacher quarter videos (15 mins concept intros)
    - Watch the intro video
    - Do the teacher review questions
    - Watch the review that goes through those questions and equips you to deal with students' questions.



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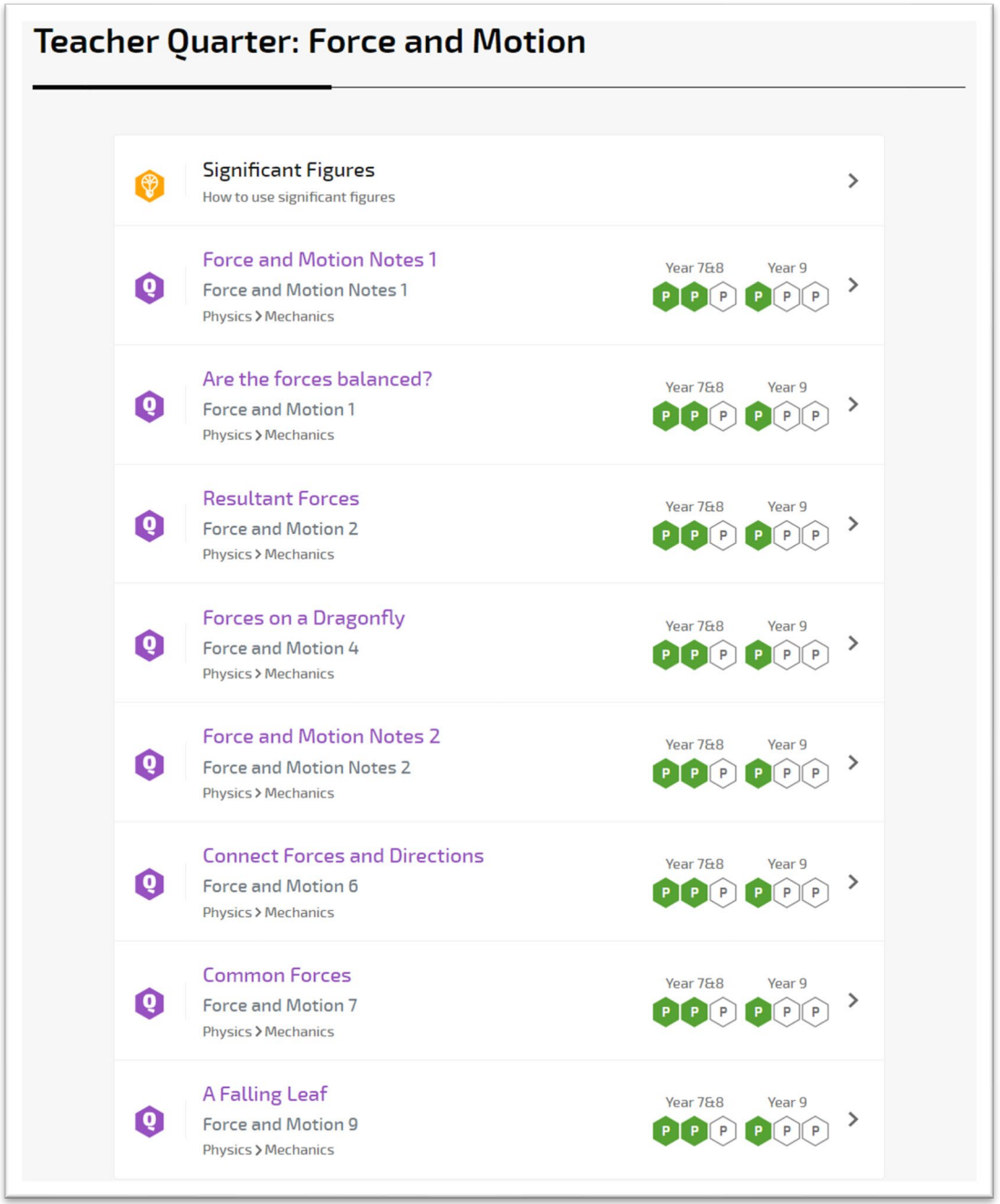
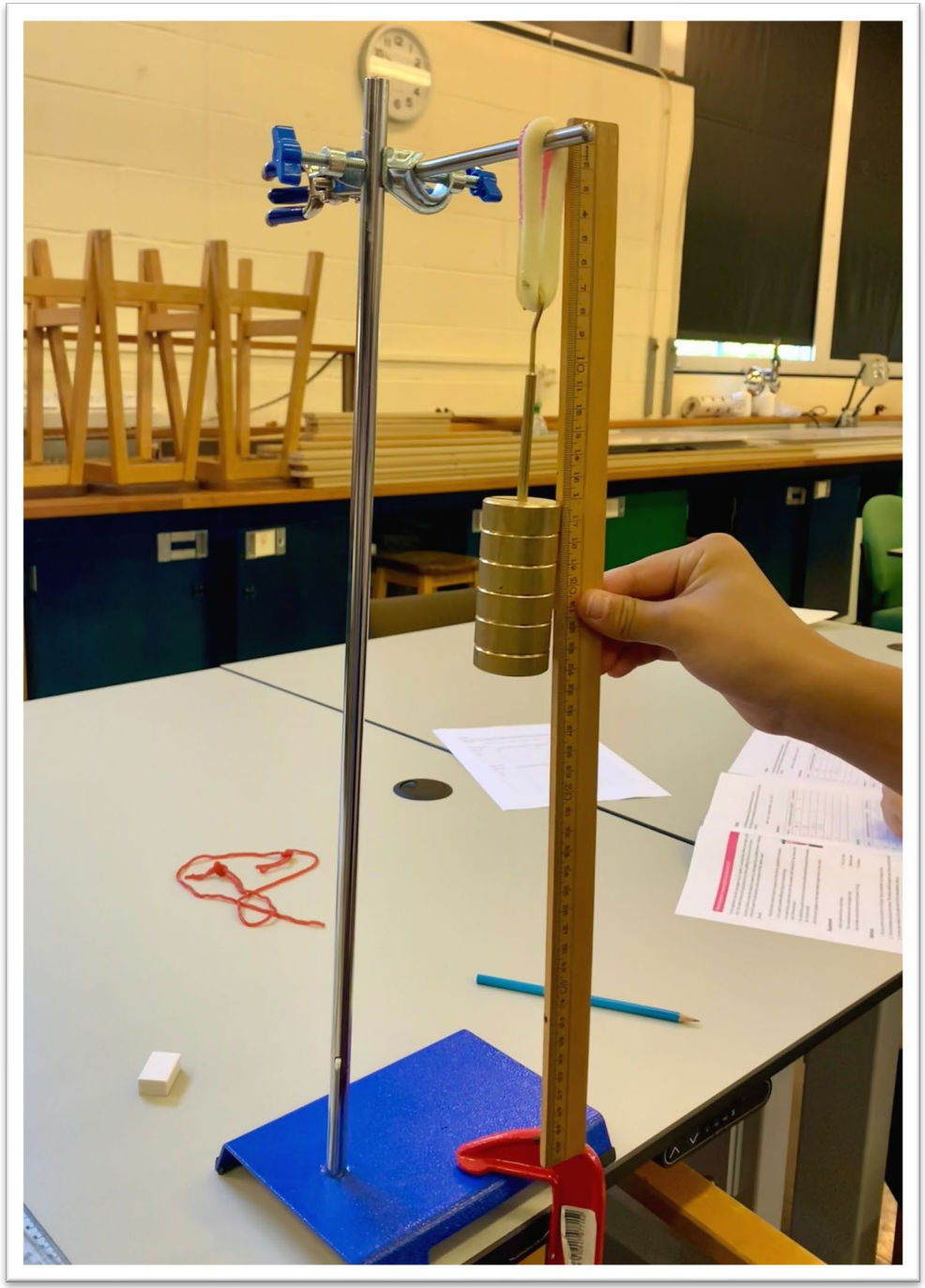


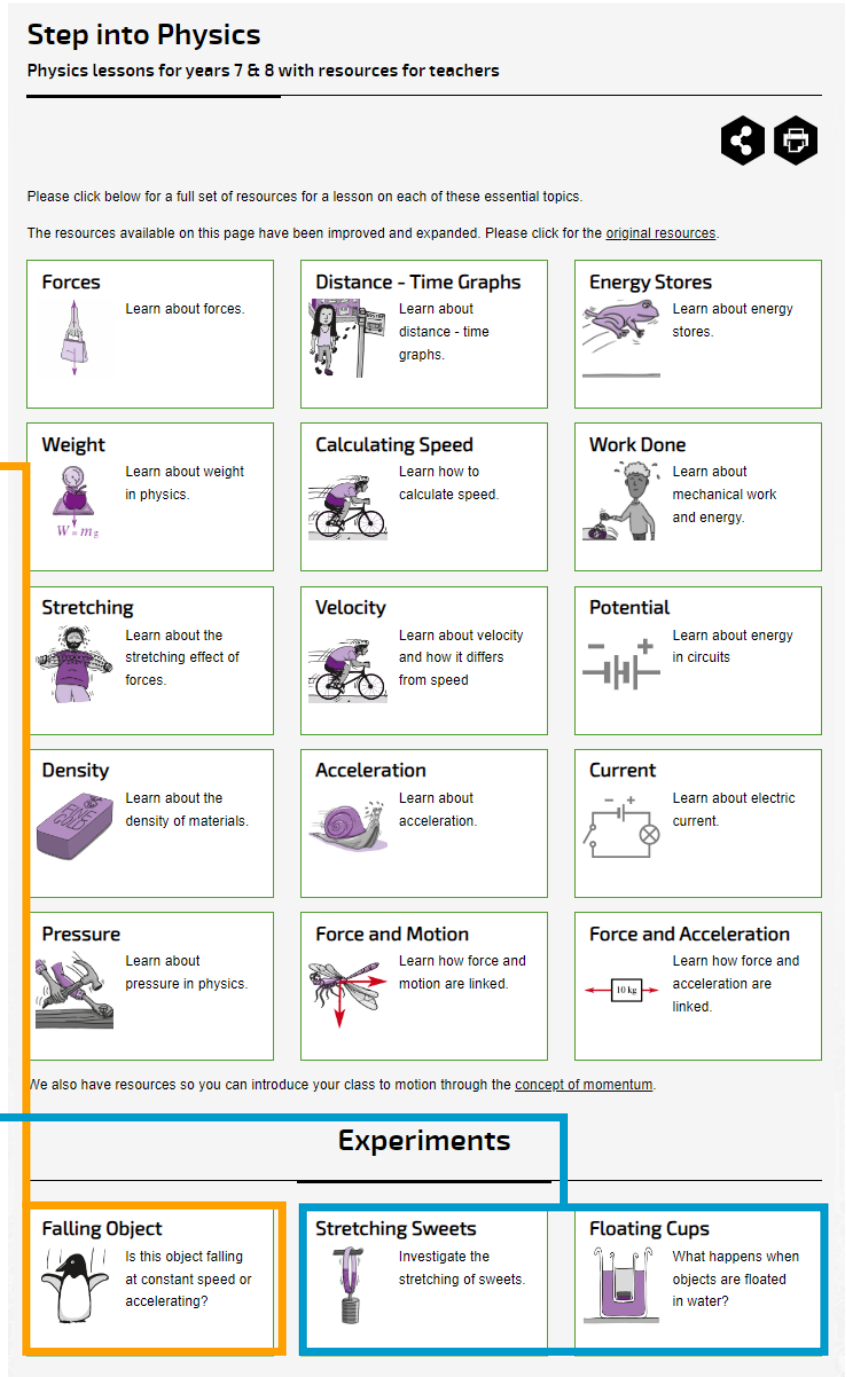
EXPERIMENTS

Dr Nicki Humphry-Baker



KS3 Experiments

- 3 experiments
  - 1 where a video of experiment is provided – students practice creating tables and graphs.
  - 2 using standard classroom (or supermarket) equipment



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Example: Stretching Sweets

- Choose from online or printable worksheet

What happens to a sweet when we stretch it?

In this experiment you will investigate how a sweet is stretched when we apply a pulling force. Our sweet is fixed at the opposite end to the pulling force so it can't move.

Our aim is to find out how the shape of a sweet is changed by a pulling force. Does the size of the force matter? Do all stretchy sweets behave in the same way?

We will:

- Describe how a sweet's length changes as the force applied increases.
- Use a graph to identify different types of stretching.
- For small forces, predict how much the sweet will stretch if we know the size of the force used.
- For small forces, predict how much force we will need to extend the sweet by a certain length.
- Describe what happens to the sweet when large forces are used.

Equipment

- Retort stand with boss and clamp
- Two strawberry laces and one apple ring
- Mass holder and slotted masses (10 g and 100 g)
- 30 cm ruler
- Marker pen
- G clamp

Method

1. Set up a retort stand with the G Clamp. Get a teacher to check this.
2. Tie two strawberry laces to the clamp. The laces will dangle over the end of the bench.
3. Tie the mass holder to the other end of the strawberry laces.
4. With a pen make 2 marks on the lace 30 cm apart. This is the "unstretched length". (Think: is this really the unstretched length and why do we use that measurement.)
5. Gently add 10 g masses one at a time and record the new length between the marks.
6. Keep adding masses till the lace breaks. Make sure your feet are not underneath! Remember to measure the length between the markers each time.
7. Calculate how much the sweet has extended for each of your measurements.
8. Plot a graph of weight against extension using the graph paper and axes provided.
9. Repeat the experiment with an apple ring. Hang the apple ring on the clamp. Your pen marks should be 5 cm apart. You will be adding 100 g masses to the mass hanger.
10. Plot a graph of weight against extension for the apple rings, what differences are there between your graph for the apple ring and the strawberry laces?

Stretching Sweets

Isaac 11-14

Year 7&8

What happens to a sweet when we stretch it?

In this experiment you will investigate how a sweet is stretched when we apply a pulling force to a sweet that is fixed at the opposite end so it can't move.

We will test strawberry laces and apple rings. What do you think will happen when we add weights to the ends of these sweets? Which of these do you think will be more stretchy?

To find out more about stretching sweets visit our background information.

Download the printable worksheet for this experiment here.

Results

Use the following two tables to write down the results for your experiment.
We can convert from mass to weight by multiplying the mass, *in kilograms*, by the strength of gravity:

$$\text{weight} = \text{mass} \times \text{strength of gravity} = \text{mass} \times 10\ \text{m/s}^2.$$

Strawberry lace

Mass (g)	Length between markers (cm)	Weight (N)	Extension (cm)
0	30	0	0
10			
20			

Created by Ingrid Murray for Isaac Physics

isaacphysics.org/questions/itsp_exp_sweets

cdn.isaacphysics.org/isaac/itsp/itsp_practicals_stretching_sweets2.pdf

Example: Stretching Sweets

Calculations

6 In an experiment, as long as the mass added to the hanger is less than 80 g, some strawberry laces stretch by 1.0 cm for each 10 g mass added.

(a) A 30 g mass is hung from the strawberry laces. How much longer will they get?

(b) When a 10 g mass hanger is hung from the laces, the laces are 6.0 cm long. An extra 50 g mass is now hung from the strawberry laces. How long are the laces now?

7 In an experiment, when the total mass added is less than 1500 g, an apple ring got longer by the same amount every time a 100 g mass was added to the hanger. To start with it was 7.0 cm long. After 1200 g had been added, it was 12.0 cm long. How much mass was on it when it was 9.5 cm long?

Conclusions

8 Write conclusions for your experiment, to do this try answering the following questions.

(a) Which sweet was stretchier?

(b) Which was stronger?

(c) Did this fit in with your prediction?

(d) Did you have any challenges doing the practical?

(e) Are there any improvements you would make if you did this experiment again?

Plotting your graph

Two sheets of graph paper are provided at the end of the handout for you to plot your graphs. It is good practice to plot each point as you collect your data in the tables above. The variable you control is the independent variable, this goes on the x axis. The variable you are measuring in response to the changes in the independent variable is the dependent variable and goes on the y axis.

Once you have plotted your data then you will need to draw a **line of best fit**. This is a straight line that agrees with your data as well as you can make it. You should not "join the dots", but instead draw a single straight line with a ruler. Do not worry if your line does not go through all of the data points (but it should be close to most of them). You may find you can only draw a sensible line of best fit for part of your data.

Discussion

1 Look at the shape of your graph from the **strawberry laces** experiment. Describe the shape of your graph.

2 Look at the shape of your graph from the **apple ring** experiment. Describe the shape of your graph.

3 (a) When you add a force of 2 N to the **apple ring** what is the extension?

(b) What is the extension when you add 4 N?

(c) What is the extension when you add 6 N?

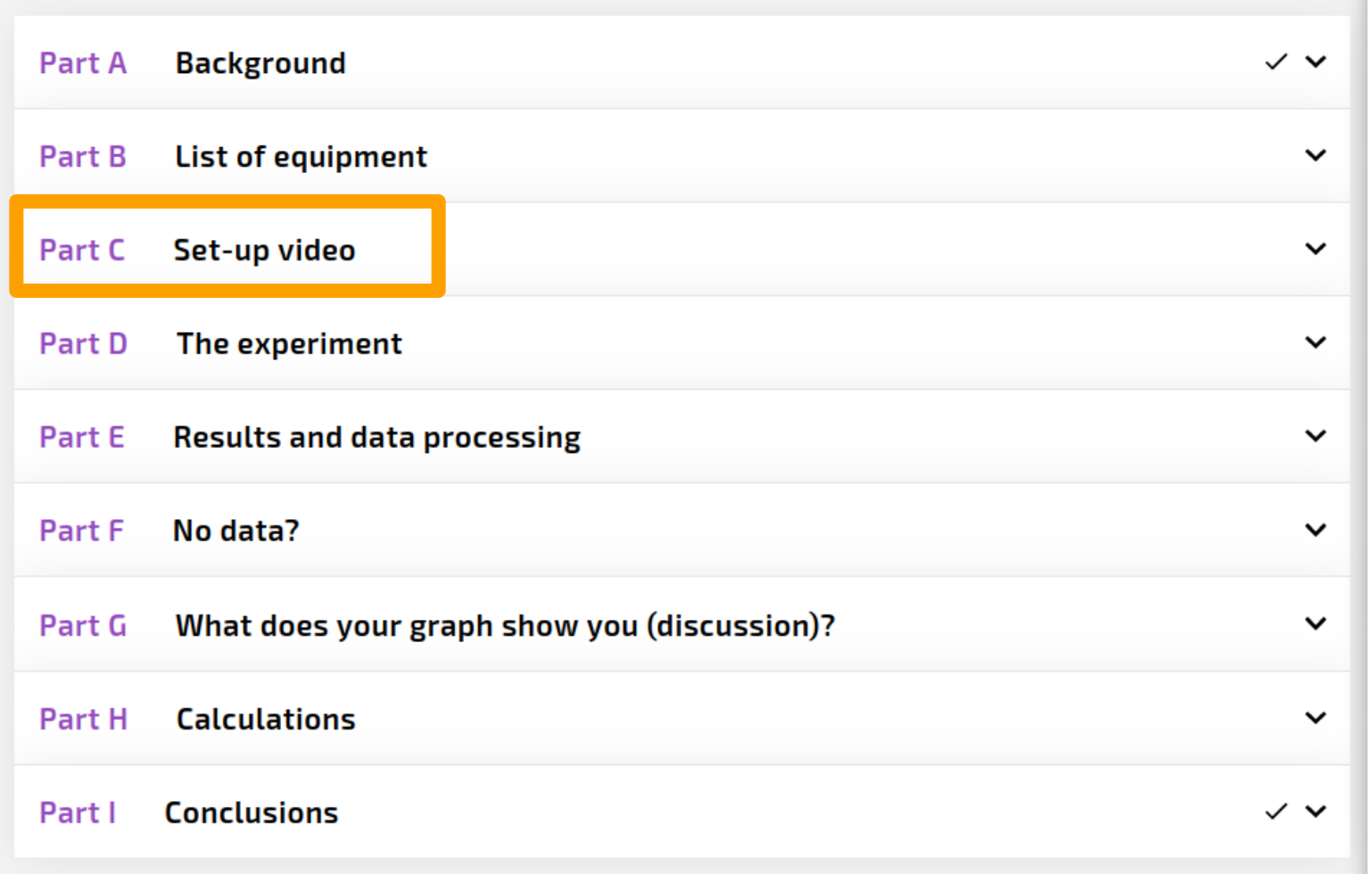
(d) Can you spot a pattern? (fill in the blanks)
When you double the force on the apple ring, the extension _____. When you treble the force on the apple ring, the extension _____. As long as the graph is _____, if you multiply the force on the apple ring by any number then the extension is also multiplied by the _____ number.

4 What about small weights with the strawberry laces? (fill in the blanks)
When you double the small weight added to the strawberry laces the extension _____.
So the extension fo the strawberry laces follows _____ pattern as the apple ring.
For small extensions their graphs are both _____.

5 When you add larger weights to the strawberry laces what do you notice?

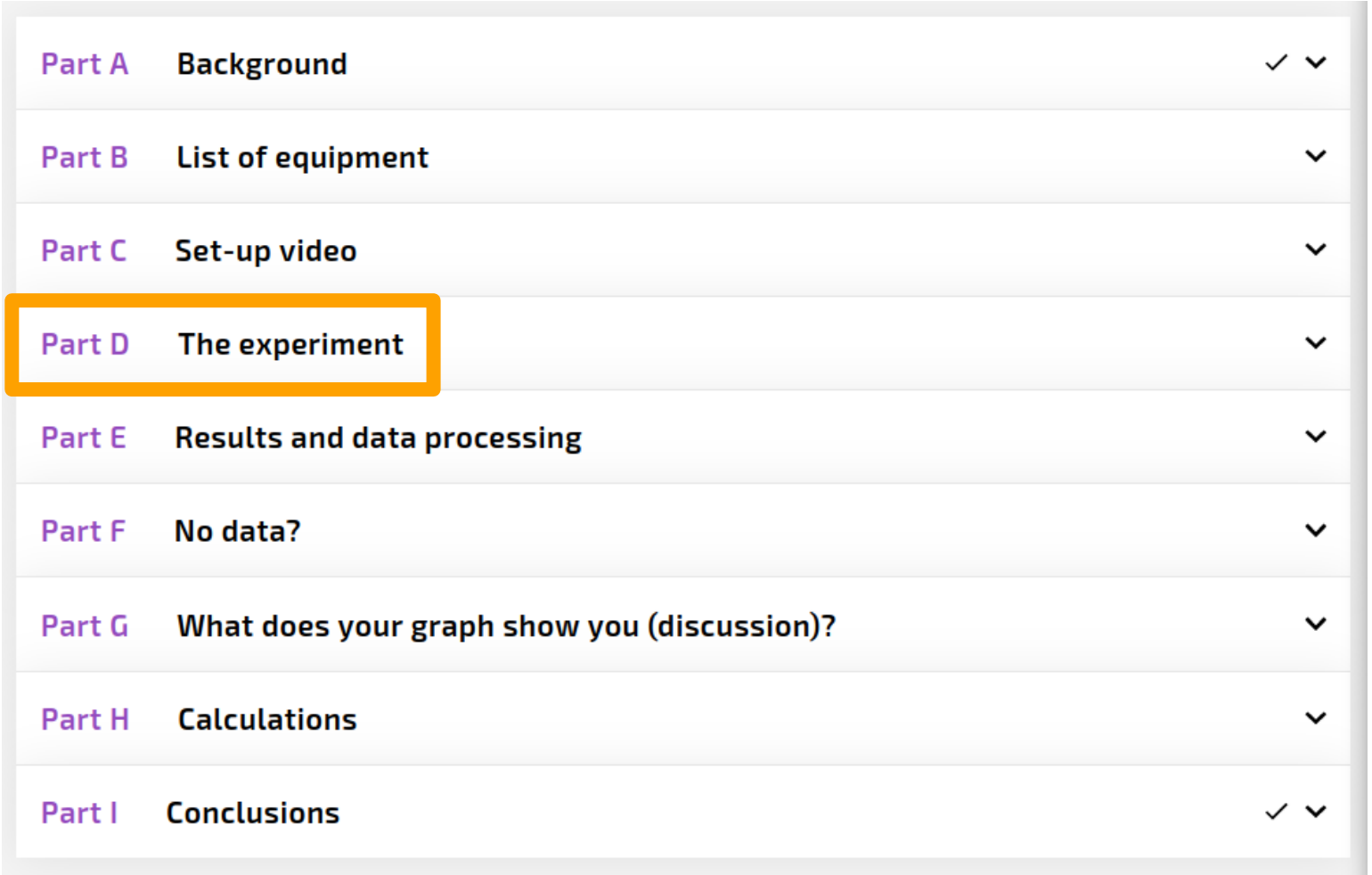
Stretching Sweets: set-up video

➢ For teachers + technicians



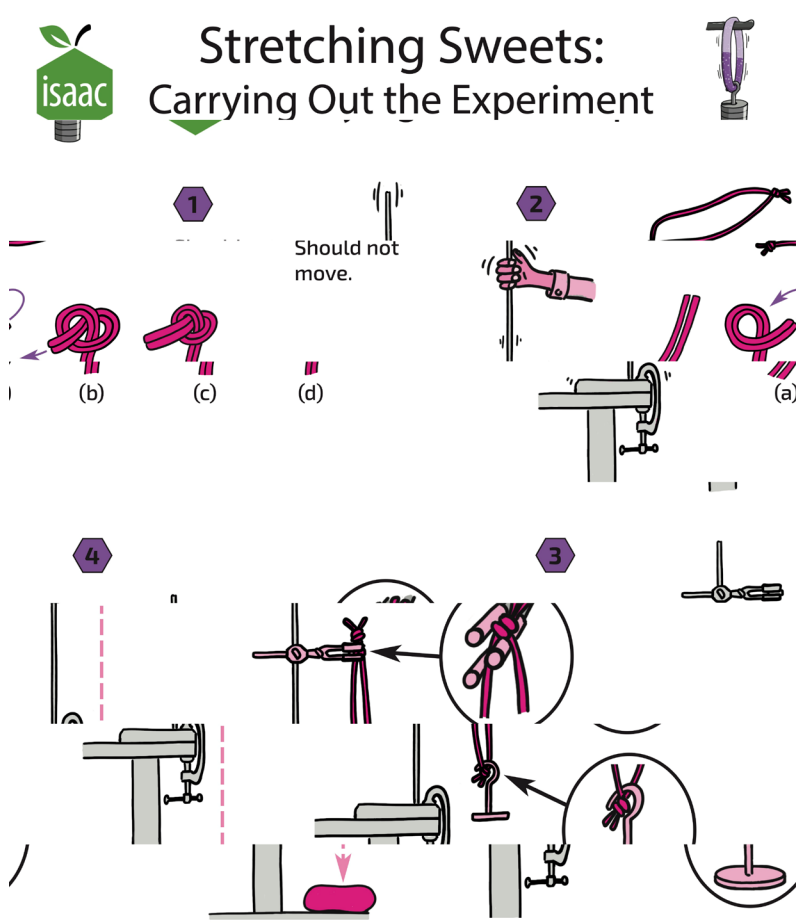
Stretching Sweets: experiment

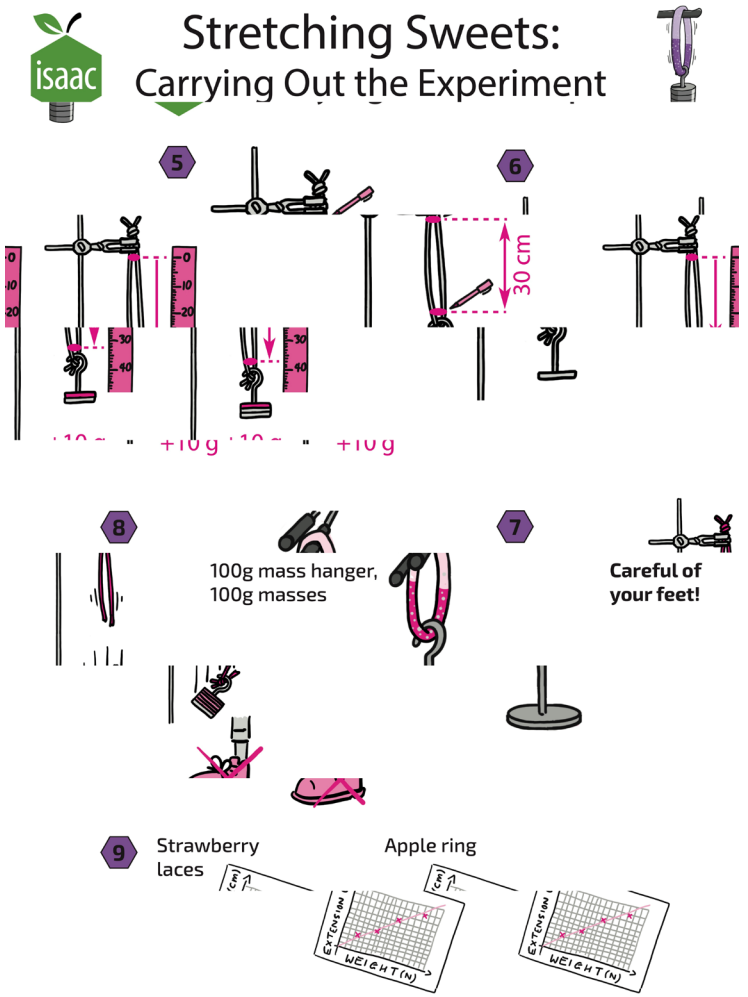
- For everyone



Stretching Sweets: experiment

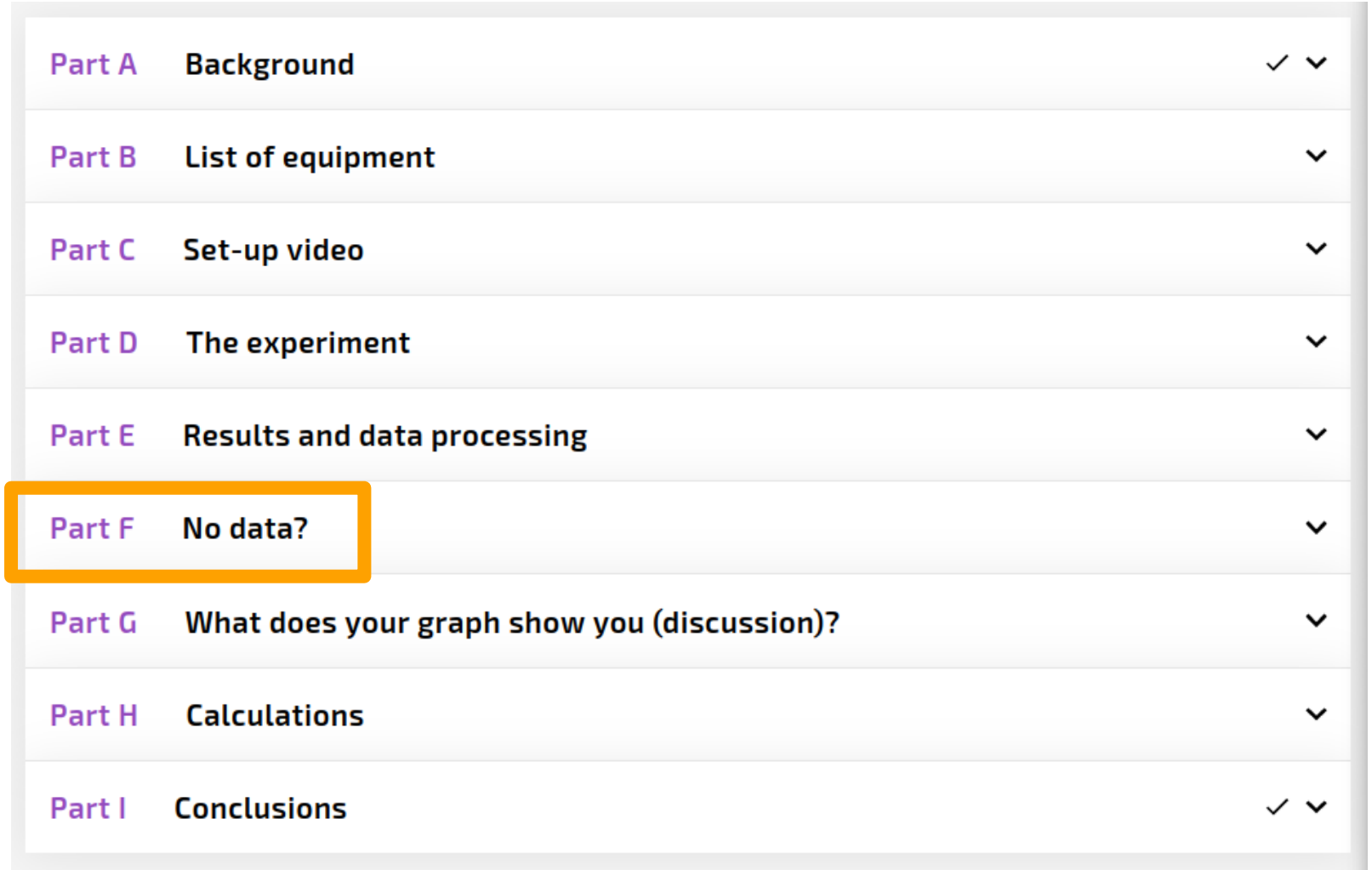
- For students





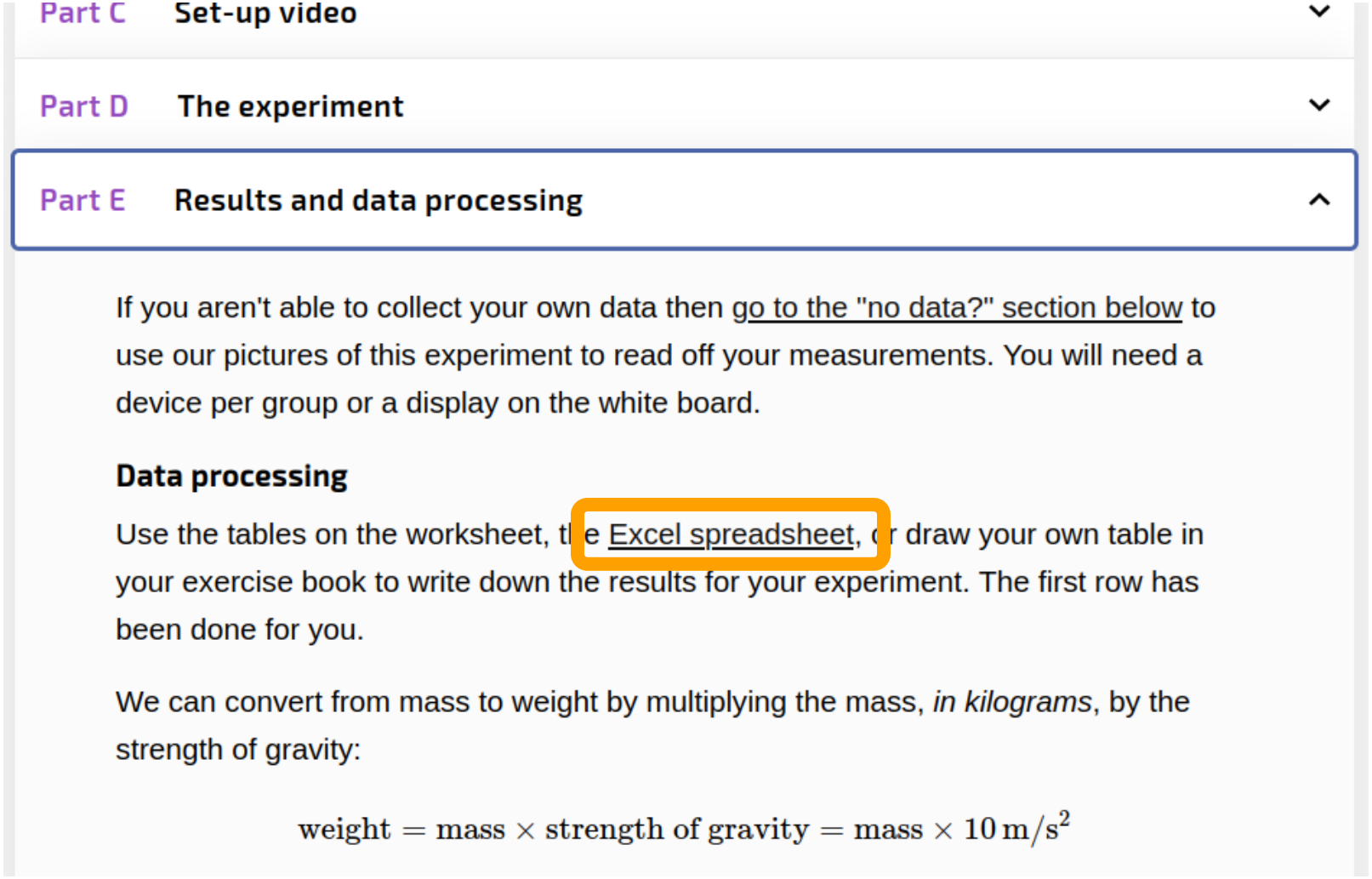
Stretching Sweets: no data?

➢ If you have no equipment or want a lesson focusing on data analysis.



Stretching Sweets: spreadsheet

➢ For a lesson focusing on doing experiments, not graph plotting.



Part C **Set-up video**

Part D **The experiment**

Part E **Results and data processing**

If you aren't able to collect your own data then go to the "no data?" section below to use our pictures of this experiment to read off your measurements. You will need a device per group or a display on the white board.

Data processing

Use the tables on the worksheet, the Excel spreadsheet, or draw your own table in your exercise book to write down the results for your experiment. The first row has been done for you.

We can convert from mass to weight by multiplying the mass, *in kilograms*, by the strength of gravity:

$$\text{weight} = \text{mass} \times \text{strength of gravity} = \text{mass} \times 10\,\text{m/s}^2$$

Stretching Sweets: spreadsheet

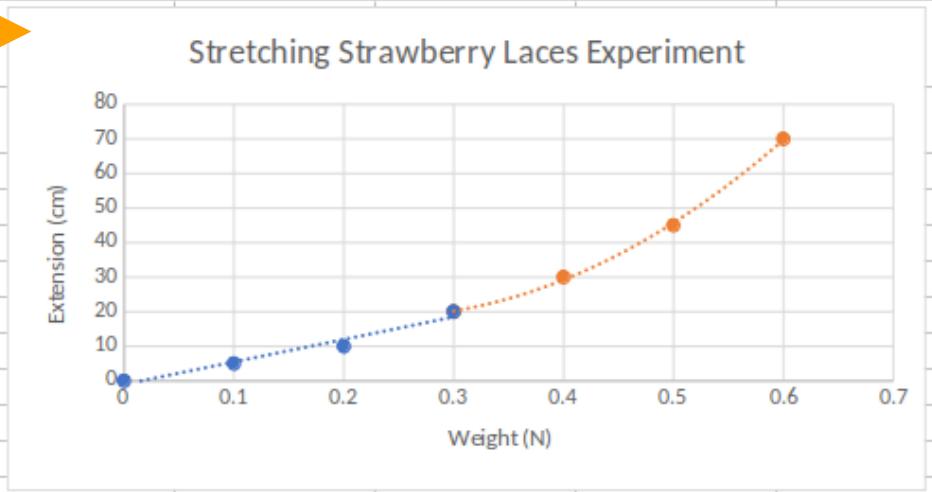
Stretching sweets measurements

Students should enter their masses in column A and their length measurements in column C underneath our starter values.

The weight and extension results will then be calculated automatically and displayed in columns B and D instead of the default -30 and -5 shown.

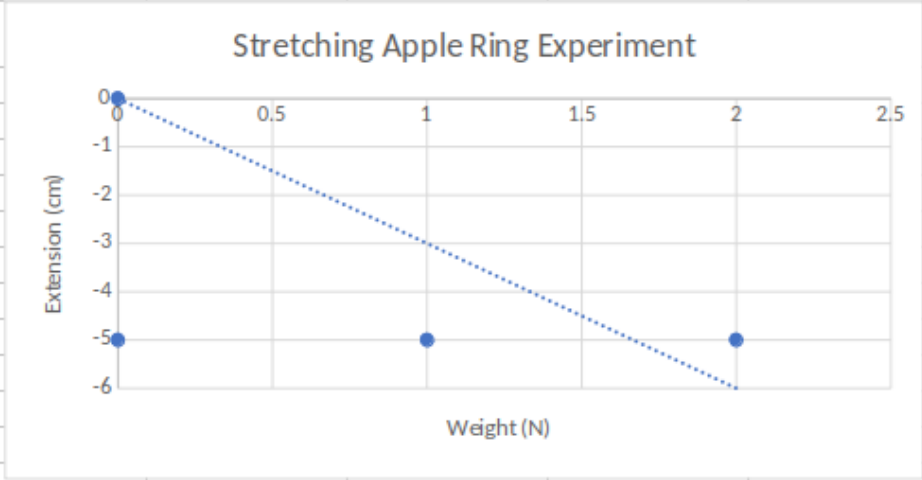
Strawberry laces

Mass (g)	Weight (N)	Length between markers (cm)	Extension (cm)
0	0	30	0
10	0.1	35	5
20	0.2	40	10
30	0.3	50	20
40	0.4	60	30
50	0.5	75	45
60	0.6	100	70



Apple Ring

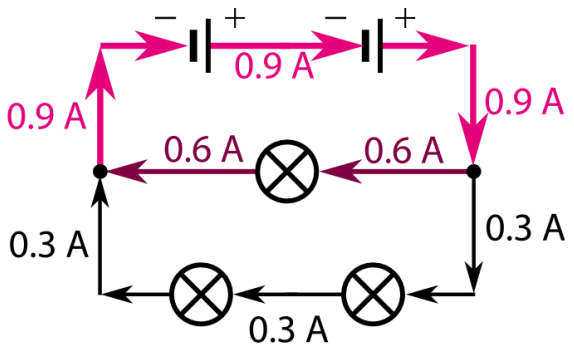
Mass (g)	Weight (N)	Length between markers (cm)	Extension (cm)
0	0	5	0
100	1		-5
200	2		-5
	0		-5
	0		-5
	0		-5
	0		-5
	0		-5
	0		-5
	0		-5
	0		-5



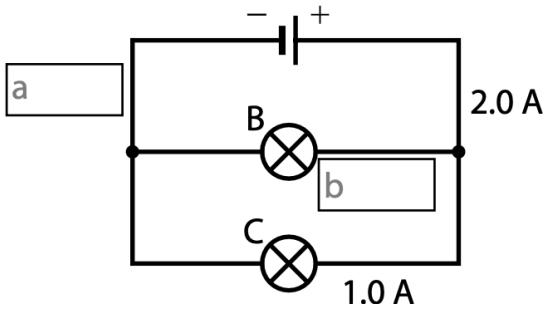
ELECTRICITY

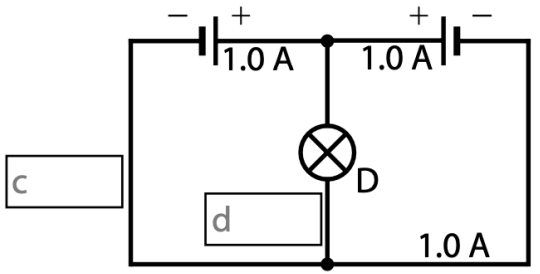
Dr Nicki Humphry-Baker

Parallel circuits have junctions. The total current flowing into a junction must be the same as the total current flowing out of the junction.

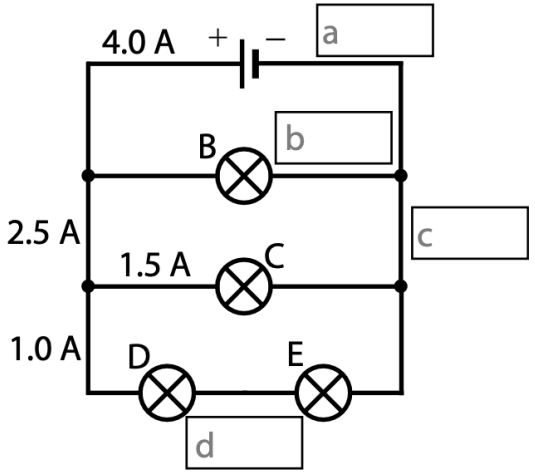


7 Write down the current in each of the boxes on the circuits from question 5.





8 Write down the current in each of the boxes.



Electricity: Year 7 and 8

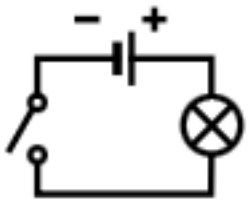
- Two new electricity resources
  - Potential and Circuits
  - Current and Circuits
  - Can be taught either way round

  - These are brand new resources, comments and feedback very much appreciated.

Potential

Learn about energy in circuits

Current

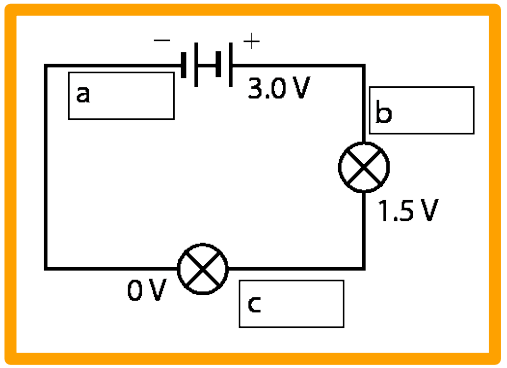


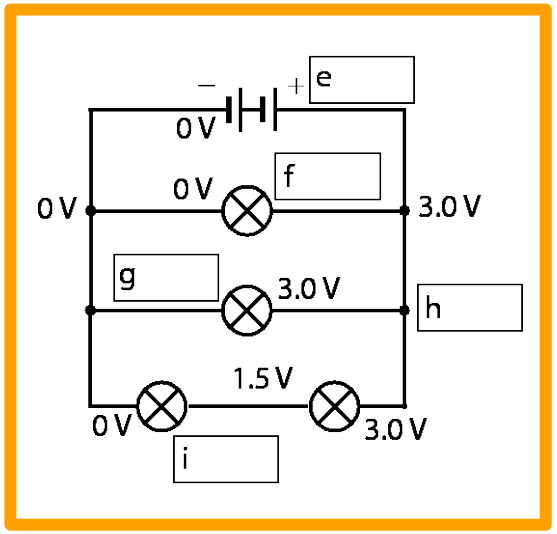
Learn about electric current.

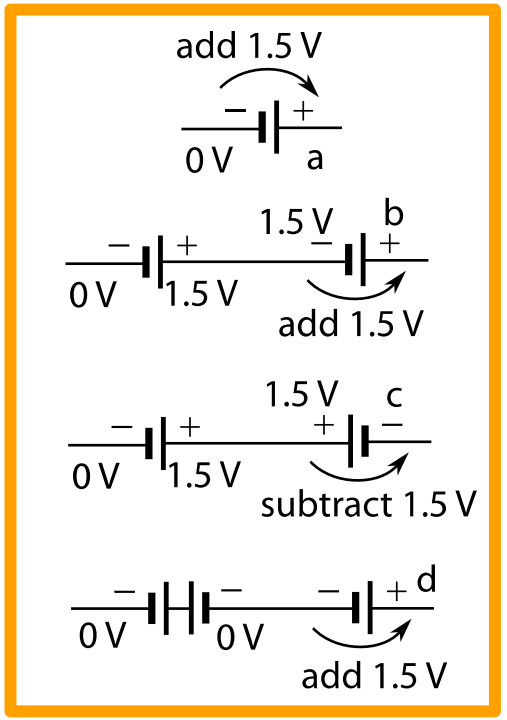
Electricity: Potential and Circuits

- Teaches:
  - Potential around a circuit
  - Addition and subtraction of potentials
  - Batteries
  - Series and parallel circuits
  - Brightness of Lightbulbs

- Components:
  - Wires
  - Cells
  - Lightbulbs

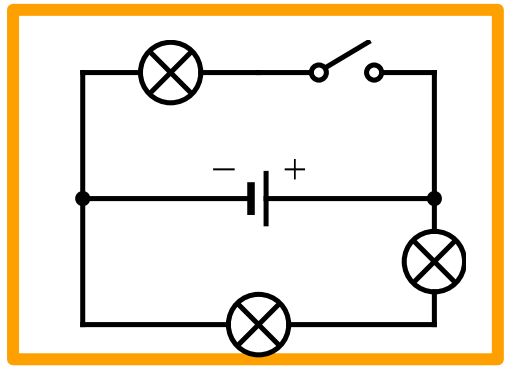


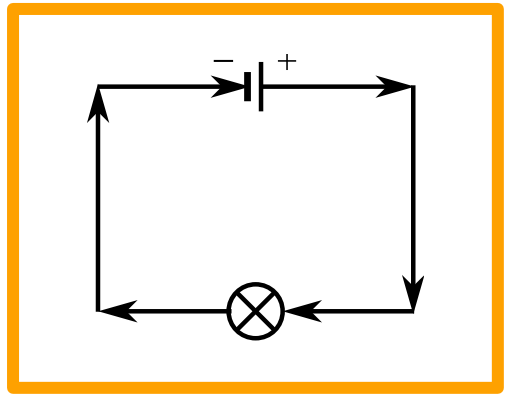




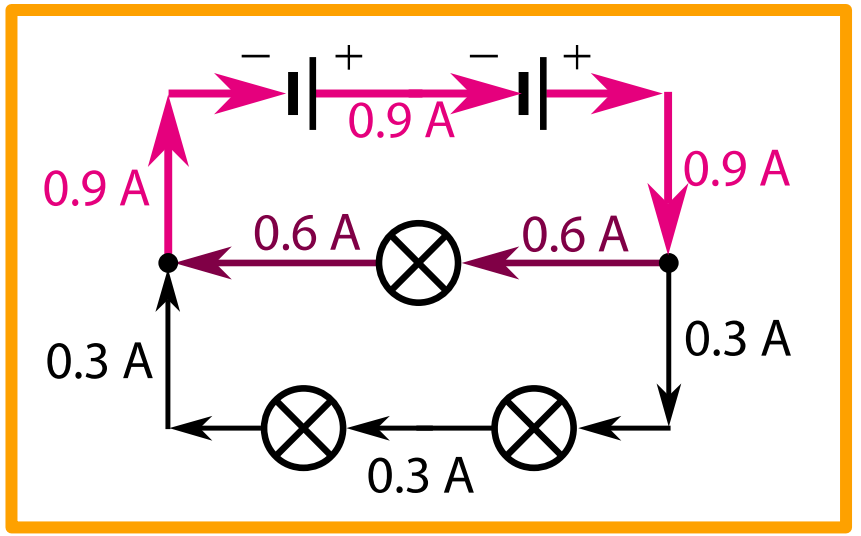
Electricity: Current and Circuits

- Teaches:
  - Open/closed circuit
  - Current direction
  - Current around a circuit
  - Series and parallel circuits
  - Brightness of Lightbulbs



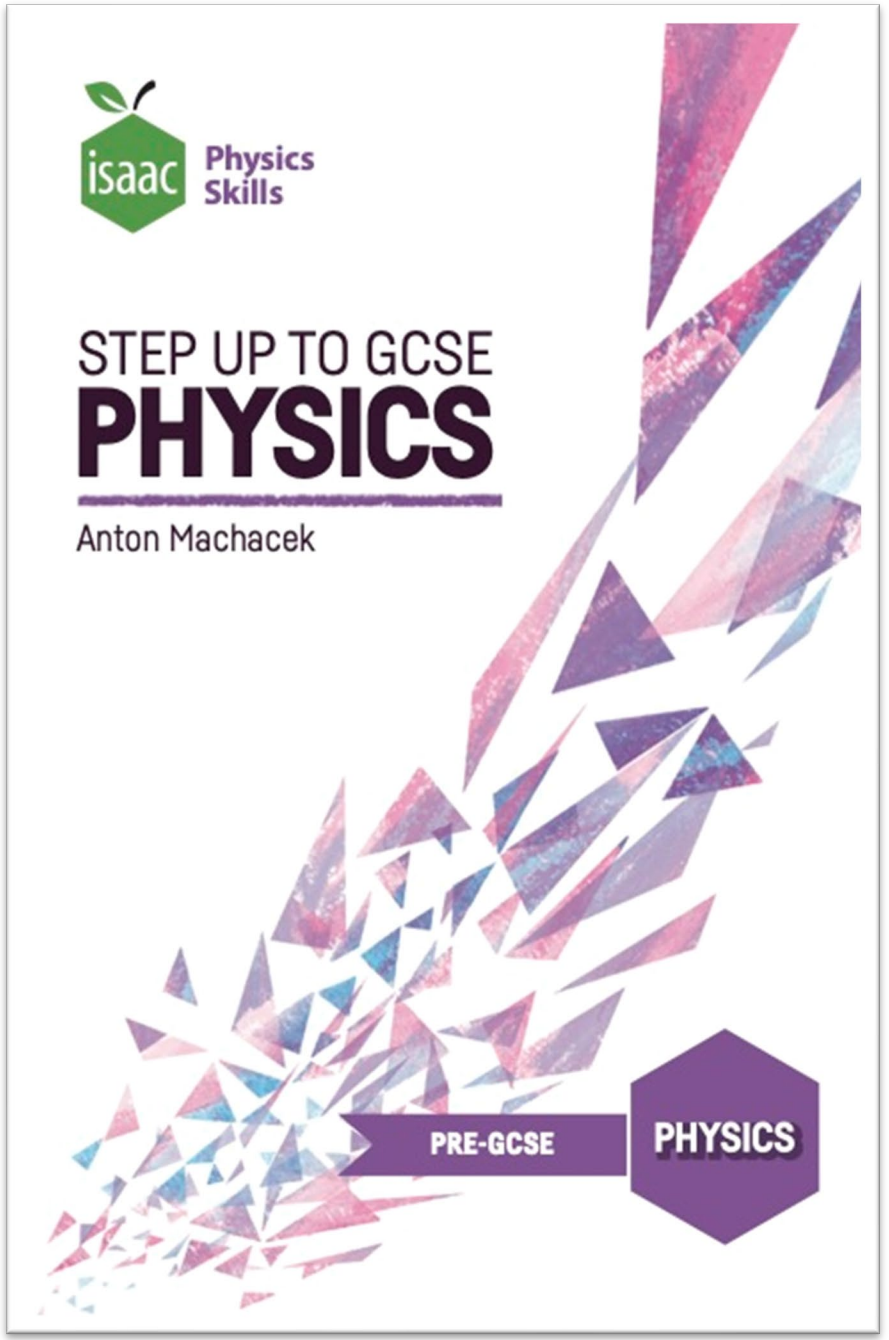


- Components:
  - Wires
  - Cells
  - Lightbulbs

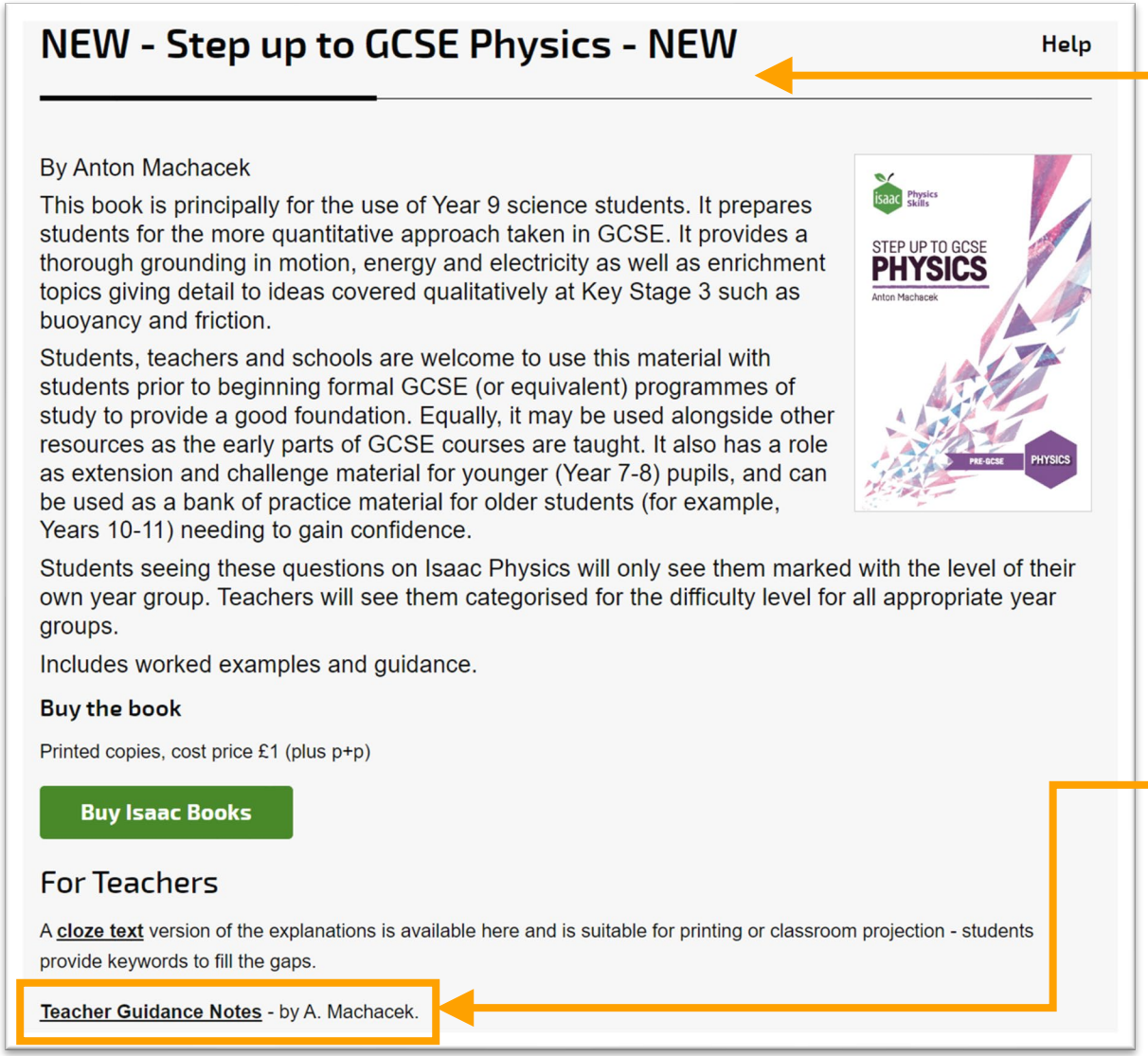


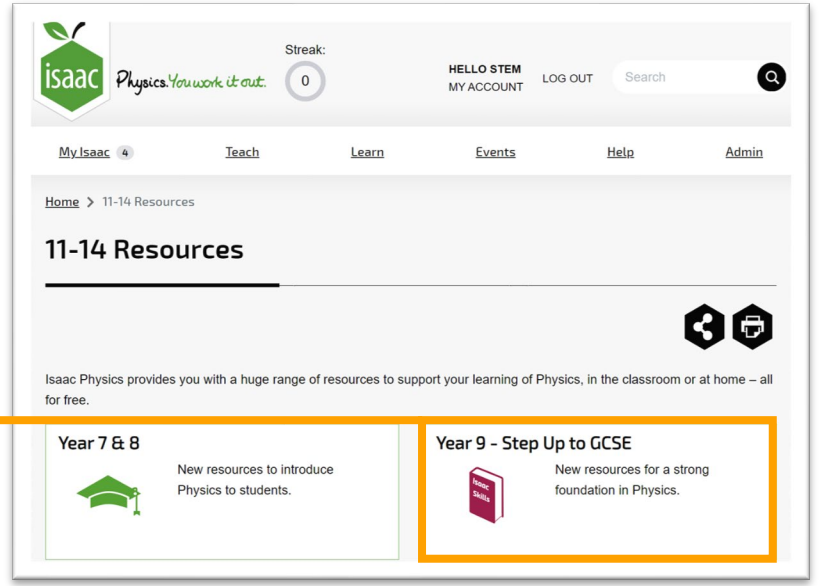
YEAR 9

Dr Lisa Jardine-Wright



Year 9: Step Up to GCSE





- Not a course **but** topics draw from principal ingredients of the KS3 science curriculum.
- Could be used as a teaching order to construct or develop a scheme of work.

isaacphysics.org/books/step_up_phys

Year 9: Step Up to GCSE

- Could be used as a teaching order to construct or develop a scheme of work.

Force and Motion

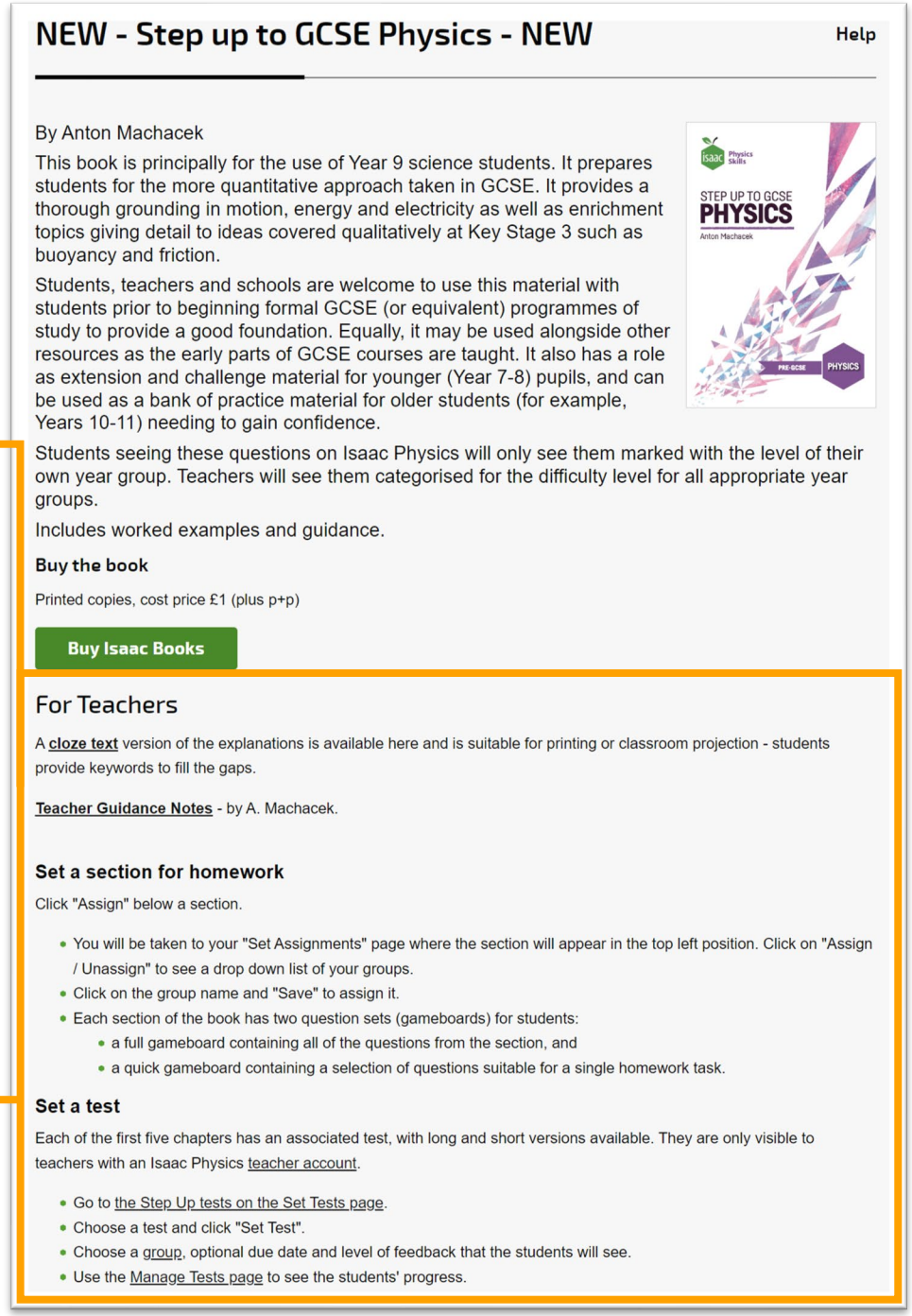
This is going to be an essential part of your physics curriculum. If you want a short course, with no bells or whistles, then you may wish to focus on the main bullet points here:

- 3 - Displacement-time graphs. Support for this given in
  - 1 - Displacement (representing position as a number)
- 4 - Velocity (introduced graphically)
- 6 - Calculating velocities. Support for this is given in
  - 2 - Converting units
  - 5- Rearranging equations
- 7 - Velocity-time graphs
- 8 - Acceleration. Extension for this is given in
  - 9 - Calculating accelerations
- 11 - Weight and Resultant Force
- 12 - Force and Acceleration

cdn.isaacphysics.org/isaac/books/isaac_step_up_to_gcse_physics_teacher_notes.pdf

Year 9: Step Up to GCSE – For Teachers

- Set a section of the book for homework (**an assignment**)
  - This will then be automatically marked, and the results returned to you live.
- Set a **test**
  - Each of the first five chapters has an associated test, with long and short versions.



NEW - Step up to GCSE Physics - NEW

Help

By Anton Machacek

This book is principally for the use of Year 9 science students. It prepares students for the more quantitative approach taken in GCSE. It provides a thorough grounding in motion, energy and electricity as well as enrichment topics giving detail to ideas covered qualitatively at Key Stage 3 such as buoyancy and friction.

Students, teachers and schools are welcome to use this material with students prior to beginning formal GCSE (or equivalent) programmes of study to provide a good foundation. Equally, it may be used alongside other resources as the early parts of GCSE courses are taught. It also has a role as extension and challenge material for younger (Year 7-8) pupils, and can be used as a bank of practice material for older students (for example, Years 10-11) needing to gain confidence.

Students seeing these questions on Isaac Physics will only see them marked with the level of their own year group. Teachers will see them categorised for the difficulty level for all appropriate year groups.

Includes worked examples and guidance.

Buy the book

Printed copies, cost price £1 (plus p+p)

Buy Isaac Books

For Teachers

A cloze text version of the explanations is available here and is suitable for printing or classroom projection - students provide keywords to fill the gaps.

Teacher Guidance Notes - by A. Machacek.

Set a section for homework

Click "Assign" below a section.

- You will be taken to your "Set Assignments" page where the section will appear in the top left position. Click on "Assign / Unassign" to see a drop down list of your groups.
- Click on the group name and "Save" to assign it.
- Each section of the book has two question sets (gameboards) for students:
  - a full gameboard containing all of the questions from the section, and
  - a quick gameboard containing a selection of questions suitable for a single homework task.

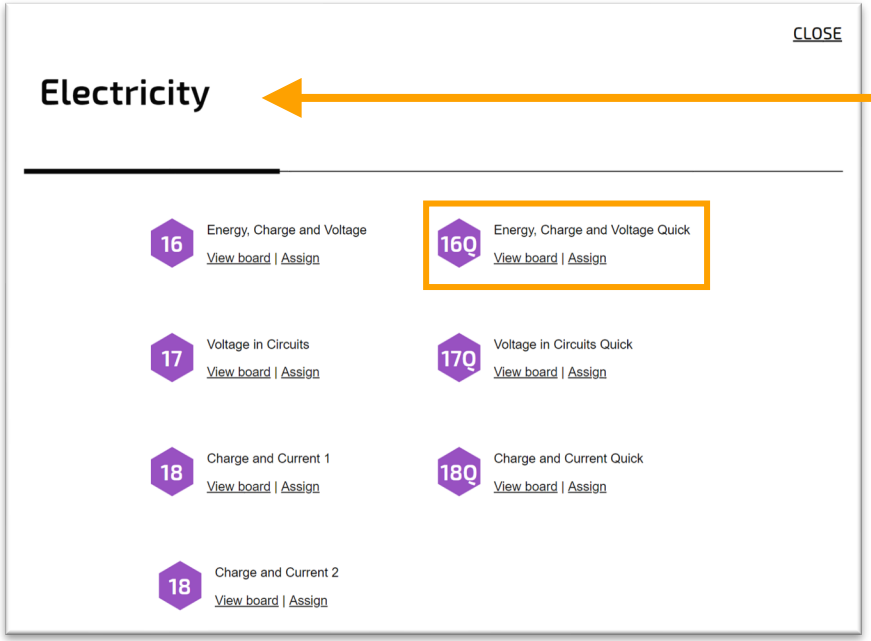
Set a test

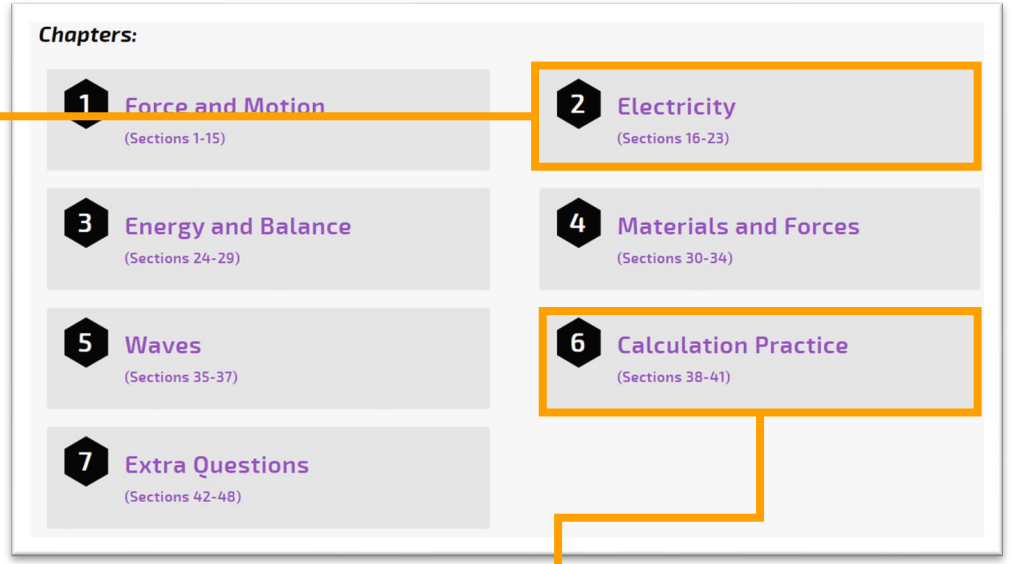
Each of the first five chapters has an associated test, with long and short versions available. They are only visible to teachers with an Isaac Physics teacher account.

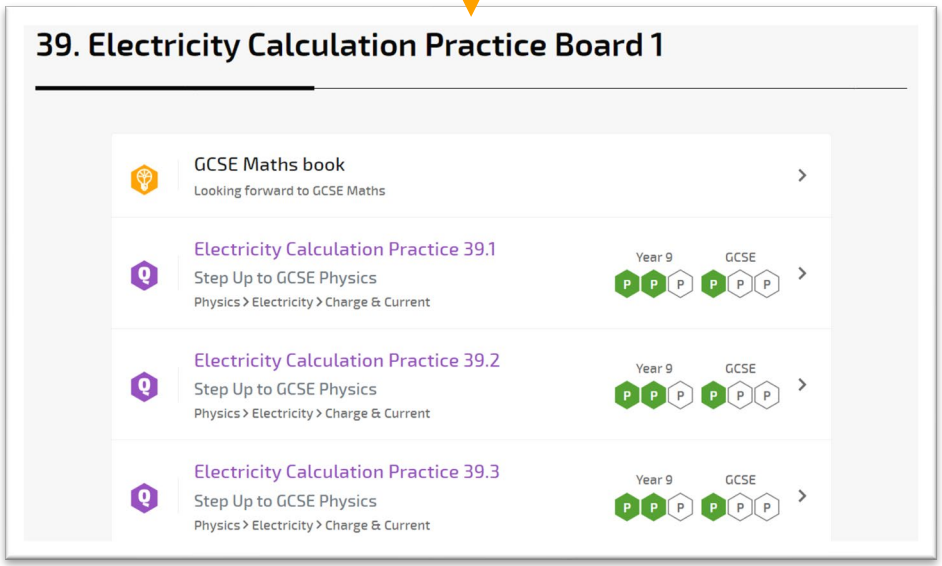
- Go to the Step Up tests on the Set Tests page.
- Choose a test and click "Set Test".
- Choose a group, optional due date and level of feedback that the students will see.
- Use the Manage Tests page to see the students' progress.

isaacphysics.org/books/step_up_phys

Year 9: Step Up to GCSE – Sections/Topics





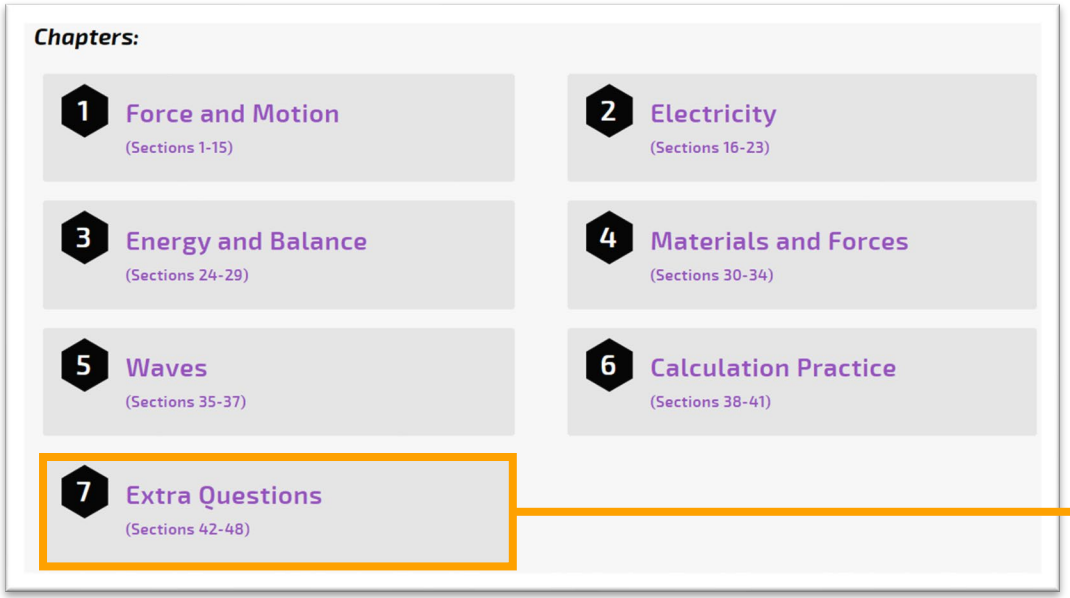


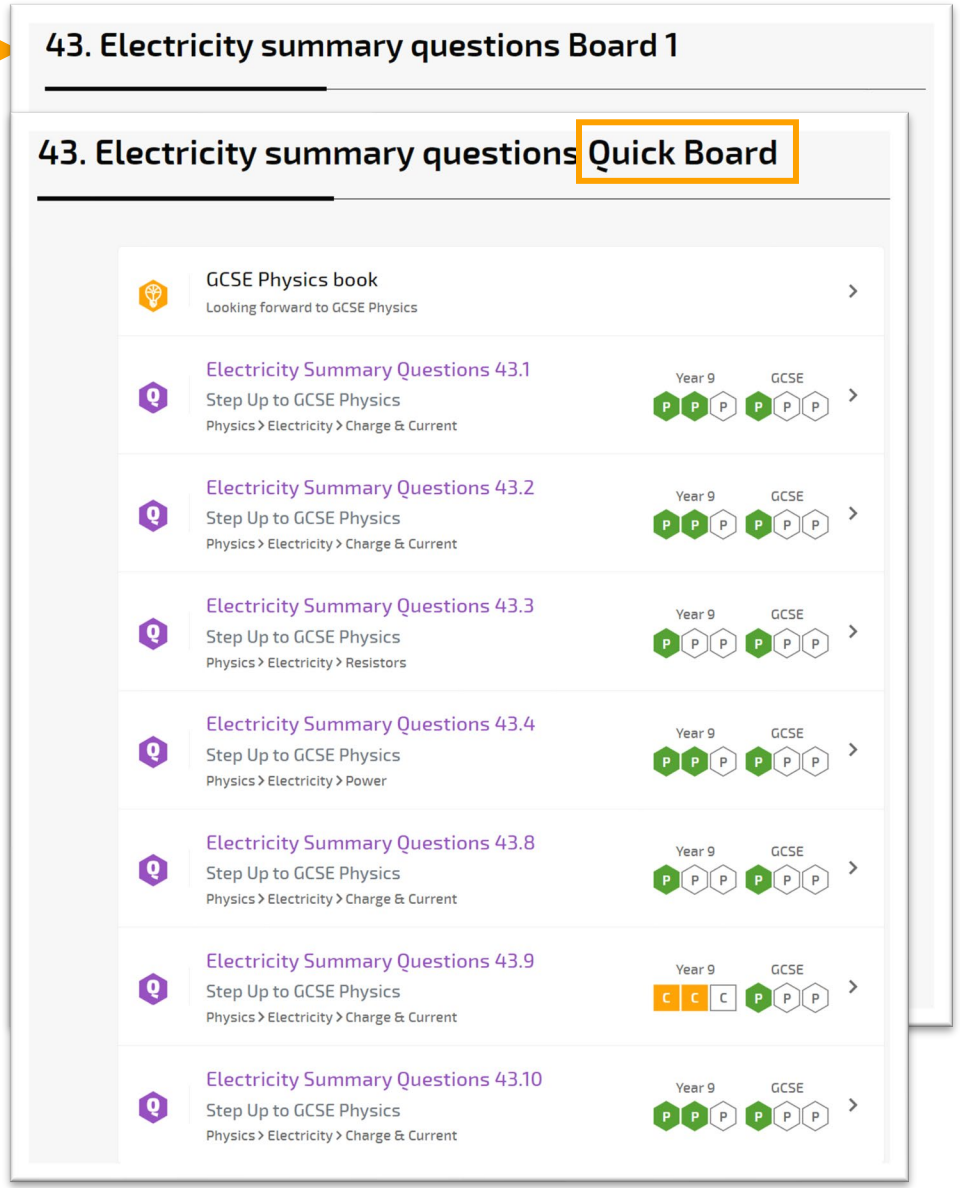
- There are quick boards which include just a subset of questions from each section.
- There are additional questions for calculation practice AND…

isaacphysics.org/books/step_up_phys

isaacphysics.org/gameboards?#step_up_phys_39_b1

Year 9: Step Up to GCSE – Sections/Topics



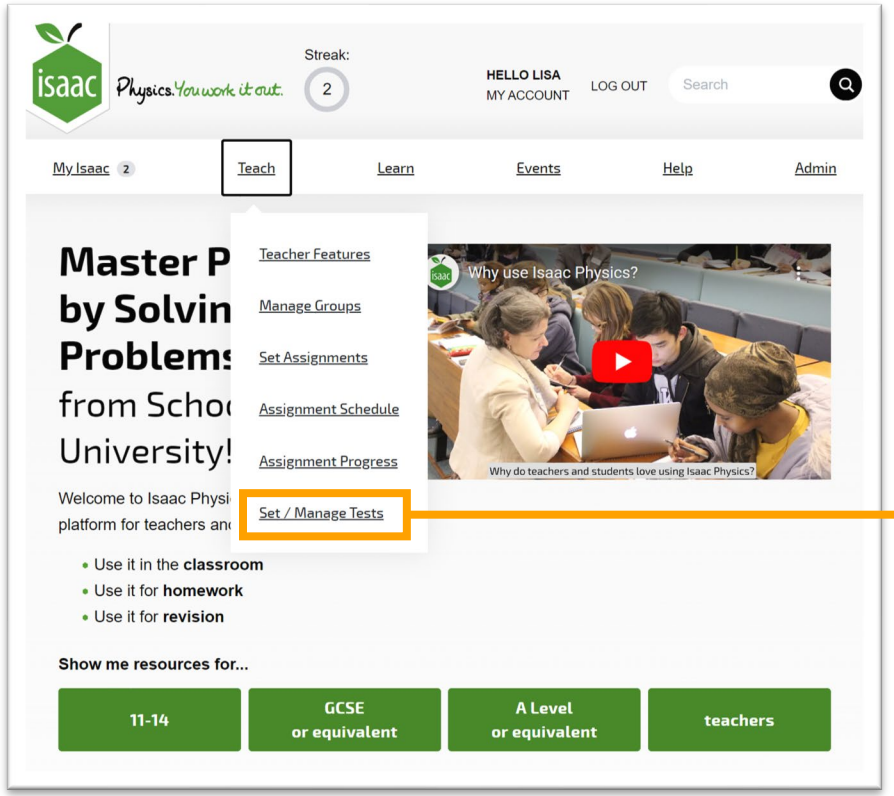


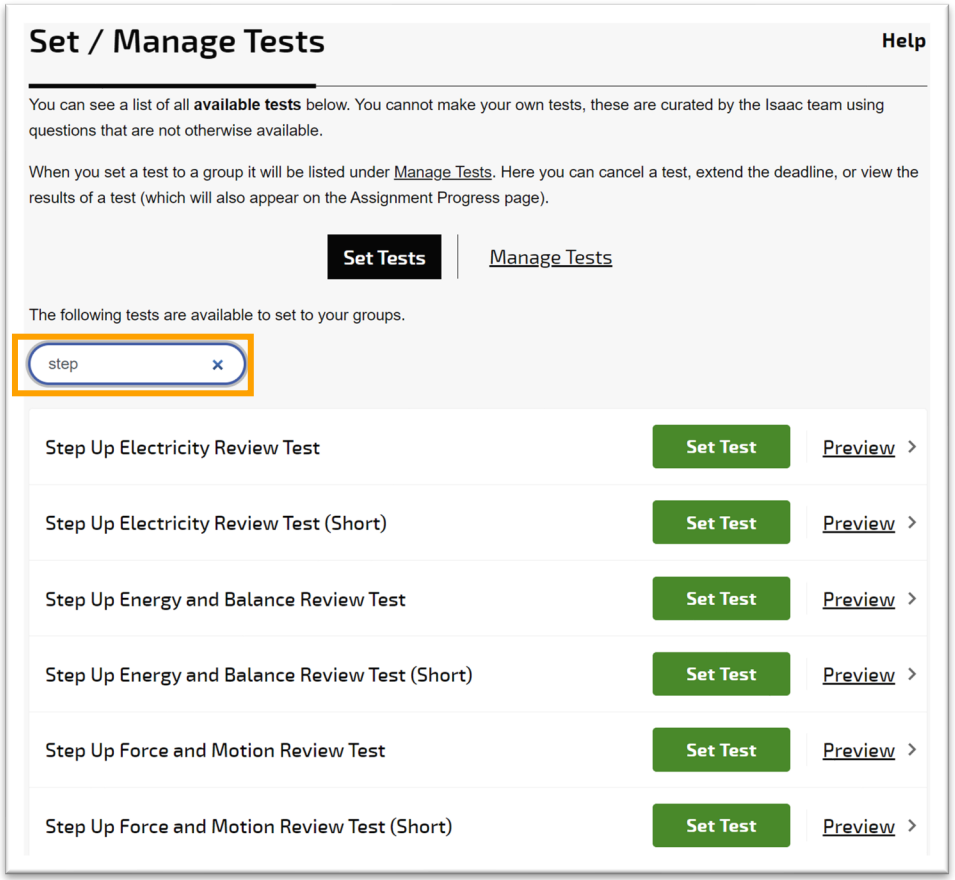
- Extra summary questions in full and quick form.

isaacphysics.org/gameboards?#step_up_phys_43_b1

isaacphysics.org/gameboards?#step_up_phys_43_quick

Year 9: Step Up to GCSE – Topic Test

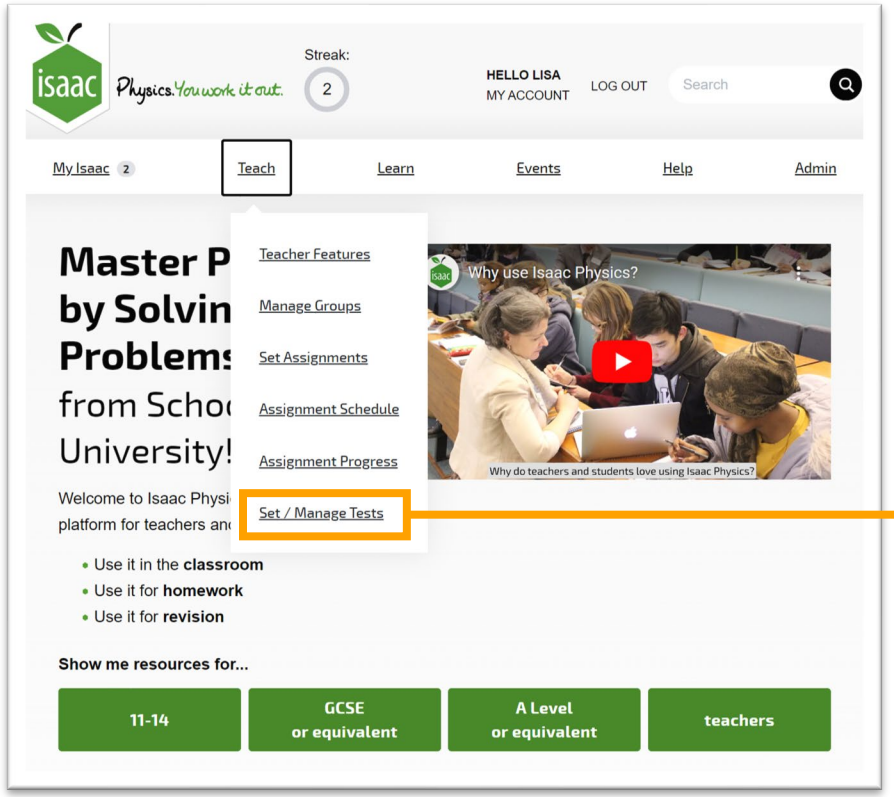


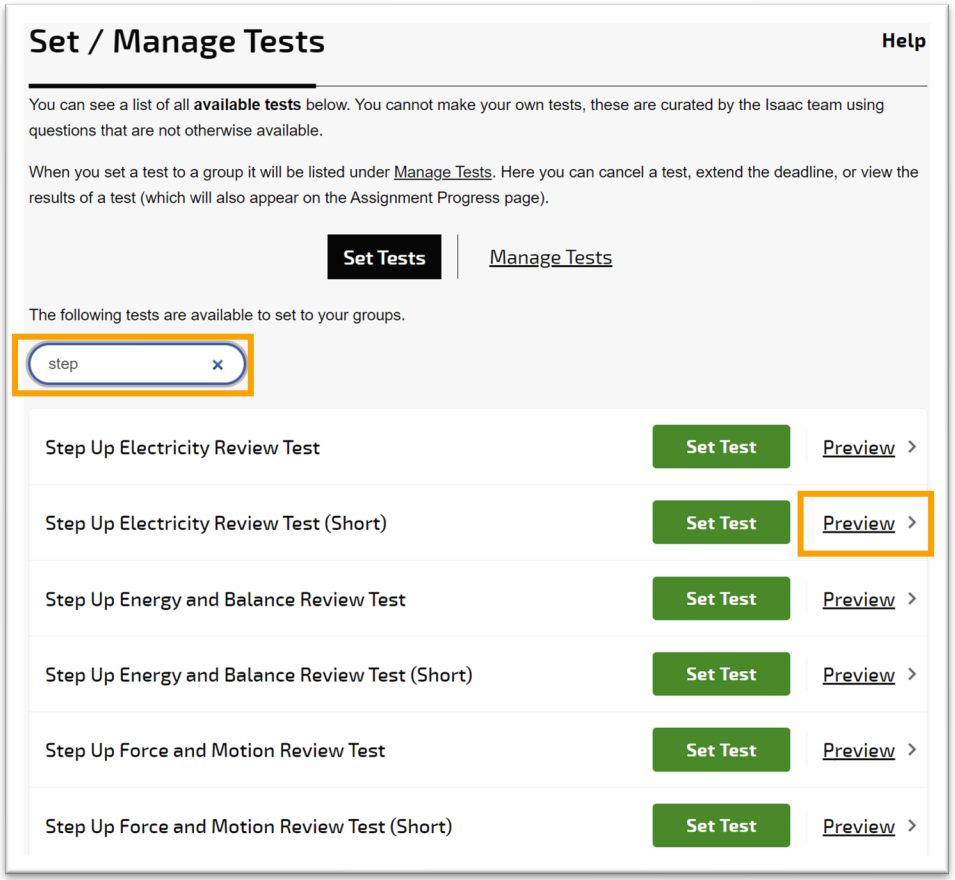


- Enter "step" into the search box
- Full and short versions of the tests are available to preview and set.

isaacphysics.org/set_tests

Year 9: Step Up to GCSE – Topic Test





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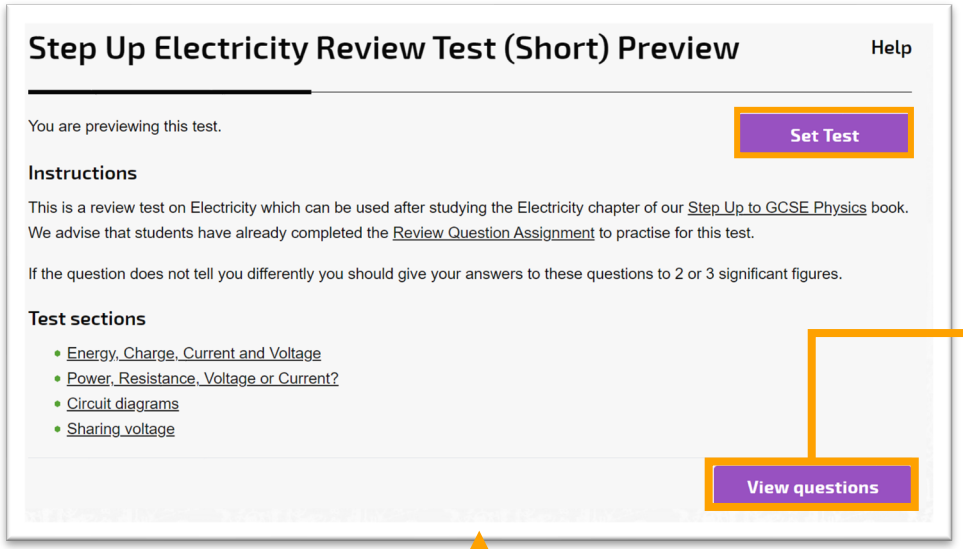
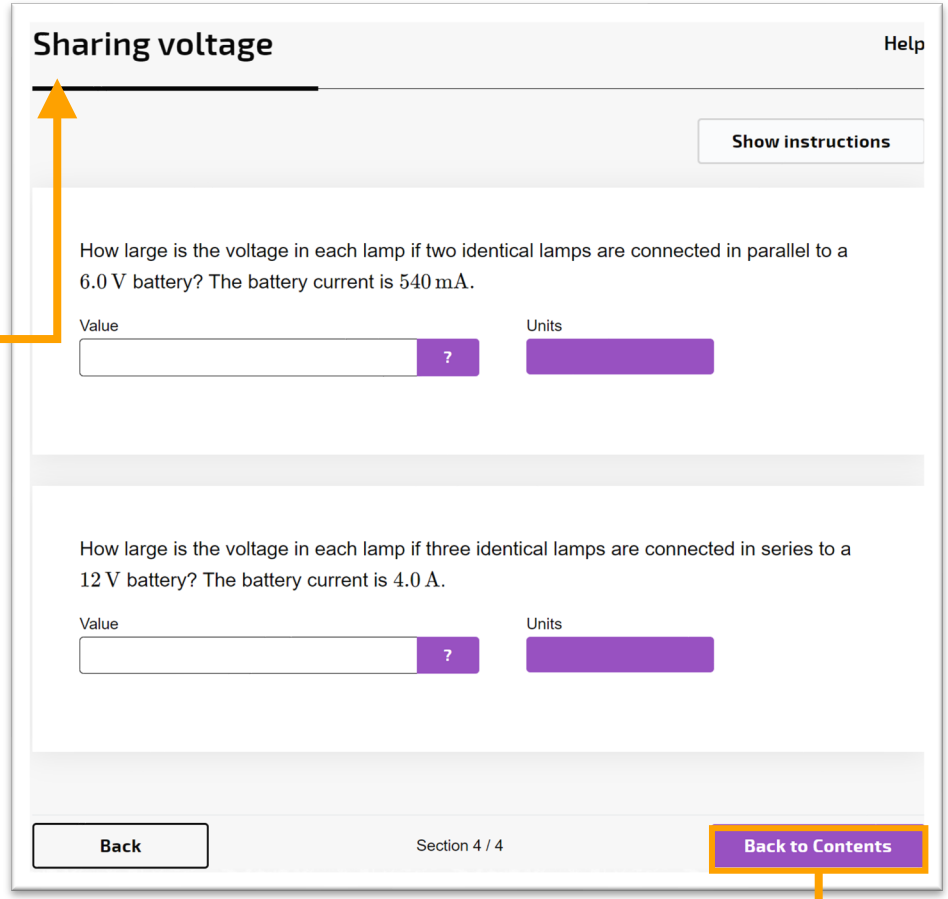
Year 9: Step Up to GCSE – Topic Test





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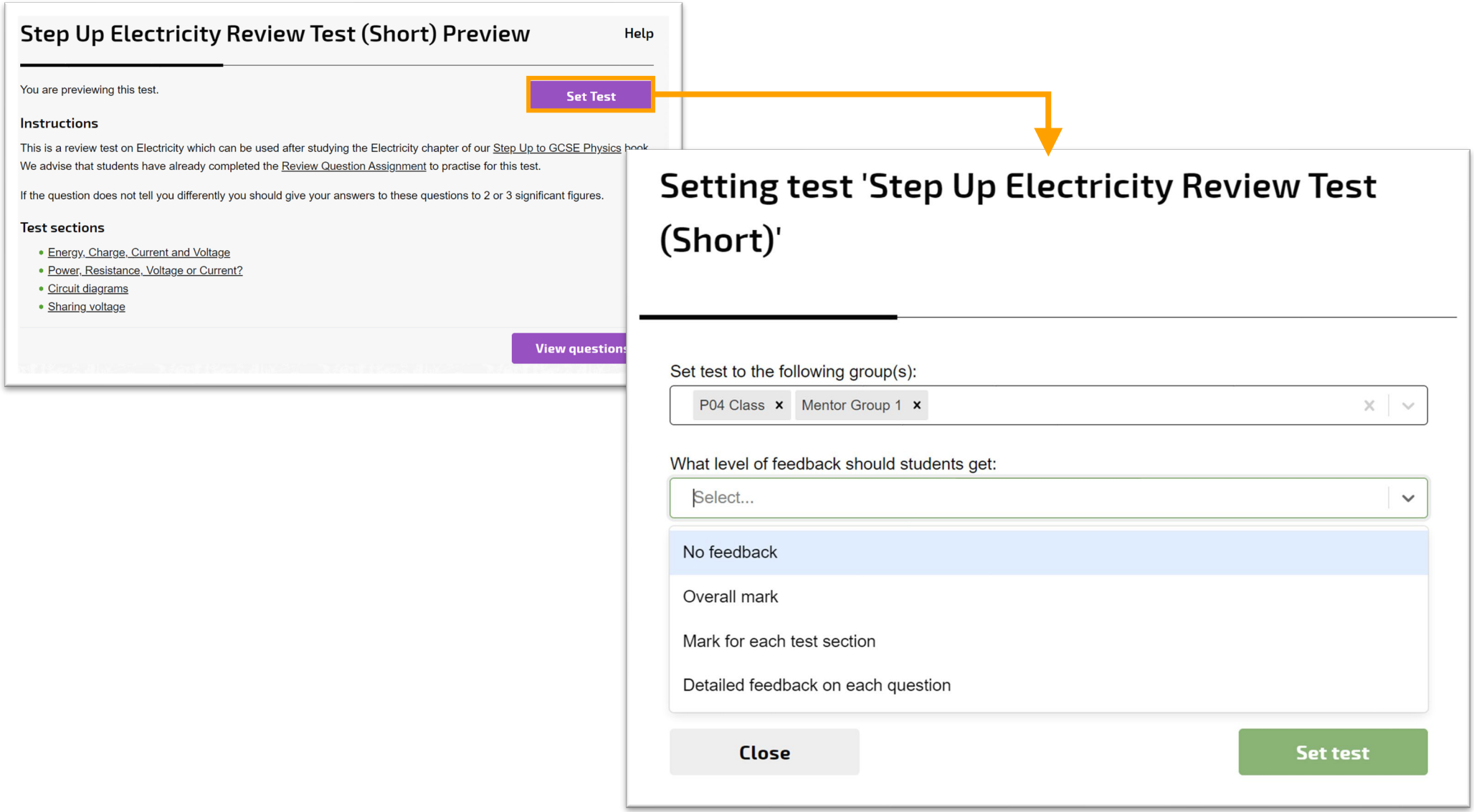
Year 9: Step Up to GCSE – Topic Test



isaacphysics.org/set_tests

TIME TO HAVE A GO!

Dr Lisa Jardine-Wright

Dr Nicki Humphry-Baker

Year 7 & 8 board

Year 9 board

Fri 4 Isaac Physics 11-14 Teacher Symposium 2024

Significant Figures How to use significant figures		
Voltage in Circuits 17.2 Step Up to GCSE Physics Physics > Electricity > Charge & Current	Year 9 P P P	GCSE P P P
Voltage in Circuits 17.3 TRY AGAIN! Step Up to GCSE Physics Physics > Electricity > Charge & Current	Year 9 P P P	GCSE P P P
Voltage in Circuits 17.4 Step Up to GCSE Physics Physics > Electricity > Charge & Current	Year 9 P P P	GCSE P P P
Electricity Calculation Practice 39.5 Step Up to GCSE Physics Physics > Electricity > Resistors	Year 9 P P P	GCSE P P P
Electricity Calculation Practice 39.6 Step Up to GCSE Physics Physics > Electricity > Resistors	Year 9 P P P	GCSE P P P
Electricity Calculation Practice 39.15 Step Up to GCSE Physics Physics > Electricity > Resistors	Year 9 P P P	GCSE P P P
Electricity Summary Questions 43.3 Step Up to GCSE Physics Physics > Electricity > Resistors	Year 9 P P P	GCSE P P P
Electricity Summary Questions 43.6 Step Up to GCSE Physics Physics > Electricity > Resistors	Year 9 P P P	GCSE P P P
Electricity Summary Questions 43.11 Step Up to GCSE Physics Physics > Electricity > Resistors	Year 9 P P P	GCSE P P P
Challenge Questions 47.3 Step Up to GCSE Physics Physics > Electricity > Resistors	Year 9 C C C	GCSE C C C

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Which of the following questions would you like to discuss?

ⓘ Start presenting to display the poll results on this slide.