Dear ambitious science teacher,

Exams are becoming more challenging. Governments are raising the stakes because it's now clear that jobs in the future will go to those students who can apply and analyse knowledge rather than just recall. We know you're ambitious about science education. You care as much about nurturing scientific thinkers as getting kids through exams.

Decades of research have shown you can do both. This means:

- Focusing on key concepts and big ideas to connect knowledge
- Taking account of the existing ideas students bring with them
- Providing enough time for sense-making
- Explicitly teaching student strategies to apply and analyse

However, schemes of work, PowerPoints and activity sheets tend to reflect either a 'transmission learning' model (ideas can be absorbed directly from a voice/page/screen in a student's mind) or the equally ineffective 'student-led' philosophy (they can discover ideas from activities and experiments).*

Mastery Science exists to help teachers adopt more ambitious practices.

Ready to swap content coverage for a 5-year big ideas curriculum?

With a 5-year perspective we can move beyond curricula that race through content. Instead it can focus on the vital key concepts, organised into a logical progression that builds on what went before, resulting in the kind of understanding that students can apply. We started this job by creating the KS3 Syllabus for AQA and then expanded it into a 5-year plan, Blueprint.

Ready to swap a 'delivery model' for a framework of learning stages?

The main message from research is that learning science is about students building and reconstructing conceptual models. Delivering information is important, but it's the mental work that matters. Because 'telling' is so ingrained in our teaching make-up we decided the best way to make research into reality was to use a set a learning stages.

activate	acquire	apply	assess	analyse
Check for prior concepts or learning gaps	Develop an accurate model of the concept	Transfer concept to unfamiliar situations	Check understanding and fill in gaps	Use higher order thinking with understanding

Pages 4-9 describe the *Complete Mastery* materials for each stage

*Don't believe us? Check out a reliable source (1 or 2), or cutting-edge science education (3):

1. How students' learn: science in the classroom (NAP, 2005)
2. Improving secondary science', 7 recommendations (EEF, 2018)
3. A framework for K-12 science education (Lead States, 2013)

Complete Mastery materials teach the key concepts

Big idea	Year 7 unit	Topics
 Forces	Contact forces	Balanced & unbalanced Friction Density
	Gravity	Weight Gravitational force Solar system
 Energy	Energy transfers	Energy Wasted energy Heat & temperature
	Electric circuits	Electric current Resistance
 Matter	Substances & particles	Particle model Mixtures Solutions
	Changing substances	Chemical & physical pH scale Neutralisation
 Organisms	Cells	Cell structure Specialised cells
 Ecosystems	Interdependence	Feeding relationships Competition Abiotic & biotic
 Genes	Reproduction	Sexual & asexual Menstrual cycle Embryo development

Complete Mastery materials teach enquiry skills

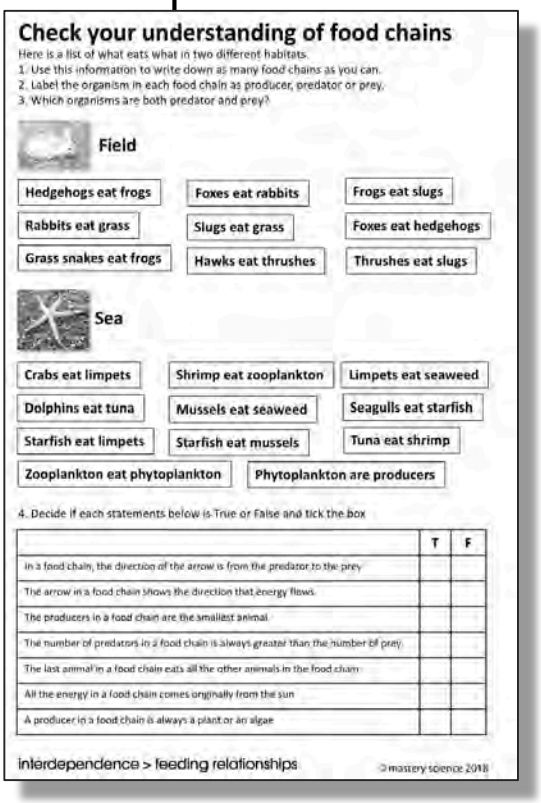
Process	Year 7-8 skills (from Blueprint)	Where it is taught
Manage variables	Choose variables to answer a scientific question	Friction
	Control variables that might affect the outcome	Solutions
Draw conclusions	Deduce patterns and relationships in data and observations	pH scale Menstrual cycle Abiotic & biotic
	Judge how well the evidence fits your conclusion	Solar system
Collect evidence	Assess the errors in your measurements	Speed
	Plan the data collection for the independent and dependent variables	Heat & temperature Resistance
Test hypotheses	Suggest a hypothesis for the observation	Solutions Particle model
	Predict the outcome of an experiment if the hypothesis is correct	Electric current Resistance Neutralisation
	Review whether the experiment agreed with the hypothesis	Electric current Resistance

Complete Mastery materials teach maths skills

Process	Year 7-8 skills (from Blueprint)	Where it is taught
Algebra	Substitute values into equations, with units and symbols	Density Weight Wasted energy
Numbers	Use ratios, fractions and percentages	Weight Energy
Graphs	Reading values off graphs, interpolating and extrapolating	Heat & temperature
Data	Draw and interpret frequency tables, diagrams, charts and histograms	Energy

Big idea	Year 7 units
Ecosystems	**Interdependence** Feeding relationships Competition Abiotic & biotic

activate	acquire
Feeding relationships ❑ **Understand food chains**	❑ Construct a visual model to show the feeding relationships in an ecosystem



Check your understanding of food chains

Here is a list of what eats what in two different habitats.
1. Use this information to write down as many food chains as you can.
2. Label the organism in each food chain as producer, predator or prey.
3. Which organisms are both predator and prey?

Field

Hedgehogs eat frogs	Foxes eat rabbits	Frogs eat slugs
Rabbits eat grass	Slugs eat grass	Foxes eat hedgehogs
Grass snakes eat frogs	Hawks eat thrushes	Thrushes eat slugs

Sea

Crabs eat limpets	Shrimp eat zooplankton	Limpets eat seaweed
Dolphins eat tuna	Mussels eat seaweed	Seagulls eat starfish
Starfish eat limpets	Starfish eat mussels	Tuna eat shrimp
Zooplankton eat phytoplankton	Phytoplankton are producers	

4. Decide if each statements below is True or False and tick the box

	T	F
In a food chain, the direction of the arrow is from the predator to the prey		
The arrow in a food chain shows the direction that energy flows		
The producers in a food chain are the smallest animal		
The number of predators in a food chain is always greater than the number of prey		
The last animal in a food chain eats all the other animals in the food chain		
All the energy in a food chain comes originally from the sun		
A producer in a food chain is always a plant or an algae		

interdependence > feeding relationships ©mastery science 2018

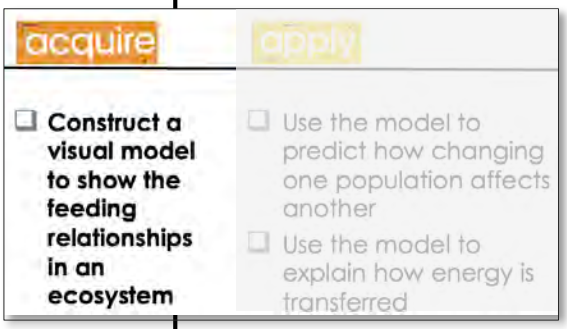
Before you teach a new concept, you need to know that students have a secure foundation to build on.
To check, *Complete Mastery* provides a **Pre-assessment** task:

- ✓ Tests understanding of an essential prior concept
- ✓ Engages students in thinking
- ✓ Reveals correct and incorrect thinking
- ✓ Detects knowledge gaps or misconceptions
- ✓ Helps you decide if you need to spend time on this foundation

Does your current scheme do this?

Complete Mastery materials

Big idea	Year 7 units
Ecosystems	**Interdependence** Feeding relationships Competition Abiotic & biotic



To help students connect the new concept with what they know and build an accurate mental model *Complete Mastery* provides an **Exploration task**:

- ✓ Engages students with an interesting phenomenon or problem
- ✓ Explores the concept with hands-on experience and structure
- ✓ Explains with enough detail and clarity
- ✓ Practises modelling and student explanation
- ✓ Develops an investigative, maths or literacy skill

Does your current scheme do this?

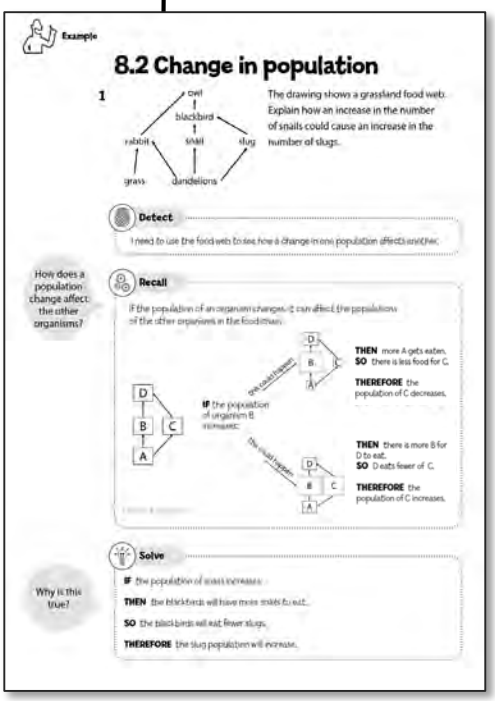
Complete Mastery materials

Big idea	Year 7 units
Ecosystems	**Interdependence** Feeding relationships Competition Abiotic & biotic

apply | assess

- ❑ **Use the model to predict how changing one population affects another**
- ❑ **Use the model to explain how energy is transferred**

- ❑ Acquire
- ❑ Apply



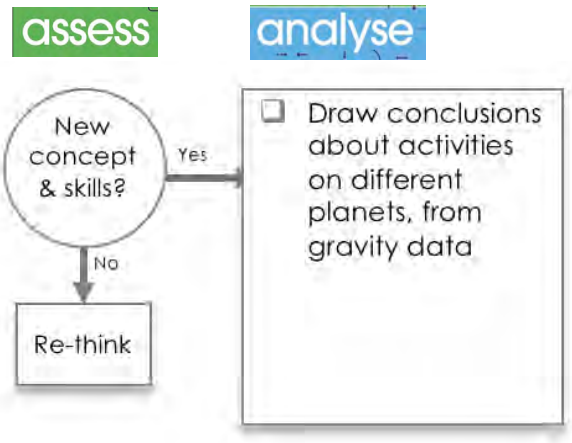
Students need to go beyond recall and transfer knowledge. That is, recognise and use concepts in situations they were not taught. For this, we developed strategies and problems in the **Mastery Practice Book**:

- ✓ Breaks down the process of how to detect, recall and solve
- ✓ Models expert thinking in detailed worked examples
- ✓ Starts with a similar context and then becomes more different
- ✓ Requires students to do more than recall knowledge
- ✓ Shows strategies to identify situations & relevant knowledge

Does your current scheme do this?

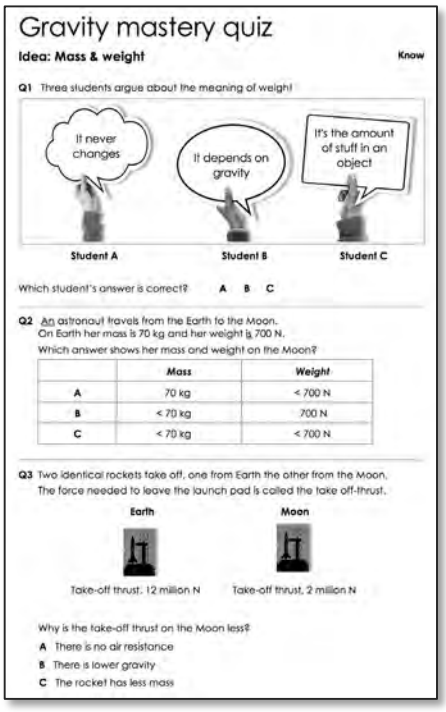
assess *Complete Mastery* materials

Big idea	Year 7 units
Forces	**Gravity** Weight Gravitational force Solar system



Some students need further learning opportunities to master the concept

Other students can move on to challenging tasks.



Gravity mastery quiz

Idea: Mass & weight Know

Q1 Three students argue about the meaning of weight

Which student's answer is correct? A B C

Q2 An astronaut travels from the Earth to the Moon.
On Earth her mass is 70 kg and her weight is 700 N.
Which answer shows her mass and weight on the Moon?

	Mass	Weight
A	70 kg	< 700 N
B	< 70 kg	700 N
C	< 70 kg	< 700 N

Q3 Two identical rockets take off, one from Earth the other from the Moon.
The force needed to leave the launch pad is called the take off-thrust.

Why is the take-off thrust on the Moon less?
A There is no air resistance
B There is lower gravity
C The rocket has less mass

If you know who mastered the concept and who struggled, you can provide the right next steps in learning. *Complete Mastery* provides accurate formative assessment information with a **diagnostic quiz:**

- ✓ Probes understanding, not just factual recall
- ✓ Reveals misconceptions using distractors
- ✓ Gives students clear feedback to learn from
- ✓ Gives teachers instant feedback
- ✓ Enables time for some students to re-think before the topic ends

Does your current scheme do this?

Complete Mastery materials

Big idea	Year 7 units
Ecosystems	**Interdependence** Feeding relationships Competition Abiotic & biotic

analyse

- ❑ Make a logical argument to support a claim about energy in food chains

The Reporter

Feed the world: go vegan

There is enough food in the world for the entire human population. So why are 1 billion people starving?

In a word, meat. The more meat the world eats, the fewer people we can feed.

A field of wheat can feed 100 people. But if you use that wheat to produce a cow for meat, it only feeds 10 people.

There is a simple solution – go vegan.
Plants feed more people than meat.

The writer has made a claim but not given evidence.
Here is a food chain to show the energy involved in growing wheat and cows.

Producer → Primary consumer → Secondary consumer

→ Means energy moves from one organism to the organism that eats it. Some energy is used for growth

↗ Means some energy is lost as heat to the surroundings

Write an argument to support the claim for going vegan, the food chain and energy.

Exam questions increasingly demand analysis. Students need to practise these cognitive processes over a long period of time to be able to tackle analysis questions in an exam. *Complete Mastery* provides a **Challenge task**:

✓ Practises interpreting, making deductions and evaluating information

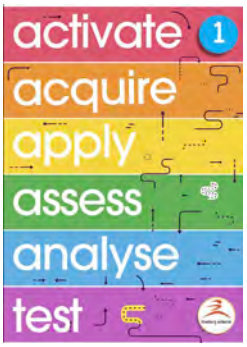
✓ Gets students to combine new information and conceptual understanding

✓ Develops literacy skills to justify answers

✓ Show strategies for tackling analyse questions

Does your current scheme do this?

Complete Mastery pricing



6 teaching and assessment packs to help all students reach mastery in year 7.

From the team behind AQA's KS3 Science Syllabus

Please visit the shop for more details about the product and pricing.

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