INTRODUCTION

Welcome to Springboard: KS3 Science!

Springboard has been developed by our expert author team with two key goals:

1 to build, develop and sustain students' knowledge and understanding of science
2 to give teachers a powerful resource to support and improve their teaching.

The course is therefore designed not just to be useful or a workload reducer, though Springboard certainly achieves these aims. The main point is to help inform and improve science teaching through evidence- and experience-based practice. In order for students to master new knowledge, teaching needs to involve explicit, narrative-driven explanations, extensive independent practice, constant checking for understanding and a coherent approach to long-term knowledge and retrieval practice. Springboard Science meets all these needs.

This is a revolutionary approach to writing textbooks and schemes of work, and Springboard is groundbreaking in its scope and ambition. Springboard won't just *help* your science teaching, it will *improve* it.

Course elements

The Springboard course is divided first into biology, chemistry and physics and then into units and topics. For example, the B1 unit is about 'Cells and organisation' and is divided into smaller topics dealing with microscopes, cell structure, diffusion and so on. Topics are not split into lessons, nor are they of uniform length. You are encouraged to teach the content according to the amount of time it takes, rather than trying to squeeze or stretch it into fixed units of time like a lesson.

While Springboard's content is not structured into fixed units of time, the curriculum plan is designed to enable you to teach through the content over three years. The Practice Books and Teacher Handbooks are organised accordingly, with a pair for each year, each containing multiple units for biology, chemistry and physics. Conceptual progression and interleaving that are built into the resources assume this teaching order is followed.

C1.2 Properties of different states of matter

	Question	Answer
1	Give two properties of gases.	Can flow; can be compressed
2	Give two properties of liquids.	Can flow; cannot be compressed
3	Give two properties of solids.	Cannot flow; cannot be compressed
4	Why can solids not flow?	There are strong forces of attraction between the particles
5	Why can liquids and gases flow?	There are weak forces of attraction between the particles
6	Why can gases be compressed?	There is space between the particles
7	Why can solids and liquids not be compressed?	The particles are already touching

The course is based on the National Curriculum for KS3 and centres around core questions: a delineation and specification of exactly what students are expected to know by the end of the course.

The elements to help deliver the course include:

- a student Knowledge Book, including core questions, key diagrams and worked examples (subject content plus working scientifically)
- student Practice Books, including extensive practice on content just taught and interleaved with topics that have been covered previously
- Teacher Handbooks, including numerous components detailed below
- additional resources on Boost, including class presentations, practical worksheets, careers worksheets, science stories, support sheets, cover work and assessment resources
- online quizzes on Boost for every topic.

For the complete curriculum experience you are encouraged to access Carousel Learning, where question banks containing all the Knowledge Book core questions are available as a flexible quizzing and retrieval resource to all Carousel users with a paid subscription.

Teacher Handbooks

The Teacher Handbooks (THBs) are the centrepiece of Springboard Science and are aimed at supporting you to deliver effective, dynamic, responsive and engaging lessons. They are designed around evidence presented by educational and psychological researchers (e.g. Rosenshine 2012, Clark et al. 2012, Agarwal 2021 and Lemov 2021) as well as the classroom experience of the author team. The THBs broadly follow principles of explicit instruction, an evidence-based approach to structuring teaching and learning.

As such, each THB has several components, broadly following the order:

General science quiz → Topic introduction and objective → Knowledge check → Guided explanation → Check for understanding → Independent practice and review

Below, the individual components are elaborated on in more detail.

General science quiz

At the start of every topic there is a short quiz testing knowledge from content that has already been taught at some point. The knowledge quizzed here is not generally related to the topic at hand, as the purpose is simply to continually revisit and reconsolidate material that has already been studied. Using retrieval practice like this is an evidence-based strategy that slows forgetting and allows students to steadily accumulate knowledge over time. In most cases, students will complete this quiz silently and on paper, followed by a review.

The questions and answers for the general science quiz are provided in the class presentation (CP) slides on Boost.

Our partnership with Carousel Learning means that you can generate further bespoke retrieval quizzes for your students using the core questions, enabling you to replicate this process every lesson if desired.

Topic introduction and objective

It is important to have an overview of the topic that is due to be taught, as well as any contextual information about prior knowledge and how it fits within the wider curriculum.

B1.2 Cell structure

Students' learning objective: *I am learning about the basic structure of cells, so I can explain the function of each part.*

Students will have an awareness of what cells are from KS2. They also now have seen cells through their microscope in Topic B1.1.

Learning objectives are concise, use student-facing language and are simply about the content of the topic, as opposed to any kind of assessment or differentiated approach to lesson planning.

Knowledge check

This is a second quiz, aimed at testing the knowledge required for the topic students are about to cover. For example, if students are about to start 'C4.5 Reactions of acids', the knowledge check might test their recall of the names of common acids and the pH scale. When students start 'P6 Light', a knowledge check might test their understanding of waves (from P5) and energy (from P1).

The purpose of the knowledge check is to establish whether students are ready to cover the topic in question. If there are holes in their knowledge, they will struggle to access the new content and will fall further behind. Because this purpose relates to assessment, you are urged to execute the knowledge check using mini-whiteboards (MWBs). If student knowledge is

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weak or contains gaps, it is *crucial* that you reteach that content there and then, before first rechecking and then moving on to the new topic.

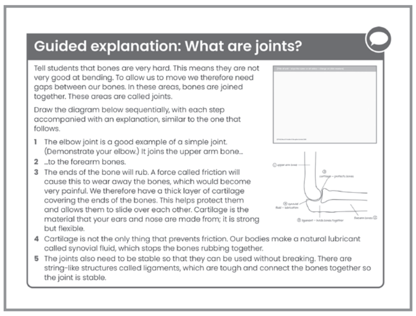
The knowledge check is best conducted one question at a time. As such, the questions are provided on the CP slides, but the answers are not, as it is best to review each question before moving on to the next. Further guidance is provided in the THB if there are any relevant misconceptions or common errors that might need to be identified and tackled. You are encouraged to use strategies like 'show call' (bringing interesting student responses to the front on a visualiser or some other easy-to-see display) for dissection and further discussion.

Guided explanation

Following a knowledge check, we have provided guidance for, and examples of, how to communicate the relevant content. These are not direct-to-teacher instructions or scripts, but step-by-step ideas and advice that can help you to make your own decisions about how you want to explain a particular concept.

The explanations generally follow a blank-canvas philosophy, which involves starting from a blank board or screen and slowly building a narrative-style explanation, ordinarily involving a diagram. As such, the CP slides often have less on them than you might expect, as a blank slide gives teachers the opportunity to slowly build an explanation and carefully manage students' attention. The THB will then include a suggested 'finished' diagram, with written steps to guide you in constructing the diagram.

The Guided explanation as it appears in the THB



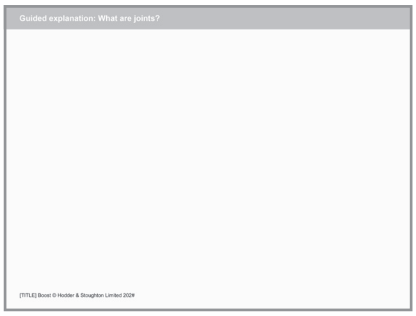
Guided explanation: What are joints?

Tell students that bones are very hard. This means they are not very good at bending. To allow us to move we therefore need gaps between our bones. In these areas, bones are joined together. These areas are called joints.

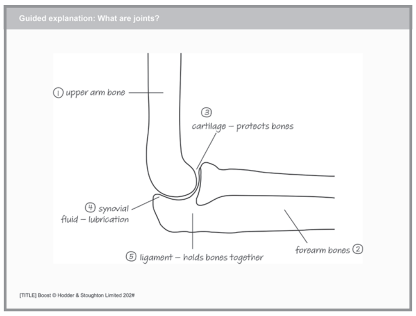
Draw the diagram below sequentially, with each step accompanied with an explanation, similar to the one that follows.

1 The elbow joint is a good example of a simple joint. (Demonstrate your elbow.) It joins the upper arm bone…
2 …to the forearm bones.
3 The ends of the bone will rub. A force called friction will cause this to wear away the bones, which would become very painful. We therefore have a thick layer of cartilage covering the ends of the bones. This helps protect them and allows them to slide over each other. Cartilage is the material that your ears and nose are made from; it is strong but flexible.
4 Cartilage is not the only thing that prevents friction. Our bodies make a natural lubricant called synovial fluid, which stops the bones rubbing together.
5 The joints also need to be stable so that they can be used without breaking. There are string-like structures called ligaments, which are tough and connect the bones together so the joint is stable.

The blank slide that you use in class to build your explanation



What your finished explanation might look like



Where diagrams are too complex or detailed to be constructed within a lesson, we have often provided unlabelled outlines or photographs on the CP slides, so you can build your explanation via annotation, highlighting and labelling of the diagram. In these cases, it is a good idea to let students have a thorough look at whatever is on the board first, before calling back their attention to you and working through your explanation.

In terms of the practicalities of delivering explanations like this, schools will vary in terms of the technology and physical resourcing available. Below is a list of accessible methods you can use.

What you might have	How you could use it
Interactive whiteboards	Display the CP slides on the interactive board and write directly onto them.
Projector directly on to a writeable whiteboard	Project the CP slides onto the board and write directly on them.
Writeable whiteboard separate to a projector/screen	Deliver your explanations in a separate location to where you may have a screen display.
Visualiser	Write underneath a visualiser into an exercise book/plain piece of paper/printout of the slides).
Tablet (sometimes called a two-in-one)	Display the CP slides. Use a stylus to write directly on to a computer screen, which is displayed simultaneously to the class via a screen/projector.
Graphics tablet	Display the slides. Plug in the graphics tablet device by USB and write directly on to it. The writing will be recognised and displayed on the computer screen.

When using the CP slides, you may want additional space for more explanations, and in both PowerPoint and Google Slides you can press the letter W in the middle of a presentation to be provided with a brand-new blank slide.

The explanations are always broken down into small steps to avoid overloading students with information.

In general, you may not want to use too many questions during your explanation as this can break up the sense of narrative flow. If you are going to question students during an explanation, using a strategy like 'cold call' (where you ask the question and then choose a student to respond) is advised.

Check for understanding

Following the explanation, the THB provides suggested questions to ask students before allowing them time to practise independently. It is advised that this is executed on MWBs in a similar way to the knowledge check (as opposed to using individual strategies like cold call). The goal here is to diagnose and concretise student understanding, so it is important that you get information from everyone in the class, rather than just asking a few students. As with the knowledge check, strategies like show call are effective at probing and developing student understanding.

It could be that your check for understanding reveals that you might need to go back to your explanation and spend more time over it or try a different approach. As such, the questions we have provided may be extensive, but they cannot be exhaustive, so you are encouraged to be prepared to add to them.

Though the questions will not be provided on the CP slides, you will often find text-based scenarios, unlabelled diagrams or tables to use as an aid when asking them.

Independent practice review

Following a check for understanding, students will be ready to use their independent Practice Books to start consolidating and stretching their knowledge. There are many different styles of question in the Practice Books, including straightforward comprehension/recall, application to unfamiliar scenarios, mathematical calculation/interpretation and specific writing strategies like 'Because/But/So'.

The questions are extremely extensive and often deliberately linked to other topics that students have learnt previously. This is called **interleaving** and is a deliberate attempt to achieve two things:

1 Make sure all content is revisited on many occasions throughout the course.
2 Help students see the links, relationships, differences and similarities between different areas of the course.

This style of practice may be new to students, so it could be worth starting periods of independent practice by explaining the style and why it is important.

While students practise, you are encouraged to circulate around the room, checking student understanding and offering feedback where appropriate.

Indicative answers to the questions are provided on the CP slides (as well as in PDF form on Boost and the Hodder Education website). The THB notes particularly common mistakes, errors or conflations to look out for when reviewing students' answers. When reviewing student work, placing a student book under a visualiser and using show call can be highly effective for developing and improving understanding. When asking individuals for their responses, make sure to use strategies like cold call to ensure that all students are listening and have their voices heard.

Working scientifically

Springboard has taken a revolutionary approach to the working scientifically (WS) content in the KS3 National Curriculum:

- **delineation**: the WS content has been delineated into either core questions or procedures, rather than leave the content as vague or poorly defined statements.
- **sequencing**: this content has then been carefully sequenced and is introduced into the course over time. It is only once students have a base of concrete knowledge that they can begin to encounter and apply the abstract knowledge that constitutes WS.
- **consistent equation calculation approach**: deliberate steps have been taken to slowly introduce the various aspects of completing calculations (e.g. unit conversions, equation selection, rearrangements, multiple steps). These are spread out across the course in a way that builds knowledge without overloading.
- **the EVERY method** for solving equations is consistently used in order to guide students to accurately complete equation calculations. This is one of many different possible models. It is important you have a consistent model for calculations, as it helps reduce the variation within the problems and therefore the cognitive load on the students.

Guided explanation:
How do we use the power equation?

Complete the worked example on the slide, as shown below, to model the EVERY method and demonstrate how we use the power equation. Explain each step line-by-line.

A TV set has a power of 800 watts and is switched on for 30 seconds. Calculate the energy transferred.

Equation	energy = power × time $E = P \times t$
Values	$E = ?$ $P = 800$ W $t = 30$ s
Enter values	$E = 800 \times 30$
Result	$E = 24\,000$
Y(units)	$E = 24\,000$ J

- **practicals**: each unit contains at least one core practical, for which student instructions are provided. However, we encourage you to use a 'slow practical' approach, which does not necessitate using instruction sheets. Instead, it hybridises demonstration with student activity. Broadly, it involves first gathering students around one desk. You then demonstrate a step to the students (often aided by a visualiser), then check students have understood the step (both 'what?' and 'why?') before asking them to complete that step themselves and then return. This allows students to be both 'hands on' and 'minds on', maintaining a purposeful environment where students know what they are doing and why, and you can easily spot and rectify errors. Suggestions for how to apply this method to each core practical are found in dedicated sections in the THB.

Independent practice for the development of practical and WS skills are found throughout the student Practice Books and in student worksheets on Boost. There are two versions of every student practical worksheet on Boost: the full worksheet with details on equipment, safety and method; and the 'slow practical' version, without these details.

A final word: who is it that is Springboarding?

Titles are important and it would be easy to assume that the individuals doing the Springboarding are the students because this course helps prepare and enthuse them for further study. This is true, but only in part, because our goal is not just to Springboard the students, but to Springboard their teachers. We want you to be able to develop and improve your practice in a way that is evidence-based and workload-friendly. We want classrooms to change, to feel different in terms of the methods and strategies teachers are using. We don't want to just slot into your classroom and make things a bit easier. We want to revolutionise it and help you become a better science teacher.