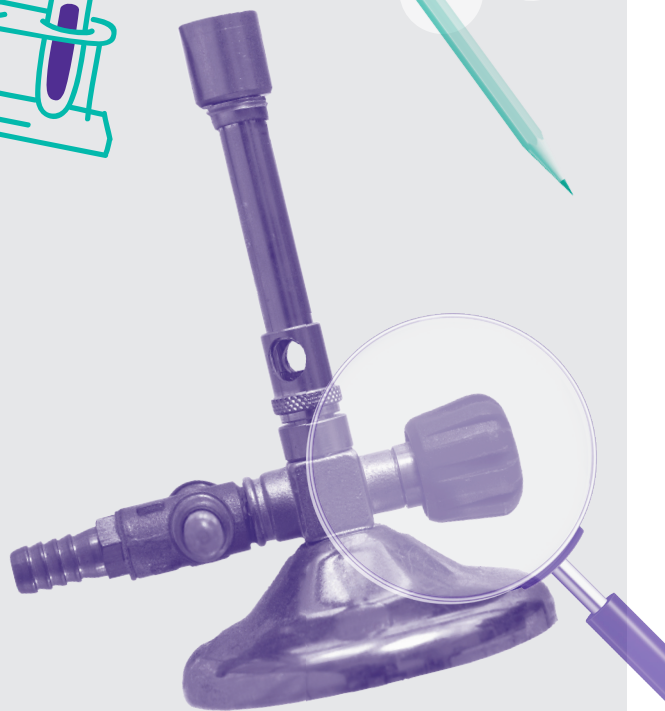
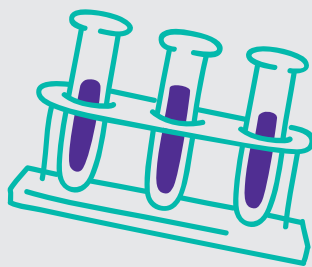


Focus on success: GCSE science

Practical questions

Build on your students' assessment performance using our self-guided, modular training pack

Pre-reading
booklet



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Using this resource

This pack is designed to enable you to deliver a CPD session on practical skills assessment for your teaching colleagues.

Using the completed pre-session health checks and the provided route map, you'll be able to design a bespoke session to focus on the areas your colleagues are less confident teaching.

This resource pack is intended to help you:

- deliver a CPD session for teaching colleagues around practical questions
- recognise the elements that make up effective practicals
- understand the progression from KS3
- identify areas for further development.

Before the session

- Ask your colleagues to each complete the pre-session health check (page 14 in this booklet).
- Use the responses to the health check to tailor the training session to the needs of your colleagues. The route map on page 7 will help you plan which activities to use in the session.
- Each colleague should have a copy of the activities booklet.
- The post-session health check (page 15 in this booklet) should be printed for each colleague.
- You will need to select some RP lesson plans or equivalent for use in activity 3.

Running the session

- Download the guidance presentation from aqa.org.uk/focus-on-success-science.
- The presentation will provide guidance and discussion questions to move you through your bespoke session.

After the session

- Ask your colleagues to each complete the post-session health check (page 15 in this booklet) to ensure the training has been successful.
- As a group, discuss how you can support each other to embed what you have learned into in your teaching. Use the prompt questions on slide 17 of the guidance presentation to guide your discussion.
- Complete the individual and group action plan templates (pages 39–41 in the activities booklet).
- A certificate of attendance can be created and printed for each delegate from aqa.org.uk/focus-on-success-science.

Summary of activities

Pre-activity discussion

This starter discussion should be used to set the scene for the training. It is essential for teachers to know that practical assessment is made up of a number of different components which cover different parts of the specification, different question types and different Assessment Objectives (AOs).

- Slide 3 on the guidance presentation.
- Conduct a whole group discussion to identify what the team think the different elements are that make up practical based questions.
- Additional information on pages 8–9 of this booklet will help further guide this discussion.
- A summary of the elements can be found on slides 4–5 of the guidance presentation.
 - The purpose of the discussion is to ensure teachers are aware that the assessment of practical work can cover a number of different things – not just recalling the method. This leads to the idea that the practicals need to be taught in a holistic way, encompassing some of these other elements each time.

Activity 1 – Identifying the elements within a RP question

- Slide 6 on the guidance presentation.
- Ensure the pre-activity discussion has taken place (slide 3 of the guidance presentation).
- To illustrate the holistic approach to assessment, in small groups/pairs look at the examples of a practical question from the summer 2018 series (pages 10–16 of the activities booklet). A question from each science discipline has been provided.
- Identify the Assessment Objective (AO), level of demand, science content, the Working Scientifically (WS) element, or maths skills as appropriate.
- Conduct a group discussion using the prompt questions on slide 7 of the guidance presentation.
 - Think about how you currently teach practicals and whether some of these different elements are included in your teaching and learning.
 - Also start to consider how well your KS3 is introducing some of these skills.

Activity 2 – The similarities and differences of ATs

- Slide 8 on the guidance presentation.
- A group activity to discuss what the similarities and differences of the ATs are.
- Use the tables on pages 17–18 of the activities booklet for guidance.
- Information regarding the importance of ATs can be found on page 10 of this booklet.
- The answers to the activity can be found on slide 9 of the guidance presentation.
- Once activities 2 and 3 have been completed, use the prompt questions on slide 11 of the guidance presentation to lead a discussion.

Activity 3 – Reviewing the coverage of AT in RP lessons

The RPs are written to cover the ATs so it is important that lessons reflect the ATs assigned. Teachers need to be aware what the AT is covering and make sure they explicitly teach the skills during these practical lessons.

- Slide 10 on the guidance presentation.
- A small group activity to review an RP to see if the ATs are sufficiently and explicitly covered in these lessons so that students understand that aspect of the AT.
- A modelled biology RP can be found on pages 20–21 of the activities booklet.
- Once activities 2 and 3 have been completed, use the prompt questions on slide 11 to lead a discussion to review how well current lessons reflect the ATs and whether this is an area that needs further work. Discuss how well your KS3 course is at introducing some of the skills, particularly the measurement skills covered in AT1 in all three science disciplines.

Activity 4 – Development and progression from KS3

- Slides 12–13 on the guidance presentation.
- This activity continues the theme of considering how well your KS3 course introduces and embeds the WS skills and their development at KS4. Practical lessons need to be holistic in their approach and cover a number of different elements. The lessons need to build on learning from KS3 and develop skills already taught in earlier years.
- Using this approach, in groups, look at the lessons covering an RP and identify:
 - what the learning is at KS4
 - how you are building on existing skills, particularly the WS skills.
- The modelled scheme of work (page 31 of the activities booklet) and enquiry skills table (pages 32–35 of the activities booklet) will help support this activity.
- Use the prompt questions on slide 14 of the guidance presentation to identify which skills are the most challenging and share best practice. Tracking the coverage across the three sciences is tricky and not time effective to try and cover everything in each science discipline.

Activity 5 – Identifying new learning and skills progression

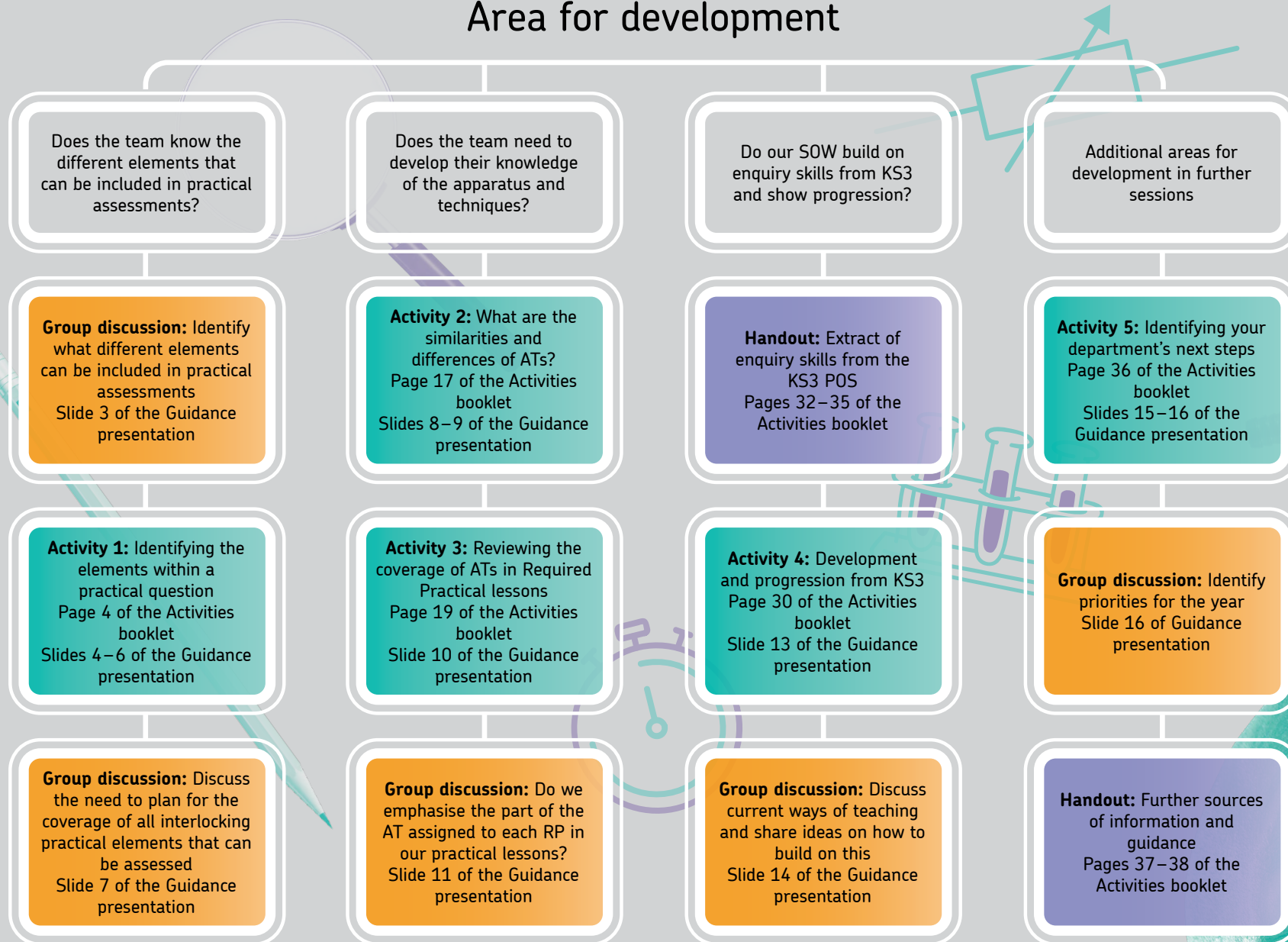
Due to the number of different elements that need to be covered at GCSE, ensuring the most effective use of practical lessons is complicated. This training concentrates on two key elements, but there are others that need to be considered when time permits. The aim of this activity is to consider which are a priority for your department and when it might be feasible to carry out development on them.

- Slide 15 on the guidance presentation reiterates the challenges.
- Use the prompts on slide 15 of the guidance presentation to start a discussion around how the team can identify priorities and a timeline for actioning them.
- The handout on pages 37–38 in the activities booklet provides links to useful resources to facilitate further development (this information can also be found on pages 12–13 of this booklet).

Practical questions route map



Area for development



Elements of practical assessment

One of the biggest challenges teachers have said they face with the current GCSEs is having time to cover everything in the specification due to the extensive breadth of the content to be covered in addition to the ATs, RPs, maths skills and WS.

The DfE's initial thoughts are that the time spent traditionally on ISAs should be freed up to give teachers more time to concentrate on the teaching and learning of the practical skills. It is clear there is a lot of pressure on teaching time and, therefore, practical lessons need to provide effective learning experiences.

A variety of elements related to practicals need to be covered over the Key Stage to ensure students are as ready as possible for their final assessments. These elements need to be strategically planned in across the sciences, consistently taught and progress from a solid experience at KS3.

Some schools may also be faced with issues related to technician support, equipment needs and lack of specialist teachers. CLEAPs and STEM (through the SLP networks) have a wealth of information and offer support for schools to help address some of these problems.

Having taught the specification for a number of years, now may be a good time to review your department's provision of practical work across both KS3 and KS4. Teachers will have more experience of what is required and the teaching time that's available to cover the syllabus/specification.

The following elements need to be considered:

- apparatus and techniques (ATs)
- Working Scientifically (WS) criteria
- teaching the Required Practicals (RPs) so they address the different assessment criteria for each of the Assessment Objectives (AOs)
- the science behind the practical activity (linking new content in the specification to the practical)
- progression from KS3 (identifying the new learning in the specification) and preparation for KS5
- AO2 requirement of scientific enquiry techniques and procedures being broader than the RP
- scientific language associated with practical based investigations
- application of maths skills appropriate to that practical activity.

The Head of Department should strategically plan to cover certain elements with teaching and learning opportunities. This can only be done by mapping the coverage of these elements across the three sciences. It is impossible to cover everything every time you carry out a practical, and many of these elements are generic to all three sciences. This means they can be taught and then embedded on numerous occasions to ensure students can show progress in them (or in their learning). Your long-term plan or route through the course could be amended to add this information.

The aim of reviewing the RP lessons is to see if:

- the content associated with the practical is taught holistically within RP lessons.
- the content that is taught emphasises the new learning moving forwards from KS3.
- learning allows students to demonstrate their understanding of the practical, allowing opportunities to analyse and evaluate.
- students understand the scientific principles covered by the RP may be set in a different context that what they experienced in lessons.

This pack focuses on the ATs and progression of WS as well as considering what new learning from KS3 is associated with the RPs.

Some schools may also be faced with issues related to technician support, equipment needs and lack of specialist teachers. CLEEAPS and STEM (through the SLP networks) have a wealth of information and offer support for schools to help address some of these problems.

The importance of the apparatus and techniques

The examiners have to assess the ATs through the RP questions. It's therefore important that teachers are aware of them and ensure that, when they teach the RP lesson, they are emphasising the points covered in the AT.

For example, AT2 is: 'the safe use of **appropriate** heating devices and **techniques** including Bunsen burners and water baths or electric heaters.' This requires the teacher to discuss with students what the possible ways of heating things are, and then discuss which is appropriate and why. For example, why do you use a water bath instead of a Bunsen burner when carrying out the Benedict's test?

For some of the ATs it might be necessary to consider and unpack what is involved. For example, AT3 in chemistry is: 'Use of **appropriate apparatus** and **techniques** for conducting and monitoring chemical reactions, including **appropriate reagents** and/or **techniques** for the **measurement of pH** in different situations.'

This AT is assigned to a number of practicals; electrolysis, temperature change and rates of reactions, so will cover different things in each.

For electrolysis, the appropriate apparatus is the electrochemical cell connected to a low voltage power supply. The technique is to ensure inert electrodes don't touch and new electrodes are used each time. The appropriate reagents in this investigation could be the different electrolytes. The practical handbook suggests copper II chloride and sodium chloride, though other solutions could be used or discussed with students. The technique to measure the pH is holding blue litmus paper in the solution next to the anode.

By referring to the tables in section 10 of the specification, you will notice that AT1 is the same for all sciences, covering appropriate apparatus to make and record measurements. Similarly, AT2, covering safe heating devices, is the same in biology and chemistry.

Many of the other ATs cover specific techniques, eg sampling techniques, purifying and/or separating chemical mixtures, and constructing circuits using circuit diagrams. It is therefore important that your schemes of work emphasis the 'unpicked' version of the assigned apparatus and techniques.

The assessment of practical skills in science consists of three components:

- Apparatus and techniques (ATs) set by the DfE
- Required Practicals (RPs) designed to deliver the ATs
- Working Scientifically (WS).

These three components are assessed across the papers at each level of demand using the full range of question types. Practical skills are also **assessed across all three of the Assessment Objectives**. At least 15% of the overall marks for the qualification are assigned to the RPs with further marks to be assigned to WS. Students will also need to apply what they know to practical situations that are **broad**er than the RPs and, in some cases, in **novel contexts**.

Progression of practical skills

The earlier students are introduced to meaningful practical work, the better prepared they will be to confidently answer this type of question. Investing time into introducing and establishing good learning for practical skills at KS3 will support progress throughout a student's school life, right up to KS5.

By looking at the programme of study (POS) (page 12 of this booklet) for KS3, it is easy to see there are clear lines of progression within WS at both key stages. A departmental review of KS3 schemes of work (SOW) may be needed to ascertain if all points are introduced and developed over the three years, especially the subject specific language such as accuracy and precision, for example.

GCSE practical science statement

The Head of Centre will be required to sign the AQA practical science statement to confirm that each student has had **reasonable opportunities** to:

- complete the Required Practicals
- make a contemporaneous record of the work undertaken during these activities together with the knowledge, skills and understanding derived from them.

Teachers need to agree with their Head of Centre as to what evidence is required in order for the declaration to be signed.

It is worth noting:

- there is no requirement to keep records of students' attendance and/or competence for each practical
- there is no need to have a separate laboratory book
- there is no requirement for any particular way in which students record their learning
- student absence from a required practical lesson should be treated as any other absence and the student should catch up as they would for any other part of the specification
- **if students are resitting GCSE science there is no need to redo all the RPs, although this might be an effective way to structure the revision of the course.**

Resources and support

Our practical handbooks offer teacher and technician notes and student worksheets for a **suggested method** to help teachers plan purposeful practical work. This is to develop both practical and investigative skills and encourages the thinking behind the doing. If students are asked for a method in the exam question, any suitable method that gives the correct outcomes will be credited.

The Required Practical handbooks available on the Teach tab of your subject on [aqa.org.uk/subjects/science/gcse](https://www.aqa.org.uk/subjects/science/gcse) offer teacher and technician notes and student worksheets for a suggested method to help teachers plan purposeful practical work. This develops both practical and investigative skills and encourages the thinking behind the doing. If students are asked for a method in an exam question, any suitable method that gives the correct outcomes will be credited.

[GCSE Biology](#)

[GCSE Chemistry](#)

[GCSE Physics](#)

[GCSE Combined Science Synergy and Trilogy](#)

Teachers are encouraged to provide other opportunities for practical work throughout the course. This is clearly stated in the AO2 criteria 'scientific enquiry, techniques and procedures encompasses, but is **broader than**, knowledge and understanding of the core practical activities (RPs)'.

Opportunities for further practical skills development are signposted in the right-hand column of the content section of each specification. Each SOW should provide ideas and suggestions for practical activities and all approved textbooks cover additional practicals beyond the RPs.

In exam papers a question is made up of items, meaning that any question will often cover more than one AO and will assess content as well as practical and maths skills. For this reason you will see that there are few questions that focus solely on a RP, rather, whole questions assess a number of different aspects.

Due to this, only parts of questions have been used in some of the examples with their accompanying mark schemes.

Resources to support activity 5

Understanding and using subject-specific language

Summer 2020 Hub materials

Subject-specific vocabulary [aqa.org.uk/subjects/science/gcse](https://www.aqa.org.uk/subjects/science/gcse)

Practicals broader than the RP

Focus on success: GCSE science – AO2 module [aqa.org.uk/focus-on-success-science](https://www.aqa.org.uk/focus-on-success-science)

AO3 analyse, interpret and evaluate information

Summer 2019 Hub materials

Focus on success: GCSE science – AO3 module (spring 2020) [aqa.org.uk/focus-on-success-science](https://www.aqa.org.uk/focus-on-success-science)

Applying maths skills in a practical context

Focus on success: GCSE science – Maths in science module (summer 2020) [aqa.org.uk/focus-on-success-science](https://www.aqa.org.uk/focus-on-success-science)
[teachitscience.co.uk](https://www.teachitscience.co.uk)

Mapping coverage of skills across all three sciences

Required practical coverage table – Focus on success: GCSE science – Practical questions module [aqa.org.uk/focus-on-success-science](https://www.aqa.org.uk/focus-on-success-science)

Identifying and integrating the science behind the practical

Specification for relevant science [aqa.org.uk/subjects/science/gcse](https://www.aqa.org.uk/subjects/science/gcse)

Further resources

The language of measurement, Boohan R, Campbell P

The language of maths in science, Boohan R, Needham, R

[exampro.co.uk](https://www.exampro.co.uk)

[ase.org.uk/mathsinscience](https://www.ase.org.uk/mathsinscience)

[science.cleapss.org.uk](https://www.science.cleapss.org.uk)

[stem.org.uk](https://www.stem.org.uk)

[gatsby.org.uk](https://www.gatsby.org.uk)

Pre-session health check

Grade the area of development statements according to your confidence where 0 is not confident at all and 5 is very confident.

Hand back to your Head of Department.

Area of development	Grading 0-5	Reasons/notes/previous training
Practical elements assessed I know all the interlocking practical elements that can be assessed.		
Apparatus and techniques I am confident in the different ATs and their coverage in the RP lessons?		
Enquiry skills I build on enquiry skills at KS3 through my teaching, and show progression.		

Post-session health check

Grade the area of development statements according to your confidence where 0 is not confident at all and 5 is very confident.

Area of development	Grading 0-5	Reasons/notes
Practical elements assessed I know all the interlocking practical elements that can be assessed.		
Apparatus and techniques I am confident in the different ATs and their coverage in the RP lessons?		
Enquiry skills I build on enquiry skills at KS3 through my teaching, and show progression.		

Notes

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