GCSE
SCIENCE

Supporting teachers with the *Focus on Success* materials

Resource booklet

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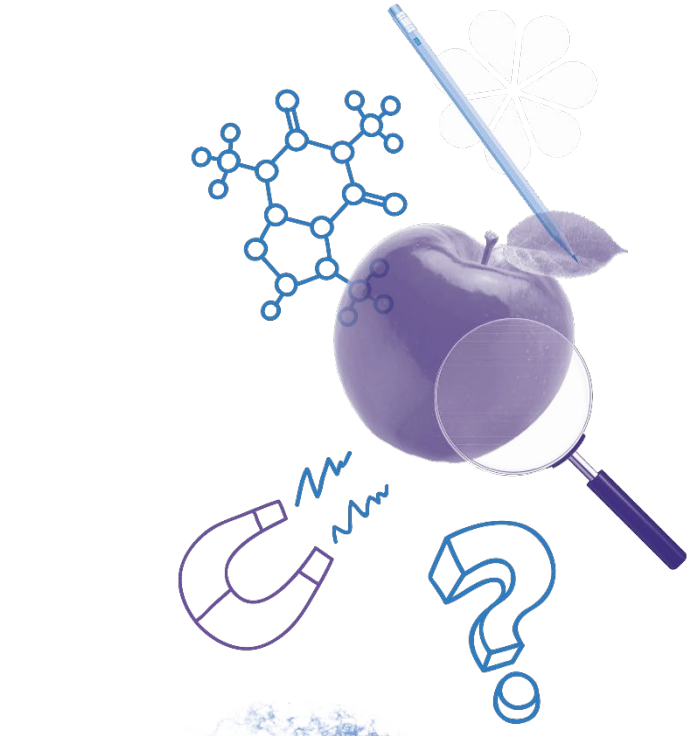
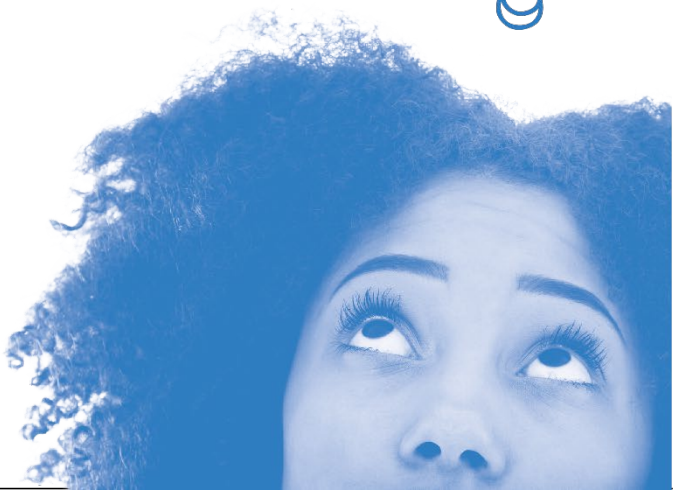




Contents

The *Focus on success* packs can be found on the Plan section of each specification:

aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464/planning-resources?f.Resource+type%7C6=Teacher+training

Extended response questions route map

Area for development

Does the team need to understand what the different command words mean?	Does the team need to see some command words are used in live questions?	Does the team need to understand how to apply a levels of response mark scheme?	Does the team need to understand the difference between each level on a levels of response mark scheme for each command word?	Does the team need to practice applying the standard correctly using a levels of response mark scheme and student examples?
Activity 1: Card sort Page 4 of Activities booklet, Slides 3-7 of Guidance presentation	**Activity 2:** Command words students find challenging Page 5 of Activities booklet, Slide 9 of Guidance presentation	**Handout:** Review annotated mark scheme and levels descriptors Pages 5-7 of Handouts booklet	**Activity 4:** Bringing command words and levels of response mark schemes together Pages 28-33 of Activities booklet, Slide 12 of Guidance presentation	**Activity 5:** Applying the process chart (page 8 of the Handouts booklet), mark student example responses Pages 34-53 of Activities booklet, Slide 23 of Guidance presentation
Group discussion: Discuss responses to activity Slide 8 of Guidance presentation	**Group discussion:** Discuss responses to activity Slide 10 of Guidance presentation	**Activity 3:** Create a process chart showing the steps taken when marking a LOR question Page 27 of Activities booklet, Slide 11 of Guidance presentation	**Group discussion:** Discuss responses to activity Slides 13-22 of Guidance presentation	**Group discussion:** Discuss the marks awarded and how this can be turned into a student activity Slide 24 of Guidance presentation
Handout: Command words Page 4 of Handouts booklet		**Handout:** Compare your process chart against the AQA process chart Page 8 of Handouts booklet		

G02159_03

AO2 route map

Area for development

Does the team need to understand what AO2 assesses?

Activity 1a: Quiz
Page 4 of Activities booklet
Slides 3–5 of Guidance presentation

Activity 1b: Understanding the Ofqual guidance and the strands of AO2
Page 5 of Activities booklet, Slides 6–8 of Guidance presentation

Handout: Key assessment points of AO2
Page 13 of Activities booklet

Group discussion:
Discuss any learnings from the activities
Slide 9 of the Guidance presentation

Can the team identify the different AOs on the exam paper?

Activity 2: Identifying AOs on exam items
Page 14 of Activities booklet, Slides 10–14 of Guidance presentation

Group discussion:
What aspects of AO2 do teachers and students find challenging?
Slides 12–14 of Guidance presentation

Do the department's schemes of work meet the challenges set by AO2?

Activity 3: Adding unfamiliar context into schemes of work
Page 33 of Activities booklet, Slides 15–16 of Guidance presentation

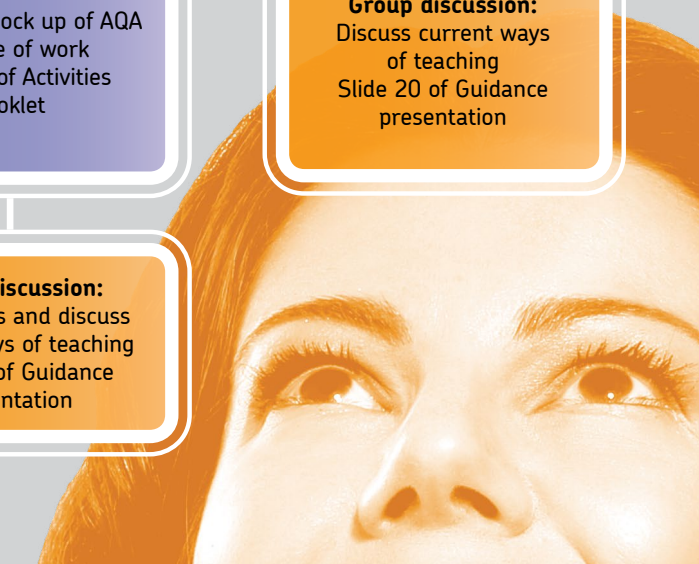
Handout: Mock up of AQA scheme of work
Page 34 of Activities booklet

Group discussion:
Share ideas and discuss current ways of teaching
Slide 17 of Guidance presentation

Are our required practicals AO2 friendly?

Activity 4: Integrating AO2 into practicals
Page 42 of Activities booklet, Slides 18–20 of Guidance presentation

Group discussion:
Discuss current ways of teaching
Slide 20 of Guidance presentation



G02159_08

Practical questions route map

Area for development

Does the team know the different elements that can be included in practical assessments?	Does the team need to develop their knowledge of the apparatus and techniques?	Do our SOW build on enquiry skills from KS3 and show progression?	Additional areas for development in further sessions
Group discussion: Identify what different elements can be included in practical assessments Slide 3 of the Guidance presentation	**Activity 2:** What are the similarities and differences of ATs? Page 17 of the Activities booklet Slides 8–9 of the Guidance presentation	**Handout:** Extract of enquiry skills from the KS3 POS Pages 32–35 of the Activities booklet	**Activity 5:** Identifying your department's next steps Page 36 of the Activities booklet Slides 15–16 of the Guidance presentation
Activity 1: Identifying the elements within a practical question Page 4 of the Activities booklet Slides 4–6 of the Guidance presentation	**Activity 3:** Reviewing the coverage of ATs in Required Practical lessons Page 19 of the Activities booklet Slide 10 of the Guidance presentation	**Activity 4:** Development and progression from KS3 Page 30 of the Activities booklet Slide 13 of the Guidance presentation	**Group discussion:** Identify priorities for the year Slide 16 of Guidance presentation
Group discussion: Discuss the need to plan for the coverage of all interlocking practical elements that can be assessed Slide 7 of the Guidance presentation	**Group discussion:** Do we emphasise the part of the AT assigned to each RP in our practical lessons? Slide 11 of the Guidance presentation	**Group discussion:** Discuss current ways of teaching and share ideas on how to build on this Slide 14 of the Guidance presentation	**Handout:** Further sources of information and guidance Pages 37–38 of the Activities booklet

G02159_30

A03 route map

Area for development

Does the team need to know what A03 assesses?

Activity 1a: Understand the Ofqual guidance and strands of A03
Page 4 of the activities booklet
Slide 4-6 of guidance presentation

Activity 1b: Identifying strands and level of demand of A03 exam items
Page 5 of activities booklet
Slide 7 of guidance presentation

Group discussion:
Discus your students' progress in A03 and ideas on level of demand

Does the team know how examiners write questions at different levels of demand?

Activity 2: Identify features of questions written at different levels of demand
Page 18 of activities booklet
Slide 9 of guidance presentation

Group discussion:
By understanding better these exam features, how might they be incorporated into lessons to support progression?

Can the team identify useful learning and assessment points for students based on A03 assessment tasks?

Activity 3: Considering the type of assessment tasks list strategies, prompts or actions to share with students
Page 30 of activities booklet
Slide 10 of guidance presentation

Group discussion:
Feedback from each group to share teaching and learning ideas

Does the team know how the legacy coursework tasks (ISAs) can be used as a learning resource?

Activity 4: Using the online data source booklets discuss how ISA materials can be used with students

Handout: Data source booklets available online

Group discussion:
Discuss any sources of stimulus materials to use with A03 activities

G02159_50

Maths in science route map

Area for development

Pre-session meeting with Maths lead

Audit of Maths skills:
Are all members of the department confident at teaching all the maths skills?

Activity 1a:
Individual audit to gauge teacher confidence in:
- teaching the skills
- differentiating this teaching for different ability groups'

Activity 1b:
Students audit their own performance in each maths skill

Handout:
Student maths skills audit

Group discussion:
Discuss if there are any common themes between:
a. what teachers find difficult to teach
b. what students in different ability groups find challenging.

Maths and science:
Have you worked collaboratively with your maths dept to develop consistent approaches to T&L of maths skills?

Activity 2:
Discuss T&L approaches used in maths and science of key areas for possible differences

Group discussion:
Are there any common ways forward to a more consistent approach?

Diagnostic questions:
Do your teachers have a quick and easy way of assessing strengths and weaknesses of students' maths skills?

Activity 3:
Using and developing diagnostic questions to identify strengths and weaknesses

Group discussion:
How might the use of diagnostic questions help to identify basic errors?

Curriculum Planning:
Have the maths and science departments compared their timings of when skills are introduced and developed?

Activity 4:
Using both departments' curriculum maps, identify timings for teaching maths skills

Handout:
Curriculum route maps
Electronic science SOW

Discuss:
Are current lessons focusing on maths skills still set at the appropriate level?

Applying a mark scheme:
Does your department apply the mark scheme consistently when marking calculations?

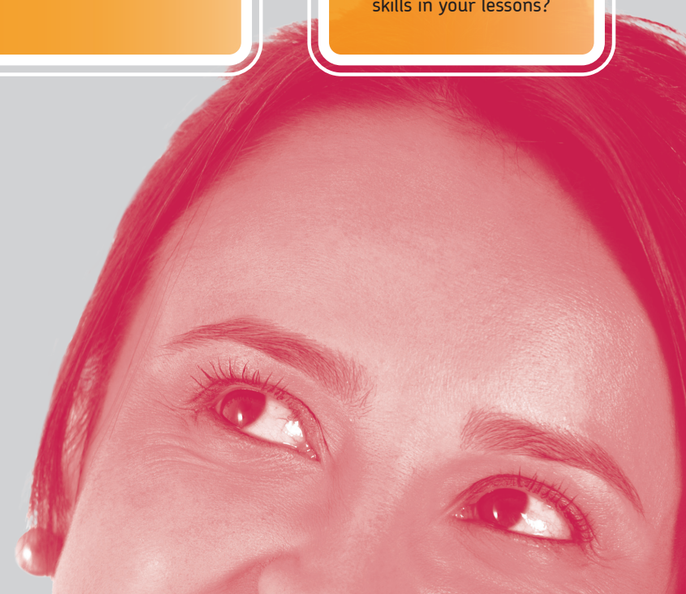
Activity 5:
Mark student responses to ensure the mark scheme is being consistently applied

Discuss:
Is everybody confident at applying the mark scheme consistently?

Assessment principles:
Are teachers familiar with the progression in skill levels for certain maths skills?

Activity 6:
Familiarising and applying the design principles to student responses to understand requirements at different levels of demand

Discuss:
How can you use the assessment design principles to plan for progression of maths skills in your lessons?



G02159_56

Practical questions

Extract from *Required practicals planning summary* document

Required Practicals planning summary

GCSE science

Assessment of practical skills encompasses a number of different elements.

- Apparatus and techniques (AT) criteria
- Working Scientifically (WS) criteria
- Scientific language associated with practical investigations – subject specific language
- The science behind the practical (linking content in the spec to the practical)
- Application of the maths skills appropriate to that practical
- AO2 requirement of scientific techniques and procedures being broader than the Required Practicals
- Questioning about the Required Practicals so they address the different assessment criteria for each of the AOs
- Building on progress from KS3 scientific enquiry.

It would be very difficult to cover every element in every set of RP lessons. One approach is to focus on just a number of these elements in one RP but cover all elements eventually over the whole course. This requires some joint planning across the three sciences and deciding where the most appropriate place is to teach and embed the skills.

Below is a modelled approach mapping possible opportunities to cover the first five bullet points above. These are just suggestions as many aspects of WS could be covered in any practical. Teachers can use this as a starting point and review and amend to suit their own students and teachers.

Biology Required Practicals

Microscopy	Spec ref	Skills, ATs and maths skills (MS)	Content including WS	Key words and subject specific vocabulary
Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.	Trilogy 4.1.1.5 Synergy 4.1.3.2 Biology 4.1.1.5	AT7 – use of appropriate apparatus, techniques and magnification, including microscopes to make observations of biological specimens and produce labelled scientific drawings. **MS** Recognise and use standard form, make and use estimations, appropriate use of significant figures, make order of magnitude calculations (1b, 1d, 2a, 2h). 3d – solve equations.	Cell structures Animal and plant cells Microscopy/calculating magnification Specialisation of cells How microscopes have changed over time and increased our understanding **WS** 1.1, 1.2, 4.4, 4.5	Resolution Magnification Mitochondria Ribosomes Eukaryotic Prokaryotic Accuracy Measurement error – would this be random or systematic if humans read it incorrectly?

Chemistry Required Practicals

Making salts	Spec ref	Skills, ATs and maths skills (MS)	Content including WS	Key words and subject specific vocabulary
Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.	Trilogy 5.4.2.3 Synergy 4.7.3.2 Chemistry 4.4.2.3	AT2 – safe use of appropriate heating devices and techniques including the use of a Bunsen burner and water bath or electric heater. AT4 – safe use of a range of equipment to purify and/or separate a chemical mixture including evaporation, filtration and crystallisation. AT6 – safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products.	Acids and alkalis Reactions of acids with metals and metal carbonates – word equations pH scale and neutralisation Making soluble salts from metals , metal oxides, hydroxides and carbonates Processes – filtration and crystallisation Weak and strong acids (HT) **WS** 2.3, 2.4	Acid Base Alkali Salt Soluble Insoluble Neutralisation Reactants Filtration Crystallisation

Physics Required Practicals

Working Scientifically
Use SI units (4.3)
Use prefixes and powers of ten for orders of magnitude (4.4)
Interconvert units (4.5) and use an appropriate number of significant figures in calculations (4.6) should be reinforced in **all** the physics practicals

Maths skills
3b,3c and 3d apply **whenever equations** are applied.

Specific heat capacity	Spec ref	Skills, ATs and maths skills (MS)	Content including WS	Key words and subject specific vocabulary
An investigation to determine the specific heat capacity of one or more materials. The investigation will involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored.	Trilogy 6.1.1.3 6.3.2.2 Synergy 4.1.1.4 Physics 4.1.1.3 4.3.2.2	AT1 – use of appropriate apparatus to make and record measurements of mass, time and temperature accurately. AT5 – use in a safe manner appropriate apparatus to measure energy changes/transfers and associated values such as work done. **MS** Recognise and use decimals (1a). Use an appropriate number of significant figures (2a). Find arithmetic means (2b). y=mx+c represents a linear relationship (4b).	Calculate the amount of energy stored or released in a system Change in thermal energy = mass × specific heat capacity × temperature change Thermal energy measured in joules Definition of specific heat capacity	A system Joules Work done/energy transfer Specific heat capacity Power

Integrating AO2 into practicals

Extract from AO2 *Activities* booklet: Activity 4

- In groups of specialism, review the following legacy ISA case studies that are relevant to the Required Practicals (RPs).
- Choose one or two of the RPs from the table and add to the case studies section.
- Discuss how the case studies might be used in class/at home to present the RP in an unfamiliar context.
- Add some notes to illustrate to students how this practical might be presented differently in an exam question.
- Share ideas as a whole group.

In the following table we have provided some ideas for themes that teachers could use to put practical work into a novel context, for a number of the Required Practicals. Most of these ideas are based on the case studies from the legacy ISAs, which are referenced in the second and third columns. The legacy ISA materials are available for download from Secure Key Materials on e-AQA if you want to look at them in more detail.

We have also included examples of common experiments that are not Required Practicals, but which you might include as part of normal teaching and illustrate what is meant by 'broader than the RP' statement in the Ofqual subject criteria document.

In some, we have exemplified how you could use the practical so it allows students to apply the science behind the practical they have done in class, to a different version.

Biology

Topic for required practical or common practical	ISA set	ISA title	Brief summary of ISA experiment	Themes and ideas
Osmosis (Required Practical)	B	BU3.2b Solutions	Factors affecting osmosis. Case study using colour intensity as a measure of salt uptake.	Themes that could be used: • concentration of solutions: look at the effect of different concentrations on plant material • different vegetables: use slices of different vegetables such as sweet potato, apple, sugar cane or carrot • surface area: look at the effect of larger or smaller surface area on uptake • different ways of measuring the effect of osmosis: change in mass, shrinking or swelling of cells, using colour intensity of a coloured protein • salt and sugar solutions: look at effect of salt or sugar on plant cells. **Ideas for varying the practical** Measure the change in mass of slices or chunks of different vegetables such as potato, sweet potato or carrot in sugar or salt solutions of different concentration. When plant cells are put into sucrose solution the cell may swell up or shrink. Look at red onion cells under a microscope in different concentrations of sucrose solution and note the effect. Count 100 cells and record how many have shrunken cell contents for each solution.

Chemistry

Topic for required practical or common practical	ISA set	ISA title	Brief summary of ISA experiment	Themes and ideas
Making salts (Required Practical)				Themes that could be used: • neutralisation reactions using different named acids and bases, alkali or metal carbonates • use the context of making a fertiliser to prepare a particular salt.
Temperature changes (Required Practical)	B	CU2.2 Self-heating cans	Factors affecting temperature change in the reaction between calcium oxide and water. Using the reaction to heat different foods.	Themes that could be used: • different reactants: look at reactions using different solids and liquids, such as calcium oxide and water, ammonium nitrate and water, different metal powders and copper chloride or copper sulfate solutions • mass of solid reactant: look at the effect using different masses of solid in the same volume of liquid • volume of liquid reactant: look at the effect of using same mass of solid in different volumes of liquid. **Ideas for varying the practical** Investigate the temperature rise when different masses of calcium oxide are added to the same volume of water.
	C	CU3.3a Sports injury packs	Factors affecting temperature changes in reaction between ammonium nitrate and water. Context of sports injury packs.	

Physics

Topic for required practical or common practical	ISA set	Relevant ISA title	Brief summary of ISA experiment	Themes and ideas
I-V characteristics (Required Practical)	C	PU2.3 Resistance	Factors affecting resistance of filament bulbs. Case study on product testing of theatre spotlights.	Themes that could be used: • different components: look at the characteristics of a variety of different circuit elements such as filament bulbs, light-emitting diodes, light-dependent resistors, thermistors • effect of changing one characteristic on another: look at how factors such as how resistance varies with current, potential difference, power, temperature of a component. Ideas for varying the practical Investigate how resistance varies: • in a filament bulb as the current through the bulb changes • with the potential difference across a filament bulb • using filament bulbs of different power • with the temperature of a thermistor • using different types of thermistor • in a LDR as light intensity is changed (simply by moving the light source or by using different light sources) • in a LDR as the current through it is changed. Use the above list as a start for investigating a different factor, for instance how current through a filament bulb changes with resistance.
	D	PU2.4 Thermistors	Investigating the effect of temperature on resistance of thermistors. Case studies based on product testing of different types of thermistor.	

AO3 Data source booklet

Extract from Chemistry

The following two resources are taken from the *data source* booklets.

- Generic questions to use with practicals, to cover 'working scientifically' criteria.
- Legacy coursework ISAs, which show the required practicals in an unfamiliar context. These can be used as ideas to drop into your teaching to get students used to seeing very familiar practicals put in a different context. Also, it could be set as a homework task, so students can practise AO3 skills, such as writing conclusions, plotting graphs, analysing data and identifying errors and improvements.

Section 2 Question 1:

Possible questions to use with all method sheets

1 (a) (i) Do your results support the hypothesis that you investigated?

You should use any pattern that you can see in your results to support your answer.

You should include examples from your results.

1 (a) (ii) Did you get any anomalous results?

Explain your answer.

Your explanation should include examples from your results.

1 (b) Describe in detail how you could use repeated readings to obtain more accurate results.

1 (c) What was the independent variable in the investigation that you did?

.....

What was the range of the independent variable?

The range was from ..... to ..... .

Explain why this was or was not a suitable range.

What was the dependent variable ? .....

One control variable was? .....

1 (d) Most investigations contain errors or uncertainties.

What do you think was the cause of the largest error or uncertainty in your investigation?

.....

.....

What could you do to reduce the size of this error or uncertainty if you were to repeat the investigation?

Explain your answer.

Example of putting a required practical into an unfamiliar context

CU2.2 Self-heating cans

Context

Investigating exothermic reactions. An exothermic reaction is one that transfers energy to the surroundings. Examples of exothermic reactions include combustion, many oxidation reactions and neutralisation. Everyday uses of exothermic reactions include self-heating cans (eg for coffee) and hand warmer. Students could develop their own hypotheses or investigate the hypothesis that the temperature rise when anhydrous sodium carbonate reacts with water depends on the mass of anhydrous sodium carbonate used. Students can identify which variables to control and what the dependent and independent variables are.

This method could be used to investigate the following hypothesis:

'The temperature rise when anhydrous sodium carbonate reacts with water depends on the mass of anhydrous sodium carbonate used.'

You will need to prepare a table for the results.

Equipment:

Eye protection ie safety glasses

Measuring cylinder

Access to a balance

Insulated plastic/polystyrene cup standing in a 250cm^3 beaker

Dry powdered anhydrous sodium carbonate

Thermometer

Method:

1. Weigh out 0.5g of anhydrous sodium carbonate onto a piece of scrap paper.
2. Place 10cm^3 of water into the insulated cup, and record its temperature.
3. Add the anhydrous sodium carbonate, stir well, and record the highest temperature achieved.
4. Repeat the experiment using up to 2g of anhydrous sodium carbonate.

Case studies

Case Study 1

A group of students investigated the temperature rise when different masses of calcium oxide were added to water.

They used equal volumes of water.

These are their results.

Mass of calcium oxide used in grams	Temperature rise of the water in °C
10	11
20	22
30	30
40	35
50	37

Case Study 2

A different group of students did another investigation using calcium oxide and water.
They used 10g of calcium oxide but different volumes of water each time.
They measured the temperature rise of the water.

These are their results.

Volume of water in cm^3	Temperature rise of the water in °C
20	42
50	35
100	31
150	26
200	22

Case Study 3

A third group of students did another investigation using calcium oxide and water.
They added different masses of calcium oxide to the same volume of water and recorded the temperature rise.

These are their results.

Mass of calcium oxide used in grams	Temperature rise of the water in °C			
	Trial 1	Trial 2	Trial 3	Mean
15	14	16	18	16
20	21	20	14	14
25	25	28	25	26
30	29	28	32	30
35	37	34	35	35

Case Study 4

Some students wanted to find out how much calcium oxide was needed to heat different foods.

They put 400 cm_3 of baked beans in a large beaker.
They placed a small beaker, containing 50cm^3 of water, in the large beaker of beans.

The students then added 15g of calcium oxide to the water.
They stirred the baked beans and recorded the highest temperature the baked beans reached.

They repeated the experiment using 400cm^3 each of different foods.

They also determined the density of each food.

These are their results:

Food	Density of food in grams per cm^3	Mass of food heated in grams	Temperature rise in °C
chicken curry	1.24	496	10
baked beans	1.19	476	15
spaghetti bolognese	1.16	464	20
vegetable soup	1.14	456	25
tomato soup	1.13	452	25

Diagnostic questions

Below is an example of how an exam question can be edited to make it into a diagnostic question. The purple boxes within the question show how it has been amended. The boxes to the side show the maths skill that is being targeted.

The 'Diagnostic question examples' table found in the appendix of the *Maths in science* training pack lists other suggested questions from 2018, which might be useful to edit as diagnostic questions.

The questions are in a Word format in Exampro so can be copied from there to edit and use in class.

Biology 1F 2018 Q8

16 marks, 16–20 mins, 6 maths skills

0 8 Metabolism is the sum of all the chemical reactions in the cells of the body.

One metabolic reaction is the formation of lipids.

0 8 . 1 Give **one** other metabolic reaction in cells.

[1 mark]

A simple stem, setting the context. Students don't need to know anything about metabolism so Q8.1 has been removed.

Table 5 shows the mean metabolic rate of humans of different ages.

Table 5

Age in years	Mean metabolic rate in kJ/m^2/hour	
	Males	Females
5	53	53
15	45	42
25	39	35
35	37	35
45	36	35

0 8 . 2 What **two** conclusions can be made from the data in **Table 5**?

[2 marks]

2c
2f

Tick **two** boxes.

- As age increases, mean metabolic rate of males and females increases. ☐
- Males have a higher metabolic rate than females after five years of age. ☐
- The mean metabolic rate of females decreases faster than males up to 25 years of age. ☐
- The mean metabolic rate of males and females decreases more quickly after the age of 35. ☐
- There is no relationship between age and mean metabolic rate. ☐

0 8 . 3 Calculate the percentage decrease in the mean metabolic rate of males between 5 years and 45 years of age.

1a
2c
3a

Use the equation:

$$\text{percentage decrease} = \frac{\text{decrease in metabolic rate}}{\text{original metabolic rate}} \times 100$$

Give your answer to 3 significant figures.

[3 marks]

To differentiate, remove the equation.

Regular exercise can increase metabolic rate.

Two people did five minutes of gentle exercise from rest.

Table 6 shows the effect of the exercise on their heart rates.

Table 6

Time in minutes	Heart rate in beats per minute	
	Person R	Person S
0 (at rest)	60	78
1	76	100
2	85	110
3	91	119
4	99	129
5	99	132

0 8 . 4 Describe **two** differences in the response of person **R** and person **S** to the exercise.

2c
4a

Use information from **Table 6**.

[2 marks]

0 8 . 5 Complete the line graph in **Figure 12** for person **S**.

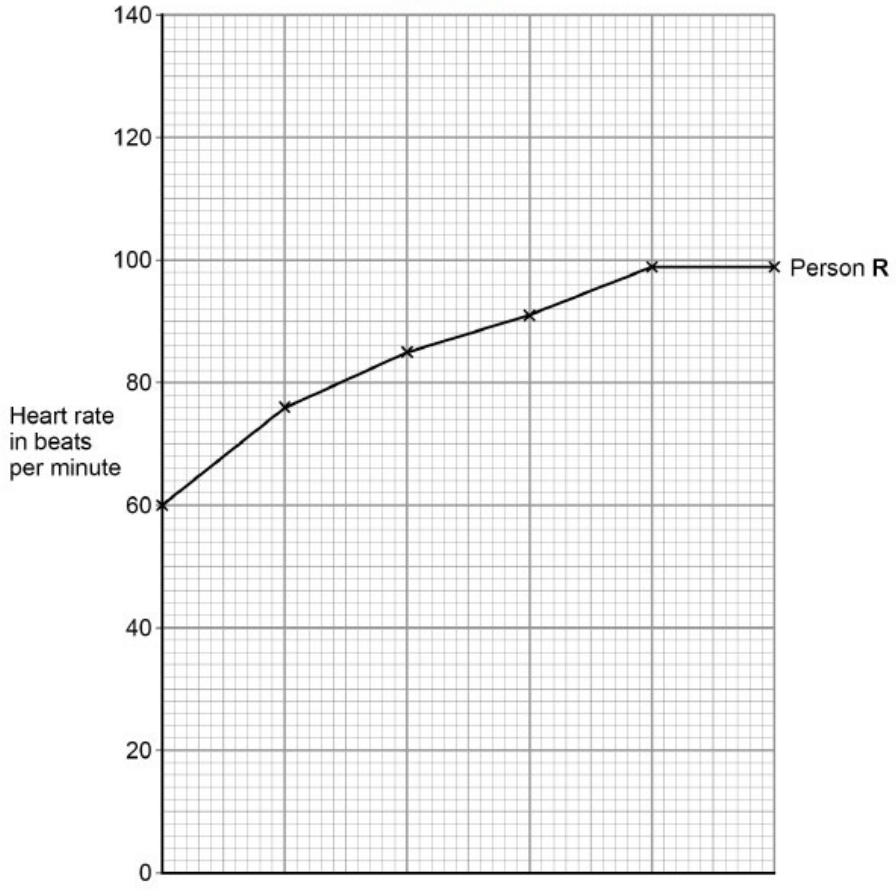
4a
4c

You should:

- add the scale to the x axis
- label the x axis.

[4 marks]

Figure 12



To differentiate, remove the scale on the Y axis and the plot of Person R. Ask students to construct a graph to show the pattern in the data for both Person R and S.

0 8 . 6 After five minutes of exercise, the heart rate of person **S** was 132 beats per minute. When person **S** rested, his heart rate decreased steadily at a rate of 12 beats every minute.

1c

Calculate how much time it would take the heart rate of person **S** to return to its resting rate.

[2 marks]

0 8 . 7 A student made the following hypothesis about the heart rate of smokers and non-smokers during exercise.

2d

"During exercise, the heart rate of smokers increases more than the heart rate of non-smokers."

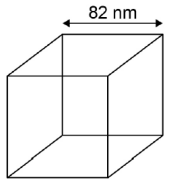
Design an investigation that would allow you to test this hypothesis.

[6 marks]

Reword to focus on controls for the two populations selected for the sample, rather than designing the whole investigation (3 marks).

Maths skills: Extract from Maths in science: *Student maths skills audit* booklet

Look at each of the maths skills and assessment examples: How confident are you at doing questions like the one in the example? RAG rate yourself so you can focus your revision on the skills you still need to master.

Maths skill	How it's used in science GCSE	Example question	R	A	G
Recognise and use expressions in decimal form	The term 'decimal' refers to the part of the number which is after the decimal point. You will need to perform calculations using decimal numbers and to round a number to a given number of decimal places (dp). This is different from the term 'significant figures' (sig figs) so don't mix them up; see example below. 34.67 to 1dp = 34.7 34.67 to 1 sig figs = 30	0 3 . 2 Calculate the relative atomic mass (A_r) of element **X** using the equation: $A_r = \frac{\text{(mass number} \times \text{percentage) of isotope 1 + (mass number} \times \text{percentage) of isotope 2}}{100}$ Use **Table 2**. Give your answer to 1 decimal place. **[2 marks]** 0 3 . 2 The man has a mass of 85 kg Gravitational field strength = 9.8 N/kg Calculate the weight of the man. Use the equation: weight = mass × gravitational field strength **[2 marks]**			
Recognise and use expressions in standard form	Standard form is a different way of writing numbers. For example, 437 can be written as 4.37×10^2. It's based on using powers of 10 and is very useful for writing very large or very small numbers. In standard form, numbers are given as a number from 1 to 10 (but not 10 itself) which is then multiplied by a power of 10. In maths textbooks this tends to be written as $\alpha \times 10^n$ where $1 \leq \alpha < 10$.	Zinc oxide can be produced as nanoparticles and as fine particles. 1 0 . 3 A nanoparticle of zinc oxide is a cube of side 82 nm **Figure 15** represents a nanoparticle of zinc oxide. **Figure 15**  Calculate the surface area of a nanoparticle of zinc oxide. Give your answer in standard form. **[3 marks]**			

Maths in science: Appendix

Diagnostic question examples

Many maths questions target a number of skill areas. In the table below, we have listed some of the questions from 2018 ,which assess each maths skill. This may make your search for the editable Word versions in Exampro easier. The ones highlighted in blue may be particularly good examples to edit and use as diagnostic questions.

Maths skill	Paper/question number	Question details
1a	Chemistry 1F Q3.2	Calculate RAM using a formula and answers given to 1dp.
1b	Chemistry 1F Q3.4 Synergy 4F Q2.8 Synergy 1H Q 9.1 Synergy 3H Q6.5 Synergy 4H Q 5.4	Calculate the radius of an atom and give answer in standard form. Using numbers expressed in standard form. Recognise order of size when expressed in standard form. Calculate the number of copper ions in the solution using the Avogadro constant and express answer in standard form. Calculate the number of moles, give answer in standard form.
1c Ratio	Synergy 3F Q1.8 Trilogy Chemistry 2F Q6.5 **Chemistry 2F Q4.3** Biology 2F Q4.7	Simplifying ratios Balance the equation **Calculate a mass using ratios** Calculate ratio from Punnett square

Misconceptions and common errors

Extract from Maths in science: *Activities* booklet.

Maths skill	Common misconceptions and errors
Arithmetic and numerical computation	
1a Recognise and use expressions in decimal form	Students need to be shown how the position of each digit in the number determines the size of the number (place value). Most misconceptions occur when converting between decimals and fractions or decimals and percentages, eg a student might think that 0.12 = 1/12 or 0.5 = 5%.
1b Recognise and use expressions in standard form	Students typically find it difficult remembering whether positive powers of ten relate to large numbers or small numbers as they recall a process rather than linking it to place value. The use of index notation within standard form makes routine problems look more difficult and students can be reluctant to attempt the questions, even though they know how to do them.
1c Use ratios, fractions and percentages	Students will need to be reminded of the following: • ratios are not the same as fractions, ie 4:7 does not mean 4/7 • we expect the answer to be reduced to the smallest ratio possible rather than the raw numbers. For instance, if a ratio works out as 12:6 we would expect it to be given as 2:1 • we don't use fractions often but students might need to understand that a value in a question is a fraction of another value and to use the value of that fraction to do a calculation • finding 10% of a number is the only percentage where you can divide by it to find the percentage, ie 10% is the same as divide by 10 but 20% is not the same as divide by 20 • percentage change is not listed in the DfE criteria for maths but it is required as part of the content in Biology and Chemistry. Students often don't know how to calculate it and confuse the equation. $= \frac{difference\ between\ two\ values}{original\ value} \times 100$

1d Make estimates of the results of simple calculations	Estimations in science require students to look at some given data and make a sensible estimation of what a missing value in the data might be. This might be when they extrapolate a line on a graph or to give the intermediate value in a set of data, for example, given the volume of gas given off at 10, 20, 30, 40, 50 degrees and asked to estimate what the value at 45 might be. Students sometimes try to do exact calculations rather than estimate, showing a lack of understanding of the term. In maths, it means rounding up or down to 1 significant figure before doing a calculation.

Contact us

Our friendly team will be happy to support you between 8am and 4pm, Monday to Friday.

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