GCSE
Science

How was it for you and your students?

Support booklet and further information

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New learning

Look at the specification content below, which parts of the statements are covered at KS3 and which is new learning?

4.1.1 Cell structure

4.1.1.1 Eukaryotes and prokaryotes

Content	Key opportunities for skills development
Plant and animal cells (eukaryotic cells) have a cell membrane, cytoplasm and genetic material enclosed in a nucleus.	
Bacterial cells (prokaryotic cells) are much smaller in comparison. They have cytoplasm and a cell membrane surrounded by a cell wall. The genetic material is not enclosed in a nucleus. It is a single DNA loop and there may be one or more small rings of DNA called plasmids.	
Students should be able to demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, including the use of standard form.	MS 1b, 2a, 2h WS 4.4 Use prefixes centi, milli, micro and nano.

4.1.1.2 Animal and plant cells

Content	Key opportunities for skills development
Students should be able to explain how the main sub-cellular structures, including the nucleus, cell membranes, mitochondria, chloroplasts in plant cells and plasmids in bacterial cells are related to their functions. Most animal cells have the following parts: • a nucleus • cytoplasm • a cell membrane • mitochondria • ribosomes. In addition to the parts found in animal cells, plant cells often have: • chloroplasts • a permanent vacuole filled with cell sap. Plant and algal cells also have a cell wall made of cellulose, which strengthens the cell.	WS 1.2 Recognise, draw and interpret images of cells.
Students should be able to use estimations and explain when they should be used to judge the relative size or area of sub-cellular structures.	MS 1d, 3a AT 7 Images of cells in videos, bioviewers, photographs and micrographs can be used as comparison for students own drawings.

Required practical activity 1: use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.

AT skills covered by this practical activity: biology AT 1 and 7.

This practical activity also provides opportunities to develop WS and MS. Details of all skills are given in Key opportunities for skills development.

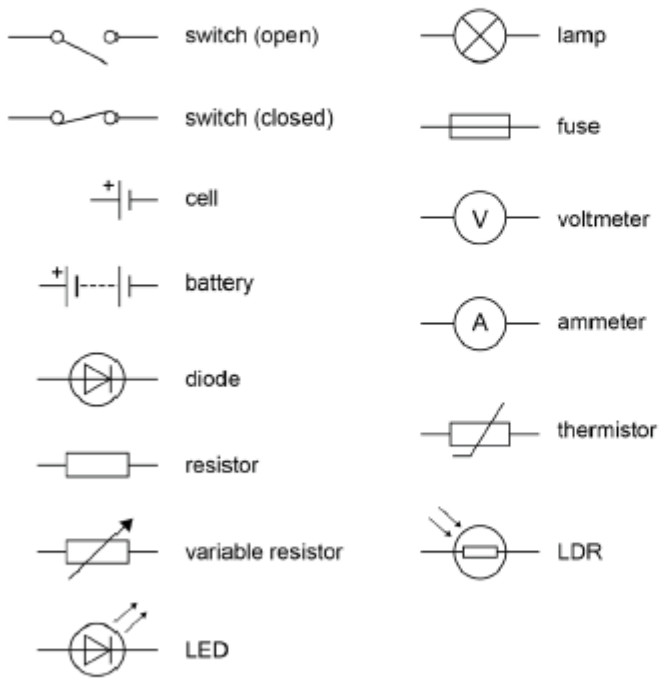
5.1.1 A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes

5.1.1.1 Atoms, elements and compounds

Content	Key opportunities for skills development
All substances are made of atoms. An atom is the smallest part of an element that can exist. Atoms of each element are represented by a chemical symbol, eg O represents an atom of oxygen, Na represents an atom of sodium. There are about 100 different elements. Elements are shown in the periodic table. Compounds are formed from elements by chemical reactions. Chemical reactions always involve the formation of one or more new substances, and often involve a detectable energy change. Compounds contain two or more elements chemically combined in fixed proportions and can be represented by formulae using the symbols of the atoms from which they were formed. Compounds can only be separated into elements by chemical reactions. Chemical reactions can be represented by word equations or equations using symbols and formulae. Students will be supplied with a periodic table for the exam and should be able to: • use the names and symbols of the first 20 elements in the periodic table, the elements in Groups 1 and 7, and other elements in this specification • name compounds of these elements from given formulae or symbol equations • write word equations for the reactions in this specification • write formulae and balanced chemical equations for the reactions in this specification. (HT only) write balanced half equations and ionic equations where appropriate.	

6.2.1 Current, potential difference and resistance

6.2.1.1 Standard circuit diagram symbols

Content	Key opportunities for skills development
Circuit diagrams use standard symbols.  Students should be able to draw and interpret circuit diagrams.	WS 1.2

6.2.1.2 Electrical charge and current

Content	Key opportunities for skills development
For electrical charge to flow through a closed circuit the circuit must include a source of potential difference. Electric current is a flow of electrical charge. The size of the electric current is the rate of flow of electrical charge. Charge flow, current and time are linked by the equation: charge flow = current × time [$Q = I t$] charge flow, Q, in coulombs, C current, I, in amperes, A (amp is acceptable for ampere) time, t, in seconds, s A current has the same value at any point in a single closed loop.	MS 3b, c Students should be able to recall and apply this equation.

Examples of required practical questions

Foundation question 6 and Higher question 1

Question		Question	
6.1	30% 0 39% 1	1.1	13% 0 22% 1
6.2	34% 0 44% 1	1.2	7% 0 42% 1
6.3	73% 0 24% 1	1.3	31% 0 55% 1
6.4	95% 0	1.4	85% 0
6.5	72% 0	1.5	50% 0
6.6	83% 0	1.6	61% 0
6.7	58% 0	1.7	25% 0
6.8	76% 0	1.8	38% 0
6.9	53% 0	1.9	30% 0

0 1 Many biotic and abiotic factors can affect the growth of plants.

0 1 . 1 Are the factors in **Table 1** biotic or abiotic?

[2 marks]

Tick **one** box for each factor.

Table 1

Factor	Biotic	Abiotic
Diseases		
Herbivores		
Temperature		
Water		

Two students investigated the effect of light intensity on the distribution of small plants.

The plants are growing under a tree in a park.

The students made the following hypothesis:

'As you move outwards from a tree there will be more plant growth.'

0 1 . 2 Explain why the students thought their hypothesis would be correct.

[3 marks]

0 1 . 3 The students used two pieces of equipment.

Give the scientific name of each piece of equipment.

[2 marks]

A square frame measuring 0.5 m × 0.5 m _____

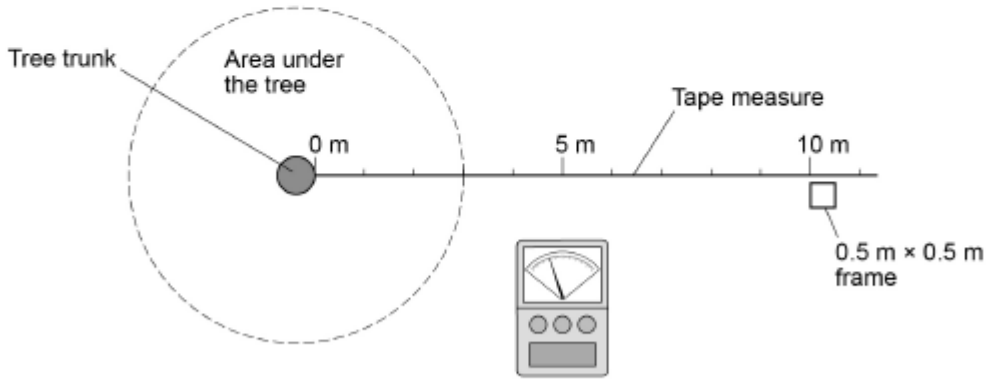
An electronic device to measure light intensity _____

This is the method used.

1. Fix one end of a tape measure at the base of the tree.
2. Fix the other end of the tape measure 11 metres from the tree.
3. At 0 metres put the square frame on the ground.
4. Identify all the plant species growing inside the frame.
5. Estimate and record the percentage cover of each plant species.
6. Measure the light intensity inside the frame.
7. Put the square frame on the ground every 2 metres along the tape to 10 metres.
8. Repeat steps 4 – 6 in every frame.

Figure 1 shows the equipment in this investigation.

Figure 1



0 1 . 4 Calculate the total area sampled.

[1 mark]

0 1 . 5 The whole investigation was done as quickly as possible on the same day.

Suggest **one** reason why.

[1 mark]

0 1 . 6 Give **one** way the investigation could be improved.

[1 mark]

Table 2 shows the results.

Table 2

	Distance from tree in metres					
	0	**2**	**4**	**6**	**8**	**10**
Percentage cover of grass	15	50	35	16	15	15
Percentage cover of plantain	0	5	10	40	25	30
Percentage cover of daisy	0	0	0	4	20	10
Percentage cover of clover	1	10	25	40	40	45
Total percentage cover of plants	16	65	70	100	100	100
Light intensity in arbitrary units	37	59	150	175	>200	>200

0 1 . 7 Which plant species in **Table 2** will only grow at high light intensity?

[1 mark]

Chemistry Foundation P1 question 5 and Higher question 1

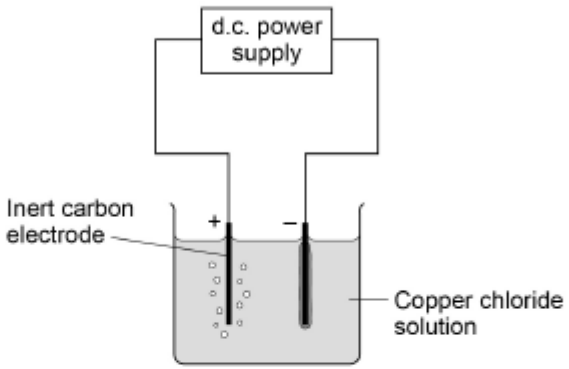
Question 5		Question 1	
5.1	72% 0	1.1	49% 0
5.2	70% 0	1.2	54% 0
5.3	58% 0	1.3	36% 0
5.4	70% 0 1% 1 28% 2	1.4	29% 0 3% 1 67% 2
5.5	87% 0 11% 1	1.5	69% 0 36% 1

0 5 This question is about electrolysis.

A student investigates the mass of copper produced during electrolysis of copper chloride solution.

Figure 12 shows the apparatus.

Figure 12



0 5 . 1 Which gas is produced at the positive electrode (anode)? **[1 mark]**

Tick **one** box.

- carbon dioxide ☐
- chlorine ☐
- hydrogen ☐
- oxygen ☐

0 5 . 2 Copper is produced at the negative electrode (cathode).

What does this tell you about the reactivity of copper?

[1 mark]

Tick **one** box.

Copper is less reactive than hydrogen ☐

Copper is less reactive than oxygen ☐

Copper is more reactive than carbon ☐

Copper is more reactive than chlorine ☐

Table 4 shows the student's results.

Table 4

	Total mass of copper produced in mg			
Time in mins	**Experiment 1**	**Experiment 2**	**Experiment 3**	**Mean**
1	0.60	0.58	0.62	0.60
2	1.17	1.22	1.21	1.20
4	2.40	2.41	2.39	2.40
5	3.02	**X**	3.01	3.06

0 5 . 3 Determine the **mean** mass of copper produced after 3 minutes.

[1 mark]

Mass = _____ mg

0 5 . 4 Calculate the mass **X** of copper produced in **Experiment 2** after 5 minutes.

Use **Table 4** on page 19

[2 marks]

Mass **X** = _____ mg

0 5 . 5 The copper chloride solution used in the investigation contained 300 grams per dm^3 of solid $CuCl_2$ dissolved in 1 dm^3 of water.

The students used 50 cm^3 of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment.

[3 marks]

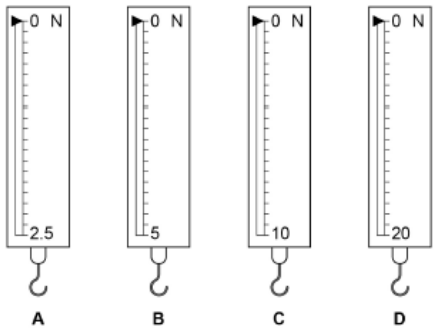
Combined Physics Higher P2 Question 4

Question 4	
4.1	27% 0 70% 1
4.2	41% 0 51% 1
4.3	65% 0 5.6% 1 5% 2 17% 3 0.8% 4 1% 5 5% 6

0 4 . 1 **Figure 6** shows four newtonmeters.

Each newtonmeter contains a spring.

Figure 6



Which newtonmeter has the spring with the greatest spring constant?

Give a reason for your answer.

[2 marks]

Newtonmeter _____

Reason _____

_____

0 4 . 2 The newtonmeter in **Figure 7** will give an error when used to make a measurement.

Figure 7

Name the type of error.

Describe how this error can be corrected.

[2 marks]

Type of error _____

Correction _____

_____

0 4 . 3 A student hangs a weight on a newtonmeter.

The energy now stored in the spring in the newtonmeter is 4.5×10^{-2} J

The student then increases the weight on the newtonmeter by 2.0 N

Calculate the total extension of the spring.

Spring constant = 400 N/m

[6 marks]

Required practicals

Useful websites and resources
Our resources:
Updated practical handbooks aqa.org.uk/subjects/science

Exampro: section on required practicals exampro.co.uk

Teachit: summary revision required practical lessons teachitscience.co.uk
£150 department subscription

Other resources:
STEM Stem.org.uk

CLEAPSS cleapss.org.uk

Getting Practical gettingpractical.org.uk

Examples of graph questions

Trilogy Physics Foundation P1 Question 7.2/Higher Question 2 – bar chart

Question 7.2	Foundation	Higher 2.2
0	22%	3%
1	9 %	3%
2	12 %	7%
3	18%	20%
4	39%	67%

0 7 . 2 Another student did a similar experiment.

He determined the density of five common plastic materials.

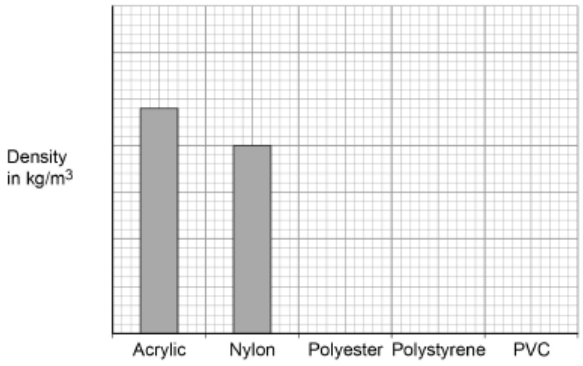
Table 3 shows the results.

Table 3

Plastic material	Density in kg/m^3
Acrylic	1200
Nylon	1000
Polyester	1380
Polystyrene	1040
PVC	1100

Figure 12 shows the results plotted in a bar chart.

Figure 12



Complete **Figure 12**

You should:

- Write the correct scale on the y-axis.
- Draw the bars for polyester, polystyrene and PVC.

[4 marks]

Trilogy Chemistry Foundation P2 Question 5.6 – line graph

Question 5.6	
0	34%
1	21%
2	34 %
3	11% 0

0 5 . 6 **Table 5** shows the student's results.

Table 5

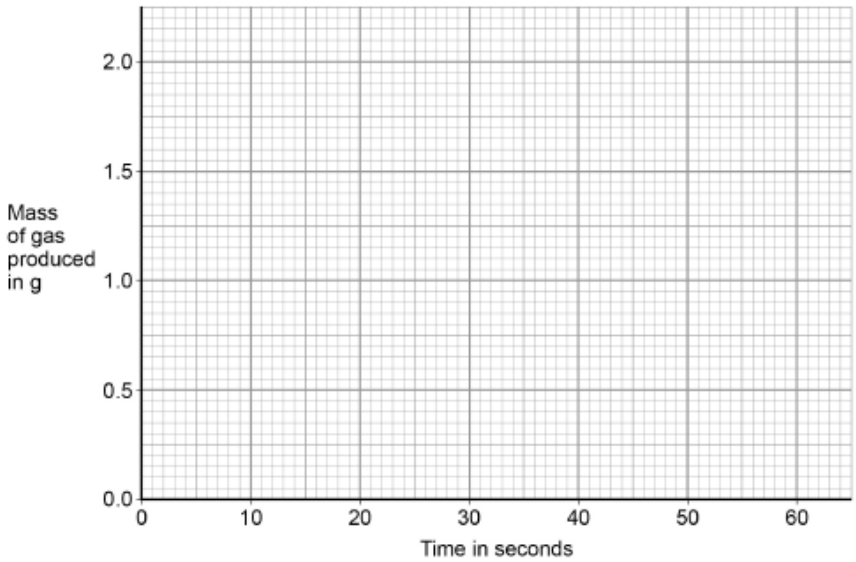
Time in seconds	Mass of gas produced in g
0	0.0
10	0.8
20	0.6
30	1.6
40	1.8
50	2.0
60	2.0

Plot the data from **Table 5** on **Figure 11**

Draw a line of best fit.

[3 marks]

Figure 11



Trilogy Biology Higher P1 Question 4 – line graph

4.1	90% 0
4.2	6% 0 or 1 , 26% 2 , 46% 3, 21% 4
4.3	66% 0
4.4	45% 0 , 28% 1, 12% 2, 10 % 3, 4% 4
4.5	97% 0

0 4 A student investigated the effect of different concentrations of sugar solution on pieces of carrot.

This is the method used.

1. Weigh five pieces of carrot.
2. Place each piece into a different tube.
3. Into each tube add 20 cm^3 of water or one of the sugar solutions as shown in **Figure 6**
4. Leave the apparatus for 2 hours.
5. Remove the carrot and dry each piece on paper towel.
6. Reweigh each piece.
7. Calculate the percentage (%) change in mass of each piece.

Figure 6 shows how the investigation was set up.

Figure 6

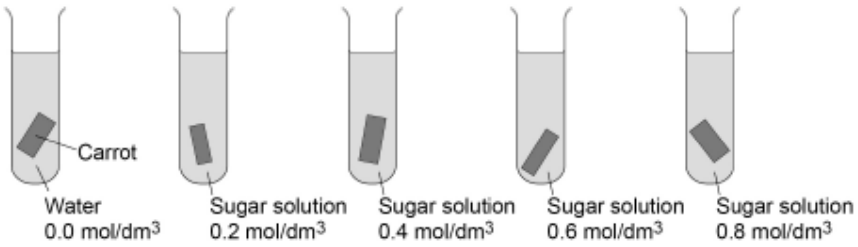


Table 2 shows the results.

Table 2

Concentration of sugar solution in mol/dm^3	Percentage (%) change in mass
0.0	+24
0.2	+12
0.4	+1
0.6	–8
0.8	–15

0 4 . 1 Suggest why the student calculated the percentage (%) change in mass of each piece of carrot.

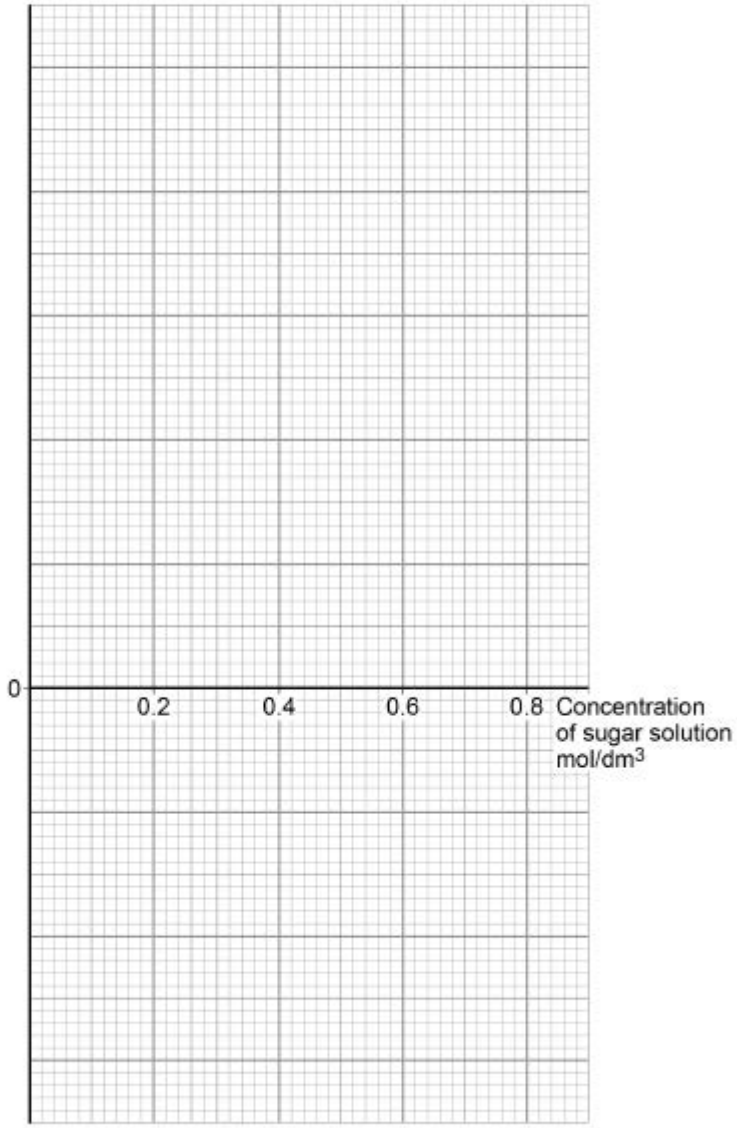
[1 mark]

0 4 . 2 Complete **Figure 7** using the results in **Table 2**

- Choose a suitable scale and label for the y-axis.
- Plot the results.
- Draw a line of best fit.

[4 marks]

Figure 7



0 4 . 3 Estimate the concentration of sugar solution inside the carrot cells.

Use your completed graph on **Figure 7**

[1 mark]

Concentration = _____ mol/dm^3

0 4 . 4 Explain why the mass of the carrot in the 0.6 mol/dm^3 sugar solution changed.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

0 4 . 5 The student repeated the investigation using boiled pieces of carrot.

The pieces of carrot did **not** change in mass.

Suggest why.

[1 mark]

Maths in science

Useful websites and resources
Our resources: aqa.org.uk/resources/science/gcse/teach/maths-skills-in-GCSE-sciences

Maths skills in GCSE science: Teaching guides and presentations to support the teaching of the following skills
1. Standard form and order of magnitude calculations
2. Estimates and significant figures
3. Averages
4. Simple probability
5. Graphs

Additional resources webcast, slides and sample maths questions from first set of sample assessment materials

Summary information on assessing Physics equations

- 23 Physics equations that students need to know and be able to apply (21 in Combined Science).
- 12 further Physics equations (7 in Combined Science) that students must be able to select from a list and apply. Students will be given the prompt 'Use the correct equation from the Equation sheet'.
- How assessed on the papers
  Low demand grades 1−3 (Foundation tier)
  - Recall (AO1) grades 1−3 be asked to recall an equation by multiple choice, link boxes. Will only be worth 1 mark.
  - Apply (AO2) students will be given the equation to apply.
  - Simple equations with substitution of two numbers, no transformations.

Standard demand grades 4−5 (Foundation and Higher tier)
- Students will be given the prompt 'Write down the equation that links…' so they access AO1. These will be written in alphabetical order not necessarily in the way they need to be used
- Calculation will involve something 'extra' eg simple transformation.

High demand grades 6−7
- No prompts about which equation to use.
- Students will not gain marks simply for writing the equation down without doing something with it (so no AO1).
- Questions will involve transformations or 'something extra'.

High demand grades 8−9
- No prompts to help students remember the equation.
- Include complex equations.
- Will involve transformations and multiple steps.

Calculations that involve multiple steps (5 mark extended response on Higher tier) will have the prompt 'Write down any equations you use', as students may need to use more than one equation.

Notes

Notes

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