GCSE
SCIENCE

Virtual communities

Resource booklet

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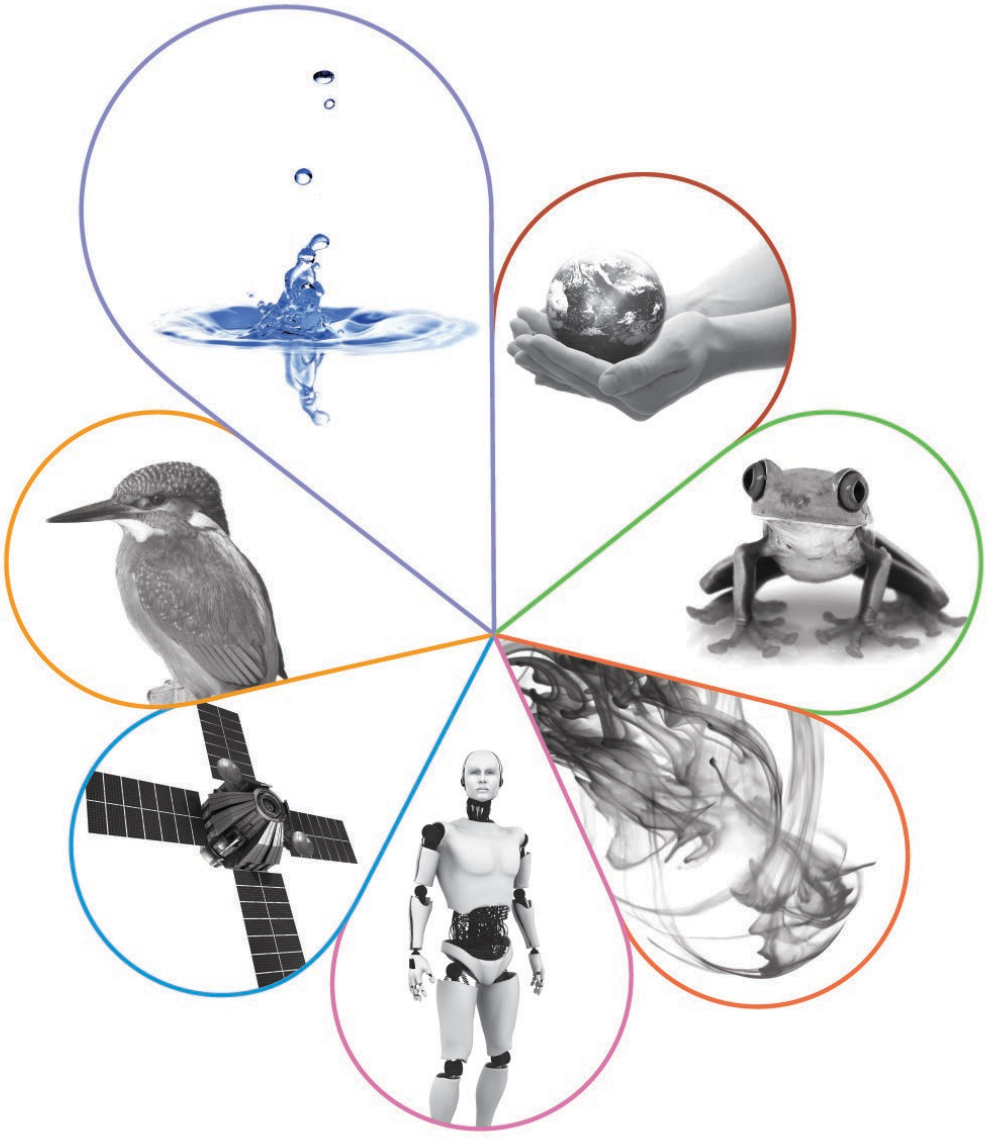
The content of this training course contains no reference to future exam content as far as we know at the time of production.



Contents	Page

Extended open prose or ‘extended response’?

Without looking at the mark schemes, are you able to tell from the question which of the following questions are categorised as ‘extended response’?

Example 1: 2022 GCSE Trilogy Biology 1H question 3.7

0 3 . 7 Explain how the structure of enzyme molecules is related to the effect of pH on the activity of amylase.

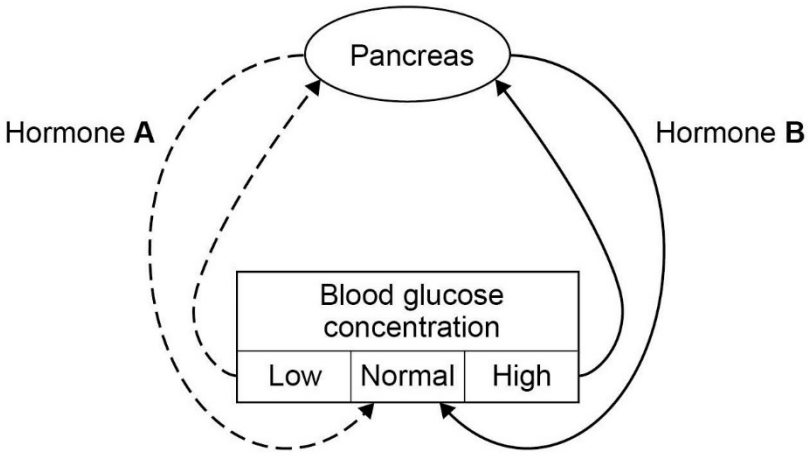
[6 marks]

Example 2: 2022 GCSE Trilogy Biology 2H question 5.3

0 5 Blood glucose concentration in the human body needs to be kept within the normal range.

Figure 4 shows that two hormones control blood glucose concentration.

Figure 4



0 5 . 3 Explain how the two hormones in **Figure 4** keep the blood glucose concentration within the normal range for 3 hours after a meal.

[6 marks]

Example 3: 2022 GCSE Trilogy Physics 1H question 6.3

0 6 . 3 A teacher wanted to find out what nuclear radiation is emitted from a source.

The teacher placed different barriers between the source and a detector.

The teacher recorded the count for 30 seconds after each barrier was put in place.

Table 2 shows the results.

Table 2

Barrier	Thickness in millimetres	Count after 30 seconds
None		985
Paper	0.1	149
Aluminium	5.0	0
Lead	20.0	0

Explain what nuclear radiation was emitted by the source.

[4 marks]

Example 4: 2022 GCSE Trilogy Physics 2F question 7.5

0 7 **Figure 10** shows competitors in the wheelchair race at the London Marathon.

The distance of the London Marathon is 42 000 m

0 7 . 5 Explain why the speed of a competitor changes during the race.

[4 marks]

Example 5: 2022 GCSE Chemistry 1H question 8.1

0 8 . 1 Explain why the pH of an acid depends on:

- the strength of the acid
- the concentration of the acid.

[4 marks]

Example 6: 2022 GCSE Synergy 3H question 8.1

0 8 . 1 The halogens are in Group 7 of the periodic table.

Explain the trend in reactivity going down Group 7.

[4 marks]

Mark schemes

Mark scheme Example 1

Question	Answers	Mark	AO / Spec. Ref.
03.7	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content • enzymes are protein molecules • (so) have a 3D structure • lock and key theory • have an active site • (which) has a specific shape • shape of active site will only match shape of substrate • starch is substrate for amylase • at pH values above or below the optimum the shape of active site is changed (in some molecules) • (so) substrate can no longer fit the active site • at extreme pH values enzyme is denatured • (so) shape of active site is changed • (so) amylase can no longer digest starch • (so) rate of digestion decreases For Level 3 reference to enzyme structure and effect of pH on enzyme activity are needed		4.2.2.1

Mark scheme Example 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3 **indirect marking** **view with 5.2**	(when blood glucose concentration is high after a meal) insulin / B is secreted (by the pancreas) causing glucose to enter cells		1	AO2
	(glucose is) converted to glycogen in the liver / muscle (cells for storage)		1	AO1
	(this causes) blood glucose concentration to return to normal so insulin / B secretion slows / stops / decreases		1	AO2
	when blood glucose concentration is low glucagon / A is secreted (by the pancreas)		1	AO2
	(which causes) breakdown of glycogen in the liver (into glucose)	allow (which causes) breakdown of glycogen in the muscle (cells)	1	AO1
	(this causes) blood glucose concentration to return to normal so glucagon / A secretion slows / stops / decreases		1	AO2 4.5.3.2

Mark scheme Example 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(some) radiation is stopped by paper		1	AO3 6.4.2.1
	so the source emits alpha radiation	MP2 dependent on MP1	1	
	and (some) radiation passes through paper but is stopped by aluminium		1	
	so the source emits beta radiation (but does not emit gamma)	MP4 dependent on MP3	1	

Mark scheme Example 4

Question	Answers	Mark	AO / Spec. Ref.
07.5	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 6.5.4.1.2
	Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	1–2	
	No relevant content	0	
	Indicative content the effect on speed must be consistent with the cause of the change • competitors accelerate at the start • so speed increases • the road is not flat • so speed increases going downhill and / or speed decreases going uphill • the competitor goes round a bend • so speed decreases • competitors may tire towards the end (so the force they exert decreases) • so they slow down • competitors may sprint during the race • causing speed to increase • may get a puncture • so speed would decrease or they would stop • resistive forces on competitors may increase/decrease • so speed would decrease/increase		

Mark scheme Example 5

Question	Answers	Mark	AO/ Spec. Ref
08.1	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3-4	AO1 4.3.2.5 4.4.2.4 4.4.2.6
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	1-2	
	No relevant content	0	
	Indicative content <u>General principle</u> • pH depends on H^+ ion concentration • the higher the concentration of H^+ ions the lower the pH <u>Strength</u> • the stronger an acid the greater the ionisation / dissociation (in aqueous solution) • (so) the stronger the acid the lower the pH <u>Concentration</u> • the higher the concentration of an acid the more acid / solute in the same volume (of solution) • (so) the higher the concentration of the acid the lower the pH		

Mark scheme Example 6

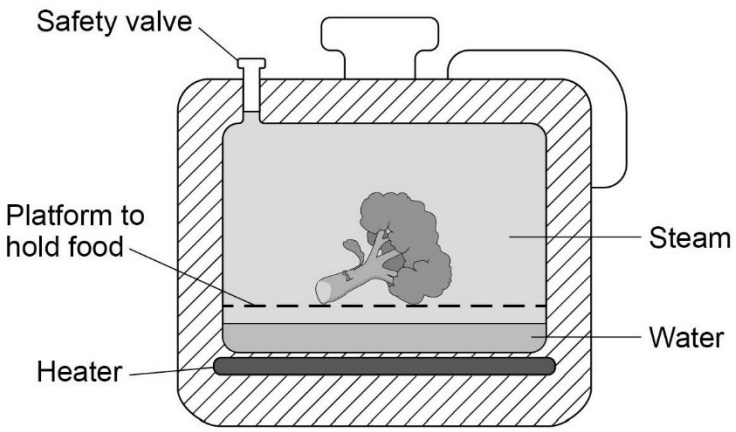
Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	reactivity decreases (going down the group)	allow energy level for shell throughout	1	AO1 4.5.1.5
	(because) the outer electrons / shell become further from the nucleus	allow (because) the atoms become larger allow (because) the number of shells increases	1	
	(so) the nucleus has less (electrostatic) attraction for the outer electrons / shell	allow (so) the nucleus has less (electrostatic) attraction for the incoming electron allow (so) there is more shielding between the nucleus and the outer electrons / shell	1	
	(so) an electron is gained less easily		1	

Example 7: 2022 GCSE Trilogy Physics 1H question 4.4

A pressure cooker is a sealed pot that uses steam to cook food.

Figure 8 shows a pressure cooker.

Figure 8



0 4 . 4 When the water in the pressure cooker starts to boil:

- the amount of steam in the pressure cooker increases
- the temperature of the steam increases above 100 °C

Explain why these changes make the pressure in the cooker increase.

[5 marks]

Mark scheme Example 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4		particles refers to particles in the steam throughout		AO2 6.3.3.1
	(as the amount of steam increases) the number of particles increases		1	
	and (as the temperature increases) particles move faster	allow (as the temperature increases) the (average) kinetic energy of the particles increases	1	
	particles collide with the wall of the cooker		1	
		if MP3 is not awarded no subsequent marks may be awarded		
	these collisions are more frequent		1	
	and each collision exerts more force		1	

Generic levels descriptors

Compare

This requires the student to describe the similarities and/or differences between things, not just write about one.

4 or 6 marks, with two levels descriptors.

Level 2: Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	3–4 or 4–6
Level 1: Relevant features are identified and differences noted.	1–2 or 1–3
No relevant content.	0

Describe

Students may be asked to recall some facts, events or processes in an accurate way.

4 or 6 marks, with two levels descriptors.

Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4 or 4–6
Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2 or 1–3
No relevant content.	0

Design/Plan/Describe a method

Students need to set out in a logical order how something can be done.

6 (or 4) marks with three (or two) levels descriptors.

Level 3: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6
Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4
Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2
No relevant content.	0

Evaluate

Students should use the information supplied, as well as their knowledge and understanding, to consider evidence for and against. Make a judgement about the value of something, with respect to a particular purpose. The response is based on analysis, so it is important to identify relevant features and use relevant criteria. Might need to look critically from a number of angles.

6 (or 4) marks with three (or two) levels descriptors.

Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6
Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4
Level 1: Relevant points are made. They are not logically linked.	1–2
No relevant content.	0

Explain

Students should make something clear, or give the reasons for something happening. The answer should not just be a simple list of reasons or points. Answers should be in more detail than in a simple description, revealing additional relevant facts.

6 (or 4) marks with three (or two) levels descriptors.

Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6
Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2
No relevant content.	0

Applying a levels mark scheme

The following guidance may be found in the 'Information to examiners' section at the front of every GCSE science mark scheme.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level.

The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Example 8: 2022 GCSE Physics 2H question 6.1

0 6 . 1 Compare the formation and life cycles of stars with a similar mass to the Sun to stars with a much greater mass than the Sun.

[6 marks]

Question	Answers	Mark	AO / Spec. Ref.
06.1	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO1 4.8.1.1 4.8.1.2
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content	0	
	Indicative content **all stars:** • form in a cloud of gas and dust (nebula) by gravity – mostly hydrogen • forms a protostar • fusion begins • fusion of small nuclei into larger nuclei (hydrogen into helium) • main sequence star – stable period where gravitational forces (inwards) balance forces (outwards) due to fusion processes **comparisons:** • stars about the same size as the Sun expand to become a red giant, stars much bigger than the Sun expand to become a red super giant • stars about the same size as the Sun contract (and temperature increases) to become a white dwarf, stars much bigger than the Sun explode in a supernova • stars about the same size as the Sun (cool to) become a black dwarf, stars much bigger than the Sun become either a neutron star or black hole		

Student A

0 6 . 1 Compare the formation and life cycles of stars with a similar mass to the Sun to stars with a much greater mass than the Sun.

[6 marks]

Stars a similar mass to the sun form red giants when the begin to cool and get rid of their dust and gas, this forms a white dwarf. Hydrogen has run out and by helium is disperct. when the white dwarf cools and and the mantel is lost it is called a black dwarf

However in stars with a much greater mass than the sun ~~when~~ they form red super giants that turn into supernovas which undergo more fusion to make elements heavier than iron once the supernova expands enough and explodes scattering elements across the universe a black hole is created.

white dwarf red giant black dwarf → wd cools

d super giant

super nova

black whole

→ r.

Student B

0 6 . 1 Compare the formation and life cycles of stars with a similar mass to the Sun to stars with a much greater mass than the Sun.

[6 marks]

- Both begin as a nubeula. This a thick layer of gas and dust
- Then they both become a protostar which is when gravity pulls all the gas and dust together to become more concentrated - increasing collisions
- Then they both become a main sequence star and this is when there are much more frequent collisions taking place and there is an increase in temperature. Fusion of hellum and hydrogen nucli take place

STARS WITH SIMILAR MASS TO SUN:

- Red Giant - this is when the star begins to increase in size forming many heavier elements such as iron.
- White dwarf - a white dwarf is a concentrated centre of mass that shines a light when the red giant loses its mass
- black dwarf - when a white dwarf dies and stops shining so bright, it loses its light and becomes black

GREATER MASS THAN SUN:

- Red super Giant - this is when the star massively increases and the fusion of elements creates a massive star with heavier elements than iron.
- Supernova - massive explosion that releases all its elements into the universe.
  - nebula - forms layer of gas and dust again
  - black whole - light doesn't shine through it is becomes a whole in the universe.

Example 9: 2022 GCSE Trilogy Chemistry 2F question 7.1/2H question 2.1

0 7 . 1 Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage)
- ground water (fresh water).

[6 marks]

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="4">07.1</td><td>Level 2: Scientifically relevant features are identified, the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.</td><td>4–6</td><td rowspan="4">AO1
5.10.1.3</td></tr>
<tr><td>Level 1: Relevant features are identified and differences noted.</td><td>1–3</td></tr>
<tr><td>No relevant content</td><td>0</td></tr>
<tr><td>Indicative content
<table>
<tr><th>ground water</th><th>waste water</th></tr>
<tr><td>easier to obtain</td><td>more difficult to obtain</td></tr>
<tr><td>fewer processes</td><td>more processes</td></tr>
<tr><td>takes less time</td><td>takes more time</td></tr>
<tr><td>filtered through filter beds

to remove insoluble particles</td><td>screening and grit removal

to remove large particles</td></tr>
<tr><td></td><td>sedimentation

to produce sewage sludge and effluent</td></tr>
<tr><td></td><td>aerobic biological treatment of effluent

to reduce solid waste</td></tr>
<tr><td>sterilised

using chlorine, ozone or uv light

to kill bacteria</td><td>and then sterilised

using chlorine, ozone or uv light

to kill bacteria</td></tr>
<tr><td></td><td>sludge is anaerobically digested

by specific bacteria

to remove organic matter</td></tr>
</table></td><td></td></tr>
</table>

Student C

0 2 . 1 Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage)
- ground water (fresh water).

[6 marks]

- Obtaining potable water from ground water is quite easy as although the water isn't potable, it is cleaner than waste water.
- To obtain potable water from fresh water, the water is filtered through a large machine that makes water pass through filter, process being called giant osmosis. *
- It takes a lot of energy.
- Obtaining potable water from waste water is a lot more complicated.
- The sewage has to be seperated into sewage sludge and effluent.
- Effluent is then sterilised, filtered, desalinated, and chemicals are added for it to be potable.

Question 2 continues on the next page

* Desaluation also has to occur for the water to become potable.

Student D

0 2 . 1 Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage)
- ground water (fresh water).

[6 marks]

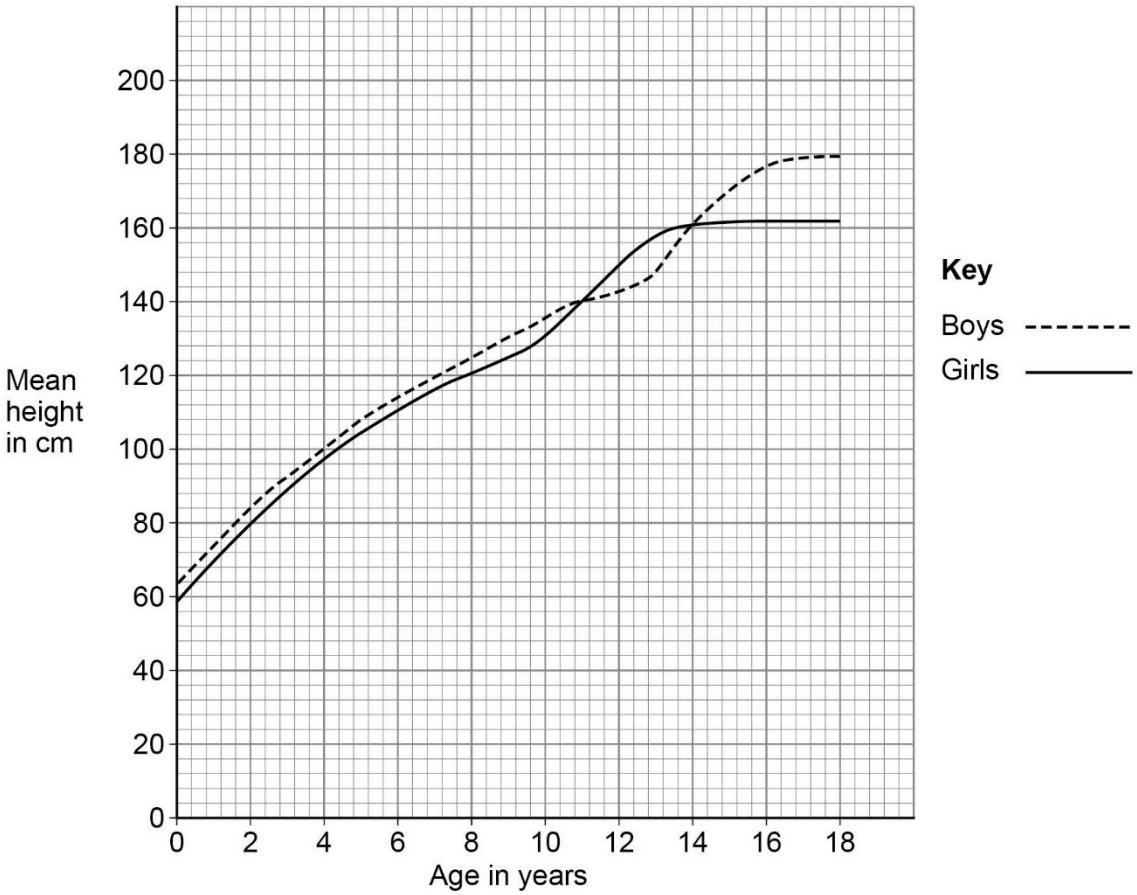
Waste water can be filtered to remove any bacteria or large solids. After removing these, the waste water becomes potable (safe to drink. Similarly, ground water needs to be filtered to remove any dirt or bacteria. Both waste water and ground water need to go through similar processes to become potable. Both processes are very similar, ~~one~~ the prices are different. In addition, waste water needs to be filtered the most as it contains more waste & bacteria than ground water.

Example 10: 2022 GCSE Trilogy Biology 1F question 6.6/1H question 2.6

Cell division is important in the growth of multicellular organisms.

0 6 . 6 **Figure 11** shows the mean height of boys and of girls from birth to age 18 years.

Figure 11



Compare the growth of boys with the growth of girls.

Use data from **Figure 11** in your answer.

[6 marks]

Question	Answers	Mark	AO / Spec. Ref.
06.6	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	4–6	AO3
	Level 1: Relevant features are identified and differences noted.	1–3	AO2
	No relevant content	0	

	Indicative content General comparisons: • boys height at birth (slightly) greater than girls height • boys are (slightly) taller than girls up to age 11 • correct height comparisons eg boys are approximately 4 / 5 cm taller than girls up to age 11 • girls and boys are the same height at age 11 • girls are taller than boys between age 11 and age 14 • girls and boys are the same height at age 14 • boys are taller than girls above age 14 • correct height comparisons eg boys are 5 to 18 cm taller than girls above age 14 • boys (eventually) grow taller than girls • boys carry on growing for a longer time than girls • girls stop growing age 13 / 14 / 15 **and** boys stop growing age 17 / 18 Rate comparisons: • rate of growth similar up to age 10 / 11 • girls grow faster than boys between 10 / 11 and 14 allow girls have a greater increase in height between 11 and 14 • growth spurt occurs at a younger age in girls • growth spurt starts age 10 / 11 in girls **and** age 13 / 14 in boys • increased rate of growth in girls aged 10 to 13 /14 **and** in boys aged 13 to 17 / 18 Key points for Level 2 are correct reference to 0-11 year period, 11-14 period and after age 14, with at least one correct reference to rate of growth or use of correct values of height and age to illustrate rate.		4.1.2.2

Student E

Compare the growth of boys with the growth of girls.

Use data from **Figure 11** in your answer.

[6 marks]

Boys	girls
· Start growing equally until 10 years old · Boys hit puberty around 13-14 years old So their height increases but ~~rapidly~~ as puberty for boys takes longer there is more time to grow.	· girls usually start puberty at 10 so their height starts increasing until 14 where they have stopped growth.

Student F

Compare the growth of boys with the growth of girls.

Use data from **Figure 5** in your answer.

[6 marks]

- At zero years the mean height of boys is bigger than girls.
- At 12 years, mean height of girls is 149cm whilst mean heigh of boys is 143cm.
- At 14 years, mean height of both boys and girls are 160cm
- At 18 years, mean height of boys is 180cm whilst girls is 163cm.
- boys grow more over 18 years compared to girls.
- from ages 11 to 14, girls grow more that boys.

Commentaries

Student A

Although there is a good comparison here of what happens after the main sequence stage, with relevant features noted, there is nothing about the formation of the stars. This is only half an answer and is not a Level 2 response.

Student B

The student has identified the scientifically relevant features of both types of star in the formation stages, using clear statements that indicate similarities ('both begin'; 'they both become'). They then have gone on to use a tabular, flow-chart style for the explanation of what happens after the main sequence stage. The comparison is clearly laid out and the stages clearly explained.
This is very definitely a Level 2 answer (and was in fact awarded full marks).
Not that, provided a clear comparison is made (as in this response), then a table or flow chart is a perfectly acceptable way of answering this question.

Student C

The first sentence is not sufficient to be counted as a comparison – we would be looking for 'easier' (comparative word); however, there is a simple comparison on lines 11 – 12, which could be taken to mean either more difficult to obtain or involves more processes. There is a relevant statement about groundwater (line 6) and are some scientifically relevant statements about waste water (lines 14 and 15).
References to reverse osmosis and desalination are not appropriate to ground or waste water so can be ignored.
This is a Level 2 response (just).

Student D

This script is a good illustration between Level 1 and bottom of Level 2. It contains some (mostly weak) comparisons (lines 6–8, 10, 11), several mentions of the need to filter (both waste water and ground water) but no scientifically relevant comments. This was awarded a mark just at the top of Level 1.

Student E

A tabular format, if used clearly, would be a suitable way of answering this type of question. This student has made an attempt at comparison, but it is very weak. There is some attempt at reference to growth before age 10 in both boys and girls but it is very unclear. The references to puberty are not relevant and ignored. This is clearly not a Level 2 answer as it does not meet the criteria in the mark scheme. Because of the inference in the final statement in the boys column that boys grow for a longer time than girls, this was just awarded 1 mark.

Student F

The first four points are correct comparisons of height covering the three age ranges. The final statements give a weak reference to the rate of growth. This is just a Level 2 response.

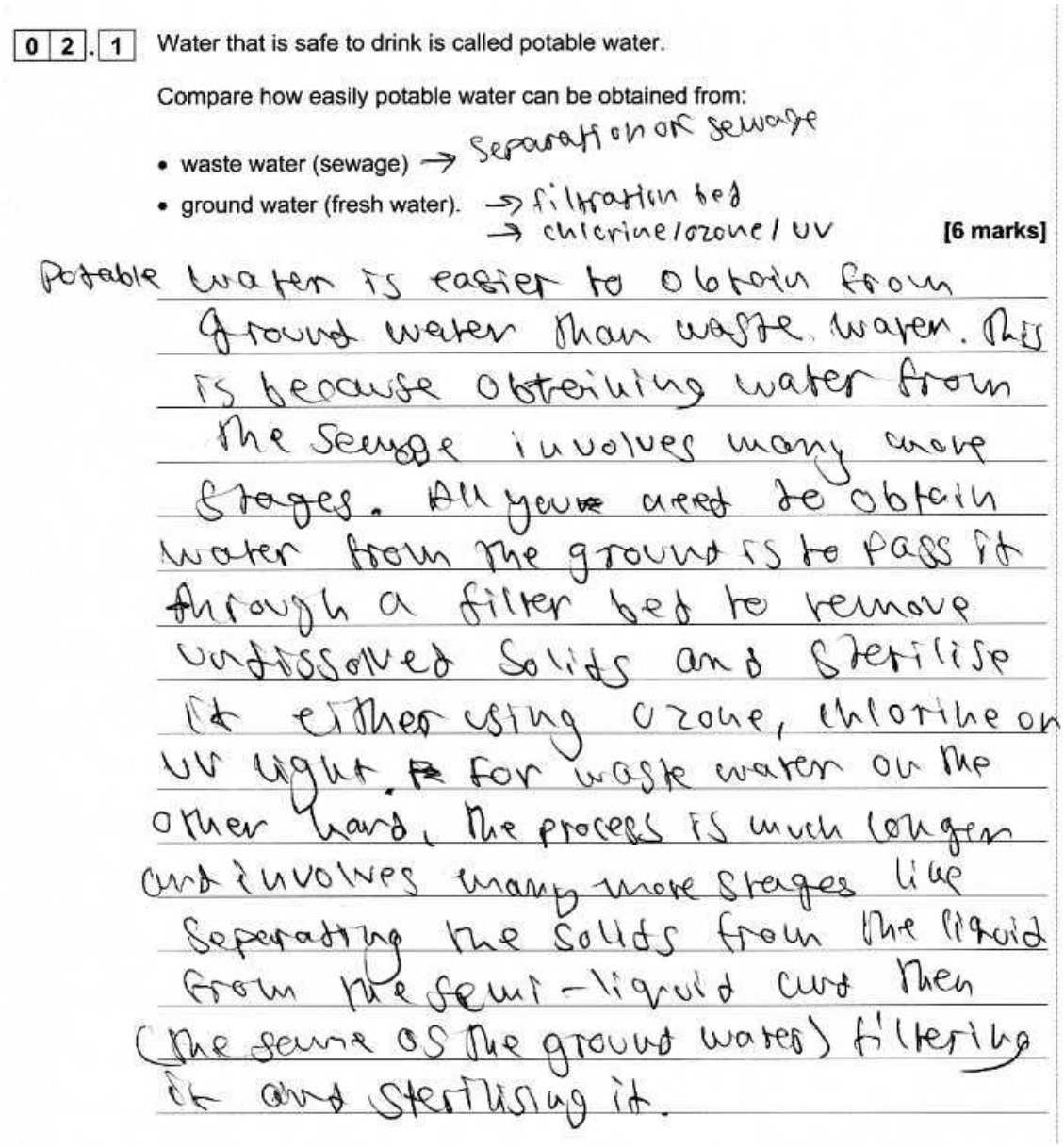
Features of a good response

All of the following examples gained full marks. Can you identify the features of each that merited the award of full marks? Commentaries are given after Example 21.

'Compare' questions

Example 11: 2022 GCSE Trilogy Chemistry 2F question 7.1/2H question 2.1

The mark scheme for Example 11 may be found on page 20.



0 2 . 1 Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage) → separation of sewage
- ground water (fresh water). → filtration bed → chlorine/ozone / UV

[6 marks]

Potable water is easier to obtain from ground water than waste water. This is because obtaining water from the sewage involves many more stages. All you need to obtain water from the ground is to pass it through a filter bed to remove undissolved solids and sterilise it either using ozone, chlorine or UV light. For waste water on the other hand, the process is much longer and involves many more stages like seperating the solids from the liquid from the semi-liquid and then (the same as the ground water) filtering it and sterilising it.

Example 12: 2022 GCSE Physics 2H question 6.1

The mark schemes for Example 12 may be found on page 17.

0 6 . 1 Compare the formation and life cycles of stars with a similar mass to the Sun to stars with a much greater mass than the Sun.

[6 marks]

All stars will start from a nebula, which is a large mass of dust and gas. If there is enough mass, the dust and gas will be condensed into a smaller volume, this friction creates energy and increases a temperature forming a protostar. As temperature increases further, nuclear fusion occurs and both type of stars turn into a main sequence star, this is the longest stage. A star with ~~the~~ similar mass to our sun would ~~turn~~ swell up and become a red giant as hydrogen and helium run out for fusion. Once all fuel is used up, the layers of dust and gas will eject, leaving a core called a white dwarf. This is hot and dense but will cool down into a black dwarf over time. On the other hand, a star with a mass much greater than our sun would become a red super giant when hydrogen and helium run out, then once all fuel is used, the star condenses and explodes it dust and gas, forming heavier elements than iron due to the energy. This is a supernova, which can leave a neutron star or black hole, depending on the mass of the star. They are both incredibly dense.

‘Describe’ questions

Example 13: 2022 GCSE Chemistry 1F question 9.7

0 9 . 7 Magnesium oxide is a compound formed from the metal magnesium and the non-metal oxygen.

Describe what happens when a magnesium atom reacts with an oxygen atom.

You should refer to electrons in your answer.

[4 marks]

Magnesium and oxygen do not have a full outer shell. When magnesium reacts with oxygen, the magnesium will transfer ~~8 electrons~~ 2 electrons to oxygen leaving magnesium ~~with a~~ and oxygen with a full outershell as magnesium ~~loses~~ loses 2 electrons and oxygen gains 2 electrons. This then created magnesium oxide.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	magnesium (atom) loses electrons		1	AO2 4.2.1.1 4.2.1.2
	oxygen (atom) gains electrons		1	
	two electrons (are transferred)		1	
	magnesium ions **and** oxide ions are formed	allow Mg^{2+} (ions) **and** O^{2-} (ions) are formed allow magnesium forms positive ions and oxygen forms negative ions allow (both) form a complete outer shell	1	

Example 14: 2019 GCSE Biology 1F question 8.6/1H question 2.6

0 2 . 6 Describe how the human body:

- prevents pathogens from entering (skin, nose, trachea/bronchi, tears)
- defends itself against pathogens inside the body. (HCl in stomach, white blood cells)

[6 marks]

How the body prevents pathogens entering:

The skin acts as a physical barrier and when it is cut, platelets form blood clots to prevent the entry of pathogens. The nose has hairs in it which act as a trap so pathogens cannot enter, and also tears from the tearducts in the eyes produce enzymes which wipe away microorganisms. The trachea and bronchi have cilia which beat and waft up mucus, and the mucus traps pathogens, then the mucus can be swallowed.

How the body defends itself against pathogens inside the body:

When the mucus is swallowed, it enters the stomach which has hydrochloric acid. This acid dissolves and kills the pathogens ~~it~~ in the mucus. Also, the blood contains white blood cells which ~~produce~~ have lymphocytes that produce antibodies that attach to the antigen on the pathogens. The phagocytes engulf the pathogens and destroy them. The white blood cells also secrete antitoxins which neutralise the effect of the toxins from the pathogen.

02.6	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	4.3.1.6 4.3.1.7 AO1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content ***prevents pathogens from entering*** **skin** • tough / dry / dead outer layer • skin acts as a barrier • sebum / oil on (surface of) skin • sebum / oil repels pathogens • scabs form over cuts **or** scabs form a barrier • platelets are involved in forming clots / scab **stomach** • contains (hydrochloric) acid • (HCl) kills bacteria • in food **or** in swallowed mucus **eyes** • produce tears • contains enzymes to kill bacteria • tears are antiseptic **breathing system** • trachea / bronchi / nose produce mucus • mucus is sticky • (mucus) traps bacteria • (mucus) carried away by cilia ***defends itself against pathogens inside the body*** • immune system / white blood cells (WBCs) • WBCs engulf pathogens • antitoxins are produced • (antitoxins) neutralise toxins / poisons (produced by pathogen) • antibodies are produced • (antibodies) help destroy pathogens • memory cells (are formed) • (memory cells give a) more rapid response if pathogen re-enters a **level 2** response should refer to body defence **and** the immune system		

Example 15: 2022 GCSE Trilogy Biology 1H question 5.1

0 5 . 1 Describe the similarities and differences between benign tumours and malignant tumours.

[4 marks]

Benign and Malignant ~~tow~~ tumours are caused by mutations in the DNA, Benign tumours are non-cancerous and can't spread to other parts of the body whereas Malignant tumours are cancerous and ~~can~~ invade other cells in the body and can also travel in the blood stream and create secondary tumours elsewhere in the body. Benign ~~tow~~ tumours are not a risk to life and can be removed easily whereas Malignant ~~ts~~ tumours are life ~~thr~~ threatning and harder to remove.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **four** from: **Similarities:** • result from changes in the cell / DNA / genes • uncontrolled cell growth / division • can form a lump of cells • made up of abnormal cells **Differences:** Malignant tumours: • are made of cancer cells, benign tumours are not **or** benign tumours are made up of cells that are more similar to normal cells • (usually) grow faster than benign tumours • invade neighbouring tissues, but benign tumours do not • can spread (to other parts of the body) but benign tumours stay in one place **or** cells can travel in the blood, but benign tumours do not • can form secondary tumours, benign tumours do not	max **three** marks if only similarities or differences given allow result from mutations allow benign tumours (often) have a layer of covering cells, malignant tumours (usually) do not ignore references to level of harm	4	AO1 4.2.2.7

‘Design/plan/describe a method’ questions

Example 16: 2022 GCSE Physics 2F question 9.1/2H question 2.1

0 2 A student used a ray box to shine a ray of light through air into a glass block.

The student investigated how the angle of refraction varied with the angle of incidence.

Table 1 shows the results.

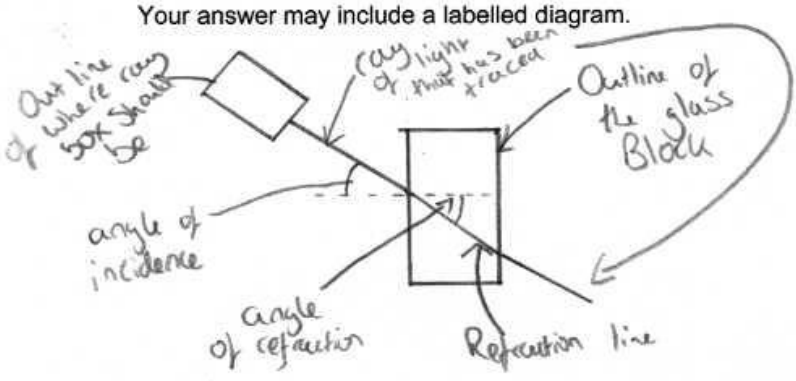
Table 1

Angle of incidence in degrees	Angle of refraction in degrees
10	5
20	10
30	14
40	19
50	23
60	26
70	28
80	29

0 2 . 1 Describe a method the student could have used to obtain the results in **Table 1**.

Your answer may include a labelled diagram.

[6 marks]



A Student firstly should place a block of glass and outline it with a pencil. Then place a ray box on a set angle of 10° to a normal which has been drawn out (normal is perpendicular to outline of glass block)

Draw lines using rulers where the ray of light enters and leaves the glass block. Remove the block and draw a line of refraction which joins up both the ray of light once it enters and exits the block. Extend the normal to the other side of the glass block. Using a protractor measure the angle of refraction, (Angle between the normal and the line of refraction). Repeat with a different angle of incidence. Increase it by 10° until 80°.

Question	Answers	Mark	AO / Spec. Ref.
02.1	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.6.1.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content Some indicative content could be indicated within a labelled diagram • place a glass block on a piece of paper • draw around the glass block • use the ray box to shine a ray of light through the glass block • mark the ray of light entering the glass block • mark the ray of light emerging from the glass block • join the points to show the path of the complete ray through the block • and draw a normal line at 90 degrees to the surface • use a protractor to measure the angle of incidence • use a protractor to measure the angle of refraction • use a ray box to shine a ray of light at a range of different angles (of incidence) • increase the angle of incidence in 10 degree intervals • from an angle of incidence of 10 degrees to an angle of incidence of 80 degrees Methods involving mirrors and reflection score zero		

Example 17: 2022 GCSE Chemistry 1H question 2.1

0 2 . 1 Plan a method to investigate the effect of changing the mass of sodium carbonate powder on the highest temperature reached.

[6 marks]

1. Place a polystyrene cup inside a beaker (so it doesn't fall over). ~~A Acid~~
2. Add 10cm³ of Hydrochloric acid to the cup.
3. Place a thermometer into the cup, with the bulb in the acid. Then add 2g ~~Scm³~~ of sodium carbonate powder.
4. ~~Wait at the~~ Place a plastic lid on top with a hole in for the thermometer, and watch the thermometer and record the highest temperature that it reaches. Use the thermometer to gently stir
5. ~~Rep~~ Rinse and dry the cup, and repeat, using the same volume of Hydrochloric acid but use 4g of sodium carbonate powder.
6. Repeat it for different grams of Sodium carbonate powder going ~~by~~ 4 up in 2g until you reach 20g.
7. Once you reach 20 g, repeat the whole experiment for each temperature 2 more times and find a mean and plot a graph.

Question	Answers	Mark	AO/ Spec. Ref
02.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.5.1.1 RPA 4
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • **measure volume of (hydrochloric) acid** • with a measuring cylinder • pour (hydrochloric) **acid into a suitable container** eg polystyrene cup • measure the initial temperature (of hydrochloric acid) • with a thermometer • **add a known mass of sodium carbonate** • measured with a balance • stir • **measure the highest temperature reached** • **repeat with different masses of sodium carbonate or add successive masses of sodium carbonate to the same mixture** • repeat the whole investigation • use the same starting temperature • use the same volume of (hydrochloric) acid each time • use the same concentration of (hydrochloric) acid each time		

‘Evaluate’ questions

Example 18: 2019 GCSE Biology 2H question 8.5

0 8 . 5 In **Table 3** and **Figure 9** some standard deviations of results overlap.

- An overlap of standard deviations shows the difference between the means is **not** significant.
- **No** overlap of standard deviations shows a significant difference between the means.

A student looked at the scientists' method and the results in **Table 3** and **Figure 9**.

The student stated:

'Metformin works better when used with other drugs.'

Evaluate the student's statement.

[6 marks]

Not He is correct as the mean of metemorphin is lower than metformin plus A or B, However metformin plus B, standard deviation overlaps metemorphin deviation so the differe in means are not significant. So metformin plus B may not be work better than metformin on its own. However metformin plus A has a higher mean and its standard deviation does not overlap with metformin therefore only metformin plus A works much better than metmorfin alone as its mean is higher and that holds significance as the standard deviations don't overlap.

So the Student is correct however he is not specific as only metformin + A works significantly better.

08.5	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content **Pro:** • Met + A gives larger (%) reduction (in blood glucose) than Met alone • so statement is supported • Met + B gives larger (%) reduction (in blood glucose) than Met alone • so statement is supported • Met + A SD does not overlap with Met SD • so difference is significant **Con:** • Met + B SD overlaps with Met SD • so difference is not significant • difference in results could be due to chance --- • number of people used is not very large • number of people in each group is different • so may not be representative **or** may not be repeatable / reproducible • so anomalies will have a bigger impact on smaller groups • 30 minute / starting levels of blood glucose are different • all 30 minute / starting levels are higher in the 2-drug trial • so may cause different % reductions • no information about control variables **or** named eg • concentration of drugs not given / may differ • so results may not be valid for level 3 an inclusion of a discussion of significance is required		4.5.3.2

Example 19: 2022 GCSE Trilogy Physics 2H question 7.3

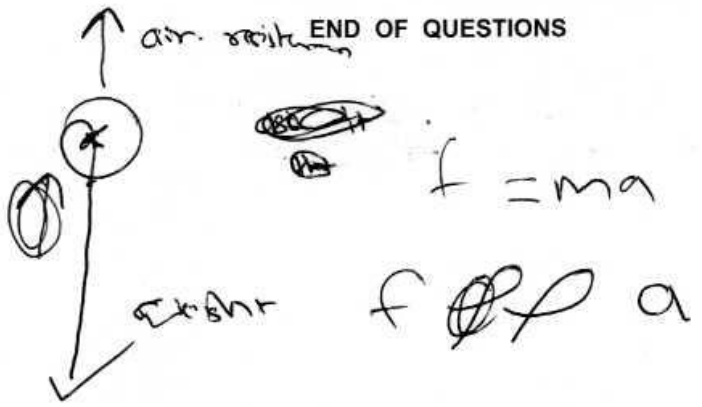
3 In Question **07.2** it was assumed that the acceleration was a constant 9.8 m/s²

Evaluate this assumption.

[4 marks]

This assumption is not accurate because as the apple falls due to it weight, the air resistance comes in play. So the resultant force decreases as, resultant force acceleration The resultant force decreases because of air resistance the acceleration also decreases Therefore there is constant acceleration unless there is not air or its a vacuum

END OF QUESTIONS



Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	as the apple falls / accelerates air resistance increases	allow there is air resistance acting on the apple as it falls	1	AO1 6.5.4.1
	so resultant force decreases		1	
	so acceleration will decrease	MP3 dependent on MP1 or MP2 being awarded	1	
	acceleration will not be constant, so not a good assumption	MP4 dependent on MP1 or MP2 being awarded	1	
	OR			
	the apple only falls for a short time/distance (1)			
	air resistance is negligible (1)			
	so resultant force is constant (1)	MP3 dependent on MP1 or MP2 being awarded		
	therefore acceleration is constant, so good assumption (1)	MP4 dependent on MP1 or MP2 being awarded		

‘Explain’ questions

Example 20: 2022 GCSE Trilogy Biology 1H question 3.7

This is a concise, clear account listing and linking relevant points about the structure of the enzyme (lines 1–3), its substrate (line 1), how the active site is changed by pH above the optimum (lines 3–6 and 8) and the effect that this has on the ability of the substrate to bind to the active site (lines 5–8).

0 3 . 7 Explain how the structure of enzyme molecules is related to the effect of pH on the activity of amylase.

[6 marks]

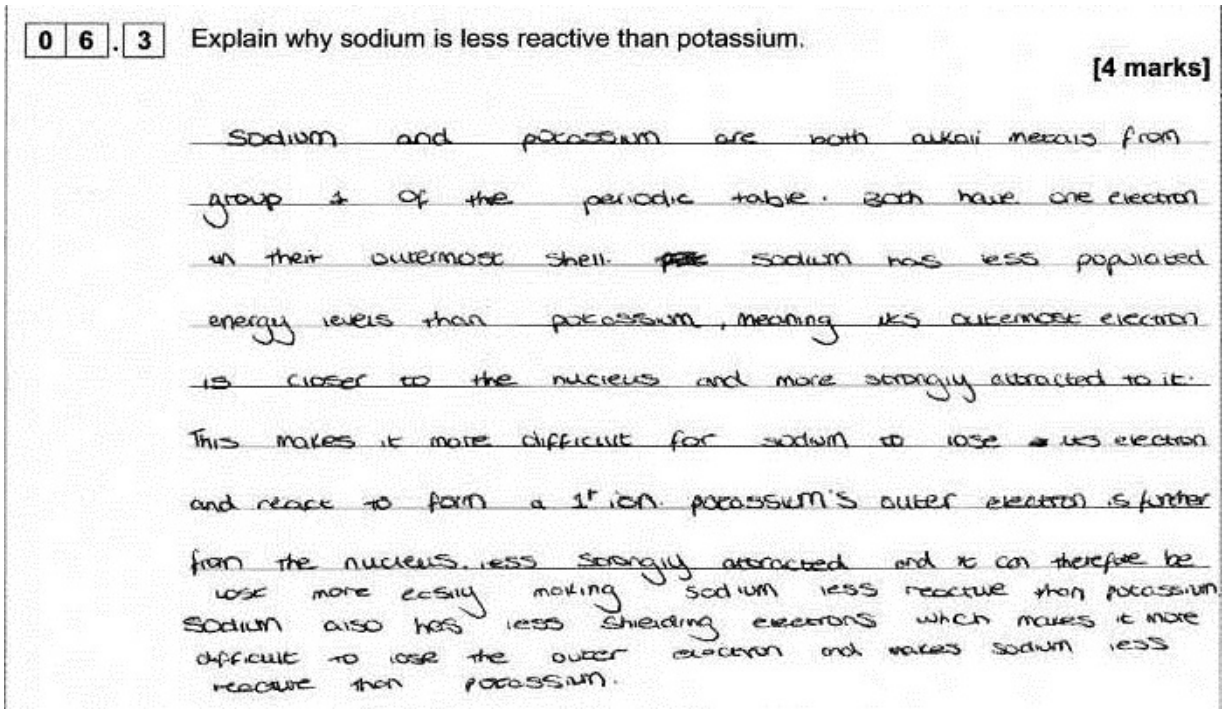
Amylase enzymes have a certain shape which only starch substrates can fit into, when the pH is increased the active site of the enzyme denatures and the starch substrate is unable to fit in the active site so starch is unable to be broken down to glucose. Whereas at the optimum pH, amylase is able to break down starch into glucose fully until so there is no more starch left in the solution.

Question	Answers	Mark	AO / Spec. Ref.
03.7	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content • enzymes are protein molecules • (so) have a 3D structure • lock and key theory • have an active site • (which) has a specific shape • shape of active site will only match shape of substrate • starch is substrate for amylase • at pH values above or below the optimum the shape of active site is changed (in some molecules) • (so) substrate can no longer fit the active site • at extreme pH values enzyme is denatured • (so) shape of active site is changed • (so) amylase can no longer digest starch • (so) rate of digestion decreases For Level 3 reference to enzyme structure and effect of pH on enzyme activity are needed		4.2.2.1

Example 21: 2019 GCSE Trilogy Chemistry 1H question 6.3

0 6 . 3 Explain why sodium is less reactive than potassium.

[4 marks]



06.3	(sodium has) fewer energy levels / shells	allow converse for potassium allow diagrams of electron structure	1	AO1 5.1.2.5
	<u>outer</u> electron / shell is closer to nucleus **or** <u>outer</u> electron / shell is less shielded		1	
	(so) greater attraction between nucleus and outer electron / shell		1	
	(so) outer electron is less easily lost	allow (so) loses an / one electron less easily allow (so) more energy needed to remove an / one electron	1	

Commentaries

Example 11

This question is levels marked. The student has made several comparisons in lines 1, 4–5 and 11–12, has included relevant points for both ground water and waste water and a number of scientifically relevant points for ground water. Although they have not made any scientifically relevant comments regarding waste water, we mark this question holistically and overall it was felt that there is enough correct science here to merit the award of full marks. (See page 20 for a copy of the mark scheme.)

Example 12

This question is levels marked. This student's presentation is different from that of Student B in Example 8, but is equally comprehensive and very clearly expressed. They have given a very clear explanation of star formation, followed by a clear comparison between the two types of stars. (See page 17 for a copy of the mark scheme.)

Example 13

This question is points marked. Students needed to make four clear points about how magnesium and oxygen combine to form magnesium oxide. Marking points 1, 2 and 3 are covered in lines 3 and 4, and again on lines 6 and 7, and the fourth marking point on lines 5 and 6 in a clearly and logically ordered response.

Example 14

The student has carefully addressed the two bullet points in separate paragraphs, in which they have identified scientifically relevant facts about both bodily defence mechanisms and the immune system. They have given scientifically relevant facts in sufficient detail to be clearly in Level 2. Not all of the statements are completely accurate, but there is nothing in this response that contradicts the correct responses and holistically this response is sufficiently accurate to merit being awarded full marks.

Example 15

The student has written a clear account, first identifying a similarity between the tumours on lines 1 and 2, which addresses bullet point 1. They then go on to give three differences between the types of tumour: lines 3–6 (addressing bullet point 5), lines 2–4 and 8 (addressing bullet point 8) and addressing bullet point 9 by implying a comparison between malignant tumours causing secondary tumours and benign tumours not causing secondary tumours by the word 'whereas' in line 5. The account is logically structured and easy to follow.

Example 16

The student has given a clearly labelled diagram, which includes most of the detail needed. The written account supplements this diagram with details of the angles to be used, resulting in a clear and logically sequenced method which would lead to a valid outcome.

Example 17

The student has given a series of numbered steps, which helps them to sequence the method clearly. They have identified the key steps in the method as outlined in the indicative content (volume of acid, step 2; suitable container, step 1; adding known mass of sodium carbonate, step 3; measure highest temperature reached, step 4; repeat using different masses of sodium

carbonate, step 6). They have included a control variable (volume of acid; step 5) and use of appropriate equipment throughout.

Example 18

The student has given a judgement in their first sentence ('He is correct'), and has supported their judgement with correct statements regarding the difference in means of Metformin alone of plus A or B and whether they support or do not support the statement. They have included discussion of significance for each set of results (lines 6, 14 and 17).

Example 19

The command word is 'evaluate' so a judgement is expected (MP4). They have written a clear account of why they think the assumption is not a good one, referring to air resistance (line 3; matches 'allow' for MP1), the resultant force decreasing (MP2; line 4) and acceleration decreasing (MP3; line 7). They have clearly linked back to the assumption, but it would have been acceptable for them to just state that acceleration is not constant (ie not always 9.8) as in their final sentence.

Example 20

This is a concise, clear account listing and linking relevant points about the structure of the enzyme (lines 1–3), its substrate (line 1), how the active site is changed by pH above the optimum (lines 3–6 and 8) and the effect that this has on the ability of the substrate to bind to the active site (lines 5–8).

Example 21

The student has written a clear and easy to follow account of the differences in reactivity, talking first about sodium: the difference in number of electron shells (MP1; lines 3–4), the effect this has on the attraction of the outermost electron to the nucleus (MP2; lines 4–5 and MP3; line 5) and therefore the ease with which the electron is lost (MP4; line 6). They then explain the converse argument for potassium, which is not needed as the explanation for sodium is clear – however, what they have said is correct and does not contradict their earlier statements.

Resources

Below are the links to the resources mentioned in the presentation.

AQA Focus on Success packs:

- Extended response
- Scientific literacy

Virtual Communities Spring 2021 (Understanding key command words in GCSE sciences)

Marking guidance scripts (Centre Services)

Exampro Highlights

Notes

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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