AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.1.3.1

Diffusion

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**2**
Available paper years	**2019–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.1.3.1 Diffusion

Answer 01 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	protist		1	AO1 4.3.1.5
04.2	any **two** methods with reason from: • Method: insecticides Reason: to kill mosquitos / vector • Method: (mosquito) nets Reason: to avoid being bitten • Method: insect repellents Reason: less likely to be bitten • Method: vaccination Reason: so people are immune (to malaria) • Method: anti-malaria tablets Reason: kills the pathogen / protist	1 mark for method and 1 mark for a correctly linked reason ignore kill insects unqualified allow long clothing ignore acts as a physical barrier allow DEET or named insect repellent allow named anti-malarial e.g. Larium / Malarone allow antibiotics allow ecf from 04.1 ignore kills malaria allow Method: drain swampy ground **or** remove pots of water **or** put oil on water / pond Reason: fewer breeding grounds for mosquitos allow Method: release GM / sterile mosquitos Reason: prevent / reduce reproduction if no other marks awarded allow **1** mark for kill mosquitos	4	AO1 4.3.1.1 4.3.1.5 4.3.1.7

4.1.3.1 Diffusion

Answer 01 · Mark scheme

June 2019 | 8464/B/1H | Original Q4

04.3	any **two** from: (bacterial cell): does not have a nucleus has plasmids is smaller	 allow DNA is free in cytoplasm allow has a single loop of DNA allow has a single strand of DNA allow description, e.g. (small) ring(s) of DNA allow bacterial cells do not have mitochondria **or** do not have membrane bound organelles allow bacteria have smaller ribosomes ignore bacterial cells do not have chloroplasts	2	AO1 4.1.1.1
04.4	to allow air / oxygen in for bacteria to respire **or** so bacteria can respire aerobically	allow to allow carbon dioxide produced in respiration to escape	1	AO3 4.4.2.1

4.1.3.1 Diffusion

Answer 01 · Mark scheme

04.5	(A) (no change in population size) because no / limited cell division / reproduction	allow (no change in population size) because bacteria / cells adjusting to environment / culture conditions ignore reference to growth unqualified	1	AO2 4.1.2.2 4.3.1.1 4.4.2.1 4.4.2.3
	(B) (rapid increase in population size) as cells dividing rapidly as (plentiful) supply of nutrients / food	allow rapid binary fission as (plentiful) supply of nutrients / food	1	
	(C) (population size stays the same) as rate of cell death equals rate of cell division		1	
	(D) (population size decreasing) as cells dying due to nutrients running out **or** (population size decreasing) as cells dying due to toxins / carbon dioxide / cell wastes building up (in solution)		1	

4.1.3.1 Diffusion

Answer 01 · Mark scheme

June 2019 | 8464/B/1H | Original Q4

04.6		a ratio of 30 000:1 for **X and** 0.55:1 for **Y** scores 3 marks		4.1.3.1
	(SA: vol ratio of **X** =) 2.4×10^{-7} **:** 8×10^{-12} **or** 0.000 000 24 **:** 0.000 000 000 008	if no other calculation marks awarded allow 1 mark for calculation of SA for **X and Y** **or** calculation of volume for **X and Y** **or** calculation of SA **and** volume for one **or** both cubes if not given as a ratio	1	AO2
	(SA: vol ratio of **Y** =) 726:1331		1	AO2
	conversion to same scale: 30 000:1 **and** 0.55:1		1	AO2
	(so) diffusion distance is longer in multicellular organism **or** (so) volume supplied by each unit of surface area is greater in multicellular organism	allow converse allow converse allow idea that some cells will have no surfaces exposed to outside in multicellular organism	1	AO1
	(so) diffusion rate per unit volume is slower in a multicellular organism	allow converse	1	AO2
Total			**17**	

4.1.3.1 Diffusion

Answer 01 · Mark scheme

June 2019 | 8464/B/1H | Original Q4

4.1.3.1 Diffusion

Answer 02 · Mark scheme

June 2024 | 8464/B/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	pituitary		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	increased blood flow to muscles		1	AO1 4.5.3.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	receptor(s) (cells / neurones)	allow sensory (cells / neurones)	1	AO1 4.5.1

4.1.3.1 Diffusion

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4		allow converse if clearly describing people who do not have diabetes		
	blood glucose (concentration) varies more (than in people who do not have diabetes)	allow blood glucose (concentration) increases / decreases more allow blood glucose (concentration) goes very high allow to get a sufficient range of blood glucose (concentrations)	1	AO2 4.5.3.2
	(because) less / no insulin produced when blood glucose (concentration) increases **or** (because) less / no insulin produced to decrease blood glucose (concentration)		1	

4.1.3.1 Diffusion

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	any **two** from: • prior familiarity with reaction time test • type of (reaction time) test • insulin (injections) • example of named drug (that would affect reaction time) • amount of sleep • distractions	ignore health unqualified allow practice allow description of part of a reaction time test to control eg which hand is used to catch the ruler ignore caffeine / alcohol allow tiredness / sleep	2	AO1 4.5.3.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	low / high blood glucose (concentration) is dangerous / unsafe	allow (to monitor for) unconsciousness / coma / headache / dizziness ignore hypoglycaemia / hyperglycaemia unqualified	1	AO3 4.5.3.2

4.1.3.1 Diffusion

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	lowest reaction times recorded in (range of) blood glucose (concentration) found in people who do not have diabetes	allow high **and** low blood glucose (concentration) increase (mean) reaction time allow lowest reaction times recorded in range 4.0 to 7.8 ($mmol/dm^3$)	1	AO3
	homeostasis keeps blood glucose (concentration) in a narrow / small range **or** low(er) reaction times are a survival advantage		1	AO2 4.5.1 4.5.3.2

4.1.3.1 Diffusion

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	when blood glucose (concentration) increases the pancreas releases insulin	allow when blood glucose (concentration) is / nears 7.8 ($mmol/dm^3$) the pancreas releases insulin allow when blood glucose (concentration) is high the pancreas releases insulin	1	AO1 4.5.1 4.5.3.2
	(insulin causes) glucose to move (from the blood) into the liver / muscle (cells)	if neither mark awarded allow **1** mark for glucose moves into cells	1	
	in (liver / muscle) (excess) glucose is converted to glycogen		1	
	when blood glucose (concentration) decreases the pancreas releases glucagon	allow when blood glucose (concentration) is / nears 4.0 ($mmol/dm^3$) the pancreas releases glucagon allow when blood glucose (concentration) is low the pancreas releases glucagon	1	
	(glucagon causes) glycogen to be converted into glucose and released into the blood	allow (glucagon causes) glycogen to be converted into glucose which increases blood glucose (concentration)	1	

4.1.3.1 Diffusion

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.9		allow electrical signal for impulse throughout ignore signal / message		
	any **two** from: (if more chemical produced / present) • diffusion of chemical (across synapse) is faster		2	AO2 AO3 4.5.2
	• an impulse in relay / motor / next neurone is more likely	allow an impulse in relay / motor / next neurone is faster / stronger / bigger allow there will be more impulses in relay / motor / next neurone(s)		
	• an impulse is more likely to reach muscle	allow an impulse reaches muscle in less time allow an impulse reaches muscle faster allow bigger impulse causes faster muscle contraction		

Total Question 6	17

4.1.3.1 Diffusion

Answer 01 · Examiner comments

June 2019 | 8464/B/1H | Original Q4

Question 4 (standard, standard/high & high demand)

04.1 About 66% of students knew that malaria is caused by a protist. The most common incorrect response was virus.

04.2 Students were asked to give two methods used to prevent people catching malaria, with a reason or explanation for how each method would work. Around 65% of students gained two or more marks.

All marking points in the mark scheme were seen. Most students referred to the use of mosquito nets, but did not always gain the reason mark. A reference to avoiding being bitten, not just to there being a physical barrier, was required. Vaccination was also given as a method, but some struggled to explain how this would work.

There was confusion between antigens, antibodies and phagocytes. Many referred to the body being able to fight off the pathogen, which we always ignore. Some students confused insecticides and insect repellents. The insecticide kills the mosquito, but the repellent just reduces the chance of being bitten. Vague references to bug spray were not credited.

Some students had learnt various methods to reduce the breeding grounds for mosquitos, or talked about GM mosquitos. These were all given credit.

Some students did not appreciate that malaria is not passed from person to person. Some talked about isolating people, hygiene or protected sex, which were incorrect.

04.3 All the marking points on the mark scheme were seen. Most students gained a mark for saying a bacterial cell does not have a nucleus. 34% of students gained both marks.

4.1.3.1 Diffusion

Answer 01 · Examiner comments

04.4 Around 16% of students scored the mark for this challenging question. Students had to relate air, oxygen or carbon dioxide to respiration. Simply saying air had to get in to the bottle was insufficient at this level of demand.

Many said the bacteria needed air to grow, reproduce or survive. These were all insufficient. There were some confused responses, saying bacteria had to be able to enter the bottle through the holes.

04.5 The question required students to apply their knowledge from different parts of the specification to cell division and survival. Over half of the students gained one or more marks. Many students just described the sections of the graph, but did not give reasons for changes in the number of living bacterial cells.

Marking points 1 and 4 were seen most often:

- In stage A, a reference to the bacterial cells dividing slowly, or the cells adjusting to the culture conditions was needed.
- In stage B, many students either referred to the rapid rate of cell division or the plentiful supply of nutrients, but both aspects were needed to gain the mark.
- Only a few students explained why the population remained constant in stage C.
- The reason why the population decreased in stage D was often well expressed. This was usually in terms of nutrients running out rather than the build-up of wastes in the solution.

04.6 In this tough question, about 11% of students scored two or more marks, whilst about 32% scored one mark. This question differentiated across the ability range of students well.

The question stated that calculations must be included, but many students did not attempt any. Three of the five marks were for calculations. Two of these were for calculating the surface area:volume ratio for each cube. Some students calculated the surface area and volume, but did not write them as a ratio. Others forgot to multiply the surface area of one face by 6. The third calculation mark, for converting the two ratios to the same scale, was rarely seen.

If no calculation marks were gained, there was a compensation mark for calculating the total surface area of both cubes, calculating the volume of both cubes or calculating the surface area and volume of one cube when they had not written it as a ratio. Most students who had attempted to do calculations gained a compensation mark.

There were many confused explanations. Quite a lot said active transport would have to be used by the multicellular organism. Many realised that the surface area of cube Y is larger than the surface area of cube X, but did not relate this to the volume. Others thought that cell Y was 55 000 times larger than cell X, which was incorrect.

4.1.3.1 Diffusion

Answer 02 · Examiner comments

Question 6 (standard, standard/high & high demand)

06.1 Nearly all students could identify that the pituitary gland releases hormones to control other glands.

06.2 Most students knew that adrenaline increases blood flow to muscles.

06.3 Most students could give the correct answer of receptor or sensory neurone/cell.

Some students were unaware that receptors that respond to stimulus are types of cells. Common incorrect answers were red blood cells, white blood cells, effector, muscle, named organs and nerve cells or neurones unqualified.

06.4 Very few students gained 2 marks. Many students stated that blood glucose goes up or is high in people with diabetes, but this is also true of people without diabetes, so the mark could not be awarded. The answer needed to be comparative.

Many students simply stated that people with diabetes do not produce enough insulin. This did not go far enough for either mark to be awarded.

Some students demonstrated confusion between Type 1 and Type 2 diabetes. Other students tried to answer in terms of how reaction time would be affected rather than blood glucose concentration.

Confusion was evident in terms of incorrect responses stating that 'insulin breaks down into glucose', or 'people with diabetes don't produce enough glucose'.

The answers to this question highlighted that many students did not understand the biological basis of diabetes. Common misconceptions included:

- people with Type 1 diabetes cannot make their own glucose (and this was sometimes followed by comments implying it is therefore safer for people with diabetes to drink glucose)
- glucose is the same as insulin
- insulin is converted to glucose
- insulin is converted to glycogen
- a lack of insulin means blood glucose concentration is lower.

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4.1.3.1 Diffusion

Answer 02 · Examiner comments

06.5 The most frequent correct responses related to amount of sleep or minimising distractions.

Common misinterpretations of the question referred to controlling the volume or concentration of glucose solution. Students should take care to read all the information provided. Different volumes or concentrations of glucose solutions would be necessary to change the independent variable. Food and drink were controlled, so references to controlling caffeine and alcohol intake could not be credited.

Many students assumed the reaction time test was the ruler drop test. If they described a suitable control variable, such as 'using dominant hand to catch the ruler' this was credited, but often these attempts at control variables were incorrect, such as 'same ruler' or 'same person dropping the ruler'.

06.6 Some students incorrectly interpreted the question as being an issue with recording accurate results. Many responses did not go far enough to be awarded the mark, such as 'blood glucose goes too high' without giving a reason why this is problematic. Common incorrect responses were too vague, such as 'in case they fell ill' or 'to give insulin injections'.

Some students suggested the health of the patient would affect the results/reaction times in the experiment, rather than considering the risk to the person with diabetes. These were not awarded the mark.

There were some good answers in which the students understood that both low and high blood glucose concentration are dangerous.

06.7 Students found this question challenging. Many simply defined homeostasis rather than answering the question. Some students approached the right idea but were imprecise with their language, such as 'faster/slower reaction times' indicating confusion between reactions, reaction times and the time recorded. Students need to be careful they are not describing time as speeding up or slowing down, which is not possible. Reactions can be faster but not reaction times.

Some students did identify that reaction times in the range for people without diabetes were lower but did not go far enough to state lowest. Similarly, some identified high blood glucose concentration increased reaction time but did not refer to low blood glucose concentration.

06.8 Many students are confused between glucose, glycogen, glucagon. Glycerol was also seen. Hybrid spellings between these terms was common and whilst phonetic spelling is acceptable, marks cannot be credited where there is ambiguity between technical terms.

Common misconceptions were that insulin or glucagon are broken down into glucose. For marking point 1, students often missed mention of the pancreas, in which case the mark would not be awarded. Few students gave marking point 2.

Some students misunderstood the question and described how people with diabetes control their blood sugar levels through diet and exercise.

Students sometimes spend time starting this style of question by re-writing the question. This is not necessary.

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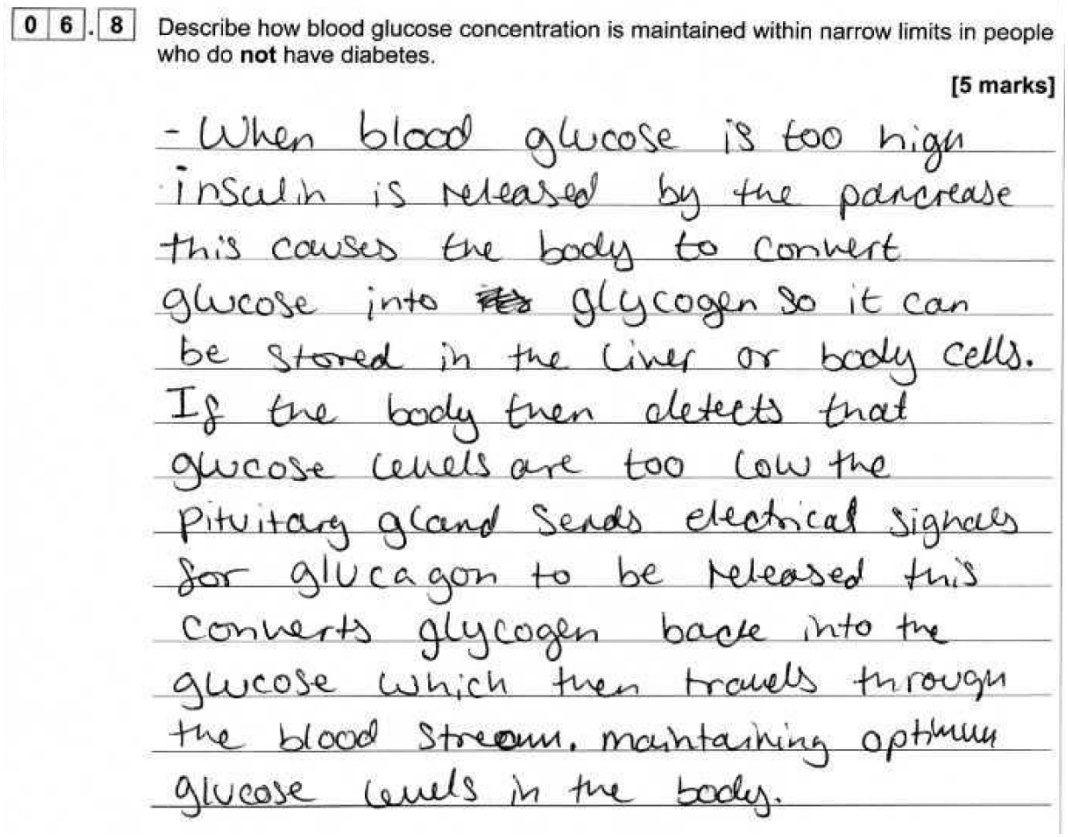
4.1.3.1 Diffusion

Answer 02 · Examiner comments June 2024 | 8464/B/2H | Original Q6

0 6 . 8 Describe how blood glucose concentration is maintained within narrow limits in people who do **not** have diabetes.

[5 marks]


- When blood glucose is too high insulin is released by the pancrease this causes the body to convert glucose into ~~FES~~ glycogen so it can be stored in the liver or body cells. If the body then detects that glucose levels are too low the Pituitary gland sends electrical signals for glucagon to be released this converts glycogen back into the glucose which then travels through the blood stream, maintaining optimum glucose levels in the body.

The student has given marking points 1 and 3. 'Pancrease' is given benefit of the doubt as a phonetic spelling of pancreas.

The student is not clear whether glucose or glycogen is entering liver cells, therefore marking point 2 cannot be awarded.

The student has not referred to where glucagon is released from when blood glucose concentration decreases, therefore marking point 4 cannot be given.

Marking point 5 is given, so the student gains 3 marks for this question.

06.9 Many students answered as if the reaction time has increased, despite the question. For the first marking point, many stated that the increase in chemical would decrease the rate of diffusion, or 'overwhelm' the body. Few students made appropriate mention of impulses. Very few students could link the role of the diffusion of chemicals to impulses in the next/motor/relay neurone.

There was frequent use of incorrect terminology, such as:

- electrical impulses travelling across a synapse
- chemical impulses travelling across a synapse
- chemicals diffusing down neurones
- neurones moving from receptors to effectors.

Although it's beyond the specification, the term 'neurotransmitters' was seen and could be used.

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4.1.3.1 Diffusion

Contact us

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