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GCSE (9-1)

Examiners' report

TWENTY FIRST CENTURY SCIENCE COMBINED SCIENCE B

J260
For first teaching in 2016

J260/01 Summer 2019 series

Version 1

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper 1 series overview

J260/01 is the Biology Foundation paper for the new examination for GCSE (9-1) Combined Science B (Twenty First Century Science). The examination covered topics B1 to B6 plus ideas about science and practical skills. To do well on this paper, candidates need to be comfortable applying their knowledge and understanding of scientific principles. They must also be familiar with a range of practical equipment and techniques. Most candidates made a good attempt at answering all the questions and limited their responses to the available spaces. The paper was challenging and discriminated well between candidates. There was no evidence that candidates ran out of time on this paper.

Candidate performance overview

Candidates who did well on this paper generally did the following:

• Produced clear and concise responses for the Level of Response question and could identify the differences between normal red blood cells and sickle cells, e.g. 3(b)(i).

• Applied knowledge of antibodies to include shape and fit to the virus proteins in 6(c).

• Performed calculations to the correct rubric, e.g. percentage to one decimal place in 6(d)(i)

• Could calculate how many times bigger an image was in 6(e)(ii)

• Understood the term positive correlation in 6(f)(ii)

• Could identify control variables in an investigation, e.g. 7(c).

Candidates who did less well on this paper generally did the following:

• Produced responses that lacked depth and sometimes simply repeated the information provided, e.g. 2(c)(i), 3(b)(i) and 7(d)

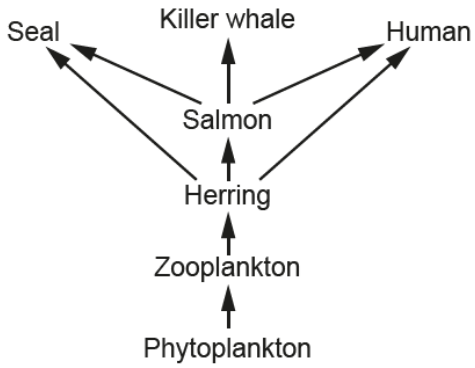
• Found the calculations difficult to access, e.g. 6(d)(i), 6(d)(ii), 6(e)(ii).

• Could not identify the movement of oxygen and carbon dioxide correctly in 4(b).

Question 1 (a) (i)

1 Herring are a type of fish. They live in the North Sea.

(a) The diagram shows a food web for the North Sea.



(i) Draw lines to connect each **organism**, below, to its **role** in the food web.

Organism	Role
Herring	1st consumer
Phytoplankton	2nd consumer
Zooplankton	Producer

[2]

In this question candidates were being tested on their ability to understand a food web and identify the different roles within it. More than half of the candidates gained full marks. When only one mark was gained it was due to making the correct connection from phytoplankton to producer, and then incorrectly connecting the herring and zooplankton to their roles.

Question 1 (a) (ii)

(ii) Write down the names of the **three** animals in the food web that eat herring.

1 .....

2 .....

3 .....

[2]

Many candidates could successfully follow the feeding relationship to identify the three animals that eat the herring. The most common incorrect answer seen was killer whales. This was read when candidates followed the herring to salmon arrows upwards. Some candidates did not use the food web provided but made other suggestions of animals that may eat herring.

Question 1 (b) (i)

(b) Biomass is passed along a food chain when organisms are eaten.

(i) Biomass is made by photosynthesis.

Complete the word equation for photosynthesis.

carbon dioxide + ... $\xrightarrow[\text{chlorophyll}]{\text{sunlight}}$ oxygen + ...

[2]

Half the candidates knew that water was a reactant and carbon dioxide was made in photosynthesis. Most of the incorrect answers were due to getting the answers the wrong way around.

Question 1 (b) (ii)

(ii) The sentences describe photosynthesis.

Put a (ring) around the correct choice to complete each sentence.

Light is needed for **the first** / **the second** / **both** stage(s) of photosynthesis.

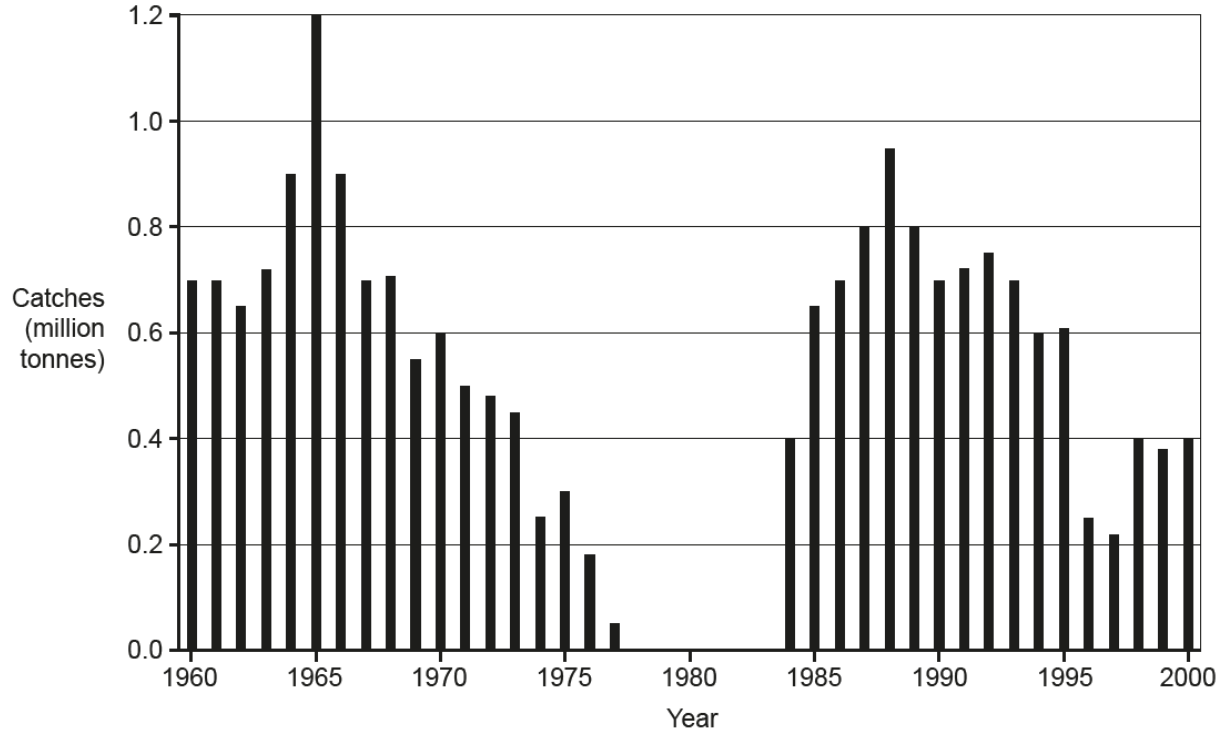
Photosynthesis is **endothermic** / **exothermic** / **respiration** because it uses energy from the Sun.

[2]

This question required knowledge about photosynthesis as a reaction. Many candidates did not know that light is only required in the first stage. Nearly half the candidates gained one mark, and this was mainly for knowing that photosynthesis is endothermic.

Question 1 (c)

The bar chart shows how many herring were caught from the North Sea each year from 1960 to 2000.



(c) Read the statements about the graph.

Tick (✓) **true** or **false** for each statement.

Statement	True	False
Catches of over 0.8 million tonnes are recorded for 4 years.		
No herring were caught between 1978 and 1983.		
Recorded catches are always between 0.2 and 1.0 million tonnes.		

[3]

Most of the candidates gained 2 or 3 marks on this question. The most common error was for suggesting that catches of over 0.8 million tonnes recorded for 4 years was false.

Question 1 (d)

(d) Since 1998 the fishing of herring from the North Sea has been described as sustainable.

Which statements are true for **sustainable** fishing of herring?

Tick (✓) **two** boxes.

Future generations could continue fishing without wiping out the herring population.	☐
It causes the herring population to decrease over a number of years.	☐
The herring reproduce fast enough to replace all the herring that are caught.	☐
The herring that are caught are recycled.	☐
The number of herring caught has to be exactly the same each year.	☐
The number of herring caught is very low.	☐

[2]

Most candidates ticked two boxes as asked to do in the question. Many correctly knew that 'the herring reproduce fast enough to replace all the herring that are caught' which gained one mark. The most common incorrect box ticked was for 'the number of herrings caught is very low'.

Question 2 (a)

2 Sarah is studying the cell cycle in a chicken embryo.

She makes a slide of some cells from the embryo. She looks at the slide using a light microscope.

Fig. 2.1 shows what she sees.

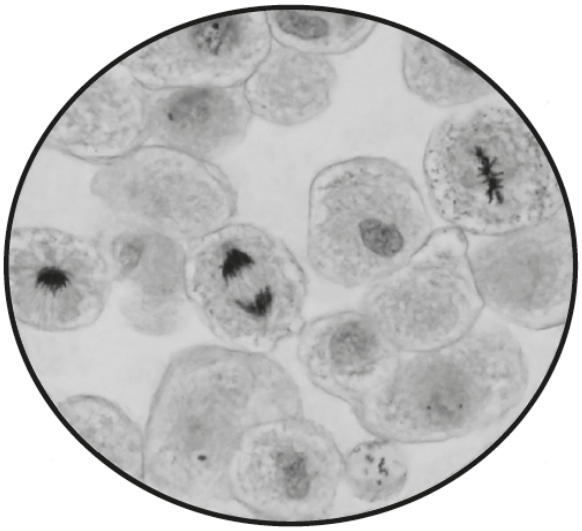


Fig. 2.1

(a) How many of the 20 visible cells are in mitosis in **Fig. 2.1**?

.....

[1]

There was a wide range of numbers given by candidates. Many counted all the cells that had a nucleus, so 10 and 12 were common incorrect answers, however answers ranging from 1 to 20 were seen.

	AfL	Teachers should highlight that chromosomes are only seen when a cell is undergoing cell division such as mitosis and meiosis. Using slides of the stained chromosomes in the allium root tip could be used to show the difference between these cells.

Question 2 (b) (i)

(b) (i) The field of view and the magnification change depending on the combination of eyepiece lens and objective lens used.

(ii) Put a ring around the combination of lenses that produces the largest field of view.

Eyepiece lens	Objective lens
×10	×20
×15	×20
×10	×40
×15	×40

[1]

Question 2 (b) (ii)

To get to the answer in both 2(b)(i) and 2(b)(ii) the candidates had to know how to calculate magnification and understand the term field of view. Of the candidates that gained marks some multiplied the eyepiece lens and objective lens and noted their answer alongside each row. This was a good technique that enabled them to choose the correct combination for 2(b)(i). Many candidates then incorrectly chose the largest total magnification as producing the largest field of view.

Question 2 (b) (iii)

(iii) When making the slide Sarah added a coloured chemical called methylene blue.

Explain why.

.....

..... **[1]**

This question proved to be very challenging. Many candidates understood that methylene blue was used to stain or see something, but most said to see the cells. Candidates were not aware that the stain was used to make specifically the nucleus, chromosomes or DNA visible.

Question 2 (c) (i)

(c) Chicken embryos develop inside an egg with a hard shell.

Fig. 2.2 shows some structures in a chicken egg.

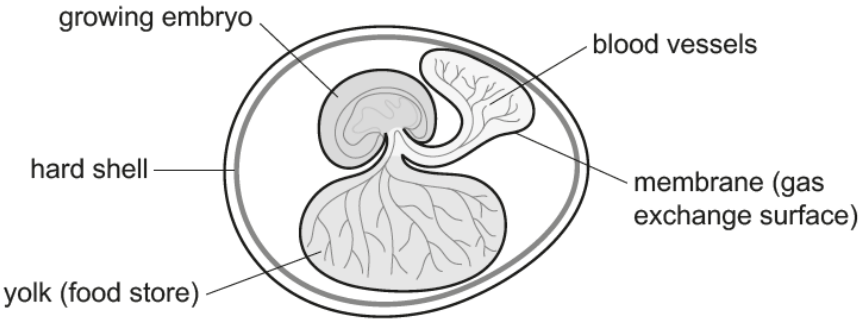


Fig. 2.2

(i) Suggest **two** ways that the gas exchange surface is similar in humans and chicken eggs.

1 .....

.....

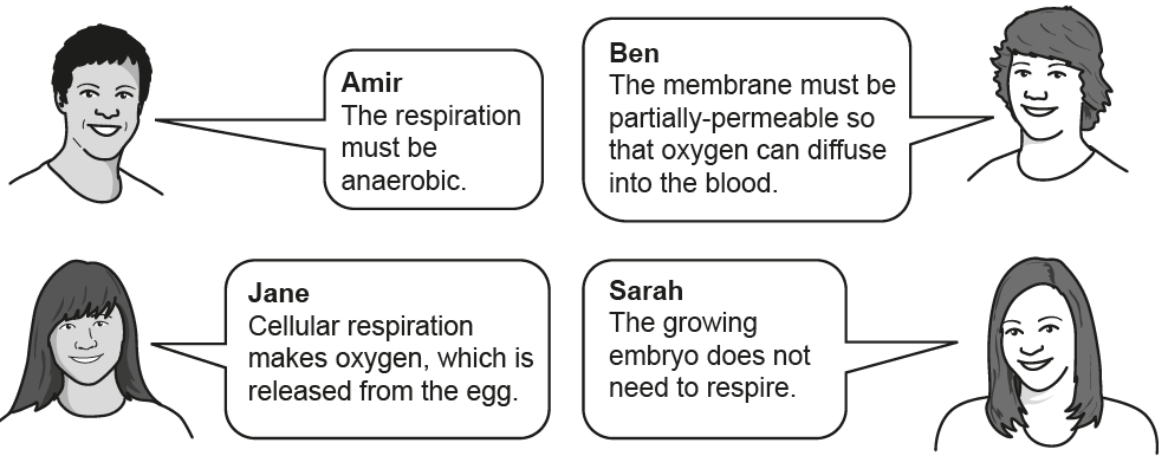
2 .....

..... **[2]**

Most candidates were able to pick out the blood vessels and/or the membrane as being common in the gas exchange surface of humans and the chicken eggs. They didn't then take the extra step of suggesting how they were similar, so no marks were gained. The most common correct responses were for either partially permeable or thin membranes or a large surface area.

Question 2 (c) (ii)

(ii) Sarah and some of her friends discuss cellular respiration in the chicken embryo.



Who is correct?

Tick (✓) **one** box.

Amir ☐

Ben ☐

Jane ☐

Sarah ☐

[1]

At least half the candidates correctly identified Ben, with Amir or Jane being the most common incorrect answers.

Question 3 (a) (i)

3 Sickle cell disease is an inherited condition.

(a) Sickle cell disease is caused by a single gene. A person will only have sickle cell disease if they inherit a faulty allele of this gene from both parents.

(i) Two parents do **not** have sickle cell disease. These parents can have a child that **does have** sickle cell disease.

Complete the Punnett square in **Fig. 3.1** to explain how this is possible.

Use:

a to represent a sickle cell disease allele

A to represent a normal allele.

		father	
	gametes / gametes	**A**	**a**
mother			

Fig. 3.1

[2]

Question 3 (a) (ii)

(ii) Put a (ring) around the heterozygous fertilised eggs in the Punnett square in **Fig. 3.1**.

[1]

This question required knowledge on the inheritance of sickle cell disease and how to use a Punnett square. Many candidates had this skill and gained marks in 3(a)(i) for using the correct letter to complete the mother's gametes and then the offspring. If an error was made on the gametes, then an error carried forward mark was gained for the offspring. Despite a correct Punnett square, at least a quarter of candidates omitted to answer 3(a)(ii) suggesting that they did not see the question and only a third of candidates knew that Aa was heterozygous.

Question 3 (a) (iii)

(iii) What is the probability that these parents in **Fig. 3.1** will have a child that has sickle cell disease?

Tick (✓) **one** box.

0.25 ☐

0.5 ☐

0.75 ☐

1 ☐

[1]

At least half of the candidates understood that the sickle cell allele was recessive and ticked 0.25. The most common incorrect answer was 0.75.

Question 3 (b) (i)

(b) People with sickle cell disease have differences in their red blood cells. They are often treated by being given extra oxygen.

Fig. 3.2 shows red blood cells from two different people. The drawing shows the same volume of blood from each person.

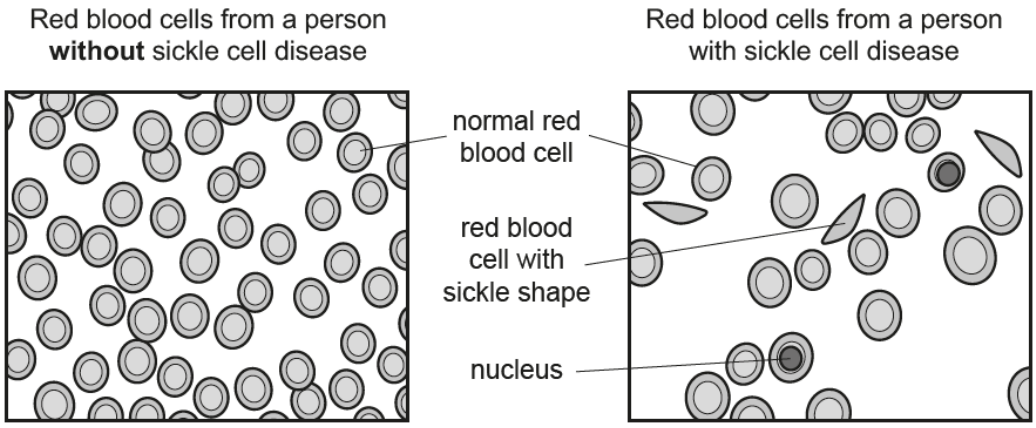


Fig. 3.2

(i)* Look at the differences in the red blood cells of people with and without sickle cell disease in **Fig. 3.2**.

Explain how normal red blood cells are adapted to carry oxygen **and** suggest why people with sickle cell disease often need to be given extra oxygen.

.....

.....

.....

.....

.....

..... **[6]**

This was the six-mark Level of Response question. It required knowledge and understanding of the adaptations of normal red blood cells. Candidates had to use Fig. 3.2 to identify the differences between the normal red blood cells and those with sickle cell disease. Many candidates secured marks at Level 1 by describing a red blood cell with no nucleus or identifying there were more of them, or by suggesting that sickle cells had a nucleus or were a different shape. Responses that could compare the features of both cells gained Level 2. There were few responses that could link these differences to the reduced oxygen carrying capacity of the sickle cells for Level 3, as many candidates just repeated the question of the need for extra oxygen.

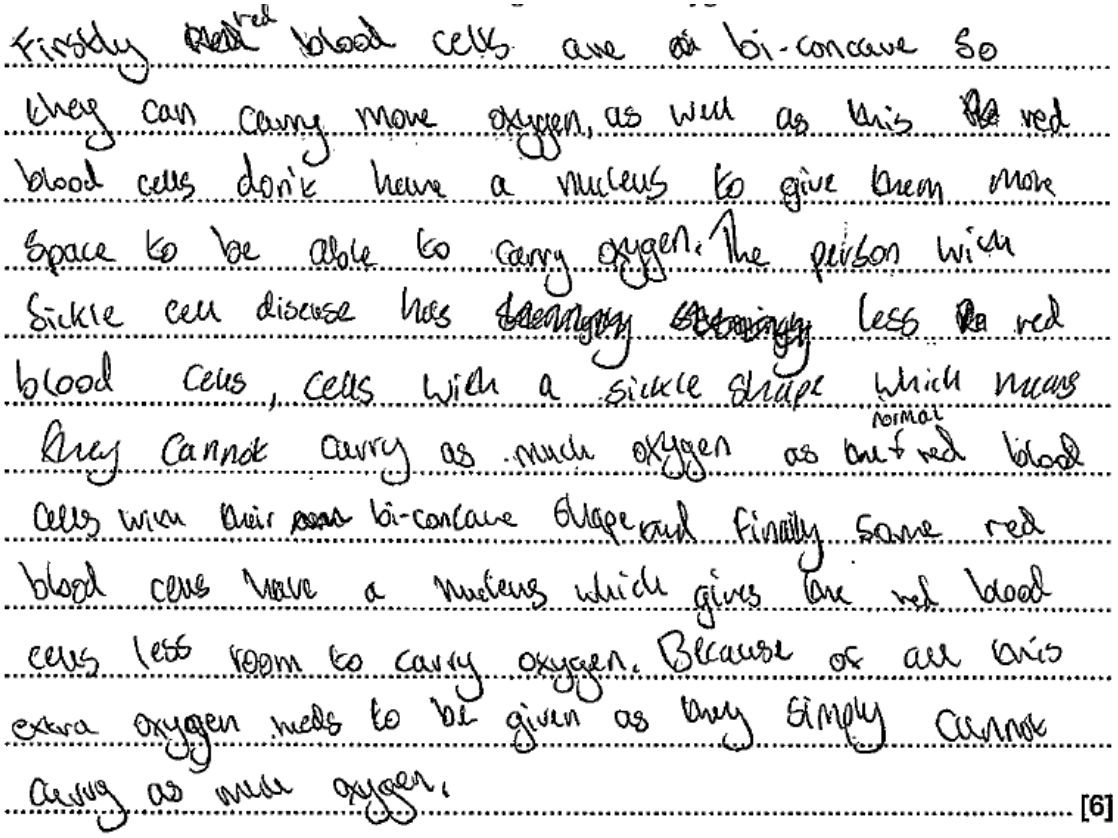
Exemplar 1

Normal red blood cells don't have a nucleus to allow them to carry more oxygen. They are also round and the same shape to allow as many into a small space as possible. They have less gaps inbetween each cell. They also have thinner walls to try and absorb as much oxygen as possible in normal cells.

[6]

This candidate gained Level 1, 2 marks. They gave some correct adaptations of normal red blood cells but did not compare them to the sickle cells to identify the differences between them.

Exemplar 2



Firstly ~~red~~ red blood cells are bi-concave so they can carry more oxygen, as well as this ~~the~~ red blood cells don't have a nucleus to give them more space to be able to carry oxygen. The person with sickle cell disease has ~~[illegible]~~ less ~~the~~ red blood cells, cells with a sickle shape which means they cannot carry as much oxygen as our normal red blood cells with their bi-concave shape and finally some red blood cells have a nucleus which gives the red blood cells less room to carry oxygen. Because of all this extra oxygen needs to be given as they simply cannot carry as much oxygen. [6]

This candidate gained full marks, Level 3, 6 marks. They have correctly identified some adaptations of a normal red blood cell and explained these adaptations. They have then given the differences they can see between the normal red blood cells and sickle cells and linked these to the sickle cells not being able to carry as much oxygen.

?	**Misconception**	Many candidates thought that the dip or biconcave shape was where the oxygen was carried. Some thought that a large surface area was linked to an increase in oxygen carrying capacity.

Question 3 (b) (ii)

(ii) Red blood cells contain a protein called haemoglobin. Red blood cells are made from stem cells in the bone marrow.

The sentences below explain why only these stem cells can make haemoglobin.

Use words from the list to complete the sentences.
Each word or phrase can be used once, more than once or not at all.

amino acids

carbohydrates

deleted

genes

not present

proteins

switched on

switched off

Every human body cell nucleus contains instructions to make ..... .

These instructions are called ..... .

In red blood stem cells the instructions give the order of ..... needed to make haemoglobin.

Other body cells cannot make haemoglobin because the instructions are

..... .

[4]

This question required knowledge of gene expression and making proteins. Most candidates gained at least one mark. Some mixed up proteins, genes and amino acids in the first three sentences. Not present was the most common incorrect answer for the fourth sentence.

Question 3 (c) (i)

(c) In 2017 scientists claimed to have found a cure for sickle cell disease. The cure used stem cells. The stem cells were taken from a man's bone marrow.

(i) Which statement about stem cells from bone marrow is true?

Tick (✓) **one** box.

They are adult stem cells ☐

They are embryonic stem cells ☐

They are specialised cells ☐

They divide by meiosis ☐

[1]

Question 3 (c) (ii)

(ii) The scientists' results were published in a **peer-reviewed** journal.

Which statements explain why we can have confidence in the reported results?

Tick (✓) **two** boxes.

Friends of the authors have checked their work and found it accurate. ☐

Other scientists can copy the methods described to reproduce similar results. ☐

Other scientists have checked the work before it is published. ☐

Other scientists have come to different conclusions using the same data. ☐

The work is imaginative and no one else has done these experiments before. ☐

[2]

On 3(c)(i) many candidates did not appreciate that stem cells from the bone marrow are adult stem cells and incorrectly ticked they are specialised cells. 3(c)(ii) was well answered with most candidates gaining at least one mark. Some candidates did tick box 1.

Question 4 (a)

4 The human heart beats continuously.

(a) Diagrams **A**, **B**, **C** and **D** in **Fig. 4.1** show stages in a heartbeat. The shading shows which chambers and arteries contain blood during each stage.

The diagrams are **not** in the correct order.

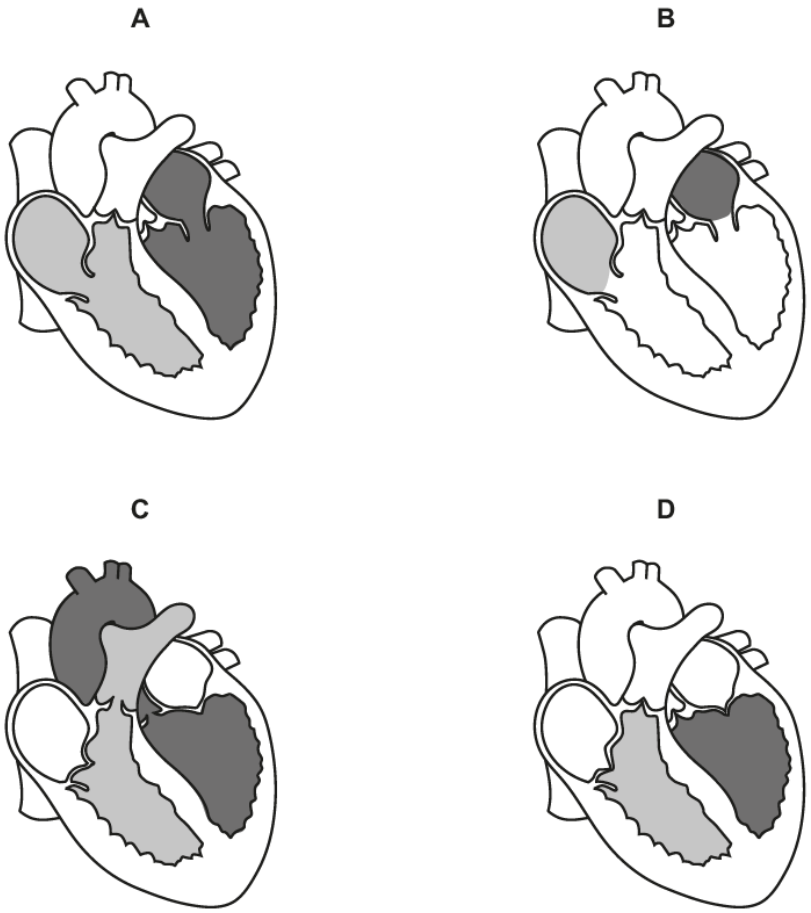


Fig. 4.1

Write down the correct order of the stages in a heartbeat. One has been done for you.

	A		

[2]

If candidates followed the amount of blood shown by the shading in the diagrams to work out the order, then they were unsuccessful with CADB. Half of all candidates gained full marks.

Question 4 (b)

(b) **Fig. 4.2** shows the relationships between the circulatory system and other systems in the human body.

The numbers **1**, **2**, **3** and **4** represent substances that move from one system to another.

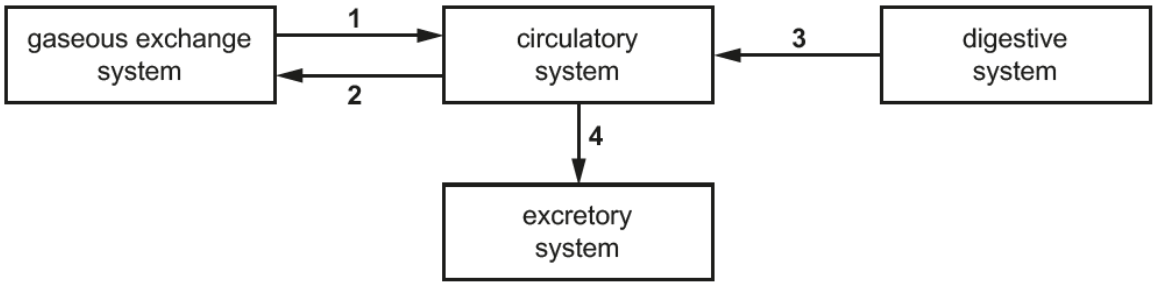


Fig. 4.2

Complete **Table 4.1** to identify each substance.

Use substances from the list.
Each substance can be used once, more than once or not at all. One has been done for you.

carbon dioxide
food
oxygen
urea

Number	Substance
1	
2	
3	
4	urea

Table 4.1

[3]

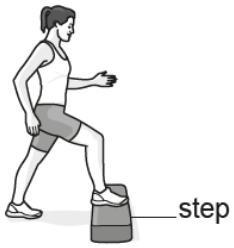
Nearly all the candidates knew that the digestive system put food into the circulatory system for number 3 so gained one mark. Half then correctly identified oxygen for number 1 and carbon dioxide for number 2. It was the mix up of oxygen and carbon dioxide that limited scoring to one mark.

Question 4 (c) (i)

(c) A student writes a plan to investigate the effect of exercise on pulse rate and recovery rate.

Method:

1. Measure the resting pulse rate by placing two fingers against the wrist (do not use your thumb) and count the number of beats in 10 seconds.



2. Step up and down on the step 30 times per minute, for 3 minutes.
3. Stop after 3 minutes and immediately measure the pulse.
4. Measure the pulse again every 30 s.

(i) The student is correct that the thumb should **not** be used to take the pulse.

Suggest why.

.....

..... **[1]**

Only a third of candidates knew that the thumb had a pulse. Some candidates thought that the skin was thicker in the thumb so you wouldn't feel it.

Question 4 (c) (ii)

(ii) In step 1 the student plans to count the number of beats.

How should the student calculate the resting **pulse rate** per minute from the count?

..... **[1]**

This question was not well answered as very few candidates recognised that the pulse was taken for 10 seconds as described in the method, so you had to multiply by 6.

Question 4 (c) (iii)

(iii) Describe how the student can work out the **recovery rate** from her measurements.

.....

..... **[1]**

This question was misunderstood as many candidates tried to describe how to calculate a pulse rate including practical details, rather than realising that they needed to use the information given in part 1 of the method. Some had the correct idea that we needed to wait until the pulse returned to its resting rate but did not mention that they had to find the time to do this.

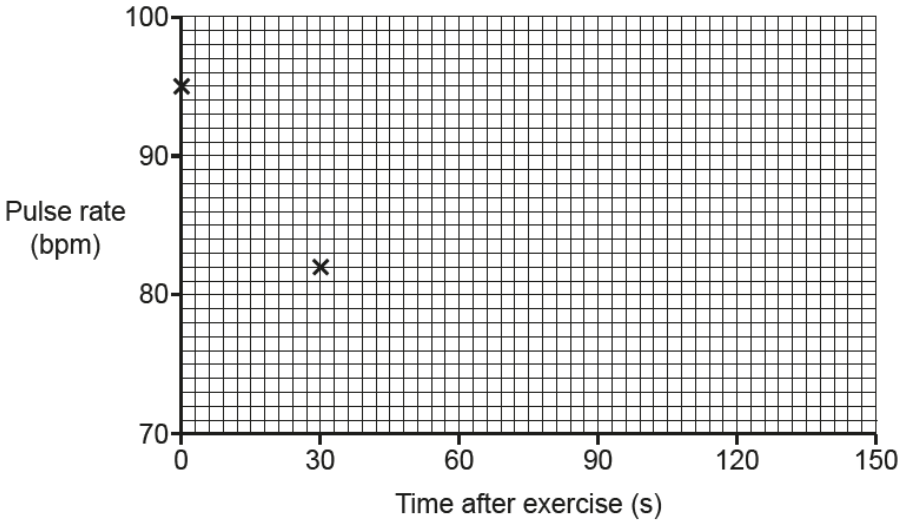
Question 4 (d) (i)

(d) The student's results are shown in **Table 4.2**.

Time after exercise (s)	Pulse rate (bpm)
0	95
30	82
60	74
90	72
120	72
150	72

Table 4.2

(i) Plot the results from **Table 4.2** on the graph **and** draw a curve of best fit.



[2]

Candidates were asked to plot four points and draw a smooth curve. Most candidates could use this scale to accurately plot the points. The smooth curve mark was often lost due to very wobbly lines, sketched lines and lines drawn dot to dot with a ruler.

Question 4 (d) (ii)

(ii) The student's resting pulse rate was 72 bpm.

She uses **Table 4.3** to decide her fitness rating.

Time taken to return to resting pulse rate (s)	Fitness rating
0–30	Excellent
31–60	Good
61–90	Fair
91–120	Poor
121+	Very poor

Table 4.3

Write down her fitness rating.

Fitness rating = ... **[1]**

Question 4 (d) (iii)

(iii) From these results, how confident should the student be about her fitness rating?

Explain your answer.

.....

..... **[1]**

Most candidates identified that the fitness rating was fair for 4(d)(ii) and then very few could carry out the explanation required for 4(d)(iii). The link to being on the border of fair so the student was nearly in the poor range was totally missed. Most answers discussed the student's fitness level or made suggestions on how to improve their fitness level if they weren't happy with it.

Question 5 (a)

5 This question is about evolution.

(a) Put a (ring) around the best choice to complete each sentence.

Evolution is a change in a population's **fossil** / **inherited** / **observable** / **natural** characteristics.

This change occurs through a process of **extinction** / **fossilisation** / **genetic engineering** / **natural selection**.

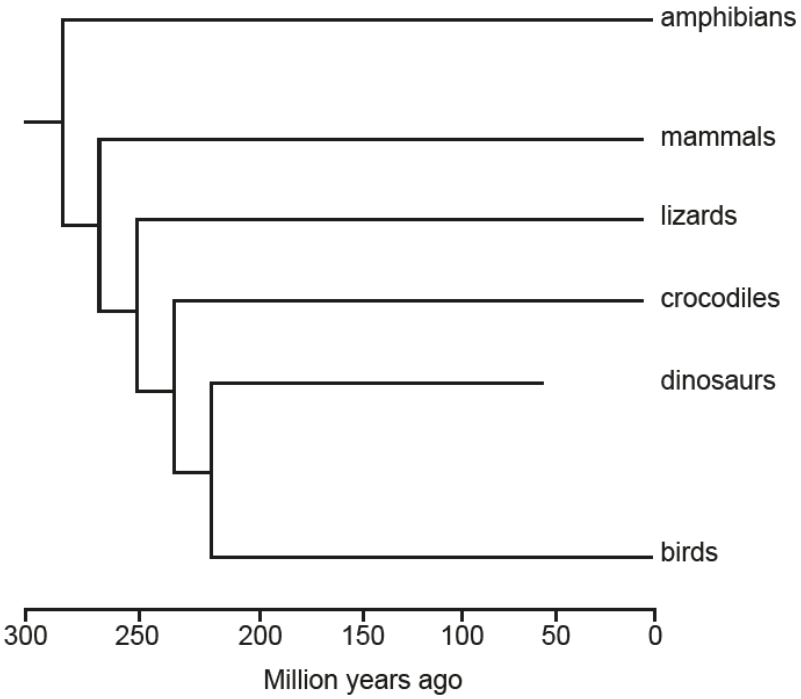
[2]

Many candidates incorrectly circled natural in the first sentence. Natural selection was a much easier mark to gain.

Question 5 (b)

(b) Scientists think all animals with backbones evolved from a common ancestor.

The diagram shows the likely evolutionary relationships between some groups of animals with backbones.



Here are some statements about the evolutionary relationships shown in the diagram.

Tick (✓) **true** or **false** for each statement.

Statement	True	False
Evidence for the evolutionary relationships of dinosaurs comes from fossils.		
The common ancestor of all animals with backbones lived 250 million years ago.		
The DNA of birds will be most similar to that of dinosaurs.		

[2]

Most candidates gained at least one mark here for box 2 and/or box 3 correct.

Question 5 (c)

(c) Evolution can result in the formation of new species.

Explain why although horses and donkeys can breed they are classed as two different species.

.....

..... **[1]**

Candidates did not know the definition of a species. Candidates missed the key words "can breed" in the question that would lead them to the answer of the offspring being infertile. Many gave reasons why they couldn't breed such as being different animals and having different genes.

Question 6 (a)

6 Influenza (flu) is a common human infection.

It is caused by a virus.

(a) The poster in **Fig. 6.1** teaches people how to prevent the flu virus spreading.

Fig. 6.1

Draw lines to connect each **part of the poster** to **why it is necessary**.

Part of the poster	Why it is necessary
CATCH IT	Flu virus can survive on skin for several hours.
BIN IT	Touching a tissue after use can contaminate you with flu virus.
KILL IT	Coughing and sneezing can spread flu virus through droplets in the air.

[2]

This question was answered well. Most candidates could correctly match the boxes.

Question 6 (b) (i)

(b) People can be given a vaccination to help protect them from flu.

(i) Vaccination causes white blood cells in the body to make antibodies against the pathogen.

How else do white blood cells protect against pathogens?

Tick (✓) **two** boxes.

- Help pathogens destroy body cells. ☐
- Prevent pathogens entering the body. ☐
- Release chemicals that break pathogens down. ☐
- Take in and digest pathogens. ☐
- Trap pathogens in mucus. ☐

[2]

Question 6 (b) (ii)

(ii) Flu vaccines cannot be given to very young babies.

Which **two** statements explain why vaccinating adults helps protect **young babies** from flu?

Tick (✓) **two** boxes.

- Each vaccination only costs a few pounds. ☐
- Only people ill with the flu virus can pass it on. ☐
- Unvaccinated people are more likely to get flu. ☐
- Vaccinations don't always work. ☐
- Very few vaccinated people have any side effects. ☐

[2]

Vaccination and white blood cells were well understood for these tick box questions, as over half got at least one mark on 6(b)(i) and over half got 2 marks on 6(b)(ii). Some candidates only ticked one box so should be encouraged to check the question and tick two boxes when asked.

Question 6 (c)

(c) A new flu vaccine is made every year. The vaccines contain proteins from the surface of the flu virus.

Fig. 6.2 shows the flu virus from 2018.

Fig. 6.3 shows the antibodies made by a person who had the vaccination in 2018.

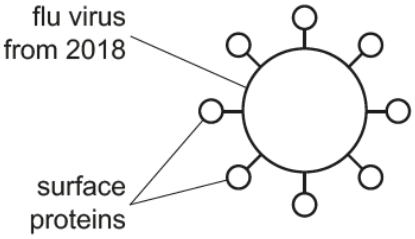


Fig. 6.2

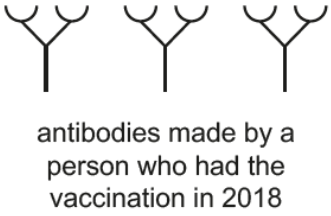


Fig. 6.3

The flu virus changes regularly.

Fig. 6.4 shows the flu virus from 2019.

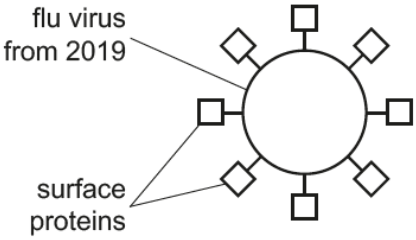


Fig. 6.4

Explain why the vaccine from 2018 would **not** protect you against the flu virus from 2019.

Use **Fig. 6.2**, **Fig. 6.3** and **Fig. 6.4** to help you.

.....

.....

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.....

.....

..... **[3]**

Many candidates only gave one extended point on the lines provided. This was usually the idea of the change of shape of the virus. Some candidates referenced the size of the proteins over the shape. There was some confusion over antibodies and the new vaccine as some candidates thought that these were the same, or that the vaccine had to fit. Just saying the antibodies would not work was too vague. Very few candidates went on to describe the idea of shape and fit linked to antibodies.

Exemplar 3

The flu virus in 2019's surface proteins are a different shape to 2018 meaning the antibodies would fit to stop the virus and consume it and digest it. And new antibodies have to be produced to fight the virus. **[3]**

This answer gained 2 marks. They identify that the surface proteins have changed from 2018 to 2019 for marking point 1 and then have shown some understanding of shapes being complementary. The second marking point is gained for the idea that new antibodies would need to be made. The third mark was not given as this question is asking why the vaccine from 2018 would not protect you in 2019 so the candidate needed to extend their answer to describe that the antibodies would not fit the surface proteins.

Question 6 (d) (i)

(d) In 2017 there was a flu epidemic in Australia. 170 000 people in Australia were infected. The population of Australia in 2017 was 25 000 000.

(i) Calculate the percentage of the population of Australia infected with flu in 2017.

Give your answer to **1** decimal place.

Percentage of population = ...% **[3]**

Some candidates scored 2 marks for the correct calculation (0.68) but many did not give their answers to 1 decimal place.

Question 6 (d) (ii)

(ii) The same flu virus could affect the UK. The population of the UK is approximately 66 000 000.

In Australia the death rate from flu was approximately 4 people in every million. Assume that the death rate in the UK would be the same as in Australia.

Estimate how many people would die of flu in the UK.

Estimated number of deaths = ... **[2]**

When candidates understood how to carry out the calculation, generally 2 marks were gained. There were many very high estimations, sometimes even bigger than the UK population showing a lack of understanding of the question and calculation required.

Question 6 (e) (i)

(e) Scientists used an electron microscope to look at a flu virus.

(i) What are the advantages of electron microscopes over light microscopes?

Tick (✓) **two** boxes.

A higher magnification is possible with electron microscopes. ☐

Electron microscopes are expensive. ☐

Electron microscopes have a very high resolution. ☐

Living cells can be seen using a light microscope. ☐

[2]

This question was well answered showing a good understanding of the advantages of the electron microscope.

Question 6 (e) (ii)

(ii) The virus is 0.1 μm in diameter. It infects a human cell that is 50 μm in diameter.

How many times bigger is the human cell than the virus?

Number of times bigger = ... **[2]**

Candidates either had the mathematical knowledge to divide 50 by 0.1 gaining 2 marks or they did not know how to do this calculation. Many took 0.1 off 50 to get 49.9.

Question 6 (f) (i)

(f) Pneumonia is a disease of the lungs. It is caused by an infection.

Fig. 6.5 shows the number of people per 100 000 who caught pneumonia between 2004 and 2012.

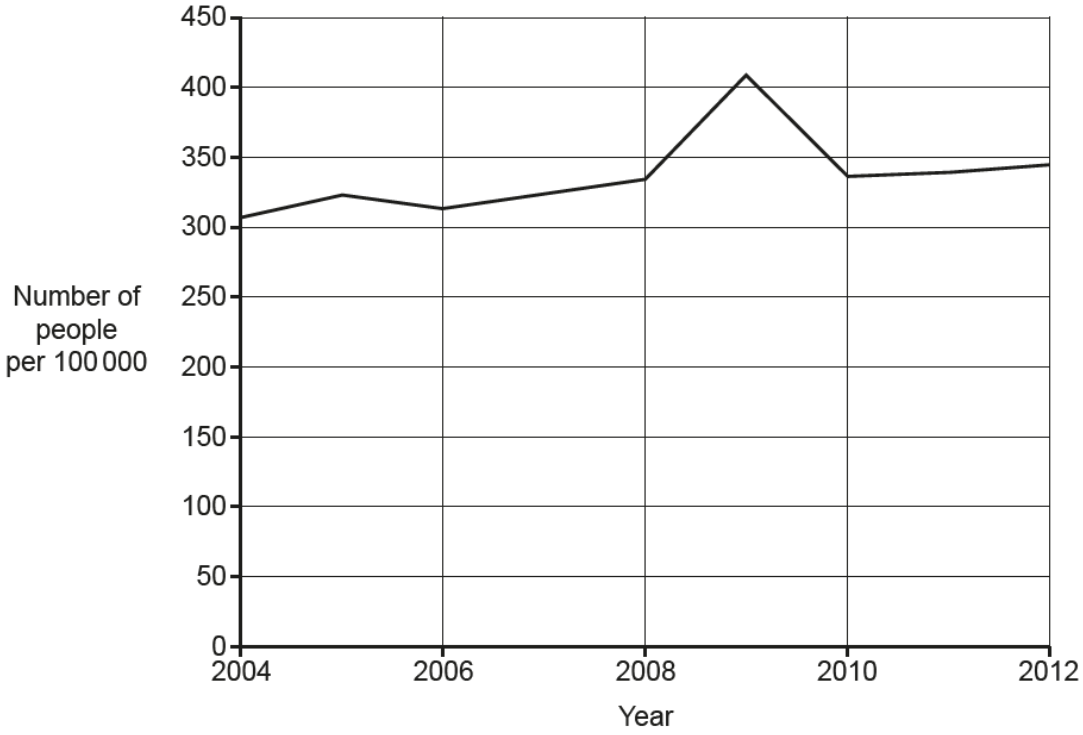


Fig. 6.5

Flu and pneumonia both affect the breathing system.

(i) There was a flu epidemic in 2009.

Use **Fig. 6.5** to estimate the increase in pneumonia cases from 2008 to 2009.

Increase = ... people per 100 000 **[1]**

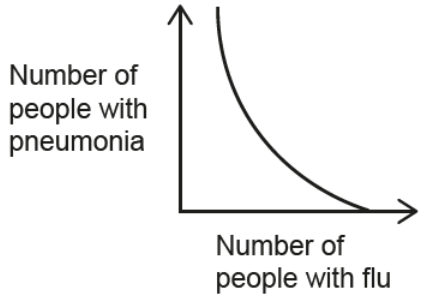
The range available for this answer was 70 to 90 to allow for the lack of detailed grid lines on the graph. Just fewer than half the candidates could read off the graph and calculate the increase. Some candidates read the highest point in 2009 and then stopped, not realising that they had to work out the increase from 2008.

Question 6 (f) (ii)

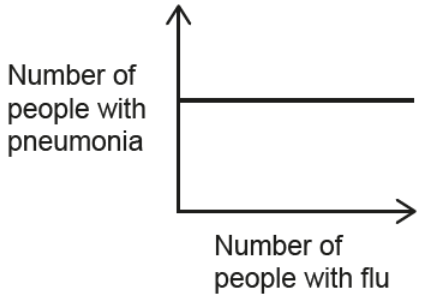
(ii) There is a positive correlation between having flu and having pneumonia.

Which graph, **A**, **B**, **C** or **D**, shows a positive correlation?

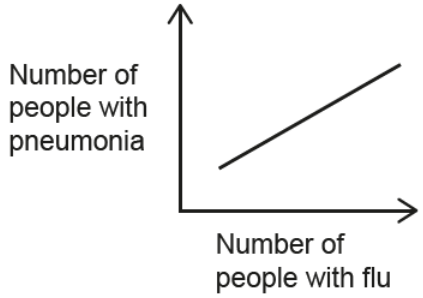
A



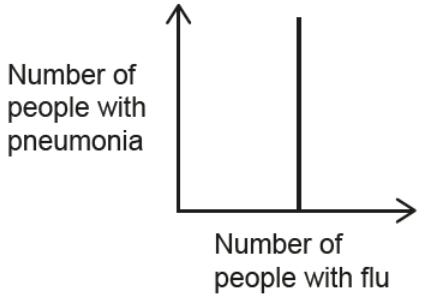
B



C



D



Tick (✓) **one** box.

A ☐

B ☐

C ☐

D ☐

[1]

Many candidates understood the term positive correlation and ticked the box for C.

Question 6 (f) (iii)

(iii) Does a correlation between flu and pneumonia prove that having flu causes pneumonia?

Explain your answer.

.....

.....

.....

..... **[2]**

This question proved to be very challenging for most candidates. Many started their answer with yes and suggested that flu caused pneumonia. Any marks that were gained were for the idea that people with flu do not always get pneumonia.

Question 7 (a)

7 Cellular respiration takes place in living cells.

(a) In which parts of a cell do the reactions of cellular respiration take place?

Tick (✓) **two** boxes.

- Cell wall ☐
- Chloroplasts ☐
- Cytoplasm ☐
- Mitochondria ☐
- Nucleus ☐
- Plasmids ☐

[2]

Candidates had to identify the location of respiration in the cell. Most candidates correctly ticked the mitochondria. The most common incorrect answer was chloroplasts.

Question 7 (b)

(b) Which processes need energy from cellular respiration?

Tick (✓) **two** boxes.

- Active transport ☐
- Diffusion ☐
- Gaseous exchange ☐
- Muscle contraction ☐
- Osmosis ☐
- Transpiration ☐

[2]

Most candidates were able to link energy to muscle contraction. The second marking point was more difficult to credit as candidates randomly ticked another box.

Question 7 (c)

All living cells produce hydrogen peroxide (H_2O_2) as a waste product.

The cells in potatoes contain an enzyme called catalase. It breaks down H_2O_2 to water and oxygen, this is the equation for the reaction that takes place.

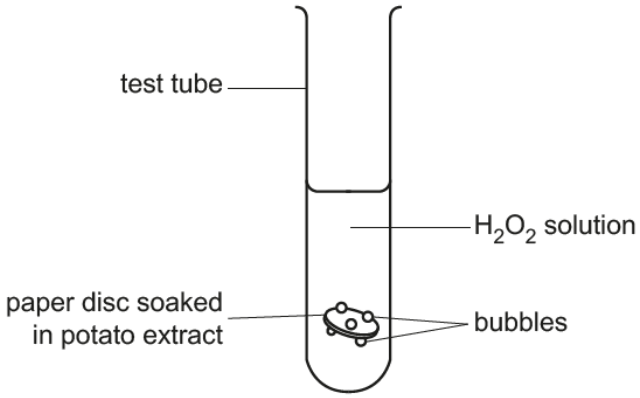
$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$

Mia investigates the effect of H_2O_2 concentration on the rate of this reaction.

She writes out her method.

1. Put a peeled potato in a liquidiser with some water to make potato extract.
2. Dip a paper disc in the potato extract. The potato extract is a source of catalase.
3. Drop the paper disc into a test tube containing H_2O_2 solution.
4. Wait until the disc has sunk to the bottom.
5. Time how long it takes for the disc to rise to the surface of the H_2O_2.

This is a diagram of her apparatus.



(c) Mia's method lacks the detail needed for another scientist to reproduce her findings.

Suggest additional detail which would allow another student to follow the method exactly.

.....

.....

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.....

.....

..... **[3]**

The diagram of the equipment led to many incorrect answers of counting the bubbles or timing how long it took the disc to get to the bottom of the test tube. Some candidates said that measurements and repeats would be needed but didn't give any details of this. Keep the type of liquidiser the same was often mentioned as candidates thought that this was a liquid to put the potato in to. At least half of all candidates gained one mark. Correct answers were often about the potato, water or the hydrogen peroxide solution.

Exemplar 4

She should say how much Potato to use. The volume of Liquidiser and water. How big the surface area of the paper disc should be. And how much of the H_2O_2 solution should of been used and how to time the practical. eg – a stopwatch. [3]

This answer provides enough detail for each point made to gain all 3 marks. They successfully identified the control variables of how much potato to use, the volume of water and the surface area of the disc.

Question 7 (d)

(d) Bubbles form on the paper disc when it is in the H_2O_2 solution. This causes the disc to rise to the surface of the solution.

Mia thinks that if a disc rises more quickly, this means that the rate of reaction is faster.

Explain why she is correct.

.....

.....

.....

..... **[2]**

Candidates found this question challenging and many just repeated the stem of the question. Few could make the link to more bubbles or more oxygen produced.

Question 7 (e) (i)

(e) The table shows Mia's results.

Concentration of H_2O_2 solution (%)	Time taken for paper disc to reach the surface (s)
0.75	19.69
1.50	15.13
3.00	12.90
4.50	10.00
6.00	7.66

(i) Calculate the rate of reaction for 6.00% H_2O_2 solution.

Give your answer to **3** significant figures.

Rate = ... s^{-1} **[3]**

This calculation of 1 divided by time was too challenging for Foundation Level candidates. Some left it blank and some attempted to use the figures 6.00 and 7.66 from the table in some sort of a calculation. A common incorrect answer was 0.7832.

Question 7 (e) (ii)

(ii) Which conclusions are supported by the data in the table?

Tick (✓) **two** boxes.

- Between 0.75% and 6.00% H_2O_2 the reaction rate increases by approximately 2.5 times. ☐
- Doubling the concentration of H_2O_2 halves the time taken for the disc to reach the surface. ☐
- Increasing the concentration of H_2O_2 decreases the rate of reaction. ☐
- Increasing the concentration of H_2O_2 increases the time taken for the disc to reach the surface. ☐
- The biggest difference in time taken for the paper disc to reach the surface is between 0.75 and 1.50% H_2O_2. ☐

[2]

Many candidates gained one mark here from either of the 2 correct boxes. Incorrect responses were not isolated to only one of the choices showing a misunderstanding of concentration and rate.

Question 7 (f)

(f) Describe what Mia could do to increase confidence in her data.

.....

..... **[1]**

Repeats and doing it again were credited with marks at least half the time. Some candidates lost this mark when they went on to say repeat with different concentrations.

Question 7 (g)

(g) Use the lock and key model to explain why the enzyme catalase can **only** break down H_2O_2.

.....

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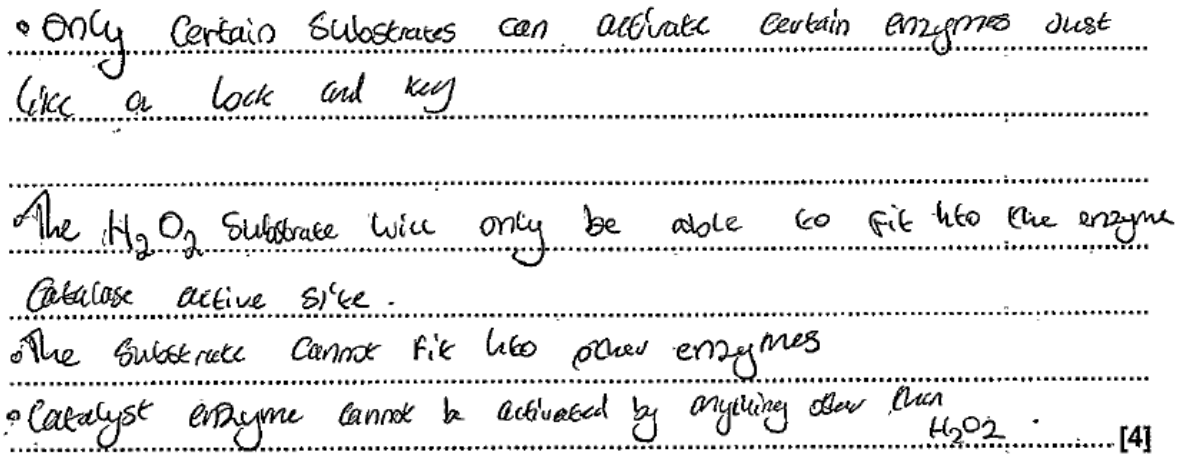
.....

.....

..... **[4]**

This question was too challenging for many of the Foundation candidates due to the specific wording required to describe the lock and key model, such as active site. Some candidates left it blank completely and some got the lock and key the wrong way around. The idea of fitting was clearly understood by many candidates and an attempt was made to describe a lock and key fitting together, although many struggled with expressing this clearly. An unlabelled diagram gained a mark if it showed complementary shapes fitting together for marking point 3.

Exemplar 5



This is an excellent example of a well written answer that incorporates 3 of the marking points in a single sentence. Hydrogen peroxide as the substrate for marking point 1. The substrate fits into the active site for marking point 2 and the idea of only that substrate fitting so marking point 4.

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