

GCSE (9-1)

Examiners' report

**TWENTY FIRST
CENTURY SCIENCE
COMBINED
SCIENCE B**

J260

For first teaching in 2016

J260/05 Summer 2023 series

Contents

Introduction.....	4
Paper 5 series overview	5
Question 1 (a) (i), (ii), (iii), (b) (i) and (ii).....	6
Question 1 (c)	7
Question 1 (d)	8
Question 2 (b) (i).....	9
Question 2 (b) (iii)	10
Question 2 (c)	10
Question 3 (a).....	11
Question 3 (b).....	12
Question 3 (c)	12
Question 3 (d)	13
Question 4 (b).....	14
Question 4 (c) (i)	15
Question 4 (c) (ii)	16
Question 4.....	16
Question 4 (c)	16
Question 4 (c) (v)	17
Question 5 (a) (i).....	18
Question 5 (a) (ii)	19
Question 5 (b).....	20
Question 5 (c)*	21
Question 6 (a).....	22
Question 6 (b) (i).....	22
Question 6 (c)	23
Question 6 (d)	24
Question 7 (b).....	25
Question 7 (c)	25
Question 7 (d).....	26
Question 8 (a).....	26
Question 8 (b)	26
Question 8 (c) (i)	27
Question 8 (c) (iii).....	28
Question 8 (d) (i).....	28

Question 8 (d) (ii) 28
Question 9 (a) 29
Question 9 (b) 29
Question 9 (c) 30
Question 9 (d) 30
Question 9 (e) 31

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. A selection of candidate answers is also provided. 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 and the mark scheme can be downloaded from OCR.

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Paper 5 series overview

J260/05 is the first of four higher tier papers taken for Combined Science and covers content from the Biology areas of the specification.

The paper comprises of short answer styles and extended response, including one Level of Response question (structured questions, problem solving, calculations, and practical skills). To be successful on this paper it is expected that candidates will be familiar with key Biology concepts and be able to apply the knowledge to unfamiliar situations. It is also expected that candidates will be familiar with a range of practical techniques and be able to identify variables.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
<ul style="list-style-type: none"> • completed the maths questions correctly • could label axis on graphs correctly • knew the role of the SRY gene in sex determination • could explain that photosynthesis took in carbon dioxide and gave out oxygen as a waste product • knew the difference between inhaled and exhaled air • could plan a science investigation and identify variables • could explain advantages and disadvantages of bone marrow transplants. 	<ul style="list-style-type: none"> • could not use significant figures • could not label the axis on graphs correctly • could not explain the role of the SRY gene in sex determination • did not know the difference between photosynthesis and respiration • thought animals breathe in oxygen and breathe out carbon dioxide • did not know how to calculate recovery heart rates • could not explain how to carry out a science investigation • could not explain that stem cells can differentiate.

Question 1 (a) (i), (ii), (iii), (b) (i) and (ii)

1 A doctor uses a light microscope to look at the chromosomes in human body cells.

(a) The microscope is shown in the diagram.



(i) Draw lines to connect each **part** of the microscope with its correct **name**.

Part	Name
Part A	Eyepiece lens
Part B	Objective lens
Part C	Stage

[1]

(ii) The doctor uses steps **A** to **D** to look at the cells on a slide.

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

A Turn the coarse focus until the image is as clear as possible.

B Turn the fine focus until the image is as clear as possible.

C Adjust the mirror until the image is bright enough to see.

D Place the slide under the microscope.

Write the letters in the boxes to show the correct order of the steps.

One has been done for you.

D			
---	--	--	--

[1]

(iii) The chromosomes in the cells are **not** clearly visible under the microscope.

Describe **one** thing the doctor can add to the slide to improve the visibility of the chromosomes.

..... [1]

Humans have X and Y sex chromosomes.

(b) The Punnett square shows how X and Y chromosomes are inherited.

		Sperm cells	
	Chromosomes	X	Y
Egg cells	X	XX	XY
	X	XX	XY

(i) What is the probability that a fertilised egg will have the chromosomes XY?

Put a ring around the correct answer.

0 **0.5** **1** **2** [1]

(ii) What is the expected ratio of XX to XY offspring?

Ratio = : [1]

These questions were well answered by most candidates.

Question 1 (c)

(c) Describe how inheriting a Y chromosome causes the baby to be born with male characteristics.

.....

 [2]

Most candidates' responses were about XY male and XX female chromosomes and that the Y chromosomes make the male characteristics. Very few candidates appeared to know about the SRY gene or the role played in sex determination.

Exemplar 1

The Y chromosome is only donated by males and contains the SRY gene which releases androgens which cause testes to develop.

This candidate response demonstrates an excellent answer to this question.

Question 1 (d)

(d) Some females have a condition called Turner syndrome.

- They only have one X chromosome instead of two.
- There is no cure.
- They need to have their heart, kidneys and reproductive system checked regularly for problems throughout their lives.

A baby can be tested for Turner syndrome before they are born. Their chromosomes are tested using a sample of amniotic fluid from the womb.

Describe benefits **and** risks of doing this test before the baby is born.

.....

.....

.....

.....

.....

.....

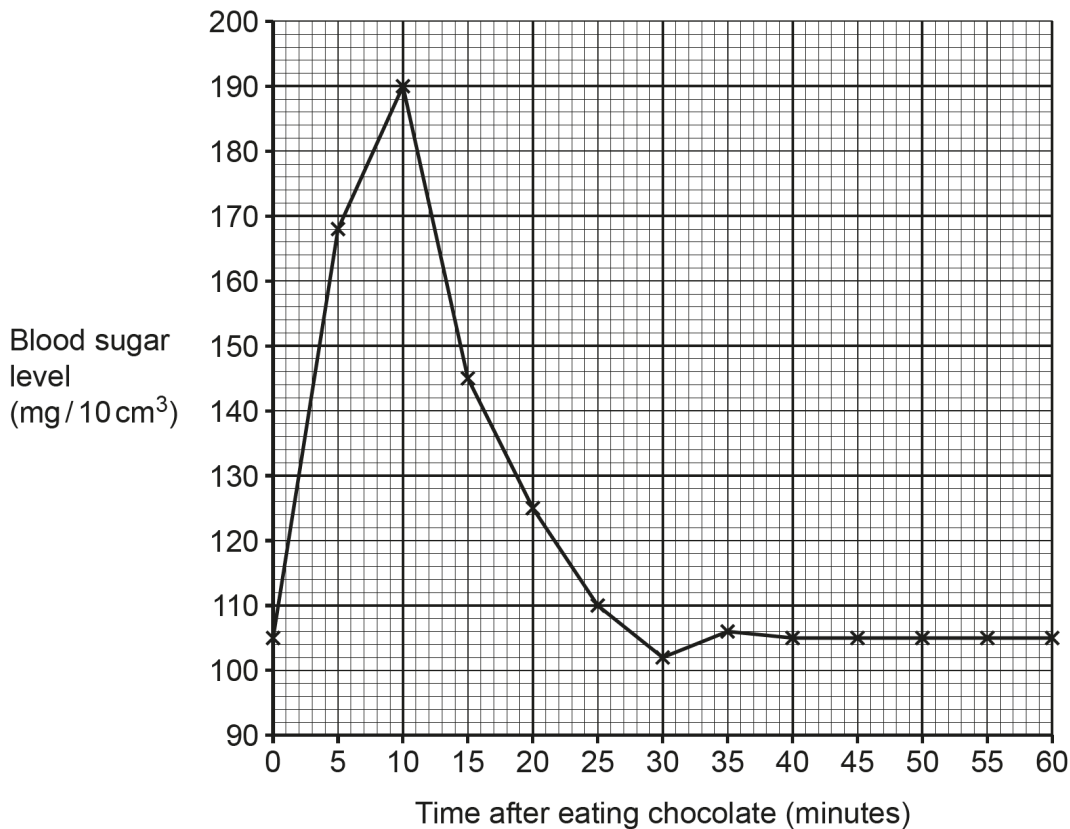
[3]

Candidates generally scored well in this question and were aware that the test can cause miscarriage. Lots of candidates did make vague references to preparing for the baby which was considered to be insufficient without extra detail.

Question 2 (b) (i)

(b) A student measured their blood sugar level every 5 minutes after eating chocolate.

The results are shown in the graph.



(i) Calculate the change in blood sugar level between 10 minutes and 25 minutes after eating the chocolate.

Change in blood sugar level = mg/10 cm³ [2]

This question was well completed with most candidates receiving full marks.

Question 2 (b) (iii)

(iii) The student concludes that their normal blood sugar level is $105\text{ mg}/10\text{ cm}^3$.

Describe evidence from the graph that supports this conclusion.

.....

.....

.....

..... [2]

Many candidates did achieve 1 mark for this question as many did acknowledge that the blood sugar level started and returned to $105\text{ mg}/\text{cm}^3$.

Candidates appeared not to notice that the blood sugar level dropped to below $105\text{ mg}/\text{cm}^3$ before increasing again.

Question 2 (c)

(c) Hormones can be used as a contraceptive.

Explain **one** benefit and **one** risk of taking a contraceptive pill containing hormones.

Benefit

.....

Risk

.....

[2]

Misconception



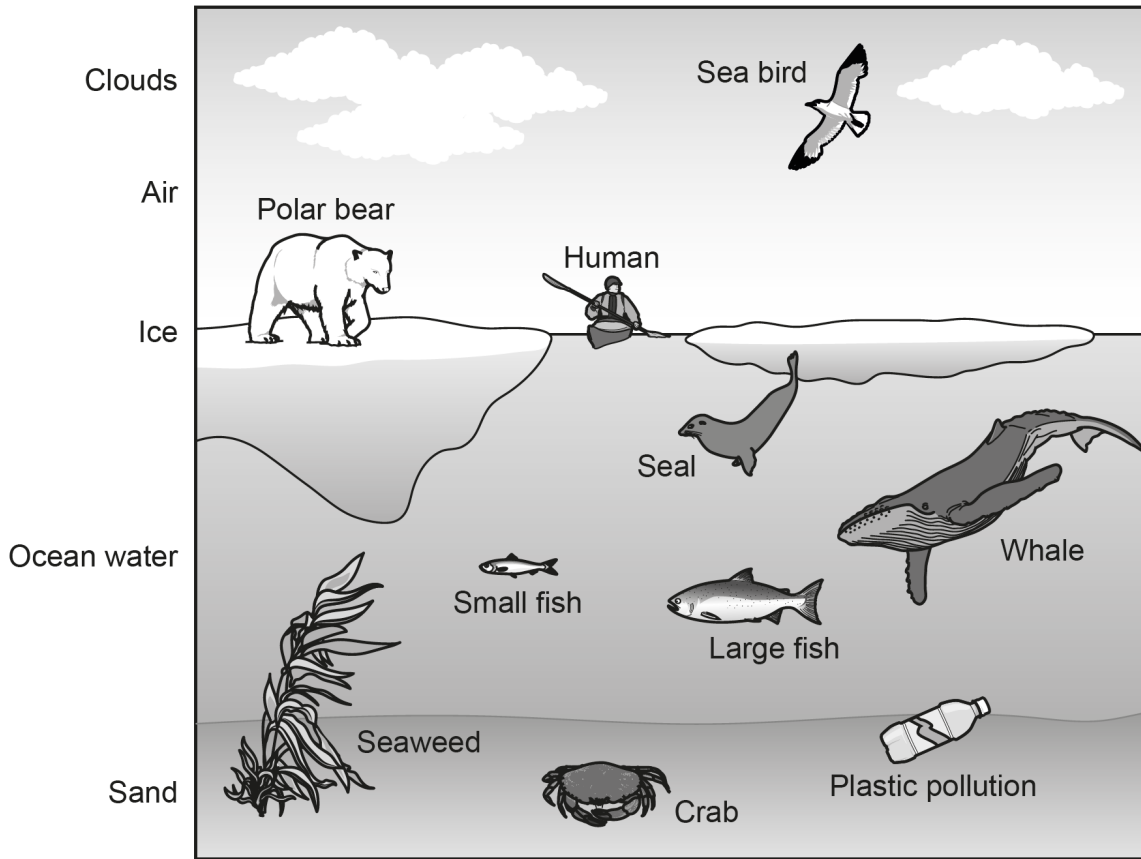
For a benefit many candidates stated that it was effective but did not state what it was effective at actually doing.

Many candidates appeared to believe that a risk of using hormones is that they make you infertile, which is a myth perpetuated by social media.

Question 3 (a)

3 The diagram shows some of the organisms that live in and around one area of the Arctic Ocean.

The organisms are **not** drawn to scale.



(a) Complete the sentences to describe the levels of organisation in this area.

Use phrases from the list.

- | | | | |
|--------------------|---------------------|---------------------|----------------------|
| a community | a population | an ecosystem | an individual |
|--------------------|---------------------|---------------------|----------------------|

All of the organisms and their environment are

All of the organisms in the area are

All of the polar bears in the area are

One piece of seaweed is

[3]

Community and population commonly were selected the wrong way, meaning many candidates only scored 1 mark on this question.

Question 3 (b)

(b) Complete the table to describe the different parts of this area of the Arctic Ocean.

Tick (✓) **one** box in each **row**.

	It is a biotic part of the ecosystem	It is an abiotic part of the ecosystem	It is not part of the ecosystem
Air			
Human			
Ocean water			
Plastic pollution			
Sea bird			
Seaweed			

[2]

Very few candidates achieved 2 marks for this question as many candidates had identified plastic as not part of the ecosystem.

Question 3 (c)

(c) State the name of the substance that the clouds help to cycle through the ecosystem.

..... [1]

A variety of responses was seen here, oxygen, carbon dioxide and plastic to name a few of the more common ones seen.

Question 3 (d)

- (d) Microorganisms in the sand feed on dead organic matter. They use it for cellular respiration and release carbon dioxide into the ocean water.

Explain why releasing this carbon dioxide is essential for the survival of the animals in the area.

.....

.....

.....


.....

.....

..... [3]

Many candidates had the misconception that plants and animals use carbon dioxide for respiration and that plants release oxygen for animal respiration. Very few acknowledged that photosynthesis makes food.

OCR support

 This [respiration checkpoint task](#) is useful to teach the candidates the basics of respiration and the gaseous exchange involved.

Question 4 (b)

- (b) **Table 4.1** shows the percentage of trees with ash dieback in four different populations of trees.

Table 4.1

Population	Percentage of trees with ash dieback (%)
1	24
2	17
3	9
4	35

Calculate the mean percentage of trees with ash dieback in these four populations.

Give your answer to **2** significant figures.

Mean percentage = % **[3]**

This question was well answered with many candidates scoring full marks. Where 2 marks were given, it was usually because the candidate had given the answer to two significant figures or had rounded the answer up.

Question 4 (c) (i)

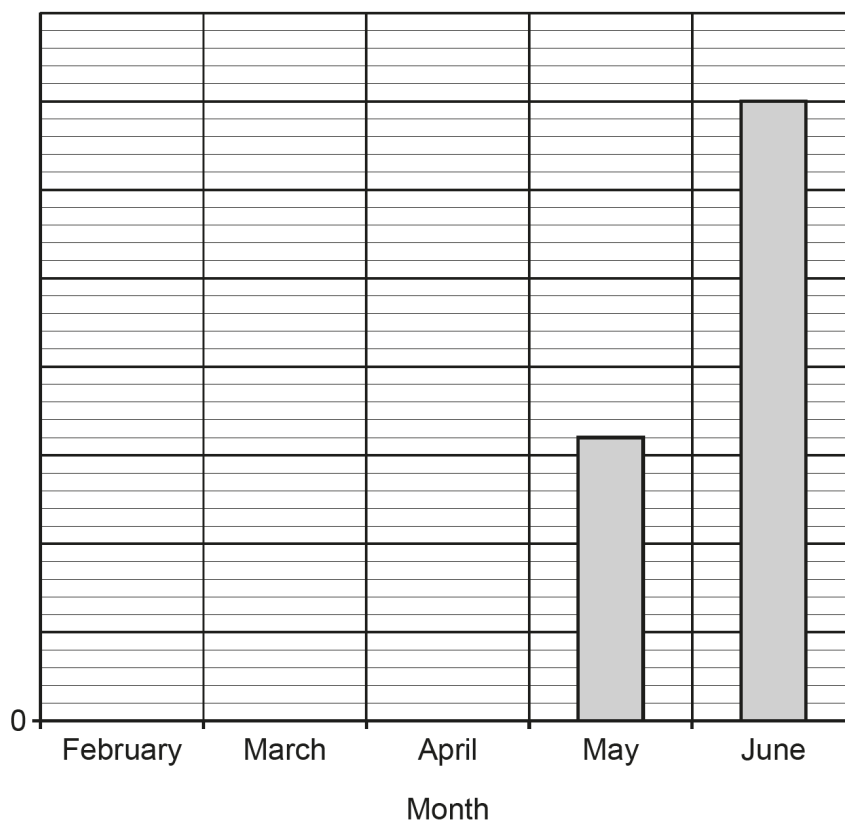
- (c) Scientists recorded the total number of trees with ash dieback in a woodland each month for five months.

The results are shown in **Table 4.2**.

Table 4.2

Month	Total number of trees with ash dieback
February	6
March	8
April	15
May	32
June	70

- (i) Complete the bar chart of the data in **Table 4.2**.



[2]

Many candidates scored only one mark as they did not fully label both axes. Candidates tended to give the numbers on the Y-axis but did not label the axis. Most candidates drew the bars correctly.

Question 4 (c) (ii)

(ii) Describe the trend in the data.

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

Many candidates correctly identified the trend but did not note the increase what at a greater amount as time went on.

Question 4

(iii) Suggest **one** way in which humans could have caused the trend in the data.

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

Many candidates believed this trend was caused by global warming, pollution or deforestation. Many candidates did not recognise that diseases can be spread from plant to plant, with many believing the disease was caused by infected soil.

Question 4 (c)

(iv) Ash dieback only causes disease in trees.

Explain **one** way in which the trend in the data could negatively affect **animals** in the woodland.

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

Many candidates were able to give ways in which animals could be affected, with most recognising the potential effect on habitats.

Question 4 (c) (v)

- (v) Scientists banned people and pets from entering the forest at the end of June.

Suggest **one other** way in which scientists could try to control the ash dieback in the forest.

.....

..... [1]

Another well answered question with many correct answers.

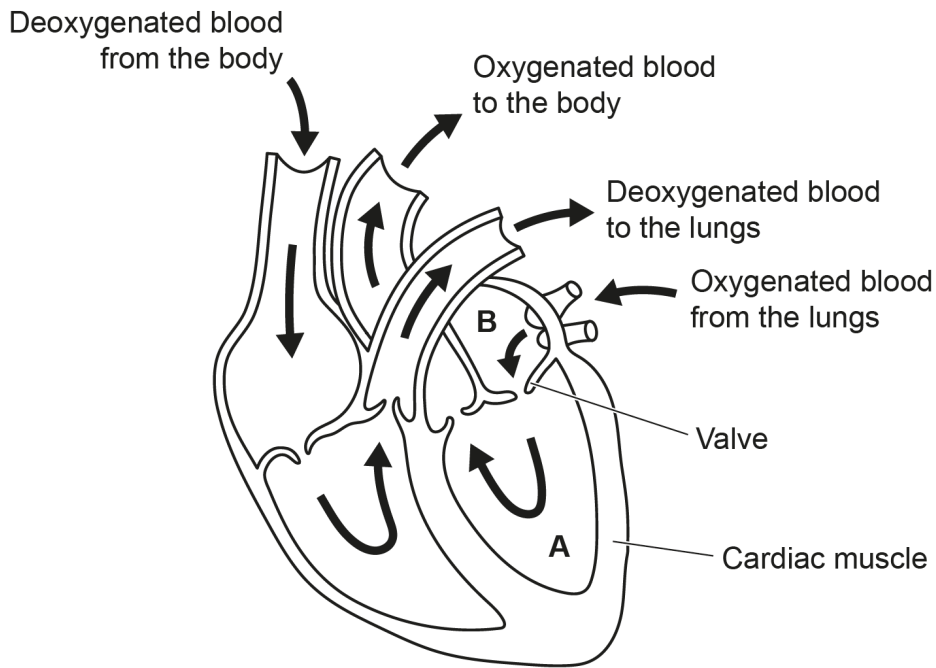
Question 5 (a) (i)

5 People have a pulse because their heart beats.

(a) Fig. 5.1 is a simple diagram of the human heart.

- Two of the chambers have been labelled **A** and **B**.
- The arrows show the directions in which blood moves.

Fig. 5.1



(i) Explain why chamber **A** has a thick wall of cardiac muscle.

.....

.....

.....

..... [2]

Marking point 2 about the high force needed and marking point 3 about blood needing to be pumped round the body were the most commonly seen. Marking point 1 regarding heart contraction was rarely seen.

Exemplar 2

Chamber A is a ventricle
and as blood gets collected in
the chamber it requires high
pressure to pump it out of the
heart to the rest of the body. [2]

This response did not describe that the heart muscle contracts, but candidates were generally aware of the high pressure needed to pump blood around the body.

Question 5 (a) (ii)

(ii) Why is there a valve between chamber A and chamber B?

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

Most candidates scored this mark

Question 5 (b)

(b) Outside the heart, blood flows through blood vessels.

Complete the table by naming the blood vessels and explaining how their structures are related to their functions.

Blood vessel	Structure of blood vessel	Function of the structure
.....	Wall is thick and very strong
Capillary	To allow rapid diffusion of substances into and out of the blood
.....	To make sure blood only flows towards the heart

[5]

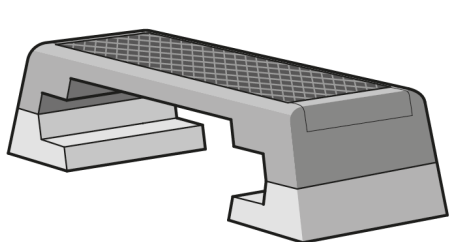
Most candidates labelled artery and vein correctly, as well as the structure, e.g. wide lumen.

Question 5 (c)*

(c)* Describe how you could use **only** the equipment shown in **Fig. 5.2** to:

- investigate the effect of exercise on a person's resting pulse rate
- calculate a best estimate for their recovery time.

Fig. 5.2



Step



Stopwatch

.....

.....

.....

.....

.....

.....

..... [6]

Most candidate did score on this question, with Level 1 or low Level 2 being given frequently. Very few candidates scored into Level 3 as the answers generally tended to miss one part of the question. Candidates appeared to know how to measure heart rate before and after exercise but did not seem aware of the measurements needed for recovery rates. Very few candidates included any control variable in their methods, limiting the marks available.

Question 6 (a)

6 Many substances are transported into, around and out of the human body.

(a) Urea is a waste product made by the body.

Complete the sentences to describe what happens to urea.

Urea is transported around the body by the system.

It is removed from the body by the system.

[1]

Many candidates correctly gave circulatory but did not appear to know what excretory means, meaning that few candidates scored marks for this question.

Question 6 (b) (i)

(b) Water and some other substances needed by body cells are absorbed into the blood by the digestive system.

(i) Complete the table by describing how to test for the presence of each substance absorbed by the digestive system.

Substance	Reagent used in test	Result when the substance is present
Glucose	Benedict's solution	Red-brown precipitate is formed
Lipids	Ethanol
.....	Biuret solution

[3]

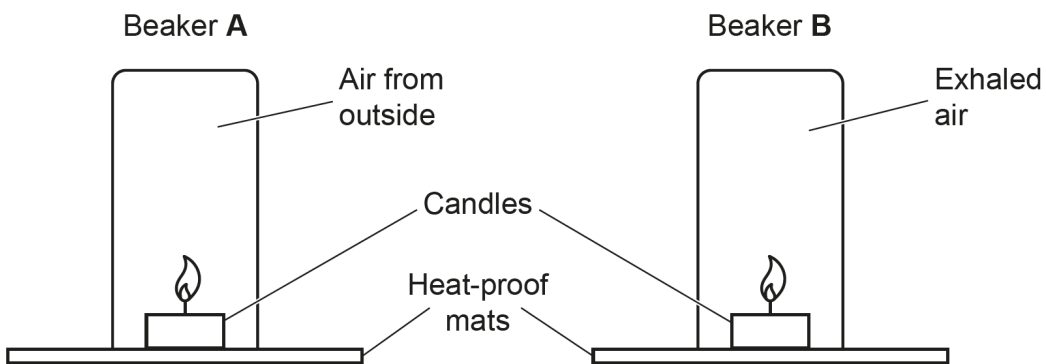
Candidates seemed to struggle with this question, with few able to answer correctly. When revising for the final exams it may be worth centres reviewing the food tests PAG.

Question 6 (c)

(c) A teacher turns two identical beakers upside-down.

- Beaker **A** is filled with air from outside.
- Beaker **B** is filled with air exhaled by a person.

The teacher places a burning candle inside each beaker, as shown in the diagram. The candles are the same size.



Candles need oxygen to burn. They cannot burn in carbon dioxide.

Predict what will happen to the burning candles.

Use ideas about the gaseous exchange and circulatory systems to explain your prediction.

Prediction

.....

Explanation

.....

.....

.....

[4]

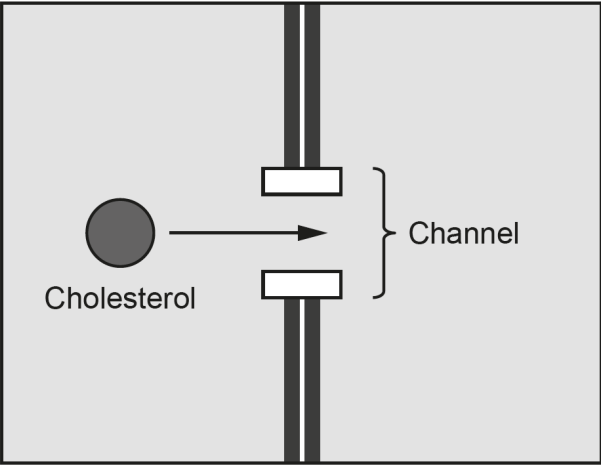
Most candidate correctly predicted that candle B would burn for a shorter amount of time. However, they did not correctly link the reasons to the circulatory system. A number of candidates seemed to think we breathe out 100% carbon dioxide and did not acknowledge respiration at all.

Question 6 (d)

(d) Read the information in the box.

- Fatty food contains cholesterol.
- Cholesterol is taken up into the circulatory system from the gut.
- Some of the uptake of cholesterol happens through specific channels made of protein.
- Some people inherit a faulty gene and **cannot** make the channels correctly.

Gut
Circulatory system



Ryan eats a lot of fatty food, and also has the faulty gene.

Explain how these factors affect Ryan’s risk of developing cardiovascular disease (CVD).

.....

.....

.....

.....

.....

.....

[3]

Many candidates wrote about cholesterol build up or the channels not working correctly but did not say whether this would increase or decrease the risk.

Question 7 (b)

- (b) In the 1300s, farmers started growing yellow carrots in the hot, dry environment in southern Europe.

Around this time, some of the plants began to produce carrots that were pale orange.

What change in the yellow carrot plants could have caused this new pale orange colour?

..... [1]

Many candidates thought that global warming was responsible for the change in colour or that it was caused by environmental factors.

Question 7 (c)

- (c) Later, farmers started growing yellow and orange carrots in northern Europe.

Plants producing darker orange carrots were better able to survive in the colder, wetter environment in northern Europe.

Explain how the farmers could have made sure they were growing the best carrots to get the highest yield each year.

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

Candidates tended to write a generalised description of selective breeding rather than relating it to carrots. Candidates did not acknowledge that the offspring of the darkest orange carrots should be bred together for several generations.

Question 7 (d)

- (d) Explain how modern technology could convince scientists to classify white carrots and orange carrots as separate species.

.....

.....

.....

..... [2]

Many candidates thought that this could be done by using a microscope. Many candidates did acknowledge that there will be differences in genes but did not recognise genetic testing techniques.

Question 8 (a)

8 Plants take up water for photosynthesis.

- (a) Explain how chloroplasts in leaf cells are related to photosynthesis.

.....

.....

.....

..... [2]

It was generally noted that photosynthesis takes place in chloroplasts but chlorophyll was a less commonly seen answer.

Question 8 (b)

- (b) State the name of the process that moves water up through a plant to its leaves.

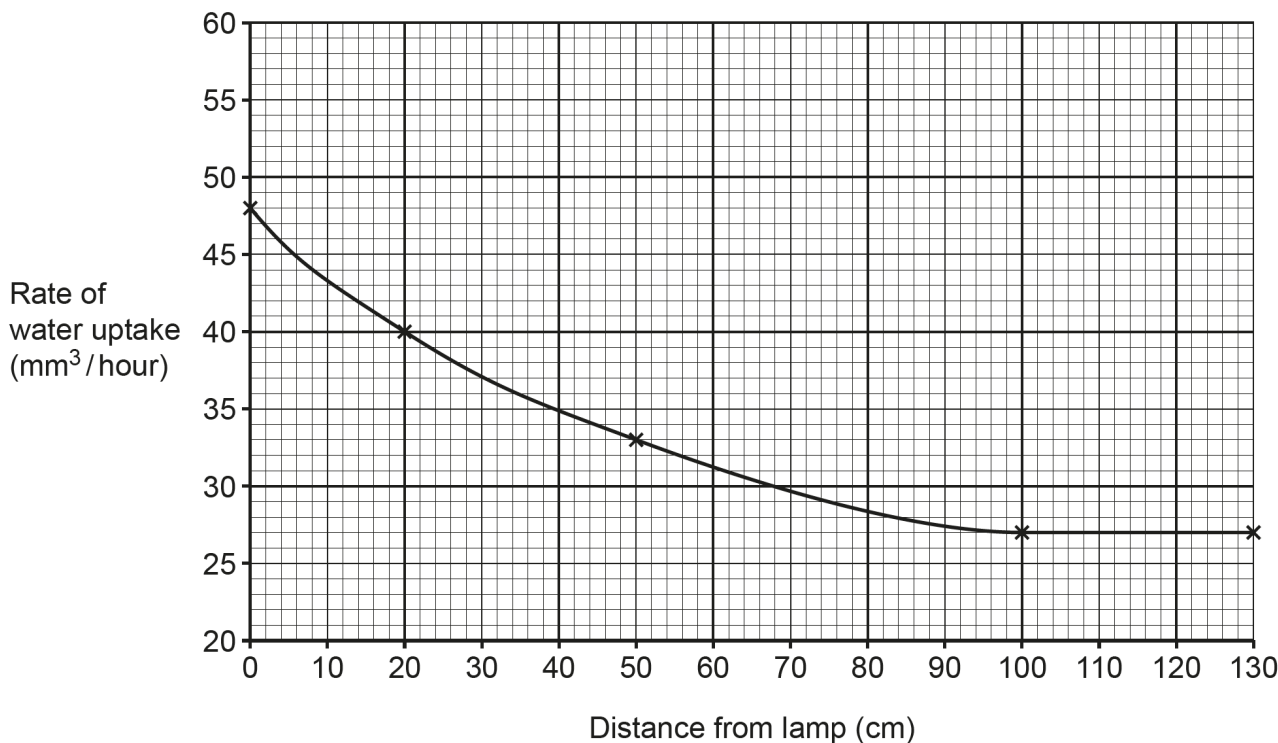
..... [1]

A variety of different answers were seen, the most common being osmosis and active transport.

Question 8 (c) (i)

A student measures the rate of water uptake by a leafy plant shoot at different distances from a lamp.

The results are shown in the graph.



(c) (i) Between which measured distances can the relationship between the distance and the rate of water uptake be represented by the equation $y = mx + c$?

Between and cm [1]

Candidates struggled to answer this question, with very few seeming to recognise the equation.

Question 8 (c) (iii)

- (iii) Calculate the change in the rate of water uptake **per cm** when the lamp was moved from 0 cm to 100 cm away.

Change in rate = mm³/hour/cm [2]

Most candidates successfully carried out the first part of the calculation but did not divide by 100 resulting in 1 mark being commonly given.

Question 8 (d) (i)

(d) Another student tested a different leafy shoot.

- This leafy shoot had a mass of 10g at the start of the day.
 - This leafy shoot took up 0.4g of water during the day.
- (i) Calculate the percentage change in mass of the shoot if the water caused its mass to increase by 0.4g.

Percentage change = % [2]

This question was generally well answered by candidates. Common mistakes were that the candidates did not divide by 10 which is the first stage of the calculation.

Question 8 (d) (ii)

- (ii) At the end of the day, the student observed that the mass of the shoot had **not** increased by 0.4g. It had only increased by an amount much smaller than this.

Suggest an explanation for this observation.

.....

.....

.....

..... [2]

Very few correct responses were seen for this question. Many thought that the observation was student error.

Question 9 (a)

9 People can get different types of cancer.

(a) Complete the sentences to describe what all cancers in humans have in common.

Use words from the list.

amino acids	genes	human
lipids	meristem	mitosis
osmosis	pathogen	translocation

The cancer cells are cells.

The disease is caused by changes in the that control the process of

[2]

The most commonly given mark for this question was 1 mark for two correct answers.

Question 9 (b)

(b) Risk factors for cancer include:

- a person's age
- exposure to substances that are carcinogens (for example in cigarette smoke).

Give **two other** risk factors that affect a person's risk of developing cancer.

1

.....

2

.....

[2]

Many candidates gave alternative carcinogenic substances so did not receive credit. Candidates did give radiation but frequently did not state that the radiation was ionising.

Question 9 (c)

(c) All blood cells are made from stem cells in the bone marrow (soft tissue inside bones).

Leukaemia is a type of cancer that disrupts this process. Having leukaemia means the person **cannot** make working white blood cells.

Explain how this will affect the balance between health and disease in the person's body.

.....

.....

.....

.....

.....

.....

..... [3]

Candidates generally attempted this question and marks were commonly awarded for awareness of the role of white blood cells in keeping healthy and that not being able to make white blood cells would weaken the immune system.

Question 9 (d)

(d) When a person develops leukaemia they **cannot** make new red blood cells.

Explain why the person's **existing** healthy red blood cells cannot divide to make more.

.....

.....

.....

..... [2]

Very few candidates scored full marks on this question. Many appeared not to know how red blood cells were specialised so could not explain why it could not divide. If candidates did receive credit, it was generally for MP2 and the knowledge that red blood cells do not have a nucleus so cannot carry out mitosis.

Question 9 (e)

(e) A treatment for leukaemia involves:

Step 1: Destroying the patient's existing affected cells.

Step 2: Giving the patient a transplant of bone marrow stem cells.

Describe one benefit **and** one risk of step 2.

Benefit

.....

Risk

.....

[2]

Candidates did not recognise that bone marrow stems cells need to differentiate into blood cells, so could not explain specialisation. Many candidates did correctly identify the risk of rejection, thus being given MP2.

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