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GCSE (9–1) Combined Science B (Twenty First Century Science)

J260/01 Biology (Foundation Tier)

Tuesday 15 May 2018 – Afternoon

Time allowed: 1 hour 45 minutes

703199606

You must have:
- a ruler (cm/mm)

You may use:
- a scientific or graphical calculator
- an HB pencil

J260001

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION
- The total mark for this paper is **95**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in the question marked with an asterisk (*).
- This document consists of **28** pages.

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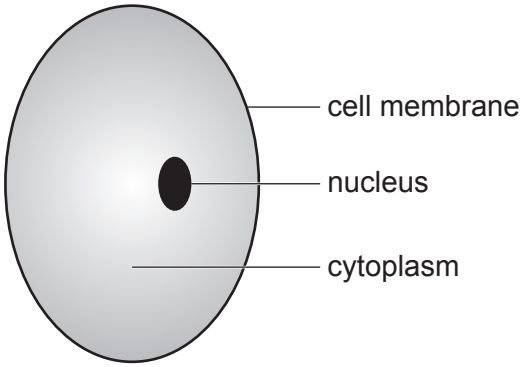
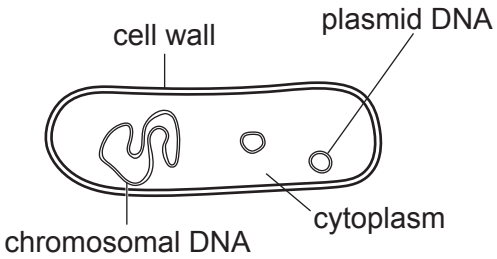
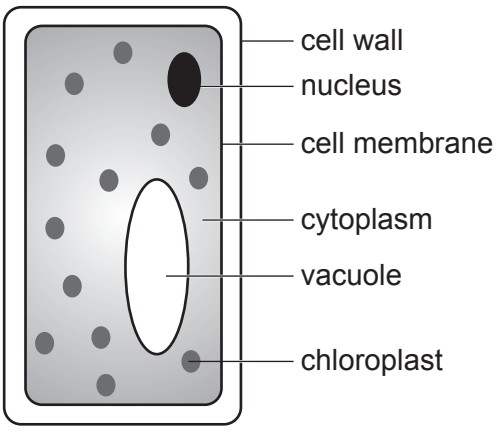
Answer **all** the questions.

1 The diagrams in the table show different types of cells.

Identify the type of cell shown in each diagram.

Tick **one** box in each row.

Diagram of cell	Type of cell		
	Plant	**Animal**	**Bacterial**
			
			
			

[3]

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2 Hormones control many processes in the human body.

(a) Complete the sentences about hormones using words from the list.

Each word may be used once, more than once or not at all.

blood **glands** **nerves** **organs**

receptors **response** **stimuli**

Hormones enable the body to respond to internal or external ..... .

Hormones are secreted by ..... .

Hormones are transported by the ..... .

Hormones attach to ..... on effectors. This causes

a ..... .

[5]

(b) The menstrual cycle is controlled by hormones.

The graph in **Fig. 2.1** shows changes in the levels of these hormones during the menstrual cycle when an egg is not fertilised.

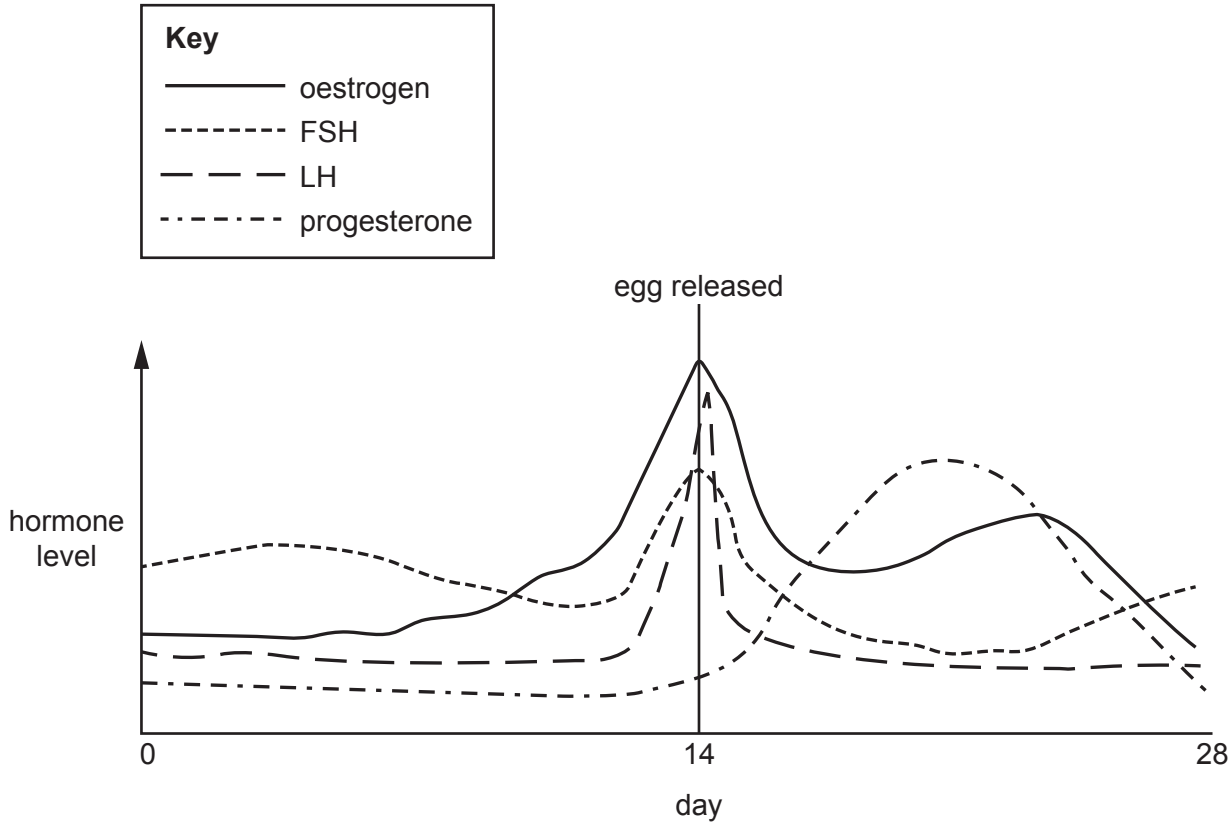

Fig. 2.1

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Look at the graph in **Fig. 2.1**.

Describe how the hormone levels change after an egg has been released.

.....

.....

.....

.....

.....

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

(c) (i) Contraceptive pills contain hormones that can prevent pregnancy.

Which statement gives the best explanation of how the hormones in a contraceptive pill prevent pregnancy?

Tick (✓) **one** box.

The hormones speed up the menstrual cycle.	☐
The hormones slow down the menstrual cycle.	☐
The hormones prevent ovulation.	☐
The hormones kill sperm.	☐

[1]

(ii) Give **one disadvantage** of relying only on a hormone contraceptive pill to prevent pregnancy.

.....

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

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3 This question is about the genome.

(a) (i) Which **two** statements about the genome are correct?

Tick (✓) **two** boxes.

The genome is the entire genetic material of an organism.	☐
Each organism's genome is identical.	☐
In most organisms, the genome is packaged into chromosomes.	☐
Only some organisms have a genome.	☐
The genome of animal cells is stored in the cytoplasm.	☐

[2]

(ii) A student makes some notes about genomes.

1. The genome is made from DNA.
2. Genes are sections of DNA.
3. DNA is wound into a triple helix.
4. DNA is a polymer.
5. DNA is made from amino acids.

The teacher spots some mistakes.

Write down the numbers of the **two** sentences that contain mistakes.

Sentences ..... and ..... **[2]**

(iii) The sequence of bases in a whole human genome can be worked out.

It cost £1 000 000 000 to sequence a human genome in 2003. It can now be done for £1000.

How many times more expensive was it in 2003 than it is now to sequence a human genome?

Put a (ring) around the correct answer in standard form.

10^4 **10^5** **10^6** **10^7**

[1]

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(b) Four students talk about genetic testing.

Nina

I'm going to have a genetic test. It will tell me exactly which diseases I'm going to get.

Jack

Our risk of getting a disease is usually affected by many genes.

Kai

If you find out you have faulty genes it doesn't mean you will definitely get a disease. The extra worry could make you ill.

Sarah

If the test says somebody has a high risk of heart disease they might decide to stop smoking.

(i) Which student suggests that only a few diseases are caused by single genes?

Tick (✓) **one** box.

Nina ☐

Jack ☐

Kai ☐

Sarah ☐

[1]

(ii) Which student suggests a possible extra health risk caused by having a genetic test?

Tick (✓) **one** box.

Nina ☐

Jack ☐

Kai ☐

Sarah ☐

[1]

(iii) Which student has forgotten that the genome and the environment both affect our features?

Tick (✓) **one** box.

Nina ☐

Jack ☐

Kai ☐

Sarah ☐

[1]

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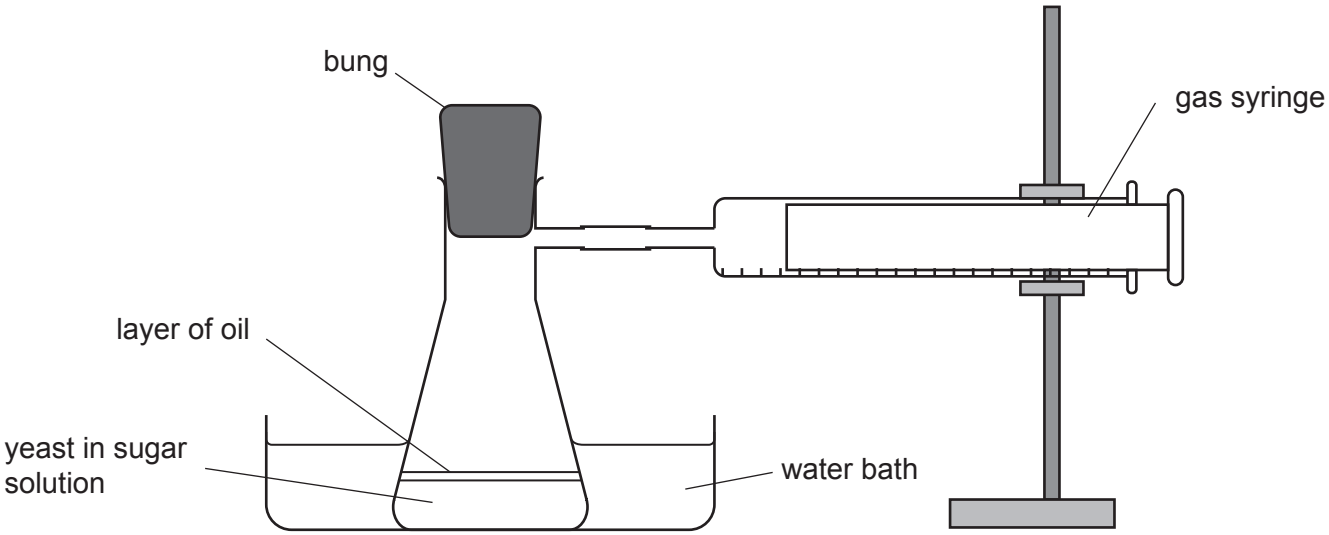
4 A student wants to investigate the effect of different sugars on the rate of anaerobic cellular respiration in yeast.

They use the apparatus shown in the diagram for their investigation.



(a) Which piece of equipment should the student use to measure the volume of sugar solution accurately?

Put a (ring) around the correct answer.

balance **conical flask** **measuring cylinder** **thermometer**

[1]

(b) A gas is produced by the yeast during anaerobic cellular respiration.

(i) What is the name of the gas produced by the yeast?

Tick (✓) **one** box.

Carbon dioxide ☐

Methane ☐

Nitrogen ☐

Oxygen ☐

[1]

(ii) The gas is collected in the gas syringe.

Explain why using a gas syringe is a better technique to use than counting the bubbles of gas produced.

.....

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

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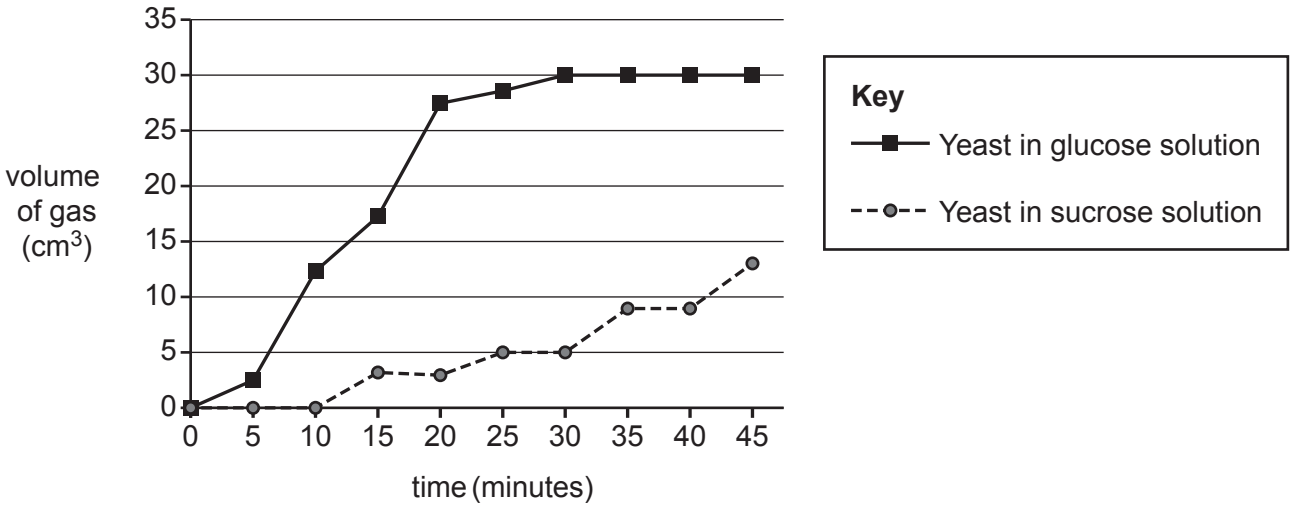
(c) The student does two experiments in their investigation:

- one using yeast in a sugar solution containing glucose
- one using yeast in a sugar solution containing sucrose.

The student plots a graph of the results.



(i) Which conclusion could be made from the graph?

Tick (✓) **one** box.

Yeast respires fastest using glucose. ☐

Yeast respires at a constant rate using sucrose. ☐

Yeast cannot use sucrose in respiration. ☐

Yeast respires at the same rate using glucose and sucrose. ☐

[1]

(ii) How much gas had been collected after 30 minutes from the yeast in glucose solution?

Volume of gas = ... cm^3 **[1]**

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(iii) The student makes some suggestions to explain the pattern of results for yeast in glucose solution after 30 minutes.

Which statements give the **two** best explanations?

Tick (✓) **two** boxes.

- The yeast have used up all the glucose. ☐
- The layer of oil has stopped any more gas escaping. ☐
- The yeast have run out of oxygen. ☐
- No more gas is being made by anaerobic respiration. ☐
- The yeast have switched to aerobic respiration. ☐

[2]

(d) The student wanted to prove that it was the yeast producing the gas.

Which suggestion would allow the student to prove this?

Tick (✓) **one** box.

- Add more sugar to the solution. ☐
- Boil the yeast to kill it before adding the sugar solution. ☐
- Repeat the experiment at different temperatures. ☐
- Use a different type of yeast. ☐

[1]

(e) Anaerobic respiration also happens in animal cells.

Put a (ring) around the correct option to complete each sentence to describe anaerobic respiration in **animal** cells.

The reactant used is **glucose / carbon dioxide / lactic acid**.

The product is **glucose / carbon dioxide / lactic acid**.

[2]

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(f) Energy from cellular respiration can be used to transport molecules across cell membranes.

What is the name of this process?

Tick (✓) **one** box.

- Active transport ☐
- Diffusion ☐
- Osmosis ☐
- Transpiration ☐

[1]

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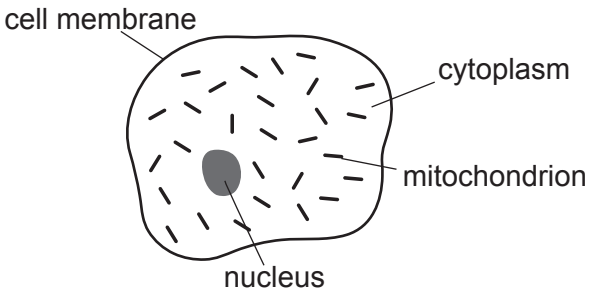
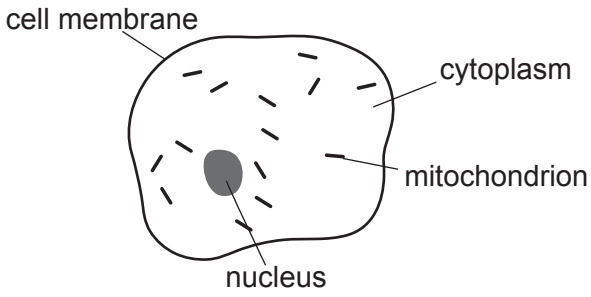
5 The heart and blood transport substances to and from cells in the human body.

The diagrams show two human cells.



Cell A



Cell B

Cell **A** has more mitochondria than cell **B**.

Cell **A** will need to take in more of some substances than cell **B**.

(a) (i) Which two substances will cell **A** need to **take in** more of?

Put (rings) around the **two** correct answers.

carbon dioxide **dissolved food molecules** **oxygen** **urea** **water**

[2]

(ii) Explain why cell **A** needs more of these substances.

.....

.....

.....

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

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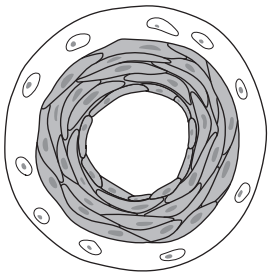
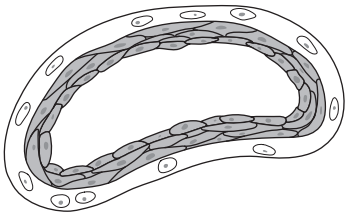
(b) Blood travels in blood vessels.

Kareem looks at two blood vessels using a light microscope.

The diagrams show what he sees.



X



Y

(i) Kareem thinks vessel **X** is an artery and vessel **Y** is a vein.

Explain why he is correct.

.....

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

(ii) What other structure **not** shown in the diagrams would be found in a vein?

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

(iii) Kareem uses a ×10 eyepiece lens and a ×40 objective lens to look at the slides using the microscope.

What is the total magnification of these two lenses?

Total magnification = ×..... **[1]**

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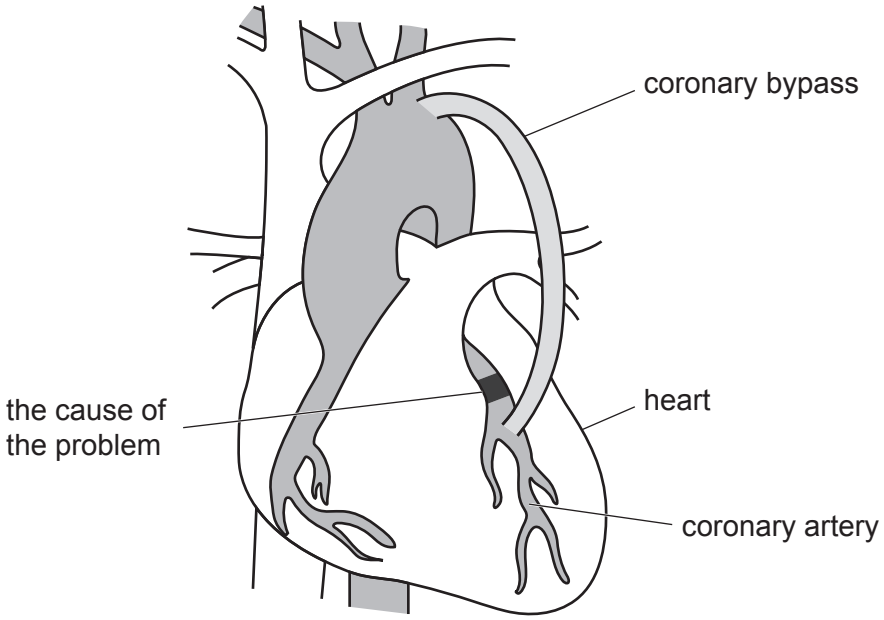
(c) A doctor finds a problem with Kareem's heart.

A bypass operation would help Kareem's heart to work normally again.

The doctor uses a diagram to show Kareem how the operation would help him.



(i) Use the diagram to explain the cause of the problem and how the bypass operation would help him.

.....

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

(ii) Kareem is at risk of having a heart attack.

If Kareem changes his lifestyle he could lower his risk of heart attack.

Explain why it may be better for Kareem to change his lifestyle rather than have a bypass operation.

.....

.....

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

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6 Approximately one quarter of all the trees in Great Britain are ash trees.

In 2012 scientists found trees with a disease called ash dieback.

(a) (i) Ash dieback is a communicable disease.

Put a (ring) around the type of pathogen that causes ash dieback.

bacterium **fungus** **protist** **virus**

[1]

(ii) How is ash dieback spread from one tree to another?

Tick (✓) **two** boxes.

- Carried by insects ☐
- Contaminated soil ☐
- Contaminated water ☐
- Movement of contaminated plant material ☐
- Wind-blown spores ☐

[2]

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(b) Scientists have collected data on the spread of ash dieback since 2012.

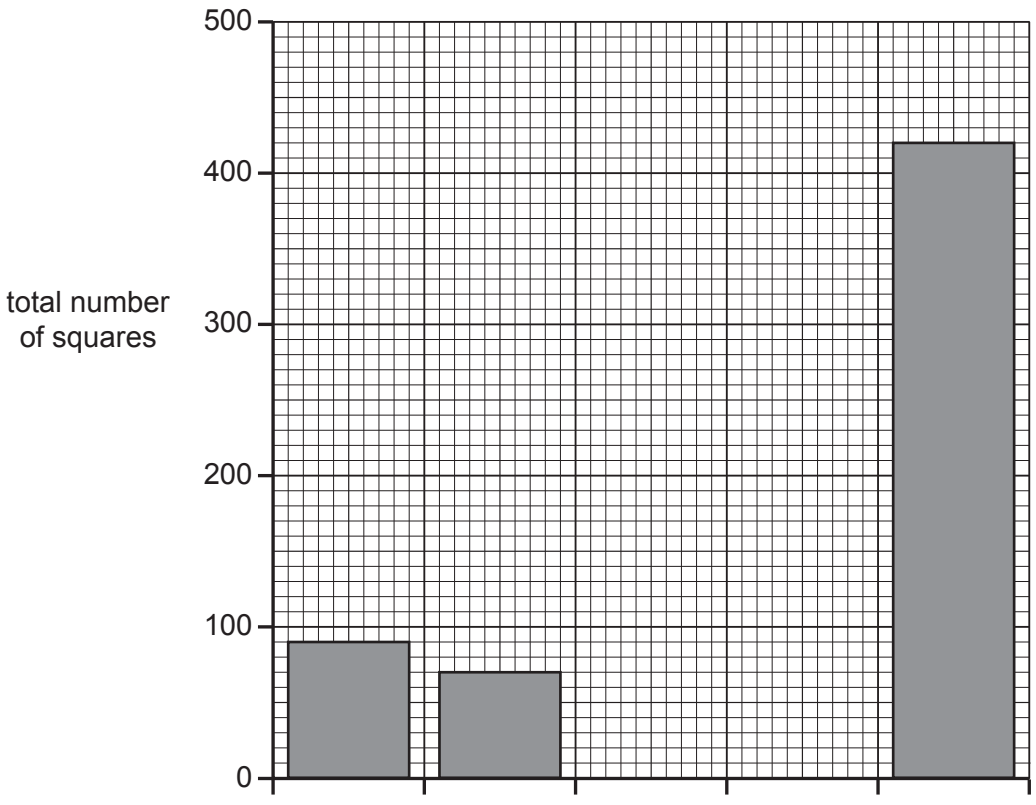
The scientists divided Great Britain into squares.

Each year they recorded the number of squares in which ash dieback was identified for the first time. The results are shown in **Table 6.1**.

Year	Total number of squares in which ash dieback identified for first time in Great Britain
2012	90
2013	70
2014	200
2015	380
2016	420

Table 6.1

(i) Complete the bar chart using the data in **Table 6.1 and** label the x-axis.



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[2]

(ii) Which year does **not** fit the trend in the data?

Put a (ring) around the correct answer.

2012 **2013** **2014** **2015** **2016**

[1]

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Table 6.2 shows data for the individual countries within Great Britain.

Country	Number of squares in which ash dieback identified for first time						Total number of squares in country
	2012	2013	2014	2015	2016	Total	
Scotland	7	5	33	125	10	180	1100
England	83	63	162	224	314	846	1470
Wales	0	2	5	31	96	134	265

Table 6.2

(iii) Calculate the percentage of all squares in **Wales** with ash dieback.

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

Percentage = ...% **[2]**

(iv) Use the data in **Table 6.2** and your own knowledge to explain why scientists are concerned about ash dieback arriving in Great Britain.

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

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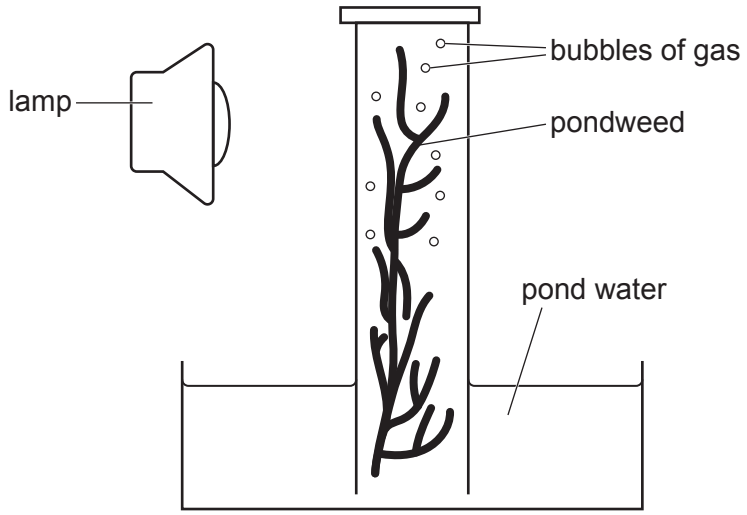
7 Amaya is planning an investigation.

She wants to find out how temperature affects the rate of photosynthesis.

The information below is taken from her lab notebook.



Method

Count the number of gas bubbles produced in 5 minutes.
Repeat 4 times.

Use these temperatures:
0 °C
20 °C
25 °C
30 °C

(a) (i) Amaya plans to investigate four different temperatures.

Room temperature is 20 °C.

Describe how Amaya can set up her experiment at the other temperatures.

.....

.....

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

(ii) Which factors should Amaya keep the same to make sure she collects valid data?

Tick (✓) **two** boxes.

- The brightness of the lamp. ☐
- The level of carbon dioxide in the pond water. ☐
- The level of oxygen in the pond water. ☐
- The size of the bubbles. ☐
- The rate of photosynthesis. ☐

[2]

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(b) **Table 7.1** shows Amaya's results.

Temperature (°C)	Number of bubbles counted in 5 minutes			
	Repeat 1	Repeat 2	Repeat 3	Repeat 4
0	2	2	0	4
20	16	12	17	13
25	24	18	25	19
30	33	25	34	26

Table 7.1

(i) What is the range for the results at 30 °C?

Range = ... **[1]**

(ii) Calculate the mean number of bubbles at 30 °C.

Mean number of bubbles = ... **[1]**

(iii) Describe the pattern of results shown in **Table 7.1** and use ideas about enzymes to explain the pattern of results.

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

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(iv) Amaya repeats her investigation at a temperature of 50 °C.

She finds a lower mean number of bubbles.

Explain why.

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

(c) A plant makes glucose when it photosynthesises. The glucose is then turned into starch for storage.

A student wants to show that there is both glucose and starch in a leaf from a plant.

Draw a line to link each **substance** to the **reagent** the student should use to test for it.

Substance	**Reagent**
	Benedict's solution
Glucose	Biuret solution
Starch	Ethanol
	Iodine solution

[2]

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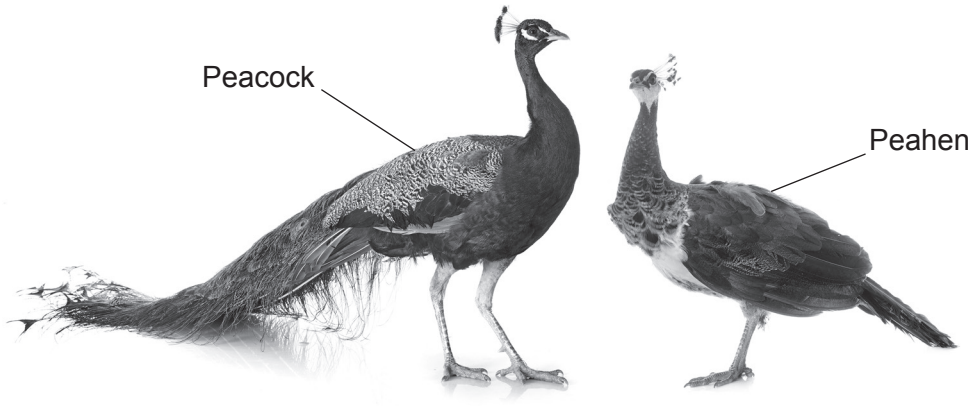
8 Jamal sees this picture of a male peacock and a female peahen in his textbook.



Peahens have plain grey feathers, which makes it hard for predators to see them.

The male peacock has brightly coloured feathers and a large tail that it uses to attract peahens so they can mate.

(a) Suggest **two disadvantages** of the male peacock's brightly coloured feathers.

1 .....

2 .....

[2]

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(b)* Jamal's textbook says that the male's bright feathers and large tail evolved by natural selection, even though there are some disadvantages to having them.

Explain how the male peacock's features evolved by natural selection and why they are still present despite these disadvantages.

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

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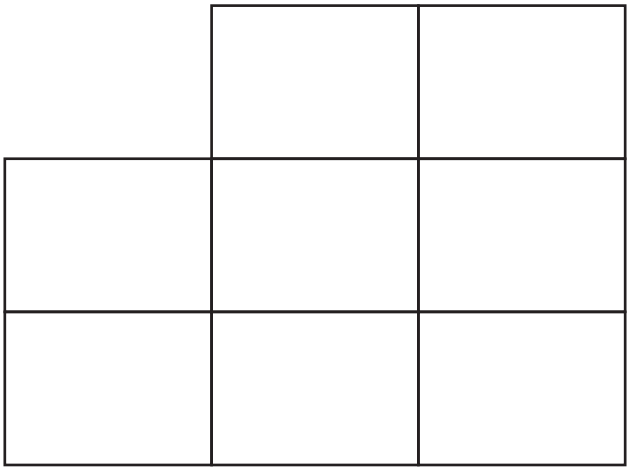
9 Read the newspaper headline.

First girl born into a family for 101 years

Having only males born into a family for this length of time is very unusual.

(a) Use your knowledge of how human sex is determined to explain why having only males is very unusual.

Use the Punnett square in your answer.



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..... **[5]**

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(b) Gametes are made by cell division.

A fertilised egg divides to make body cells using a different type of cell division.

Complete the table describing the two types of cell division.

Type of cell division		
Type of cells made	gametes	body cells
Number of cells at the start of the process	1	1
Number of cells at the end of the process		
Number of rounds of cell division		
Number of chromosomes in the cell at the start of interphase	46	46
Number of chromosomes in each cell at the end of the process		

[5]

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10 Scientists collected data on blood cholesterol levels and death from heart disease in men.

The graph in **Fig. 10.1** shows the relationship between blood cholesterol and the death rate from heart disease in the United States, Japan and two areas of Europe.

Adapted from © W M M Verschuren, D R Jacobs, B P M Bloemberg, D Kromhout, A Menotti, C Aravanis, H Blackburn, R Buzina, A S Dontas, F Fidanza, M J Karvonen, S Nedelijković, A Nissinen, H Toshima, 'Serum Total Cholesterol and Long-term Coronary Heart Disease Mortality in Different Cultures', pp131–136, JAMA, Vol. 274.2, 12 July 1995. Item removed due to third party copyright restrictions. Link to material: https://jamanetwork.com/journals/jama/article-abstract/389185

Fig. 10.1

(a) (i) Blood cholesterol levels are measured in millimoles per litre (mmol / l).

How many moles are there in a millimole?

Put a (ring) around the correct answer.

0.001 **0.01** **0.1** **10** **100** **1000**

[1]

(ii) A student reads off the graph and concludes that the death rate for men with a blood cholesterol level of 5.20 mmol / l is 15 deaths from heart disease per 1000 men.

Is the student's conclusion correct?

Use data from the graph in **Fig. 10.1** to explain your answer.

.....

.....

.....

.....

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

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(b) (i) A man in the United States has a blood cholesterol level of 6.50 mmol / *l*.

The graph in **Fig. 10.1** shows that 15 out of every 1000 men with this blood cholesterol level will die from heart disease.

Calculate the probability that he will die from heart disease.

Give your answer to **1** significant figure.

Probability = ... **[2]**

(ii) In a sample of 1000 men from the United States, 20 died from heart disease.

Use the graph in **Fig. 10.1** to estimate the mean blood cholesterol level of these men.

Blood cholesterol level = ...mmol / *l* **[1]**

(c) The scientists could collect other information to help explain the data on the graph.

One example of other information they could collect is the ages of the men in the study.

Suggest **other** examples of information they could collect to help explain the data.

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

END OF QUESTION PAPER

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If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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