OCR
Oxford Cambridge and RSA

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

J260/05 Biology (Higher Tier)

Tuesday 15 May 2018 – Afternoon

Time allowed: 1 hour 45 minutes

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

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

J260/05

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 **24** pages.

Answer **all** the questions.

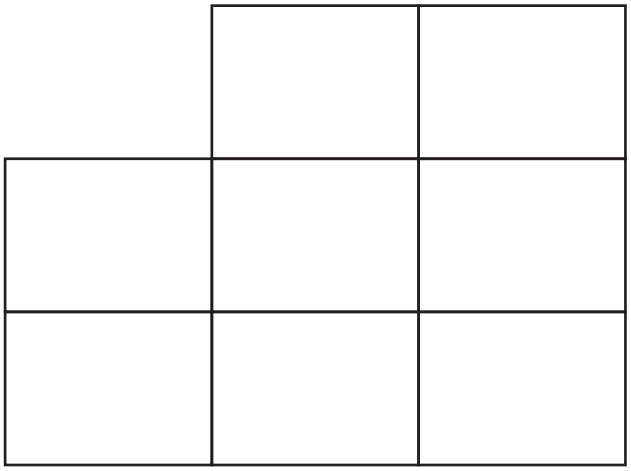
1 Read the newspaper headline.

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]**

(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]

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

The graph in **Fig. 2.1** 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. 2.1

(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. 2.1** to explain your answer.

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

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

The graph in **Fig. 2.1** 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. 2.1** 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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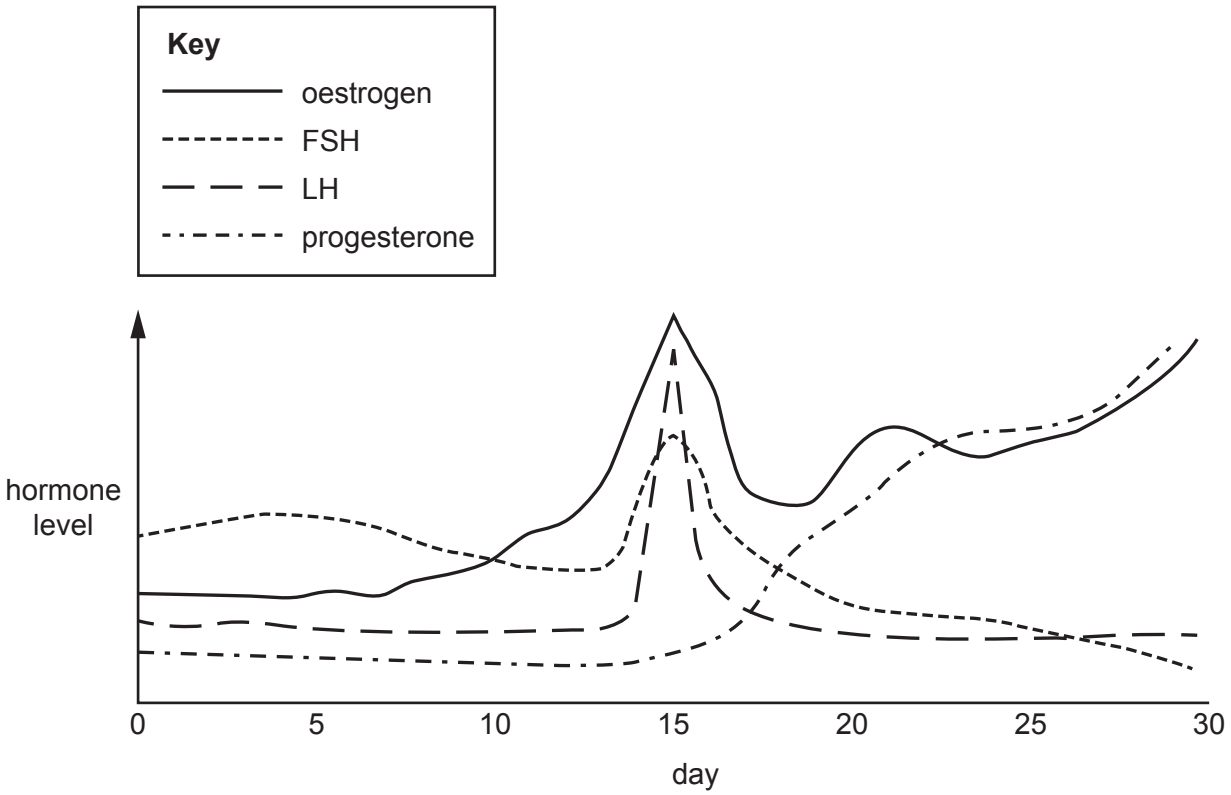
..... **[2]**

3 Hormones control many processes in the human body.

(a) The graph shows changes in the levels of hormones that control the menstrual cycle in one female human during one complete cycle.



(i) On which day during this menstrual cycle did ovulation take place?

Explain your answer.

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

(ii) During this menstrual cycle the egg was fertilised. This caused a change in hormone levels and the female did not menstruate.

Draw **one** line to join the correct **change in hormone levels** to its **effect** to explain why she did not menstruate.

Change in hormone levels	Effect
Oestrogen levels decreased	The uterus wall began to thicken
Oestrogen levels did not decrease	The thickened uterus wall broke down
Progesterone levels decreased	The thickened uterus wall did not break down
Progesterone levels did not decrease	The thickened uterus wall was discharged

[2]

(b) A different female is being treated for infertility. She has to have injections of the hormone FSH.

Explain how these injections will help to treat her infertility.

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

(c) Thyroxine is another hormone produced in the human body.

Describe the effects that thyroxine has in the body **and** explain how production of thyroxine is controlled.

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

4 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) Describe the cause of ash dieback and how it is spread.

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

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

The scientists divided Scotland, England and Wales into squares.

Each year they recorded the number of squares in which ash dieback was identified for the first time.

Table 4.1 shows their results.

Country	Number of squares in which ash dieback identified for first time						% of all squares in country with dieback
	2012	2013	2014	2015	2016	Total	
Scotland	7	5	33	125	10	180	16.4
England	83	63	162	224	314	846	57.6
Wales	0	2	5	31	96	134	50.6

Table 4.1

(i) The scientists calculated that 50.6% of all squares in Wales had ash dieback.

Calculate the total number of squares in Wales.

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

Total number of squares in Wales = ... **[3]**

(ii) **Table 4.1** shows that the spread of ash dieback was slower overall in Scotland than in England.

Suggest some possible explanations for this.

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

(c) Research shows that some British ash trees have some resistance to ash dieback.

Describe how ash trees could be selectively bred to increase resistance to ash dieback.

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

(d) Some corn plants have been genetically engineered to be resistant to disease.

Genetic material from a different organism was added to the corn. The genetic material allows the corn to make toxins that kill insects.

(i) Complete the sentences to describe the main steps in the process of genetically engineering corn in this way.

Choose the correct words from the list.

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

amino acid **enzyme** **gamete** **gene**

genome **plasmid**

The ..... that codes for the toxin is isolated from the original organism using a specific ..... .

The isolated ..... is then inserted into a ..... , which is added into a bacterium.

The bacterium is used to infect cells from corn.

The new genetic material becomes part of the ..... in the corn cells.

[5]

(ii) Describe some of the risks of growing genetically engineered corn.

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

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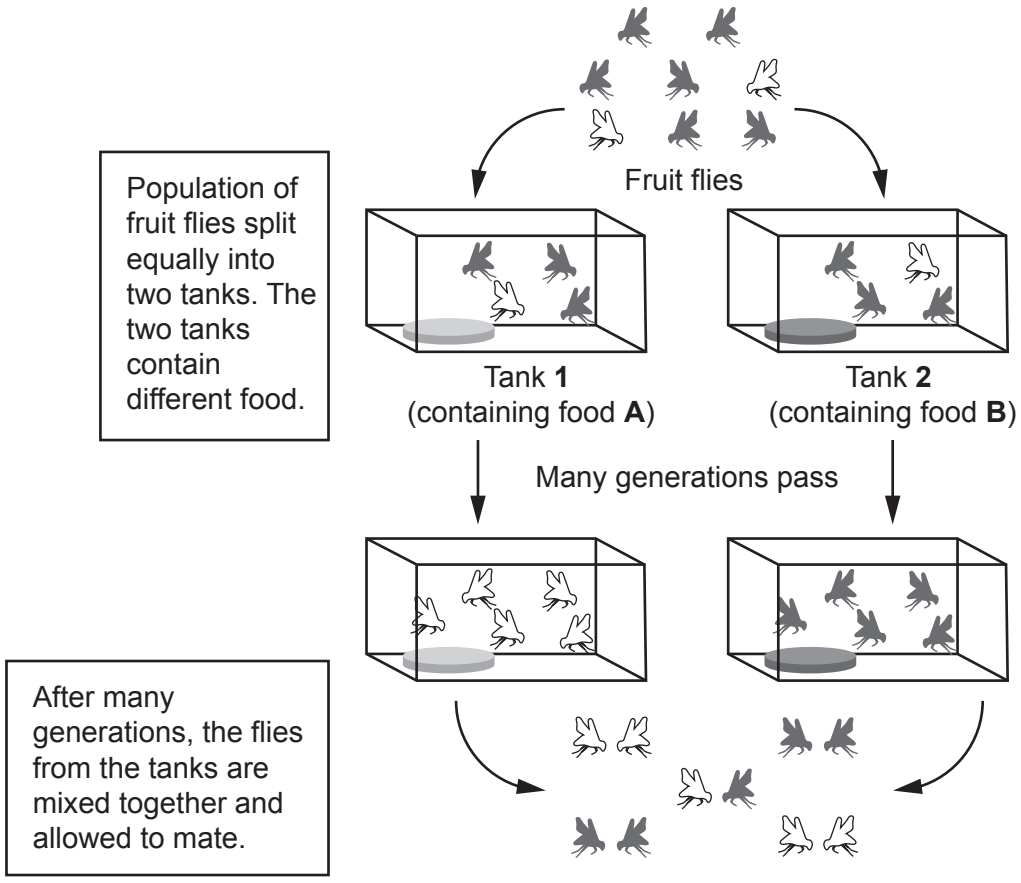
5 Darwin published his theory of evolution by natural selection in 1859.

(a)* Many scientists have carried out experiments to test Darwin's theory.

In one laboratory experiment a scientist used fruit flies. The diagram illustrates the experiment she did.



The results of the experiment are shown in the table.

Mating pair		Number of fertile offspring
Male	**Female**	
From tank **1**	From tank **1**	19
From tank **1**	From tank **2**	0
From tank **2**	From tank **1**	0
From tank **2**	From tank **2**	18

Describe the results from the experiment **and** use ideas about evolution to explain what has happened.

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

(b) Scientists have found evidence that supports the theory of evolution by natural selection.

Some of this evidence is provided by fossils.

Describe **two** ways in which fossils have provided evidence of evolution.

1 .....

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2 .....

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[2]

(c) Living and fossilised organisms can be classified into groups.

Early classification systems put organisms into large groups called kingdoms.

Later evidence suggested that the kingdoms of animals, plants, fungi and protists could be grouped into one large domain. The evidence was the observation of the cell nucleus.

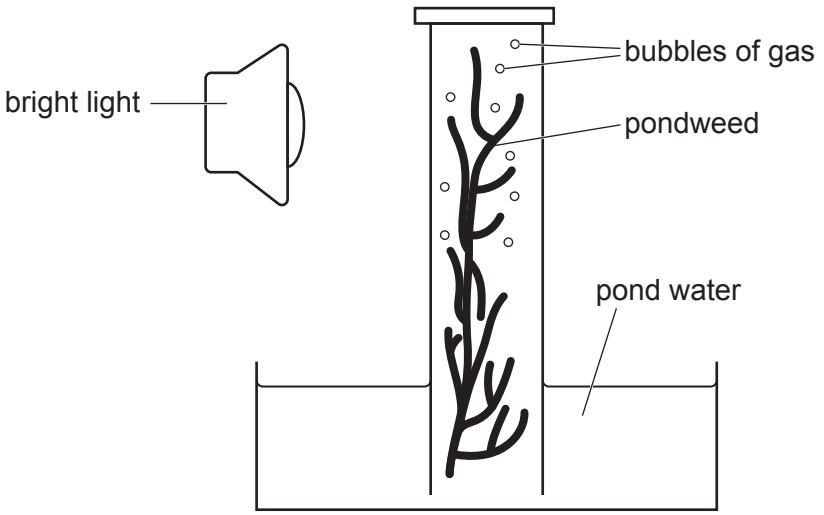
What name is given to the domain that contains all organisms with a cell nucleus?

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

6 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
35 °C
40 °C

(a) (i) The bubbles contain oxygen gas.

During which stage of photosynthesis is oxygen gas formed?

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

(ii) What factors should Amaya keep the same in each repeat to make sure her investigation produces valid data?

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

(iii) There are different methods that can be used to collect the gas produced by the pondweed.

Describe a different method that Amaya could use **and** explain why it is better than the method shown in Amaya's notes.

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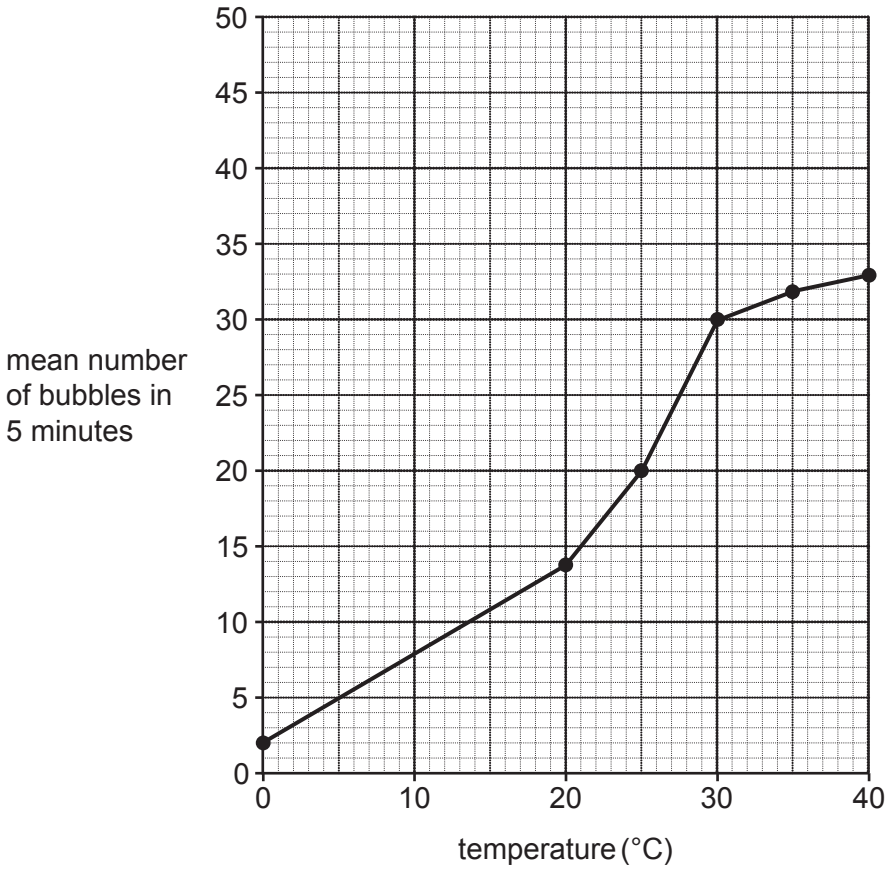
..... **[2]**

(b) Amaya draws a graph of her results.



(i) Use the graph to calculate the rate of gas production at 40 °C.

Rate = ... bubbles per minute **[2]**

(ii) Amaya concludes that increasing the temperature above 30 °C does **not** cause a large increase in the number of bubbles produced.

Use your knowledge of the requirements of photosynthesis to explain why.

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

(iii) Amaya does a second investigation into the effect of temperature on the rate of photosynthesis.

For this investigation she adds sodium hydrogen carbonate to the pond water.

Draw a line on the graph to show the pattern of results you would predict for this investigation.

[2]

(c) Amaya repeats the investigation again, but this time at 60 °C.

Write a testable hypothesis for the investigation at 60 °C and explain why this occurs.

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

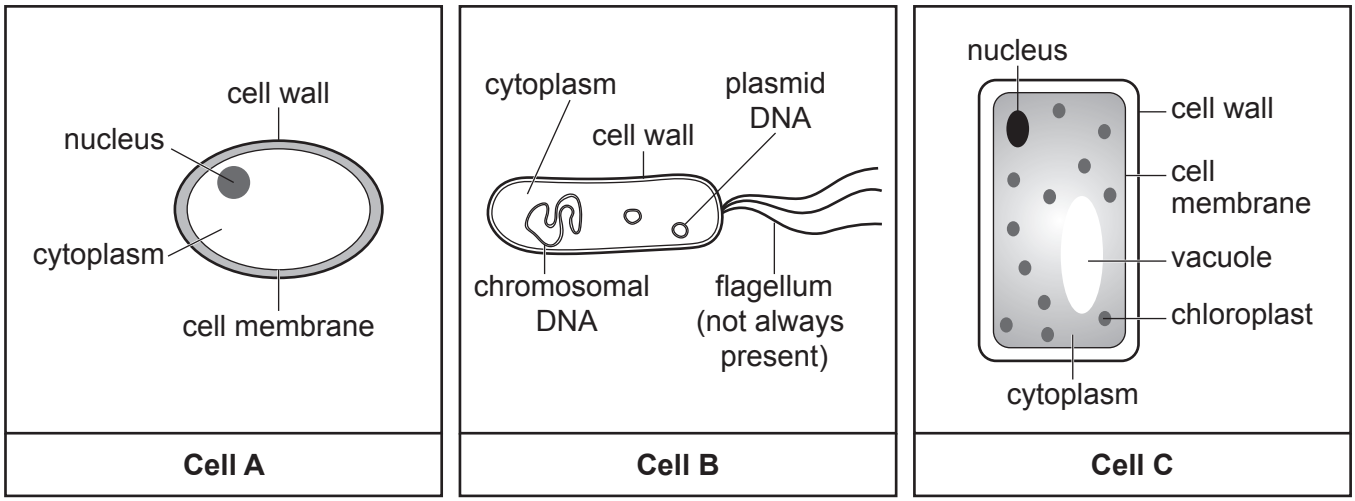
(d) Glucose is a product of photosynthesis.

Write down the name of the reagent you would use to test for the presence of glucose.

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

7 Some students are learning about cells.

They look at some diagrams of different cell types:



Cell A	Cell B	Cell C

Not to scale

(a) Use information in the diagrams to answer the following questions.

(i) Which cell, **A**, **B** or **C**, is a prokaryotic cell?

Cell .....

Explanation .....

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

(ii) Which cell, **A**, **B** or **C**, is a yeast cell?

Cell .....

Explanation .....

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

(iii) Two of the cells also contain an organelle that is not shown in the diagrams. Some of the reactions of aerobic respiration take place in this organelle.

Write down the name of the organelle and which **two** cells, from **A**, **B** and **C**, will contain this organelle.

Name of organelle .....

Found in cells ..... and .....

[2]

(b) The students write down simple word summaries of cellular respiration in different types of organisms.

Complete the word summaries in the table.

Type of organism	Type of cellular respiration	Input	Output
All	.....	glucose + oxygen	carbon dioxide + water
Animal	anaerobic	glucose	.....
Yeast	anaerobic	glucose	.....

[3]

(c) The word summaries are simple models of cellular respiration. In cells, respiration is a complex process involving several reactions.

A paper in a scientific journal includes some more detailed models of anaerobic and aerobic respiration in yeast.

(i) The students have confidence in the information in the paper.

Explain why.

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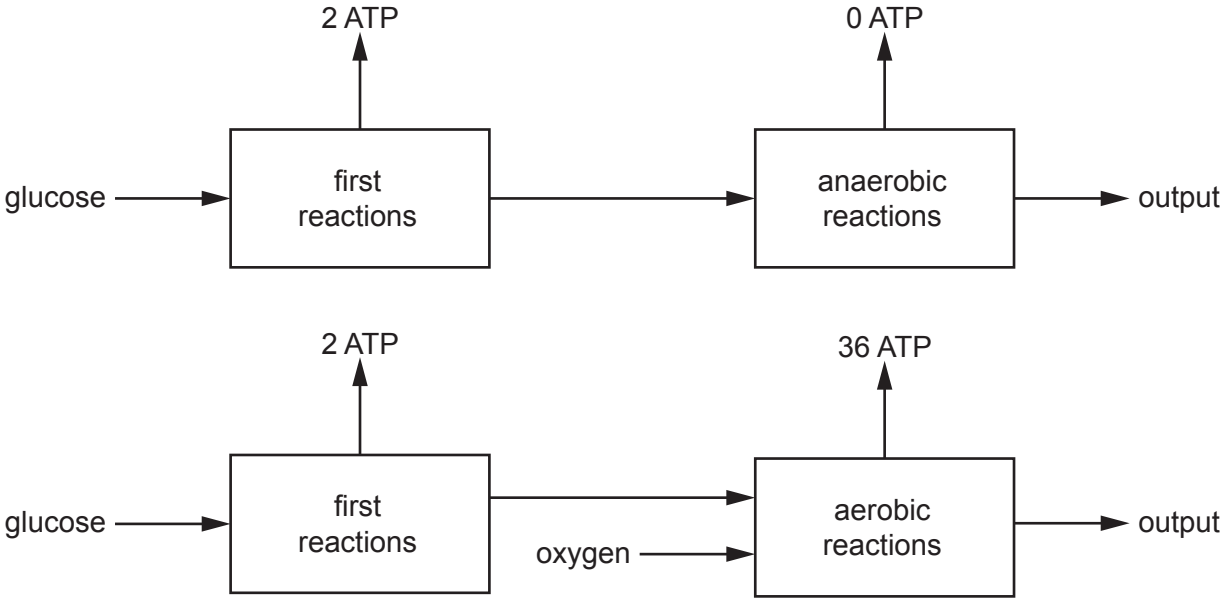
..... **[2]**

The models of anaerobic and aerobic respiration from the paper are shown in the diagram.



These models show that:

- the first reactions of anaerobic and aerobic respiration are the same
- anaerobic and aerobic respiration produce different amounts of ATP.

(ii) Calculate the anaerobic:aerobic ratio of ATP produced by cellular respiration in yeast.

anaerobic:aerobic ratio of ATP produced = ... : ..... **[2]**

(iii) Look at the diagram showing the models of respiration.

Yeast will use **anaerobic** respiration even when oxygen is available.

Which **two** statements, taken together, could explain this?

Tick (✓) **two** boxes.

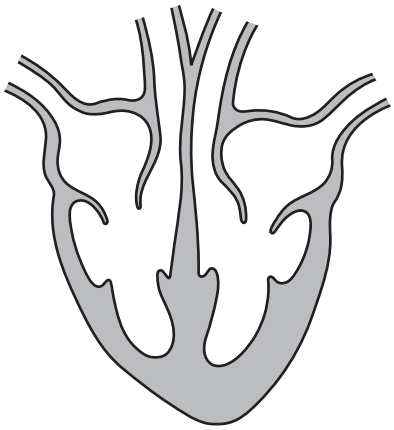
- Anaerobic respiration does not need glucose. ☐
- Anaerobic respiration does not need oxygen. ☐
- Anaerobic respiration has a much faster rate of reaction. ☐
- Anaerobic respiration produces less ATP. ☐
- Anaerobic respiration produces ATP more quickly. ☐ **[2]**

8 Jack has been feeling tired and short of breath. He visits his doctor.

The doctor thinks Jack may have a problem with his heart valves and sends him for a scan of the heart.

Jack's scan shows he has a faulty valve between the left atrium and the left ventricle.

(a) Draw a circle on the diagram of the heart around the valve between the left atrium and the left ventricle.



[1]

(b) Explain to Jack the function of heart valves **and** why his faulty valve is making him feel tired and breathless.

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

(c) Write down one **other** type of structure in the circulatory system that has valves.

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

(d) This information is about Jack's circulatory system:

- The volume of blood pumped out by Jack's heart in one beat is 40 cm^3.
- Jack's resting pulse rate is 80 beats per minute.
- When Jack is exercising, his pulse rate increases by 90%.

Calculate the volume of blood, in **litres**, pumped out by Jack's heart in one minute when he is exercising.

Volume = ... litres **[4]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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).