AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS
BIOLOGY

Paper 1

Thursday 24 May 2018 Afternoon Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a ruler with millimetre measurements
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for the questions are shown in brackets.
- The maximum mark for this paper is 75.

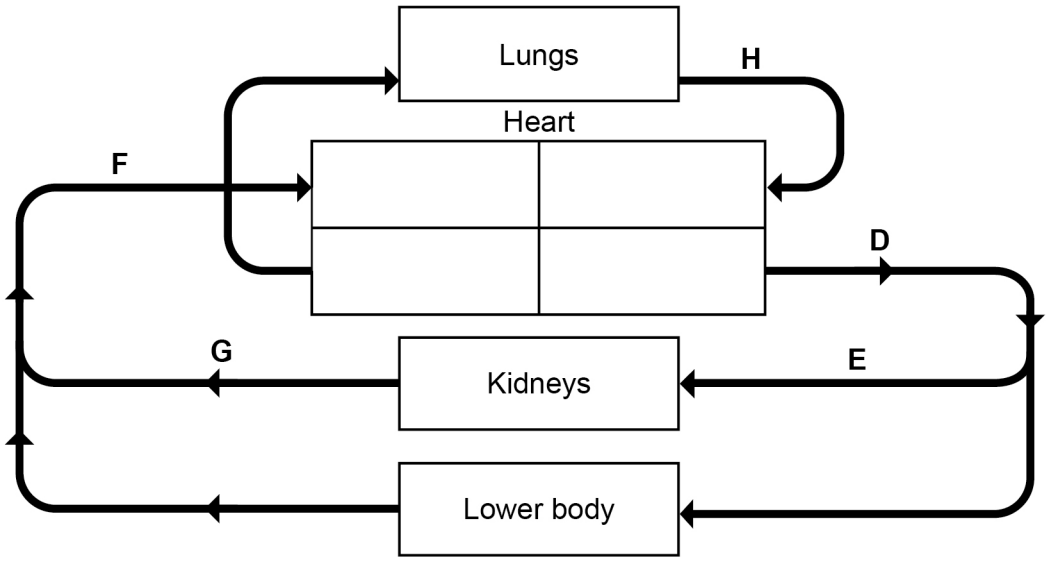
For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

Answer **all** questions in the spaces provided.

Do not write outside the box

0 1 . 1 **Figure 1** shows part of the blood circulation in a mammal.

Figure 1



Use **Figure 1** to give the letter that represents each of these blood vessels.

[3 marks]

Aorta ☐

Renal vein ☐

Vena cava ☐

0 1 . 2 Name the blood vessels that carry blood to the heart **muscle**.

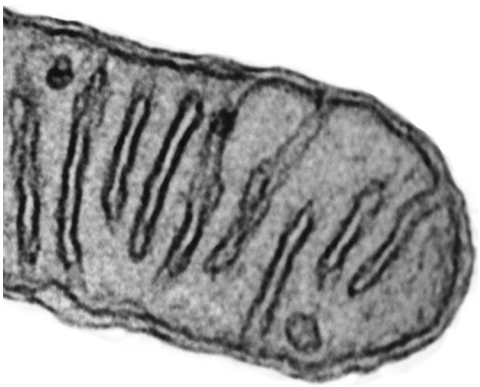
[1 mark]

_____

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0 1 . 3 **Figure 2** shows a photograph of part of a mitochondrion from a mouse liver cell taken using a transmission electron microscope at × 62 800 magnification.

Figure 2



Produce a scientific drawing of the mitochondrion in **Figure 2** in the box below.

Label the following parts of the mitochondrion on your drawing.

- Matrix
- Crista

[4 marks]

8

Do not write outside the box

0 2 . 1 What is a monomer?

[1 mark]

0 2 . 2 Lactulose is a disaccharide formed from one molecule of galactose and one molecule of fructose.

Other than both being disaccharides, give **one** similarity and **one** difference between the structures of lactulose and lactose.

[2 marks]

Similarity

Difference

Do not write outside the box

0 2 . 3 Following digestion and absorption of food, the undigested remains are processed to form faeces in the parts of the intestine below the ileum.

The faeces of people with constipation are dry and hard. Constipation can be treated by drinking lactulose. Lactulose is soluble, but is not digested or absorbed in the human intestine.

Use your knowledge of water potential to suggest why lactulose can be used to help people suffering from constipation.

[2 marks]

0 2 . 4 Lactulose can also be used to treat people who have too high a concentration of hydrogen ions (H^+) in their blood.

The normal range for blood H^+ concentration is 3.55×10^{-8} to 4.47×10^{-8} mol dm^{-3}

A patient was found to have a blood H^+ concentration of 2.82×10^{-7} mol dm^{-3}

Calculate the minimum percentage decrease required to bring the patient's blood H^+ concentration into the normal range.

[2 marks]

Answer = _____

7

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0 3 . 1 Draw **and** label a single DNA nucleotide.

[2 marks]

0 3 . 2 Give **two** features of DNA **and** explain how each one is important in the semi-conservative replication of DNA.

[2 marks]

1 _____

2 _____

Do not write outside the box

0 3 . 3 Replication of mitochondrial DNA (mtDNA) is different from that of nuclear DNA.

The replication of the second strand of mtDNA **only** starts after two-thirds of the first strand of mtDNA has been copied.

A piece of mtDNA is 16 500 base pairs long and is replicated at a rate of 50 nucleotides per second.

Tick (✓) the box that shows how long it would take to copy this mtDNA.

[1 mark]

A 330 seconds ☐

B 440 seconds ☐

C 550 seconds ☐

D 660 seconds ☐

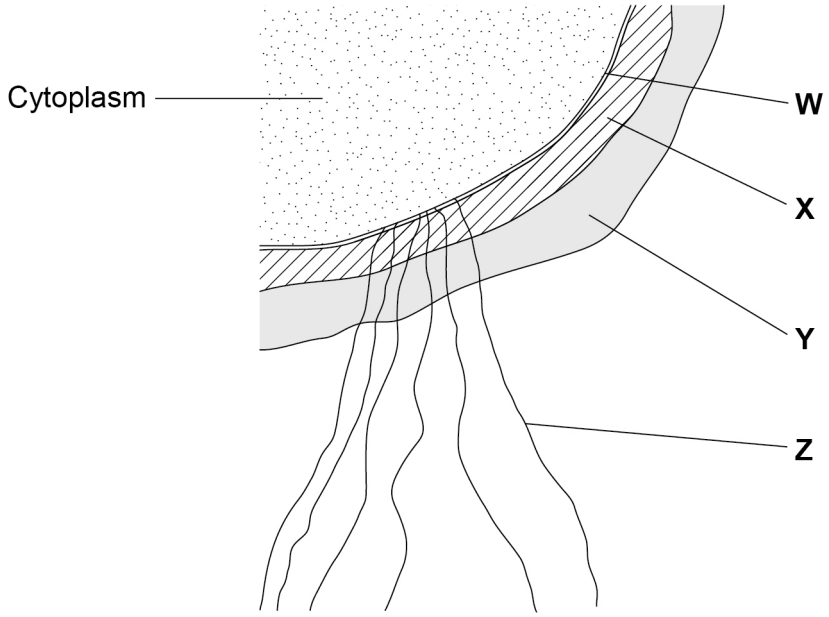
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Turn over for the next question

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0 4 **Figure 3** shows part of a prokaryotic cell.

Figure 3



0 4 . 1 Name the structures labelled **W** to **Z** in **Figure 3**.

[2 marks]

W _____

X _____

Y _____

Z _____

0 4 . 2 Name the main biological molecule in:

[2 marks]

W _____

X _____

Do not write outside the box

0 4 . 3 Name the process by which prokaryotic cells divide.

[1 mark]

_____

0 4 . 4 Some prokaryotic cells can divide every 30 minutes. A liquid culture contained a starting population of 1.35×10^4 cells.

Assuming each cell divides every 30 minutes, calculate how many cells there will be after 3 hours. Assume no cells die during this time.

[2 marks]

Answer = _____

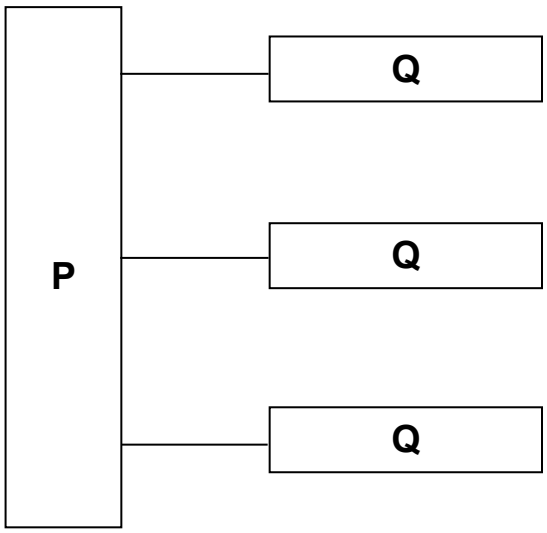
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Turn over for the next question

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0 5 **Figure 4** represents a triglyceride.

Figure 4



0 5 . 1 Name the molecules represented in **Figure 4** by:

[2 marks]

Box **P** _____

Box **Q** _____

0 5 . 2 Name the type of bond between **P** and **Q** in **Figure 4**.

[1 mark]

_____

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0 5 . 3 Describe how you would test a liquid sample for the presence of lipid **and** how you would recognise a positive result.

[2 marks]

5

Turn over for the next question

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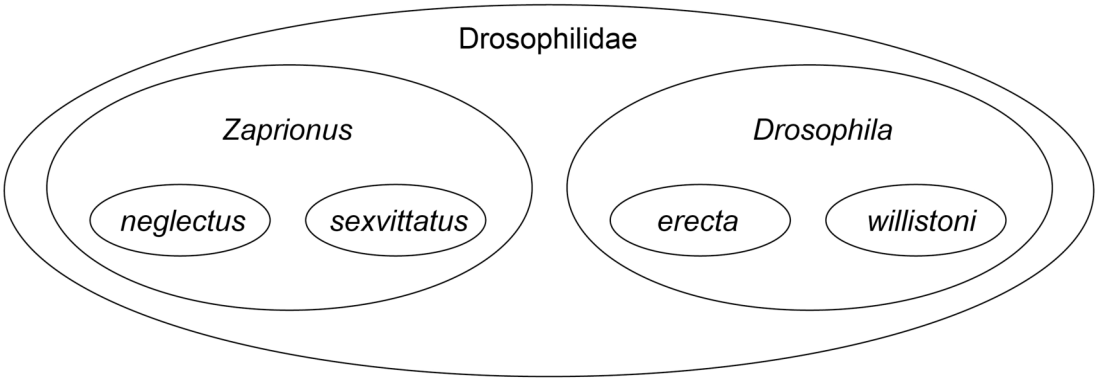
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ANSWER IN THE SPACES PROVIDED

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0 6 **Figure 5** represents the phylogenetic classification of **four** different species of fruit fly.

Figure 5



0 6 . 1 **Figure 5** shows a hierarchy. Explain how.

[2 marks]

0 6 . 2 Name the taxon to which Drosophilidae belongs.

[1 mark]

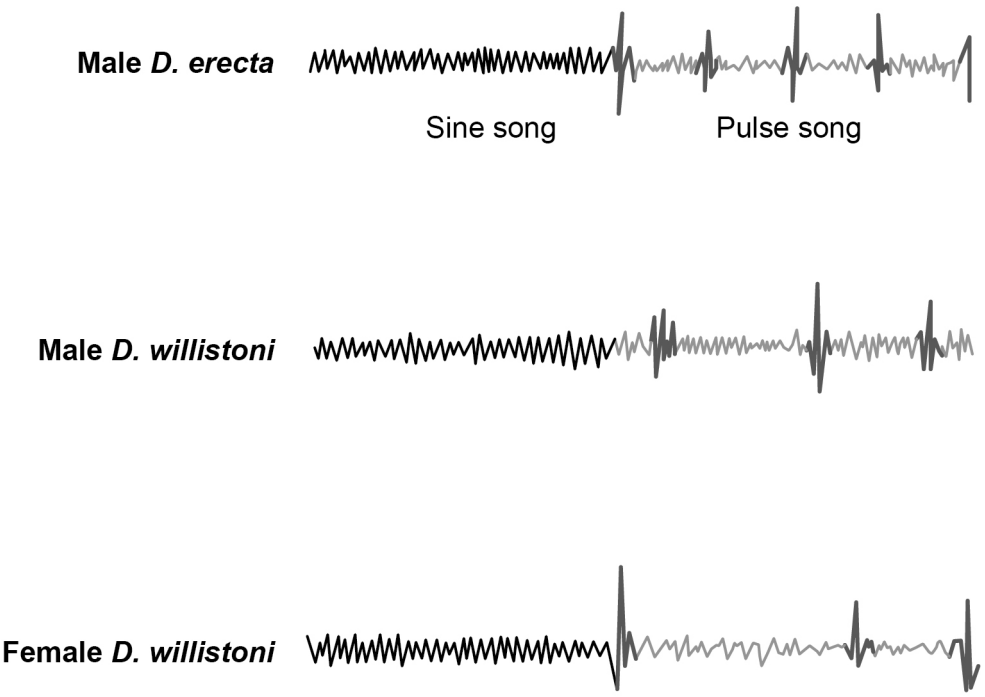
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Drosophila fruit flies display courtship behaviour. One of the stages of courtship is singing by males. Normally a male will produce a 'sine song', in which continual noise is made, and a 'pulse song', in which there is continual noise with some louder peaks.

Scientists showed fruit flies a visual stimulus that made them sing. They made recordings of these songs.

Figure 6 shows the recordings of the songs of three flies over the same time period.

Figure 6



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0 6 . 3 *D. erecta* and *D. willistoni* are closely related species **but** different species.

Describe evidence from **Figure 6** that supports this statement.

[2 marks]

0 6 . 4 The scientists repeated their experiments, using female fruit flies as the visual stimulus. When a male and female *D. willistoni* were together, their songs led to mating.

When two female *D.willistoni* were together, their songs did **not** lead to any attempt to mate.

Use information from **Figure 6** to suggest why the two females did not attempt to mate.

[2 marks]

7

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0 7 . 1 What is the proteome of a cell?

[1 mark]

0 7 . 2 Give **two** structural differences between a molecule of messenger RNA (mRNA) and a molecule of transfer RNA (tRNA).

[2 marks]

1

2

Do not write outside the box

0 7 . 3 Starting with mRNA in the cytoplasm, describe how translation leads to the production of a polypeptide.

Do **not** include descriptions of transcription and splicing in your answer.

[5 marks]

8

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0 8 . 1 State **and** explain the property of water that can help to buffer changes in temperature.

[2 marks]

0 8 . 2 Water is used to hydrolyse ATP.

Name the **two** products of ATP hydrolysis.

[1 mark]

1 _____

2 _____

Do not write outside the box

Hydrolysis of ATP is catalysed by the enzyme ATP hydrolase.

A student investigated the effect of ATP concentration on the activity of ATP hydrolase. She used shortening of strips of muscle tissue caused by contraction as evidence that ATP was being hydrolysed.

- She took four slides **A**, **B**, **C** and **D**, and added strips of muscle tissue of the same length to each slide.
- She then added the same volume of ATP solutions of different concentrations to the four slides and left each slide for five minutes.
- She then recorded the final length of each strip of muscle tissue.

Her results can be seen in **Table 1**.

Table 1

Slide	Concentration of ATP solution added to slide / $\times 10^{-6}$ mol dm^{-3}	Final length of muscle tissue after 5 minutes / mm
A	2	36
B	4	31
C	6	29
D	8	26

0 8 . 3 Other than those given, name **two** variables the student should have controlled.

[2 marks]

1 _____

_____

2 _____

_____

Do not write outside the box

0 8 . 4 Describe **and** explain the pattern shown by the data in **Table 1**.

[2 marks]

Description _____

Explanation _____

0 8 . 5 The hydrolysis of 1 dm^3 of a 1 mol dm^{-3} solution of ATP releases 30 500 J of energy.

60% of the energy released during the hydrolysis of 1 mol dm^{-3} of ATP is released as heat; the rest is used for muscle contraction.

The student added 0.05 cm^3 of ATP solution to slide **D**.

Calculate the energy available from ATP for contraction of the muscle on this slide.

[3 marks]

Answer = _____ J

10

Turn over ►

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0 9 . 1 Describe the pathway taken by an oxygen molecule from an alveolus to the blood.

[2 marks]

0 9 . 2 Explain how **one** feature of an alveolus allows efficient gas exchange to occur.

[2 marks]

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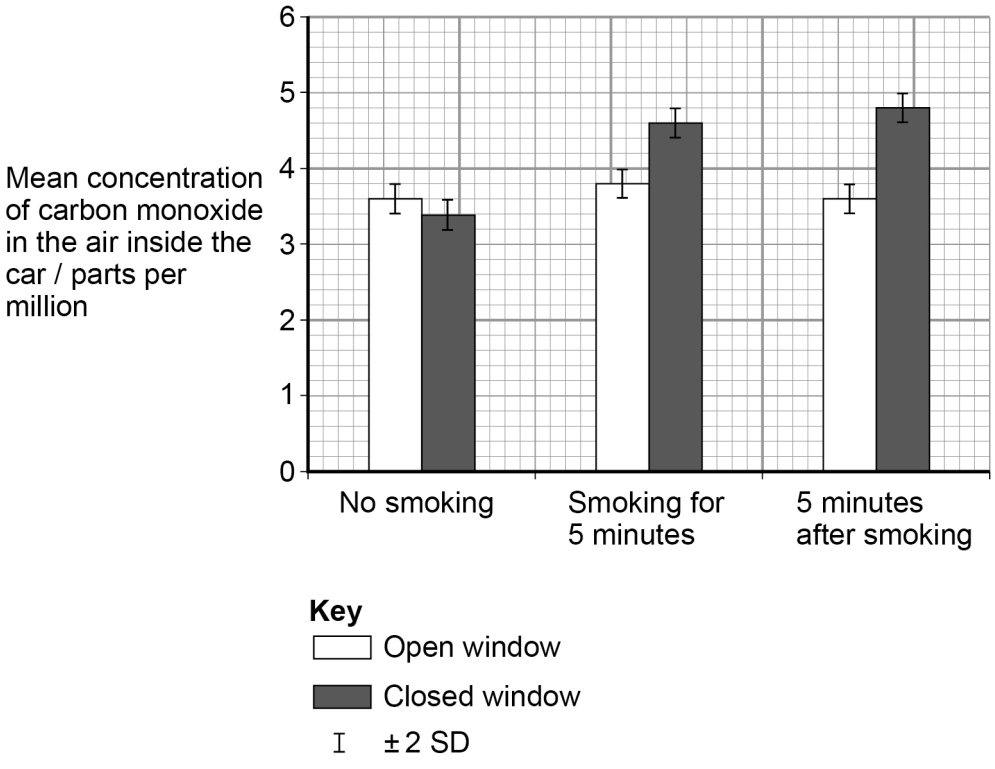
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Carbon monoxide is a poisonous gas that is present in cigarette smoke. This carbon monoxide can be absorbed into the blood where it binds with haemoglobin.

Scientists investigated the concentration of carbon monoxide in cars in which people were smoking or not smoking. They measured the concentration with the car windows open and closed. **Figure 7** shows the scientists' results as they presented them. A value of $\pm$ 2 standard deviations from the mean includes over 95% of the data.

Figure 7



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0 9 . 3 In England, in October 2015, a law was introduced making it illegal to smoke in a car carrying someone who is under the age of 18.

Following the introduction of the law, a politician stated:

'It is dangerous to smoke when a child is in the car. Higher levels of deadly toxins can build up, even on short journeys, and children breathe faster than adults, meaning they inhale more of the deadly toxins.'

Use the information provided **and** the data in **Figure 7** to evaluate the politician's statements.

[4 marks]

8

Turn over ►

Do not write outside the box

1 0 Read the following passage.

Sizes of populations of normal intestinal bacteria are usually controlled by T cells that are produced slowly and in small numbers by the immune system. These T cells do not normally survive for very long. As a result, they do not release large amounts of cytokines. Cytokines are chemicals that can cause swelling of the lining of the intestines.

Crohn's disease is a long-lasting disease that causes swelling of the lining of the intestines. It is believed that Crohn's disease can be caused by a loss of tolerance to normal intestinal bacteria, as shown by an unusually large response by T cells. This response can be triggered by pathogenic bacteria in the intestines of people with a genetic tendency to Crohn's disease.

Some people's Crohn's disease can be controlled by a drug called 5-aminosalicylic acid (5-ASA) that reduces swelling. Another drug called 6-mercaptopurine (6-MP) may also be used. 6-MP inhibits an enzyme required to make adenine and guanine. This is effective because most cells can recycle nucleotides, but T cells are not able to do so.

Use information from the passage and your own knowledge to answer the questions.

Do not write outside the box

1 0 . 1 The Crohn's disease symptom of swelling of the lining of the intestines could be triggered by pathogenic bacteria in the intestines (lines 6–10).

Suggest how.

[3 marks]

Question 10 continues on the next page

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1 0 . 2 Suggest the meaning of 'a genetic tendency to Crohn's disease' (line 10).

[2 marks]

1 0 . 3 Suggest why 5-ASA is only effective in controlling the swelling of the lining of the intestines in **some** people with Crohn's disease (lines 11–12).

[2 marks]

Do not write outside the box

1 0 . 4 Suggest why 6-MP can be used to control the symptoms of Crohn's disease (lines 13–15).

Do **not** include details of enzyme inhibition or protein synthesis in your answer.

[3 marks]

10

END OF QUESTIONS

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