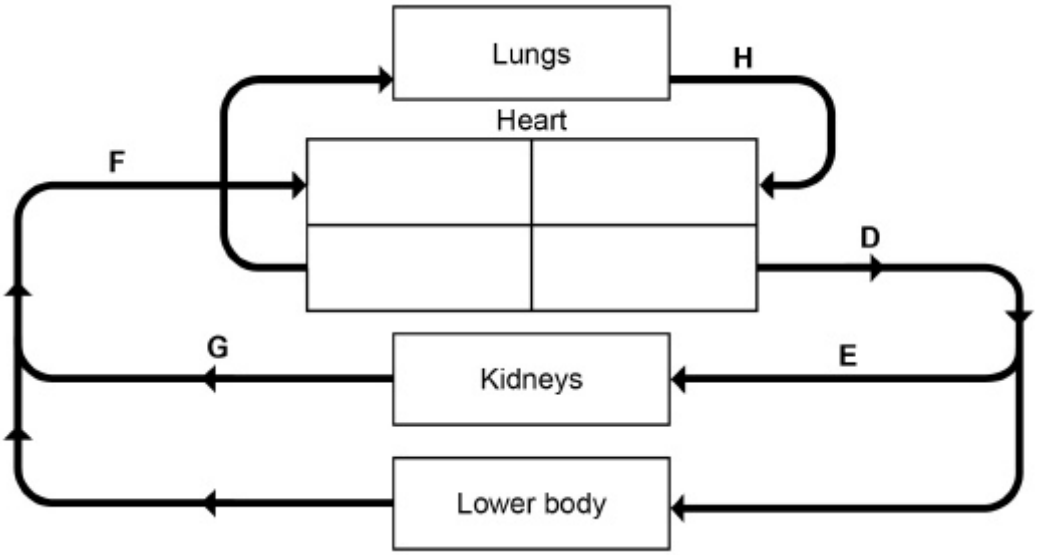
Q1.

(a) **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.

Aorta ☐

Renal vein ☐

Vena cava ☐

(3)

(b) Name the blood vessels that carry blood to the heart **muscle**.

_____

(1)

(c) **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)
(Total 8 marks)

Q2.

A student investigated the effect of three types of disinfectant on the growth of *Lactobacillus* bacteria.

During the investigation, the student:

- boiled the agar before pouring the agar plates
- transferred 0.5 cm^3 of a diluted liquid culture of *Lactobacillus* onto each agar plate
- left some agar plates as controls
- added to other agar plates different concentrations of the disinfectants as shown in the table in part (a).

After 2 days, she counted the number of colonies of bacteria on each agar plate.

(a) Explain the purpose of:

boiling the agar

_____

_____

_____

_____

transferring the same volume of liquid culture onto each agar plate.

_____

_____

_____

_____

(2)

The three disinfectants used by the student were Lysol, propan-2-ol and ammonia.

The table shows the student's results.

Concentration of disinfectant / arbitrary units	Number of colonies of bacteria		
	Lysol	Propan-2-ol	Ammonia
0	300	300	300
5	0	290	300
10	0	195	295
15	0	0	275
20	0	0	240

The liquid culture the student transferred was diluted by 1 in 10 000 (10^{-4}).

(b) Use information in this question to calculate how many bacteria were present in 1 cm^3 of undiluted liquid culture.

Answer = _____

(2)

(c) The student concluded that the minimum concentration of propan-2-ol needed to stop the growth of *Lactobacillus* was 15 units. This conclusion is incorrect.

Describe how you could obtain a more accurate estimate of the minimum concentration of propan-2-ol needed to stop the growth of this species of bacterium.

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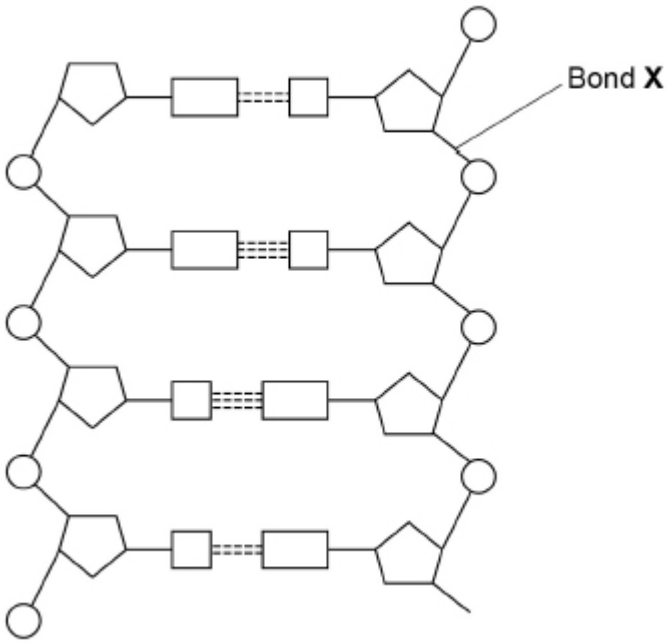
(2)
(Total 6 marks)

Q3.

The diagram shows part of a DNA molecule.



(a) How many nucleotides are shown in the diagram above?

_____

(1)

(b) Name the type of bond labelled **X** in the diagram.

_____

(1)

(c) The enzymes DNA helicase and DNA polymerase are involved in DNA replication.

Describe the function of each of these enzymes.

DNA helicase _____

_____

_____

_____

DNA polymerase _____

_____

_____

_____

(2)

(d) Adenosine triphosphate (ATP) is a nucleotide derivative.

Contrast the structures of ATP and a nucleotide found in DNA to give **two** differences.

1. _____

_____

_____

_____

2. _____

_____

_____

_____

(2)
(Total 6 marks)

Q4.

(a) Describe how a peptide bond is formed between two amino acids to form a dipeptide.

_____

_____

_____

_____

_____

_____

_____

(2)

(b) The secondary structure of a polypeptide is produced by bonds between amino acids.

Describe how.

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(2)

(c) Two proteins have the same number and type of amino acids but different tertiary structures.

Explain why.

_____

_____

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_____

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(2)

(Total 6 marks)

Q5.

(a) Describe the pathway taken by an oxygen molecule from an alveolus to the blood.

_____

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_____

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(2)

(b) Explain how **one** feature of an alveolus allows efficient gas exchange to occur.

_____

_____

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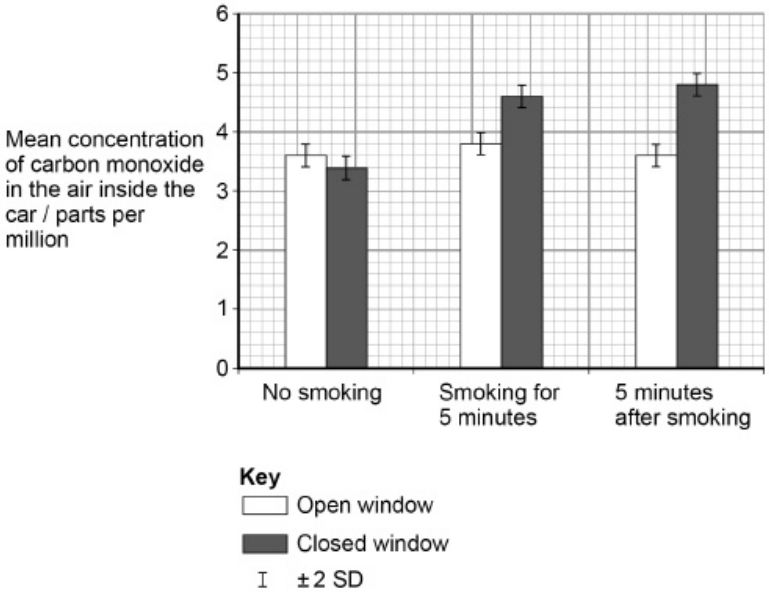
_____

(2)

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. The graph shows the scientists' results as they presented them. A value of ± 2 standard deviations from the mean includes over 95% of the data.



(c) 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 the graph to evaluate the politician's statements.

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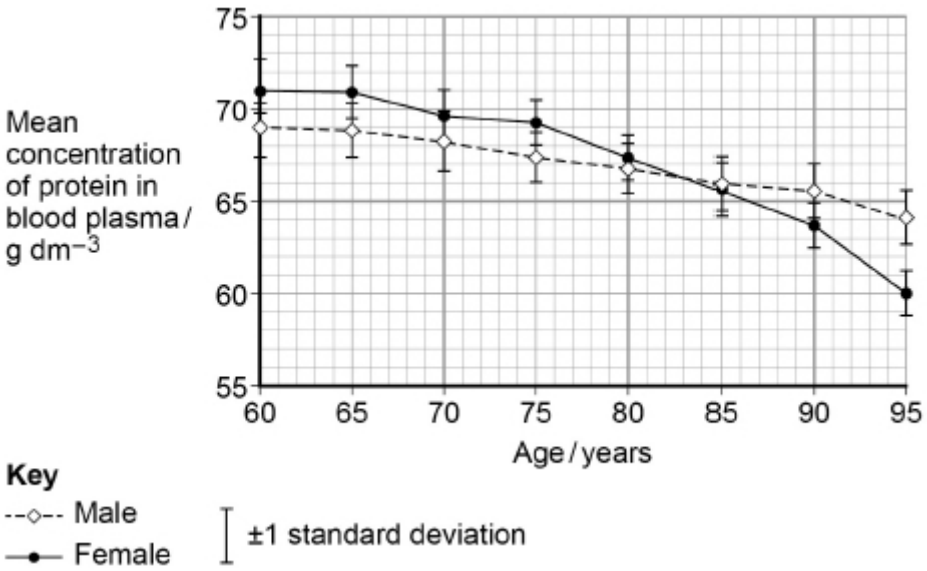
(4)
(Total 8 marks)

Q6.

Scientists investigated how the concentration of protein in blood plasma changes in people between the ages of 60 and 95.

The graph shows the scientists' results. The bars show ±1 standard deviation.



(a) What is the difference between males and females in the fall in mean concentration of protein in blood plasma between 60 and 95 years?

Answer = _____ g dm^{-3}

(1)

(b) Use the graph above to calculate the rate of change of the mean concentration of protein in the blood plasma of males between the ages of 60 and 95.

Show your working.

Answer = _____ g dm^{-3} $year^{-1}$

(2)

(c) What can you conclude from the graph above about the effect of ageing on the mean concentration of protein in the blood plasma in males and females?

_____

_____

_____

_____

_____

_____

(2)

(d) The scientists measured the absorption of each sample of blood plasma using a colorimeter. They used a calibration curve to find the concentration of protein in samples of blood plasma.

Describe how the scientists could obtain data to produce a calibration curve and how they would use the calibration curve to find the concentration of protein in a sample of blood plasma.

_____

_____

_____

_____

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_____

_____

_____

(3)

(e) Older people are more likely to suffer from infectious diseases.

Suggest how this may be linked to the decrease in the mean concentration of protein in the blood as people get older.

_____

_____

_____

(1)
(Total 9 marks)

Your mark ☐

Your percentage ☐

Mark Sheme

Marks I Dropped Analysis Sheet

TT Progress Chart

PAPER TOTAL
43 marks