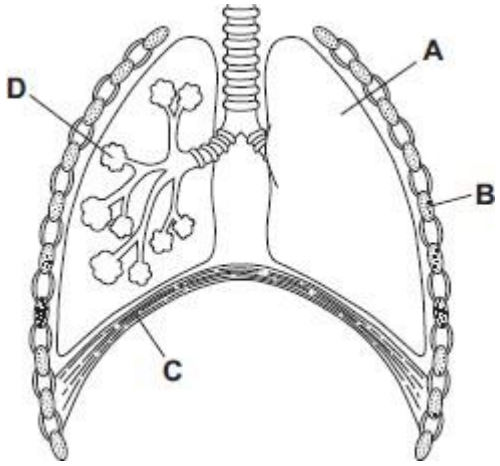
1 (a) **Diagram 1** shows part of the breathing system.

Diagram 1



(i) Use words from the box to name the parts labelled **A**, **B**, **C** and **D**.

alveolus	**diaphragm**	**lung**	**rib**	**trachea**

A _____

B _____

C _____

D _____

(4)

(ii) Parts **B** and **C** move when we breathe **in**.

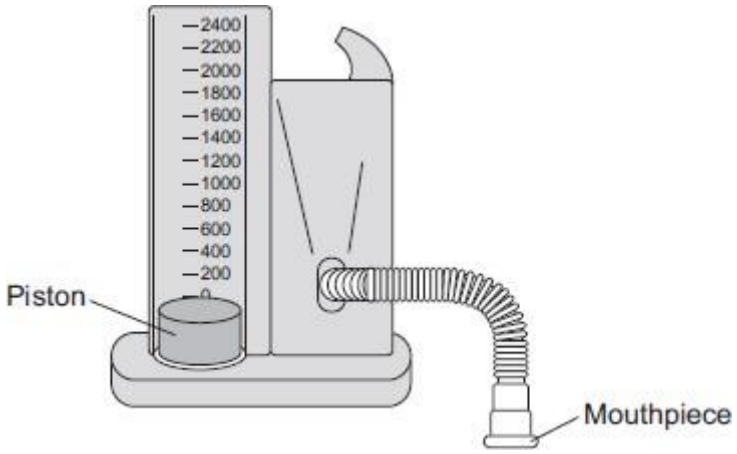
Part **B** moves _____

Part **C** moves _____

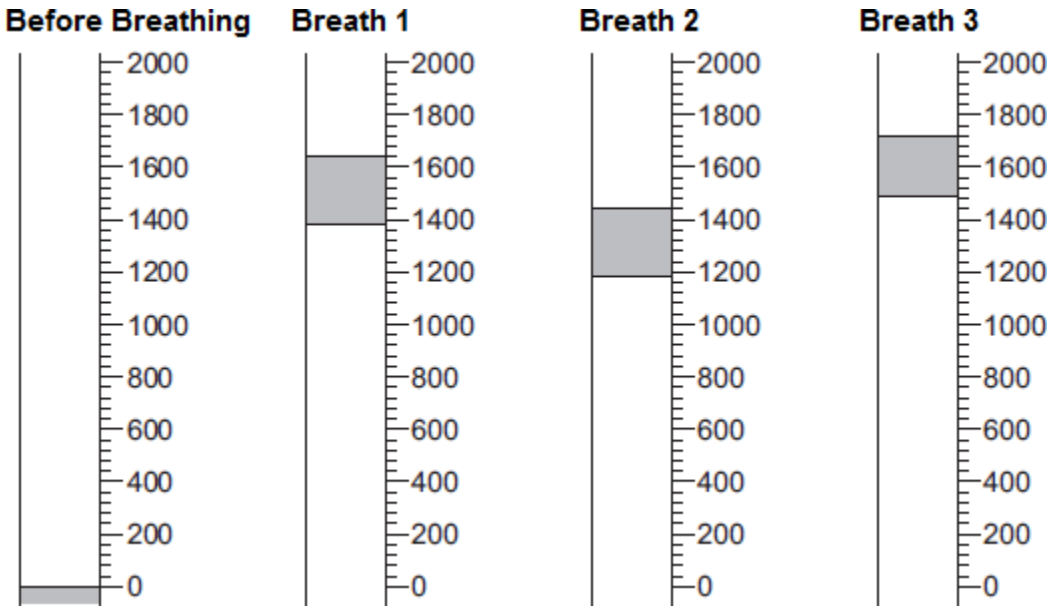
(2)

(b) A student used the apparatus shown in **Diagram 2** to measure the maximum volume of air that he could breathe in one breath.
When the student breathes in, the piston moves upwards.
The piston moves back down after the student has breathed out.

Diagram 2



The student breathes in through the apparatus three times.
The drawings show the position of the piston after each of the three breaths.
The volumes are measured in cm^3.



(i) Read the volume of each breath and write the volume in the table.

	Breath 1	Breath 2	Breath 3
Volume in cm^3	_____	_____	_____

(3)

(ii) Calculate the mean volume of air breathed in.

_____

_____

Mean volume of air breathed in = _____ cm^3

(2)

(c) A teacher asks the student to investigate if students who take part in sports activities can breathe in a larger volume of air than students who do not take part.

Describe briefly how the student could use the **same** apparatus to do the investigation.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(d) **Photograph 1** shows a different piece of apparatus used to measure the volume of air that a person can breathe in one breath.

Photograph 1

© Digital Vision/Photodisc

When the student breathes out through the apparatus the pointer on the scale moves. The pointer stays in the same position when the student has finished.

Explain **one** advantage, apart from size, of using this apparatus rather than the apparatus described in part **(b)**.

_____

_____

_____

_____

(2)

(e) **Photograph 2** shows one type of mechanical ventilator.

Photograph 2

© Emine Donmaz/iStock

(i) Use information from **Photograph 2** to suggest how this type of ventilator works.

_____

_____

_____

_____

(2)

(ii) Use information from **Photograph 2** to suggest two disadvantages of this type of ventilator.

1. _____

_____

2. _____

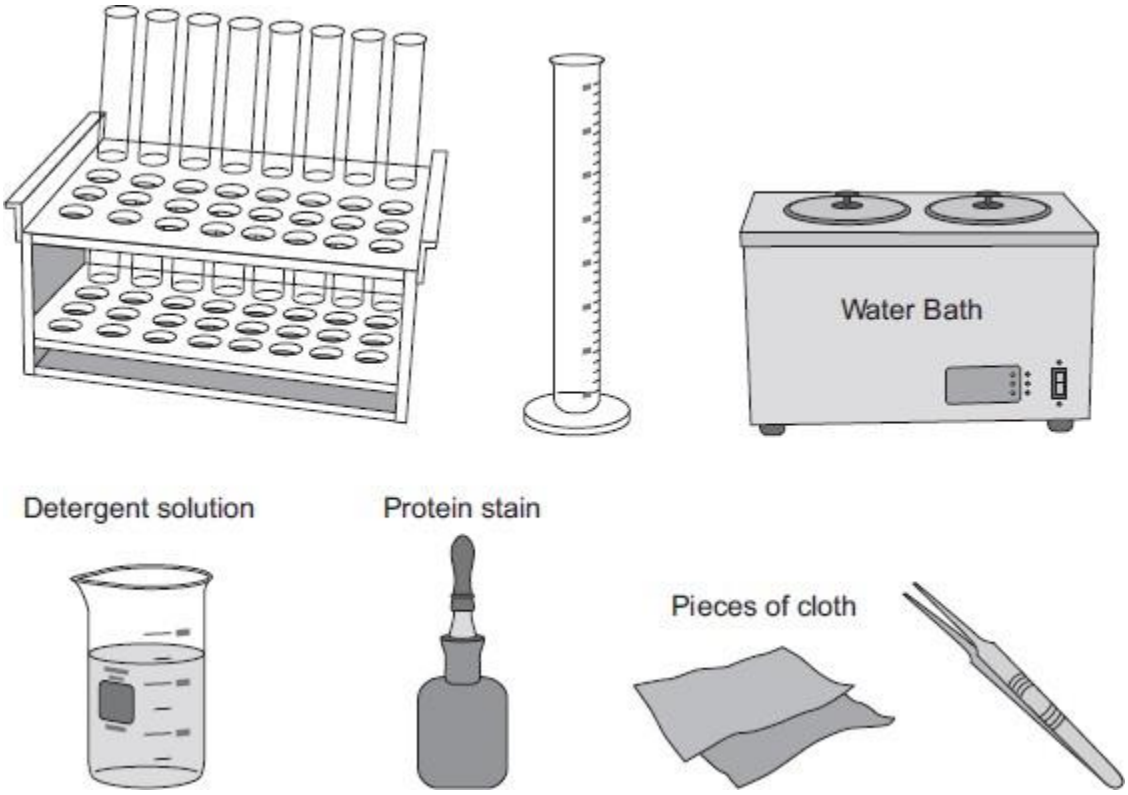
_____

(2)

(Total 20 marks)

2 Biological detergents contain protease enzymes.

(a) The drawings show some apparatus and materials.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how you would use the apparatus and materials shown in the drawings to find the best temperature for removing stains from clothing.

You should include how you would make the investigation a fair test.

(6)

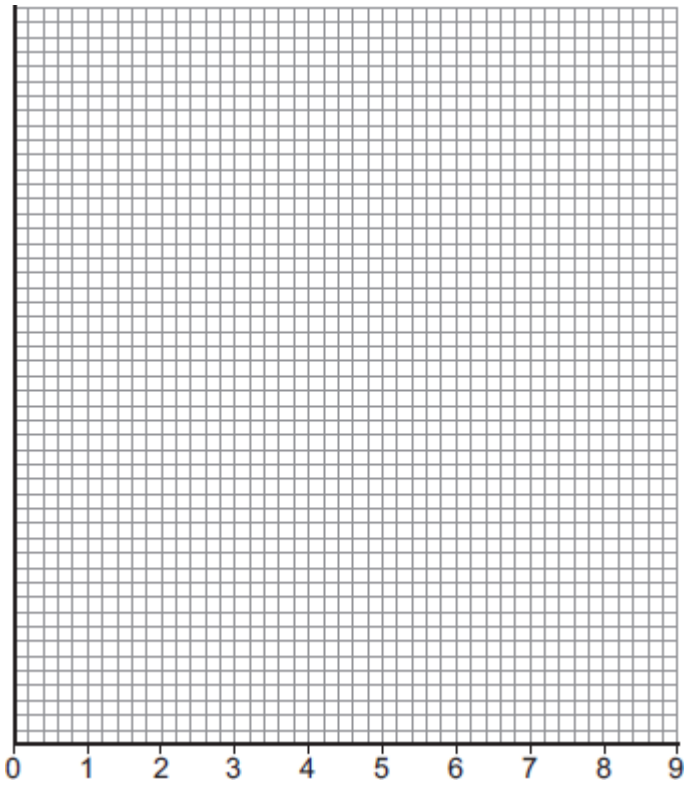
(b) In a similar investigation a student investigated the effect of pH on the time taken to remove a stain from pieces of cloth.

The table shows the student's results.

	pH of detergent solution								
	1	2	3	4	5	6	7	8	9
Time taken to remove stain in minutes	20	19	17	14	10	4	8	12	16

(i) On the graph paper below draw a graph to show the student's results.

- Add a suitable scale and label to the y axis.
- Plot the student's results.
- Draw a line of best fit.



(4)

(ii) Which is the best pH for using the detergent?

pH _____

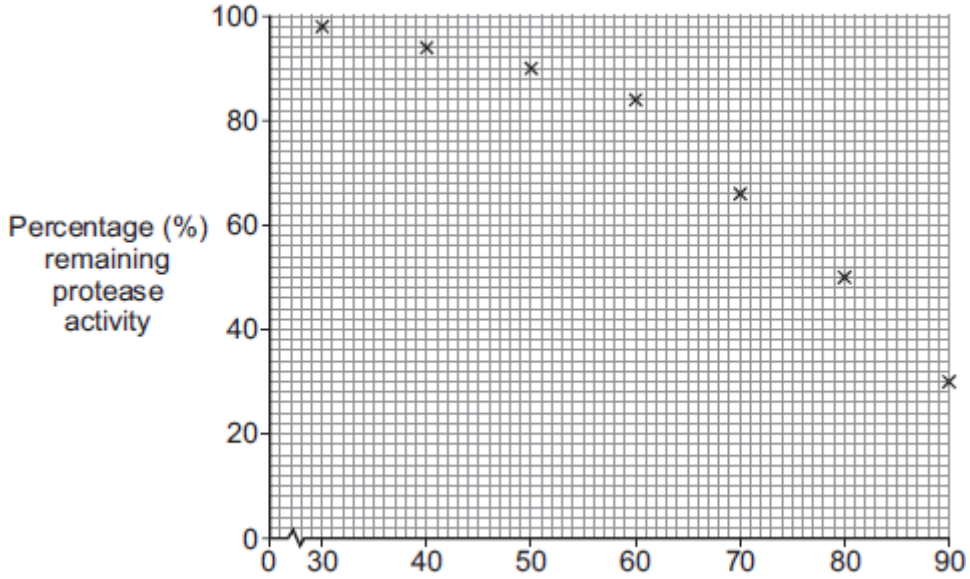
(1)

(c) Scientists investigated the stability of a protease enzyme. The protease enzyme was extracted from plants.

The scientists:

- pre-incubated samples of the enzyme at various temperatures for 30 minutes
- put each sample on ice for a further 10 minutes
- measured the percentage (%) remaining activity of the enzyme in each sample. This was done by incubating each sample with protein at 37 °C for 6 hours.

The graph shows the scientists' results.



The scientists recommended that the enzyme could be used in detergents at a temperature of 60 °C.

Suggest why the scientists recommended a temperature of 60 °C.
Use information from the graph and your own scientific knowledge in your answer.

_____

_____

_____

_____

_____

_____

(3)

(Total 14 marks)

3 Fruit is crushed to release fruit juice.

More juice can be collected if the plant cell walls in the fruit are broken down.

Some students tested the effect on the volume of fruit juice that they could collect of:

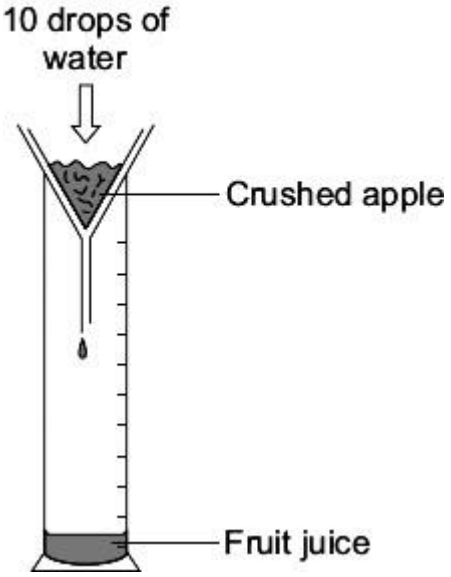
- **either** boiling the fruit
- **or** adding the enzyme pectinase to the fruit
- **or** adding the enzyme amylase to the fruit.

In their first experiment the students:

- crushed 20 g of apple
- added 10 drops of water
- measured the volume of fruit juice that they collected.

Diagram 1 shows how they collected the fruit juice.

Diagram 1



The students did three more experiments.

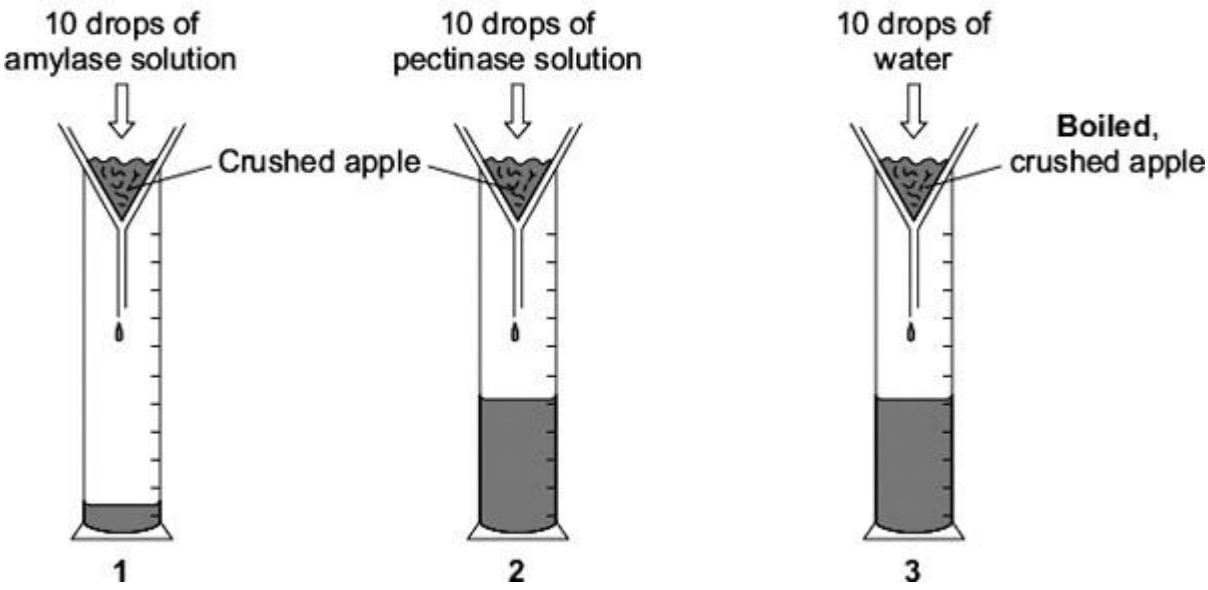
1 They added 10 drops of amylase solution to 20 g of crushed apple.

2 They added 10 drops of pectinase solution to 20 g of crushed apple.

3 They added 10 drops of water to 20 g of **boiled**, crushed apple.

Diagram 2 shows these experiments.

Diagram 2



(a) Give **one** control variable in this investigation.

_____

(1)

(b) Using drops to measure the volume of water and enzyme added might lead to inaccurate results.

Give **one** reason why.

_____

(1)

(c) The students' results are shown in the table.

What was added to the crushed apple	Was the apple boiled?	Volume of juice collected in cm^3
10 drops of water	No	1.2
10 drops of amylase solution	No	1.2
10 drops of pectinase solution	No	11.3
10 drops of water	Yes	11.6

Explain as fully as you can the students' results shown in the table.

Use all the information given to help you answer this question.

_____

_____

_____

_____

_____

_____

(3)

(d) One student said:

'If we add 10 drops of pectinase solution to crushed apple *while it is boiling*, we should collect more juice than if we add 10 drops of water to boiled apple.'

This is **not** correct.

What volume of juice would you predict the students would collect if 10 drops of pectinase solution were added to crushed apple *while it was boiling*?

Draw a ring around **one** answer.

1.2 cm^3 **11.3 cm^3** **11.6 cm^3** **22.9 cm^3**

(1)

Explain your answer.

_____

_____

_____

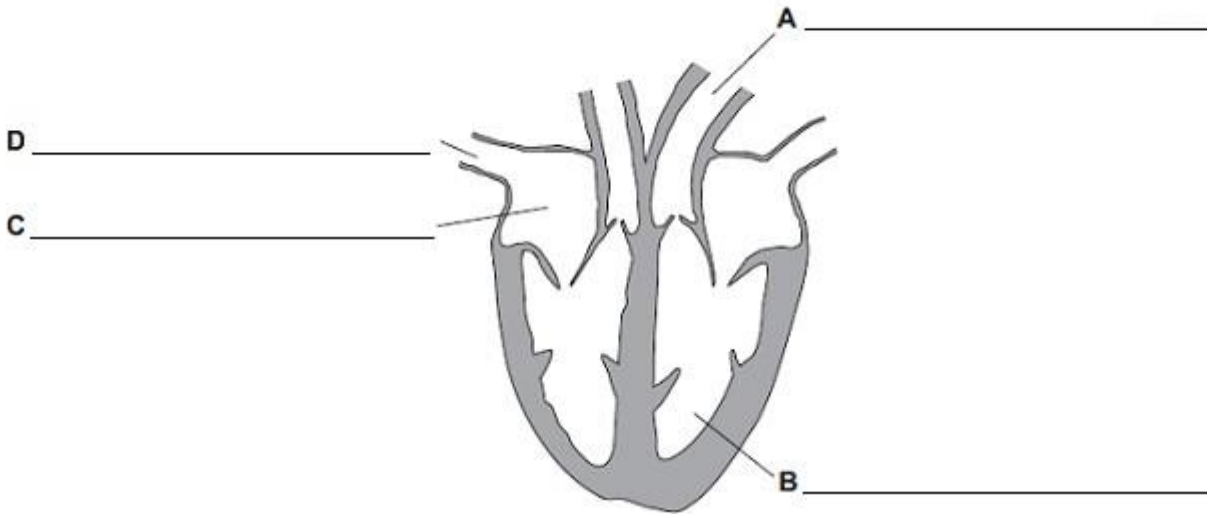
_____

(2)

(Total 8 marks)

4 **Diagram 1** shows a section through the heart.

Diagram 1



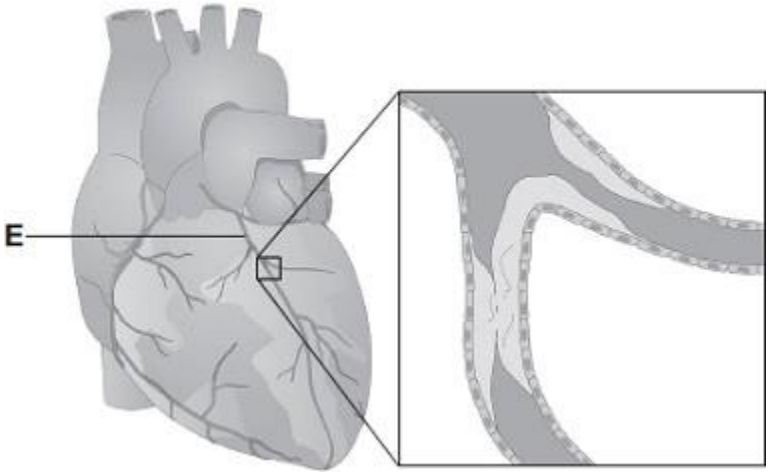
(a) On the diagram, name the parts labelled **A**, **B**, **C** and **D**.

(4)

(b) **Diagram 2** shows the blood vessels that supply the heart muscle.

Part of one of the blood vessels has become narrower.

Diagram 2



(i) Name blood vessel **E**.

_____

(1)

(ii) Give **one** method of treating the narrowed part of blood vessel **E**.

_____

(1)

(iii) Explain how the method of treatment works.

_____

_____

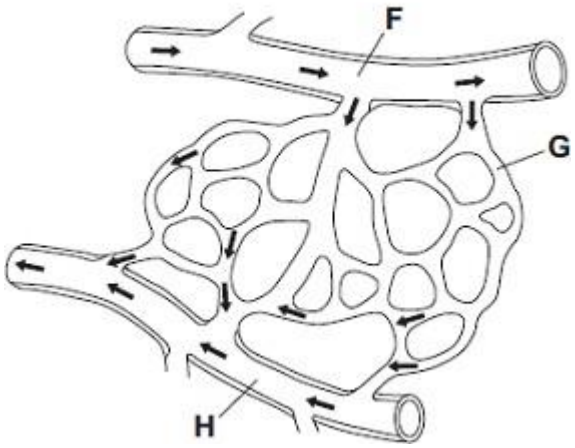
_____

_____

(2)

(c) **Diagram 3** shows part of the blood supply in the lungs.

Diagram 3



(i) Name the types of blood vessel labelled **F**, **G** and **H**.

F _____

G _____

H _____

(3)

(ii) Give **one** way in which the composition of the blood in vessel **F** is different from the composition of the blood in vessel **H**.

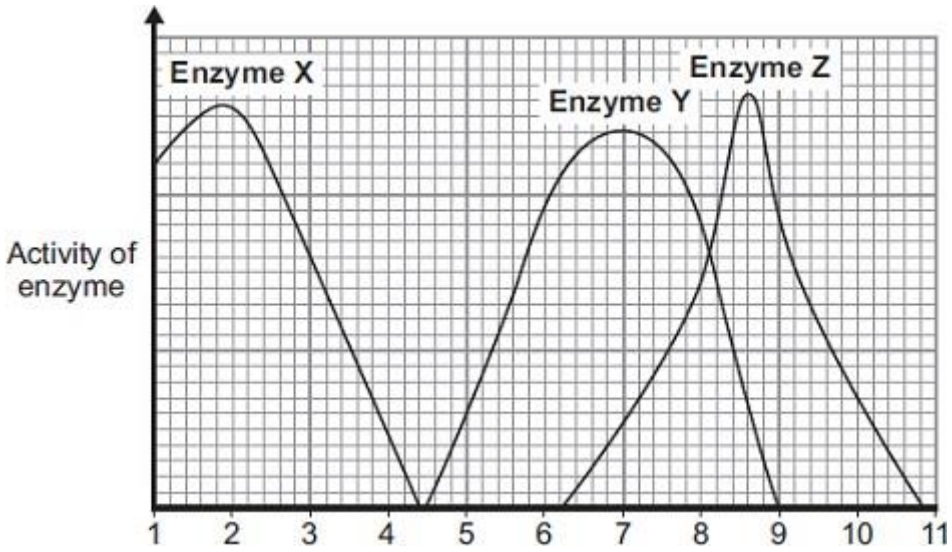
_____

_____

(1)

(Total 12 marks)

5 (a) The graph shows the effect of pH on the activities of three enzymes, **X**, **Y** and **Z**.
These enzymes help to digest food in the human digestive system.
Each enzyme is produced by a different part of the digestive system.



(i) What is the optimum (best) pH for the action of enzyme **Z**?

_____

(1)

(ii) The stomach makes a substance that gives the correct pH for enzyme action in the human stomach.

Name this substance. _____

(1)

(iii) Which enzyme, **X**, **Y** or **Z**, will work best in the human stomach?

_____

(1)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Different parts of the human digestive system help to break down molecules of fat so that they can be absorbed into the body.

Describe how.

To gain full marks you should refer to:

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved.

(6)

(Total 9 marks)

Mark schemes

1 (a) (i) **A** lung

1

B rib

1

C diaphragm

1

D alveolus / alveoli

1

(ii) (**B** moves) up(wards) / out / up and out

1

(**C** moves) down(wards) / flattens

*do **not** allow inwards*
ignore outwards
*if neither mark gained allow **1** mark for correct reference to muscle contraction*

1

(b) (i) 1640

1

1440

1

1720

*allow max **1** for 3 correct values using of bottom of piston:*
1380 + 1180 + 1480 to 1485

1

(ii) 1600

*correct answer gains **2** marks*
*if answer incorrect allow **1** mark for evidence of*
(1640 + 1440 + 1720) ÷ 3
*allow ecf from **(b)(i)***
allow use of two numbers divided by two if one is considered anomalous:

$\frac{(1640 + 1720)}{2}$ = *1680*

*for **2** marks*

2

(c) two groups of students − one group sports activity participants, other not

allow students as a group

1

fair test eg groups same height / same mass / same sex

1

measure air breathed in by each student / repeat previous experiment then calculate mean for group

1

(d) pointer remains still after breathing / cylinder will move down after breathing (in)

1

error reading volume less likely

allow more accurate / reliable

1

(e) (i) operator squeezes bag

1

air forced / pushed into lungs

or

positive pressure ventilator

1

(ii) any **two** from:

- air pressure / volume not regulated
- operator will tire / must be present at all times / variable intervals
- too much / too little air

allow may 'overbreathe' the patient

2

[20]

2 (a) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best − fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 − 2 marks)
The method described is weak and could not be used to collect valid results however does show some understanding of the sequence of an investigation.

Level 2 (3 − 4 marks)
The method described could be followed and would enable some results to be collected but lacks detail.

Level 3 (5 − 6 marks)
The method described could be easily followed and would enable valid results to be collected.

examples of biology points made in the response:

- (use of measuring cylinder to) measure equal volumes of detergent solution
- (use of dropping bottle to) apply same number of drops / amount of stain to each piece of cloth
- include stainless cloth as control
- use of forceps to transfer cloths
- use of test tubes as containers for detergent solution + stained cloth
- use water bath to provide a range of temperatures
- cloths left in detergent solution at each temperature
- for same length of time or measure time taken to remove stain
- repetition
- assessing the stain removal

6

(b) (i) *y* axis: labelled 'Time (taken to remove stain in) minutes' plus suitable scale
data spread greater than half of grid

1

points or bars plotted correctly to within ± 1 mm
*deduct **1** mark for each incorrect plot up to a maximum of 2*

2

one suitable line of best fit drawn on graph
not feathery
not extrapolated to (0,0)
not point to point as on this occasion it is inappropriate

1

(ii) 6 ± 0.1
accept ecf from student graph

1

(c) activity of enzyme still very high / 84% / over 80%
or
only lost 15% / 16% activity

allow above 60 °C marked decrease in activity
allow 85%

1

any **two** from:

- rate of reaction high at 60 °C / higher than at lower temperatures
  allow in terms of reaction kinetics / collisions
- higher temperatures would increase (energy) costs
  or
  might damage cloth
  ignore enzyme denaturation
- higher temperatures / 60 °C is better (than lower temperatures) to remove other stains / named stains

  or
  better for killing bacteria / infection control
  eg grease

2

[14]

3 (a) any **one** from:

*ignore control variables that are not given in the method, such as 'equally crushed' **or** same time*

*do **not** accept volume of apple juice*

- 20 g (of apple) **or** (same) mass / amount / weight of apple
  ignore volume / size
- crushed (apple)
- 10 drops (of solution) **or** (same) number / amount / volume of drops
  *do **not** accept 10 drops of amylase alone*
- apple **or** type of fruit
  ignore type of apple

1

(b) (may) have different volume / amount / sizes

ignore reference to human error

ignore don't know / can't measure size of drop

1

(c) amylase has no / little effect on cell / walls / apple

accept ideas that refer to shape of enzyme being 'incorrect'

or amylase does not breakdown / digest cell / walls / apple

accept amylase <u>only</u> breaks down / digests starch

1

pectinase breaks down cell / walls / apple

allow digest for breakdown

allow shape of pectinase fits cell / walls / apple

1

boiling breaks down cell / walls / apple

1

(d) 11.6

1

enzyme / pectinase destroyed / denatured / damaged / broken down

*do **not** allow kill*

1

only effect of boiling (relevant)

1

[8]

4 (a) A aorta

ignore left and right

1

B ventricle

1

C atrium

allow atria

1

D vena cava

1

(b) (i) (coronary) artery

allow arteriole

1

(ii) stent / description

accept (coronary) by-pass operation

allow statins

allow diets low in cholesterol

allow balloon (angioplasty)

1

(iii) (stent) keeps artery open

must relate to (b)(ii)

1

or

ignore reference to capillary / vein

(by-pass) new blood vessel / vein connecting around narrowed region;

or

(statins / low cholesterol diet) remove some of the cholesterol blockage

or

(balloon) widens / opens the blood vessel

1

which allows (more) blood through or allows blood to go around the blockage

(c) (i) F artery

accept arteriole / branch of pulmonary artery

1

G capillary

1

H vein

H accept venule / branch of pulmonary vein;

1

(ii) F (Pulmonary artery) has <u>less</u> oxygen / <u>more</u> carbon dioxide / <u>more</u> glucose / sugar

accept F (Pulmonary artery) is deoxygenated

accept converse for H (Pulmonary vein)

'It' refers to F

1

[12]

5 (a) (i) 8.6

accept value in range 8.5 to 8.7

1

(ii) hydrochloric acid / HCl

accept HCL

accept hydrogen chloride

ignore hcl / etc.

1

(iii) X

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a simple description of part of a process or a reference to at least one of: mechanical digestion, lipase, product of enzyme action, bile, site of production or site of digestion

Level 2 (3-4 marks)
There is a description of at least one process linking ideas

Level 3 (5-6 marks)
There is a clear description of the process including reference to the majority of: mechanical digestion, lipase, bile, where they are produced, products, function of bile and site of digestion / absorption

Examples of biological points made in the response:

- mechanical breakdown in mouth / stomach
- fats →fatty acids and / or glycerol
- by lipase
- (produced by) pancreas
- and small intestine
- fat digestion occurs in small intestine
- bile
- produced by liver
- neutralises acid from stomach
- produces alkaline conditions in intestine
- refs. to increased surface area related to emulsification or chewing
- products are small molecules / water-soluble
- products absorbed by small intestine

6

[9]