Name: _____

Class: _____

Date: _____

Organisation part 5 AQA Triple Biology

Time: **98 minutes**

Marks: **91 marks**

Comments:

1. **Table 1** shows information about some food components in cow's milk.

Table 1

	Value per 500 cm^3	Recommended Daily Allowance (RDA) for a typical adult
Energy in kJ	1046	8700
Fat in g	8.4	70.0
Salt in g	0.5	6.0
Calcium in mg	605	1000
Vitamin B-12 in µg	4.5	2.4

(a) How much **more** milk would a typical adult have to drink to get their RDA for calcium compared with the amount of milk needed to get their RDA for vitamin B-12?

_____

_____

_____

_____

_____

_____

Volume of milk = _____ cm^3

(3)

(b) Describe how a student could test cow's milk to show whether it contains protein and different types of carbohydrate.

(6)

A scientist investigated the effect of bile on the breakdown of fat in a sample of milk.

The scientist used an indicator that is colourless in solutions with a pH lower than 10, and pink in solutions with a pH above 10.

This is the method used.

1. Add 1 drop of bile to a test tube and one drop of water to a second test tube.

2. Add the following to each test tube:
   - 5 cm^3 of milk
   - 7 cm^3 of sodium carbonate solution (to make the solution above pH 10)
   - 5 drops of the indicator
   - 1 cm^3 of lipase.

3. Time how long it takes for the indicator in the solutions to become colourless.

The results are shown in **Table 2**.

Table 2

	Time taken for the indicator to become colourless in seconds
Solution with bile	65
Solution without bile	143

(c) Explain why the indicator in both tubes became colourless.

(3)

(d) Give the reason why the measurement of the time taken for the indicator to become colourless might be inaccurate.

(1)

(e) Explain the difference in the results for the two test tubes in **Table 2**.

_____

_____

_____

_____

_____

_____

(3)

(Total 16 marks)

2. Gases enter and leave the blood by diffusion.

(a) Define the term diffusion.

_____

_____

(1)

(b) Name the main gases that diffuse into and out of the blood **in the lungs**.

Into the blood _____

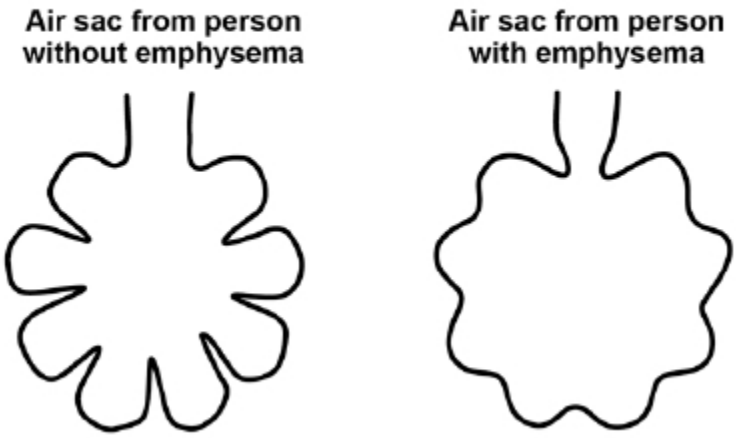
Out of the blood _____

(1)

(c) Smoking can cause emphysema.

Look at **Figure 1** below.

Figure 1



Emphysema causes the walls of the air sacs in the lungs to break down

Explain how this will affect the diffusion of gases into and out of the blood.

_____

_____

_____

_____

(2)

Smoking during pregnancy can cause low birth mass in babies.

Table 1 shows the World Health Organisation categories for birth mass.

Table 1

Category	**Birth mass in g**
Above normal birth mass	> 4500
Normal birth mass	2500–4500
Low birth mass	1500–2499
Very low birth mass	1000–1499
Extremely low birth mass	< 1000

(d) Complete **Table 2**.

Use information in **Table 1**.

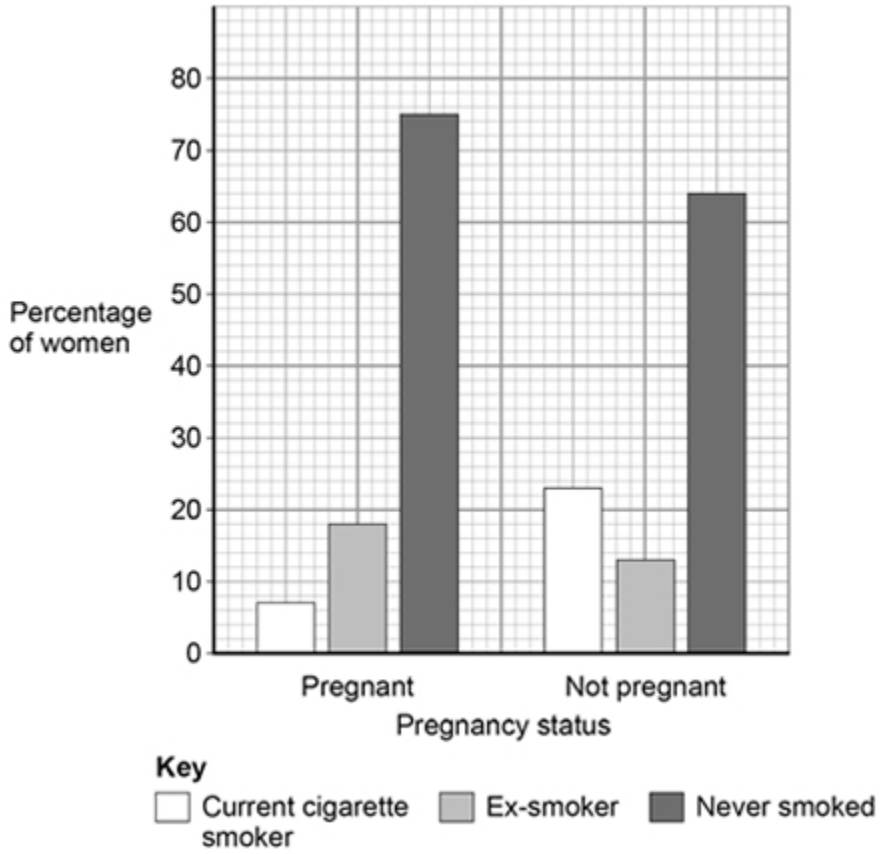
Table 2

Baby	Birth mass in g	Category
A	2678	Normal birth mass
B	1345	
C	991	

(2)

Figure 2 shows data from a study about pregnancy and smoking in women in the UK.

Figure 2



(e) Sampling from the whole UK population would **not** be appropriate for this study.

Give **one** reason why.

_____

_____

(1)

(f) Give **three** conclusions that can be made about smoking in pregnant women compared with non-pregnant women.

Use information from **Figure 2**.

1. _____

_____

2. _____

_____

3. _____

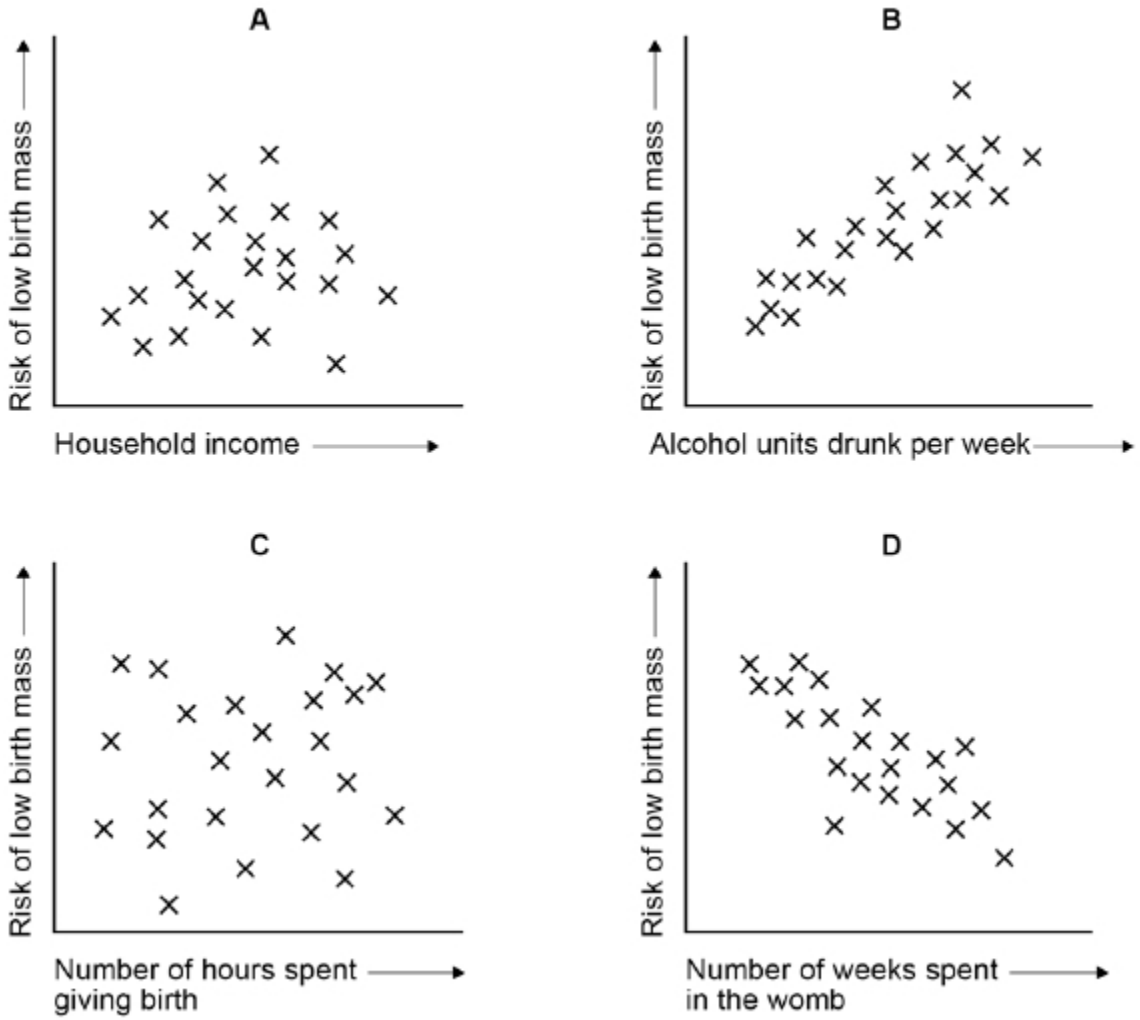
_____

(3)

Other factors can also be linked to low birth mass.

Figure 3 shows the relationship between four of these factors and the risk of low birth mass.

Figure 3



(g) What type of graph is shown in **Figure 3**?

Tick **one** box.

Bar graph ☐

Histogram ☐

Line graph ☐

Scatter graph ☐

(1)

(h) Which of the graphs in **Figure 3** shows a positive correlation?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(i) A student concluded that the longer a woman spends giving birth, the greater the risk of low birth mass.

Give **one** reason why the student's conclusion is **not** correct.

Use evidence from **Figure 3**.

_____

_____

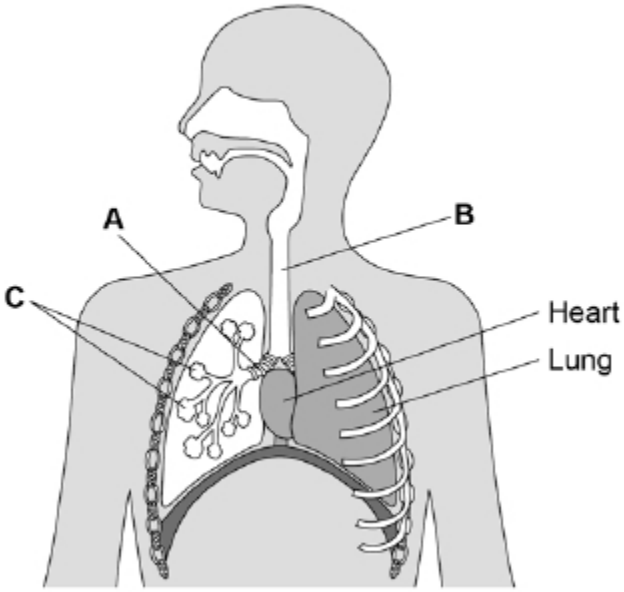
(1)

(Total 13 marks)

3. Animals and plants contain organs and tissues.

Figure 1 shows some organs in the human thorax.

Figure 1



(a) Name parts **A**, **B** and **C**.

A _____

B _____

C _____

(3)

(b) Which organ system is the heart part of?

Tick **one** box.

Breathing system ☐

Circulatory system ☐

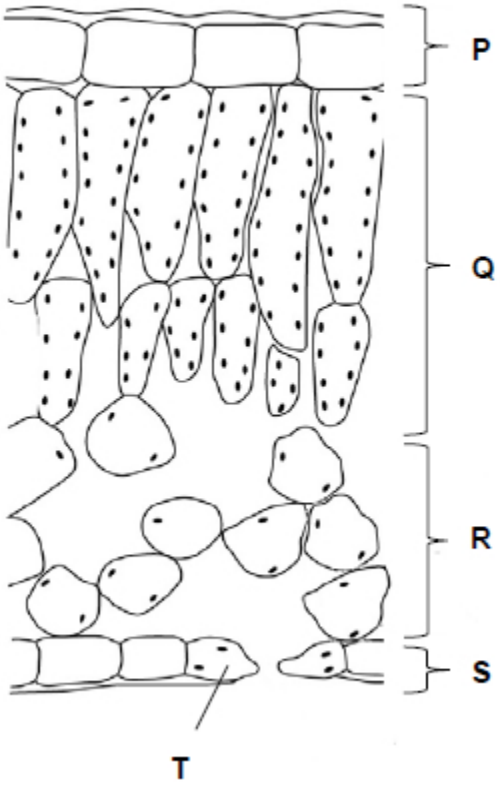
Digestive system ☐

Excretory system ☐

(1)

Figure 2 shows a cross section of a leaf.

Figure 2



(c) In which part of the leaf does most photosynthesis take place?

Tick **one** box.

P ☐ Q ☐ R ☐ S ☐

(1)

(d) What is part **T**?

Tick **one** box.

- Guard cell ☐
- Phloem ☐
- Stoma ☐
- Xylem ☐

(1)

(e) A leaf is an organ made of tissues.

What is a tissue?

_____

_____

(1)

(f) Draw **one** line from each tissue to its function.

Tissue	Function
	Allows diffusion of gases through the leaf
Epidermis	Allows light through to the photosynthesising parts of the leaf
Phloem	Allows water into the leaf
Spongy mesophyll	Transport sugars around the plant
	Transports water around the plant

(3)

(Total 10 marks)

4. A student carried out an investigation using leaf epidermis.

This is the method used.

1. Peel the lower epidermis from the underside of a leaf.
2. Cut the epidermis into six equal sized pieces.
3. Place each piece of lower epidermis into a different Petri dish.
4. Add 5 cm^3 of salt solution to the six Petri dishes. Each Petri dish should have a different concentration of salt solution.
5. After 1 hour, view each piece of epidermis under a microscope at ×400 magnification.
6. Count and record the total number of stomata present and the number of open stomata that can be seen in one field of view.

The student's results are shown in the table.

Concentration of salt solution in mol / dm^3	**Number of stomata in field of view**	**Number of open stomata in field of view**	**Percentage (%) of open stomata in field of view**
0.0	7	7	100
0.1	8	8	100
0.2	7	6	**X**
0.3	9	6	67
0.4	10	4	40
0.5	9	2	22

(a) Calculate value **X** in the table above.

_____

_____

X = _____ %

(1)

(b) Give **one** conclusion from the results in the table above.

_____

_____

(1)

(c) How could the student find out what concentration of salt solution would result in half of the stomata being open?

_____

_____

(1)

(d) The student measured the real diameter of the field of view to be 0.375 mm.

Calculate the number of open stomata per mm^2 of leaf for the epidermis placed in 0.4 mol / dm^3 salt solution.

Use information from the table above.

Take π to be 3.14

_____

_____

_____

_____

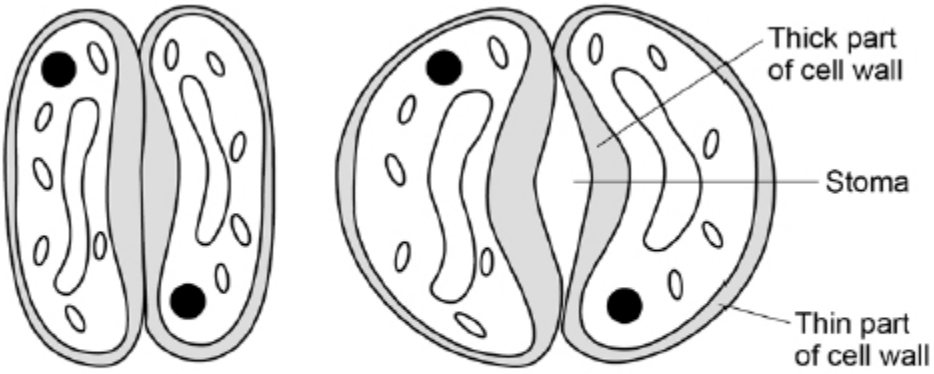
_____

_____

Number of open stomata = _____ per mm^2

(3)

(e) The diagram below shows two guard cells surrounding a closed stoma and two guard cells surrounding an open stoma.



Closed stoma **Open stoma**

When light intensity is high potassium ions are moved into the guard cells.

Describe how the movement of potassium ions into the guard cells causes the stoma to open.

(4)

(Total 10 marks)

5. The heart pumps blood to the lungs and to the cells of the body.

(a) Name the blood vessel that transports blood from the body to the right atrium.

(1)

(b) The aorta transports blood from the heart to the body.

In a person at rest:

- blood travels at a mean speed of 10 cm/s in the aorta
- blood travels at a mean speed of 0.5 mm/s in the capillaries
- the speed of blood decreases at a rate of 0.4 cm/s^2 as blood travels from the aorta to the capillaries.

Calculate the time it takes for blood to travel from the aorta to the capillaries.

Assume that the speed of blood decreases at a constant rate.

Use the equation:

$$\text{rate of decrease in speed} = \frac{\text{change in speed}}{\text{time}}$$

Give your answer to 2 significant figures.

Time = _____ s

(4)

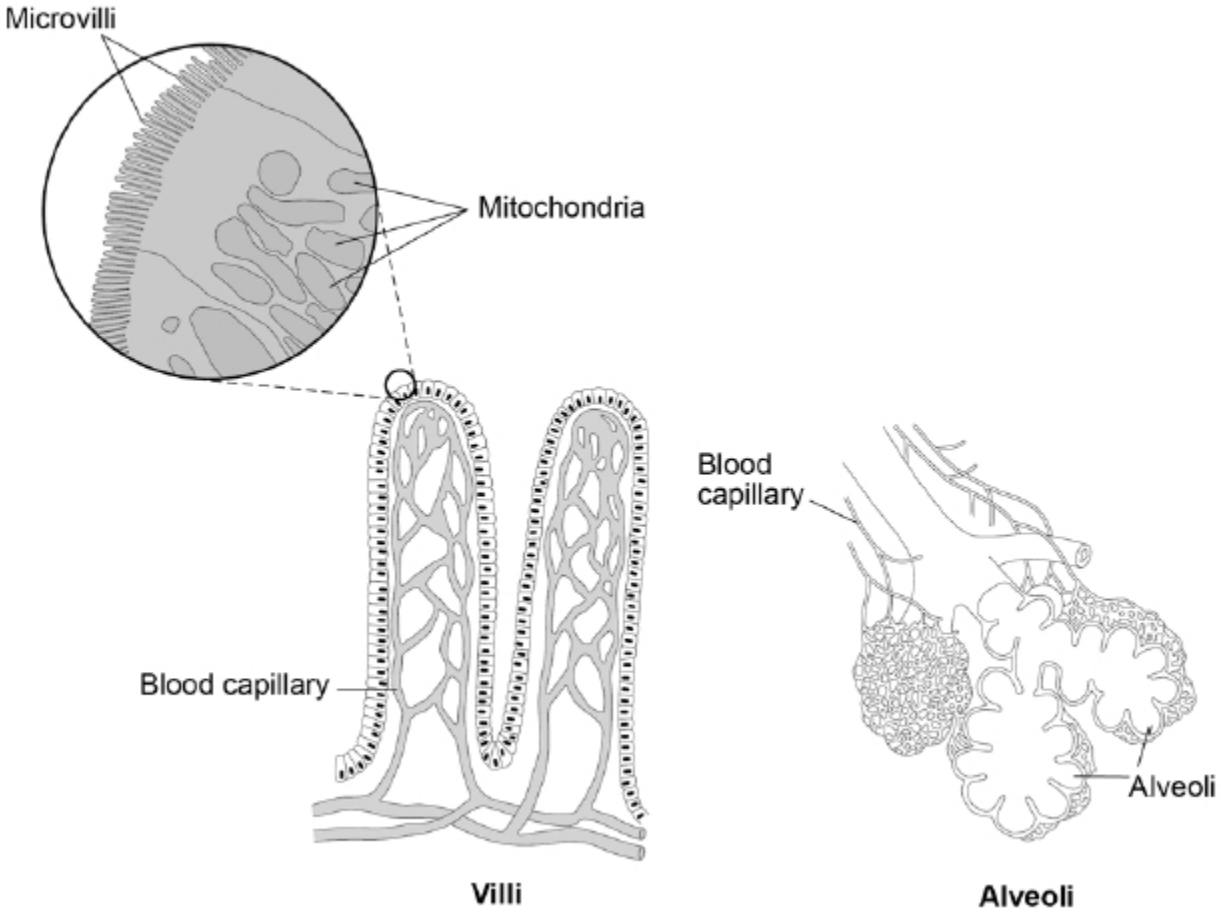
(c) Describe the route taken by oxygenated blood from the lungs to the body cells.

(4)

(d) The digestive system and the breathing system both contain specialised exchange surfaces.

- In the digestive system, digested food is absorbed into the blood stream in structures called villi.
- In the breathing system, gases are absorbed into the blood stream in the alveoli.

The diagram below shows the structure of villi and alveoli.



Explain how the villi and the alveoli are adapted to absorb molecules into the bloodstream.

(6)

(Total 15 marks)

6. Amylase is an enzyme found in the human body.

Amylase breaks down starch into sugars.

(a) Where is amylase produced in the human body?

Tick **one** box.

- Liver and pancreas ☐
- Liver and stomach ☐
- Salivary glands and pancreas ☐
- Salivary glands and stomach ☐

(1)

(b) Enzymes speed up chemical reactions.

Explain how amylase breaks down starch.

_____

_____

_____

_____

_____

_____

(3)

(c) One sugar in the body is glucose.

Glucose is used for respiration.

Give **one** other use for glucose in the body.

_____

(1)

(d) A student investigated the effect of temperature on the activity of human amylase.

This is the method used.

1. Put 2 cm^3 of 1% starch solution into a boiling tube.
2. Put 2 cm^3 of amylase solution into a second boiling tube.
3. Put both boiling tubes into a water bath at 20 °C.
4. After 5 minutes, mix the amylase and the starch together in one boiling tube.
5. After 30 seconds, add a drop of the starch and amylase mixture to a drop of iodine solution in one well of a spotting tile.
6. Repeat step 5 until the iodine solution no longer changes colour.
7. Repeat steps 1 – 6 at 40 °C and at 60 °C and at 80 °C

Why did the student leave the starch and amylase solutions in the water bath for 5 minutes in step **3**?

_____

_____

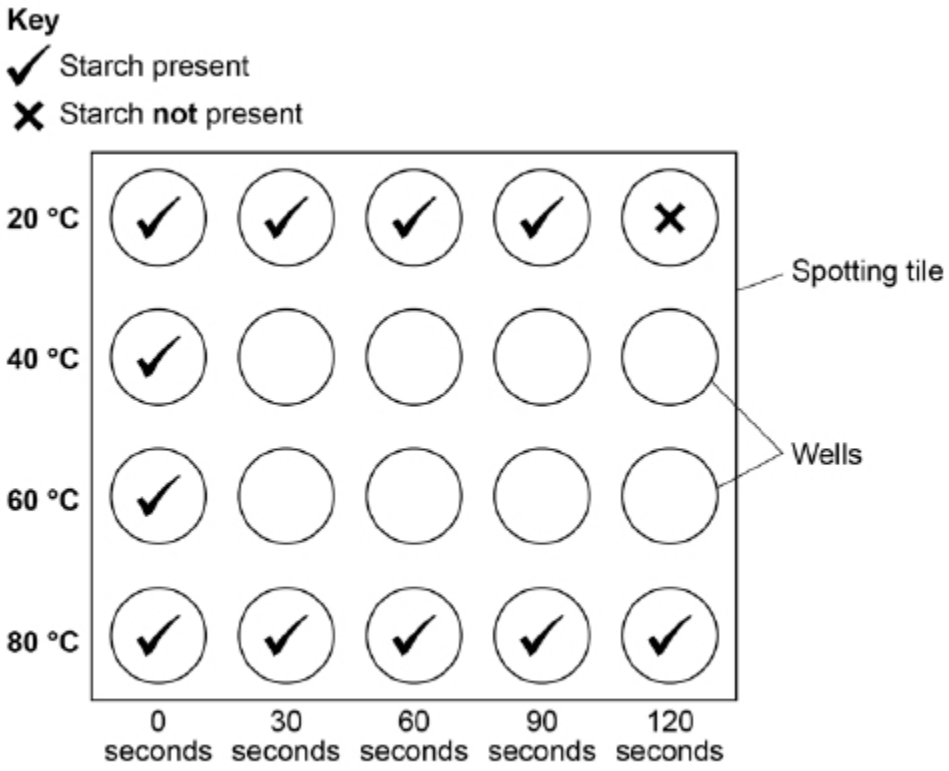
(1)

(e) The temperature of the human body is 37 °C

The diagram below shows the results of the investigation at 20 °C and at 80 °C

Complete the diagram to show the results you would expect at 40 °C and at 60 °C

You should write a tick or a cross in each well of the spotting tile.



(2)

(f) There are different ways to investigate the breakdown of starch by amylase.

One other method is to measure the **concentration** of starch present in the solution every 30 seconds.

Why is this method better than the method the student used?

_____

_____

_____

_____

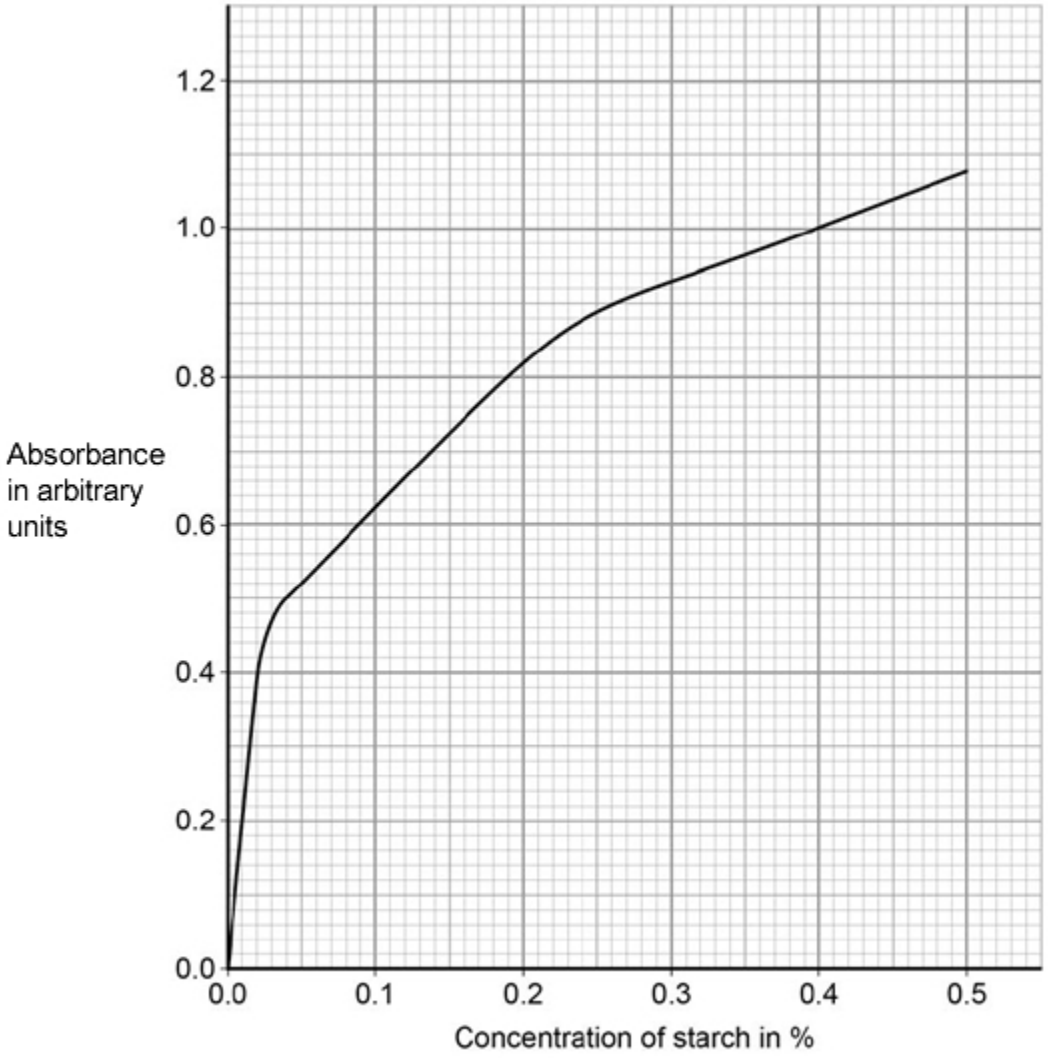
(2)

A colorimeter can be used to measure the concentration of starch present in the solution every 30 seconds.

A colorimeter measures the amount of light that **cannot** pass through a solution.

This is known as absorbance.

Below shows a graph of absorbance against concentration of starch.



(g) The absorbance of the solution at 40 °C was 0.56 arbitrary units after 30 seconds.

What was the concentration of starch in this solution?

Concentration of starch = _____ %

(1)

(h) The concentration of starch in the solution at 20 °C after 1 minute is different from the concentration at 40 °C after 1 minute.

Explain why.

_____

_____

_____

_____

(2)

(i) Predict the absorbance for the solution at 80 °C after 30 seconds.

Give a reason for your answer.

Absorbance = _____ arbitrary units

Reason _____

_____

_____

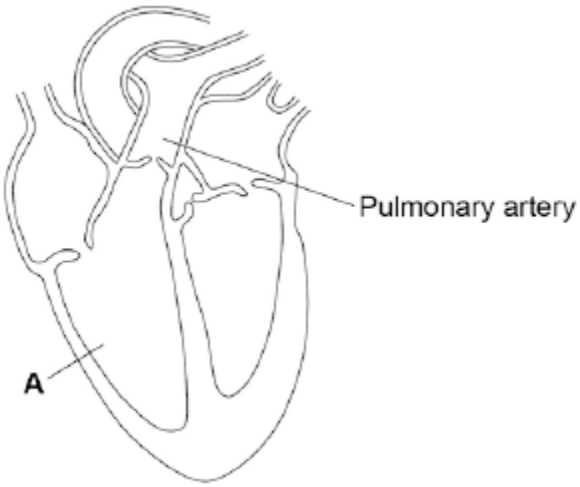
_____

(3)

(Total 16 marks)

7. **Figure 1** shows a diagram of the human heart.

Figure 1



(a) What part of the heart is labelled **A**?

Tick **one** box.

Aorta ☐

Atrium ☐

Valve ☐

Ventricle ☐

(1)

(b) Where does the pulmonary artery take blood to?

Tick **one** box.

Brain ☐

Liver ☐

Lungs ☐

Stomach ☐

(1)

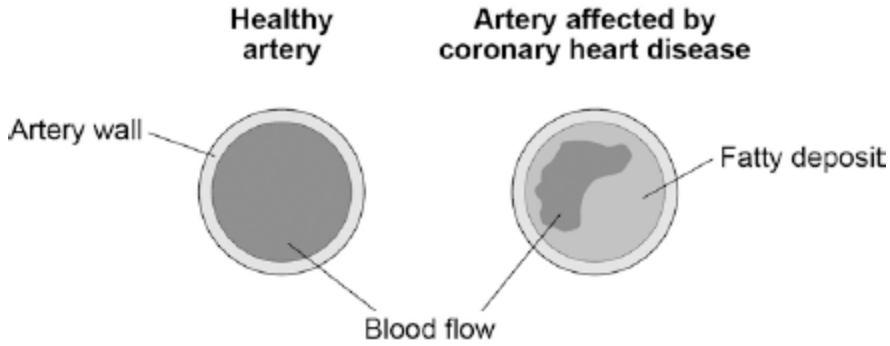
(c) Circle a valve on **Figure 1**.

(1)

(d) The coronary arteries supply blood to the heart.

Figure 2 shows two coronary arteries.

Figure 2



Describe **two** ways the healthy artery is different from the artery affected by coronary heart disease.

1. _____

_____

2. _____

_____

(2)

(e) What can be used to treat people with coronary heart disease?

Tick **two** boxes.

Antibiotics ☐

Hormones ☐

Statins ☐

Stent ☐

Vaccination ☐

(2)

(f) Suggest **two** risk factors for coronary heart disease.

1. _____

_____

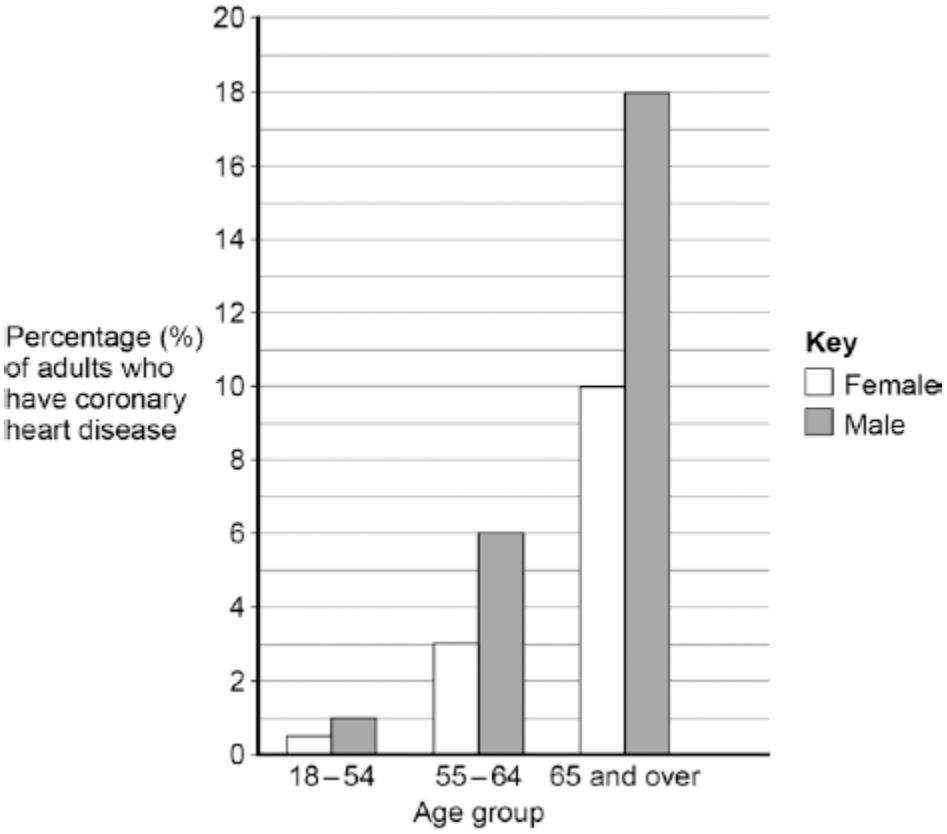
2. _____

_____

(2)

(g) **Figure 3** shows the percentages of adults in the UK who have coronary heart disease.

Figure 3



Calculate the difference in the percentage of male and female adults aged 65 and over who have coronary heart disease.

_____ %

(1)

(h) Which is the correct conclusion for the data in **Figure 3**?

Tick **one** box.

Children do **not** suffer from coronary heart disease ☐

More males suffer from coronary heart disease than females ☐

More younger people suffer from coronary heart disease than older people ☐

(1)

(Total 11 marks)

1. (a) (for calcium)

$$\frac{500}{605} \times 1000 = 826.446281\,(cm^3)$$

allow any correct rounding to minimum 3 significant figures
allow alternative route with correct rounding

1

(for vitamin B-12)

$$\frac{500}{4.5} \times 2.4 = 266.67\ (cm^3)$$

allow alternative route with correct rounding

1

560 / 559.8 / 559.78 / 559 (cm^3)

allow only correct answer based on values given for vitamin B-12 and calcium

1

*an answer of 560 / 559.8 / 559.78 / 559 (cm^3) scores **3** marks*

an incorrect answer for one step does not prevent allocation of marks for subsequent steps

(b) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

- Biuret reagent (allow $CuSO_4$ and NaOH) tests for protein
- add Biuret reagent to milk
- solution will turn (from blue) to lilac if positive
- iodine solution tests for starch (ignore iodine unqualified)
- add iodine solution to milk
- solution will turn (from orange / brown) to blue / black if positive
- Benedict's reagent tests for sugars
- add Benedict's reagent to milk and boil / heat (allow any temperature above 60 °C)
- solution will turn (from blue) to (brick) red / brown / orange / yellow / green if positive

for **level 2**, reference to all three food tests is required

(c) lipase breaks down fat into fatty acids (and glycerol)

*do **not** accept if 'glycerol' is contradicted*

1

(and) fatty acids lower the pH

1

(and when) fatty acids cause the pH to be below 10 (the indicator becomes colourless)

1

(d) observation of colour change is subjective / based on opinion

ignore human error unqualified
ignore experimental error or examples of this

1

(e) bile emulsifies fats

allow a correct description of emulsification (i.e. breaks fat from large droplets into smaller droplets)

*do **not** accept a description of chemical breakdown*

1

creates a larger surface area (of fat)

1

(so) lipase can break down fat (to produce fatty acids) more quickly / effectively

allow fatty acids produced by action of lipase more quickly

1

[16]

2. (a) movement of particles from (an area of) high concentration to (an area of) low concentration

allow movement of particles down a concentration gradient

*do **not** accept along / across a concentration gradient*

1

(b) oxygen

allow O_2

carbon dioxide

allow CO_2

in this order only

*both needed for **1** mark*

1

(c) less diffusion

allow less gas will enter / leave the blood

allow ecf from (b)

1

(because of the) reduced / smaller surface area

1

(d) (**B**) very low birth mass

1

(**C**) extremely low birth mass

1

(e) any **one** from:

- men would be included in the study (can't be pregnant)
- children / older (post-menopausal) women would be included in the study

ignore reference to cost

1

(f) any **three** from:

- higher percentage of pregnant women have never smoked (compared with non-pregnant women)
- higher percentage of pregnant women are ex-smokers (compared with non-pregnant women)
- lower percentage of pregnant women currently smoke (compared with non-pregnant women)
- in both pregnant and non-pregnant women, the highest percentage of women have never smoked

allow converse throughout

allow appropriate use of correct figures throughout

3

(g) scatter graph

1

(h) **B**

1

(i) there is no correlation (between the variables)

allow (all) the points are widely scattered

allow idea that the person with the longest birth time does not have the highest risk

1

[13]

3.

(a) (**A**) bronchus

allow bronchi

allow bronchiole

1

(**B**) trachea

allow windpipe

1

(**C**) alveolus

allow alveoli

ignore air sac

1

(b) circulatory system

1

(c) **Q**

1

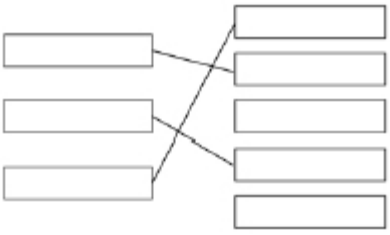
(d) guard cell

1

(e) a group of cells with a similar structure / function

1

(f)



1 *mark for each correct line*

extra line from a tissue negates the mark for that tissue

3

[10]

4.

(a) 86

allow this answer only

*do **not** accept 85.7*

if no answer given, check for answer in the table

1

(b) as salt concentration increases, percentage of open stomata (in field of view) decreases (above 0.1 mol / dm^3)

or

allow percentage of open stomata stays the same between 0.0 and 0.1 (mol / dm^3 then decreases as salt concentration increases)

ignore references to number of open stomata

allow converse

allow idea that mean concentration (of salt) in guard cells is between 0.3 and 0.4 mol per dm^3

1

(c) use concentrations between 0.3 (mol / dm^3) and 0.4 (mol / dm^3)

or

draw a graph of the data and read off the value at 50% (open stomata)

allow a list of appropriate concentrations i.e. 0.32 mol / dm^3), 0.34 (mol / dm^3), 0.36 (mol / dm^3) etc.

1

(d) ($\pi \times 0.1875^2$) = 0.11 (mm^2)

*an answer of 36 scores **3** marks*

1

$$\frac{4}{0.11}$$

1

36 (per mm^2)

*allow 36.22 / 36.23 **or** 36.2*

*if answer is incorrect allow for **2** marks for sight of number of open stomata = 9 per mm^2 (diameter used instead of radius)*

*if no other marks awarded allow for **1** mark any **one** from:*

- *sight of area = 0.44(mm^2) (diameter used instead of radius)*
- *sight of number of open stomata = 9.1 / 9.05 / 9.06 per mm^2 (diameter used instead of radius and no rounding)*

1

(e) (potassium) ions increase the concentration of the solution (inside guard cells)
or
(potassium) ions make cell more concentrated / less dilute

allow (potassium) ions decrease concentration of water / water potential (of guard cells)

1

water moves into the (guard) cell by osmosis

1

cell swells unevenly (so stoma opens)

1

as inner wall is less flexible than outer wall **or** thick part of the wall is less flexible than the thin part (of the wall)

1

[10]

5. (a) vena cava

1

(b) 0.5 mm = 0.05 cm

1

time = $\frac{10.00 - 0.05}{0.4}$

allow alternative correct substitution

1

24.875

1

25 (s)

*an answer of 25 (s) scores **4** marks*

*allow 24 for **3** marks (no conversion of mm to cm)*

*allow 23.8 / 23.75 for **2** marks (no conversion of mm to cm and incorrect sf)*

1

(c) (blood) travels through (the) pulmonary vein

1

(blood) enters left atrium

1

(blood) enters (the) left ventricle

1

(blood) leaves the heart via / through (the) aorta

allow blood travels through arterioles

allow blood (travels round the body and) reaches the cells / tissues via / in capillaries

1

ignore ref to valves / systole / diastole throughout

(d) **Level 3 (5-6 marks):**
Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

Level 2 (3-4 marks):
Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

Level 1 (1-2 marks):
Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

No relevant content (0 marks)

Indicative content

S = structural F = functional

- (S) both have a large surface area
- (S) villi have many microvilli
- (S) alveolar walls are not flat / are folded

- (F) to maximise diffusion (of gases) / absorption of (food) molecules

- (S) both have many capillaries / good blood supply / capillaries near the surface
- (F) to maintain concentration / diffusion gradient

- (S) both have thin walls / walls that are one cell thick / one cell thick surface
- (F) to provide a short diffusion distance (for molecules to travel)

- (S) villi have many mitochondria
- (F) to provide energy for active transport (of food molecules)

- (S) cells of the villi have microvilli / more projections
- (F) to further increase the surface area / increase the number of proteins in the membrane / to allow more active transport to take place

[15]

6. (a) salivary glands and pancreas

1

(b) starch / substrate fits into active site (of enzyme)

1

shape of active site is unique / complementary to substrate

allow converse

or

substrate is specific to active site / enzyme

allow enzyme has a high specificity for substrate

1

bonds (within starch / substrate

or

between sugar molecules) are broken

1

(c) converted to new carbohydrates / glycogen / named organic compound (e.g. protein / fat)

1

(d) to allow (the starch and amylase / solutions) to equilibrate (to the temperature of the water bath)
or
to get the starch and amylase / solutions to the same temperature / 20 °C
or
to get the starch and amylase / solutions to the (same) temperature of the water bath

1

(e) **40 °C**
all wells contain a symbol
and
must contain at least two crossed (×) wells at the end

allow final three wells crossed

(×)

1

60 °C
all wells contain a symbol
and
must have fewer crossed (×) wells at the end than at 40 °C

allow all wells ticked (✓)
*for either mp do **not** allow a crossed well followed by a ticked well*

1

(f) more accurate

allow (so) closer to (the) true value

1

(because) it is a quantitative measure

allow (it's) an actual value as opposed to an opinion

or
less / not subjective

allow colour is only qualitative

1

(g) 0.07 (%)

1

(h) starch is broken down less quickly (at 20 °C)

allow converse

1

because, at 20 °C, substrates / enzymes / molecules have less (kinetic) energy

1

(i) 1.08 (arbitrary units)

1

at 80 °C, enzyme / amylase has denatured

allow description of denaturation

*do **not** allow enzyme is killed*

1

so starch is not broken down (at all)

allow the concentration of starch is still 0.5%

1

[16]

7. (a) ventricle

1

(b) lungs

1

(c) valve circled on heart

1

(d) no fatty deposit

1

healthy artery is wider / bigger hole / has more blood flow

1

(e) statins

1

stent

1

(f) any **two** from:

- smoking
- high-fat diet
- lack of exercise

allow:

- *overweight / obese*
- *having high blood pressure*
- *having high cholesterol*

2

(g) 8 (%)

1

(h) more males have coronary heart disease than females

1

[11]