

Organisation part 3 AQA Triple Biology

Name: _____

Class: _____

Date: _____

Time: **85 minutes**

Marks: **79 marks**

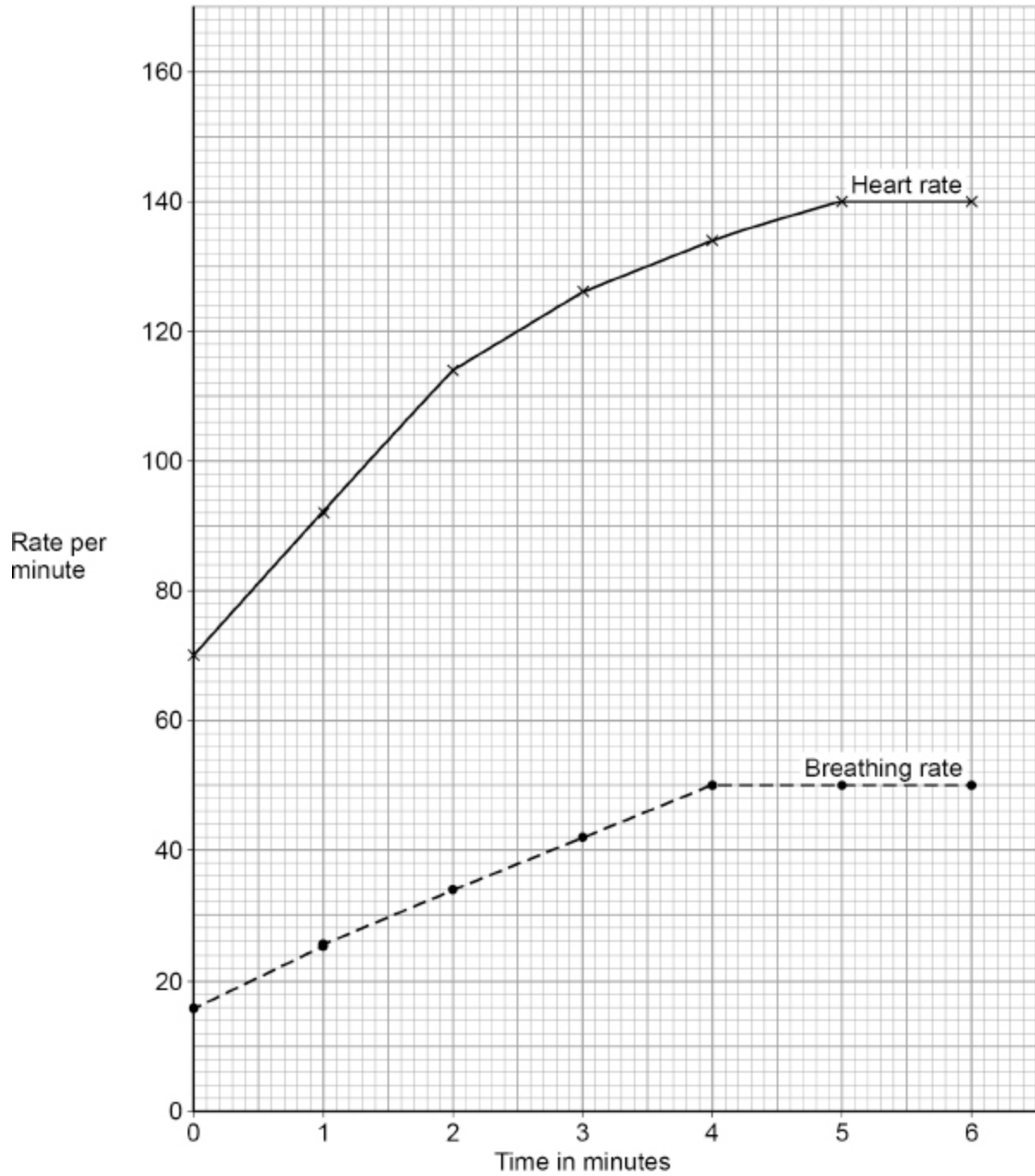
Comments:

1.

A 45-year-old man exercised on a rowing machine for six minutes.

A fitness monitor recorded his heart rate and breathing rate every minute.

The graph below shows the results.



(a) Describe the trend for breathing rate shown in graph.

Use data from the graph in your answer.

(3)

(b) The safe maximum heart rate for a person exercising can be calculated using the equation:

$$\text{safe maximum heart rate} = 220 - \text{age in years}$$

Calculate the safe maximum heart rate for the man.

$$\text{Safe maximum heart rate} = \text{_____} \text{ beats per minute}$$

(1)

(c) What is the man's maximum heart rate?

Use the graph above.

$$\text{Man's maximum heart rate} = \text{_____} \text{ beats per minute}$$

(1)

(d) The man concluded that he was exercising at a safe heart rate.

Give the reason for his conclusion.

Use your answers from part (b) and part (c)

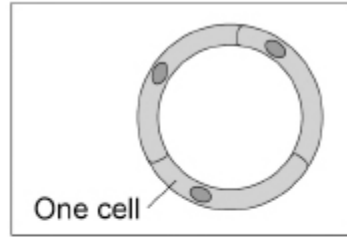
(1)

(a) Draw **one** line from each type of blood vessel to the structure of the blood vessel.

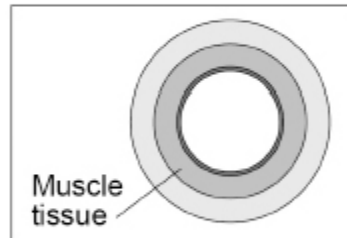
Type of blood vessel

Structure of blood vessel

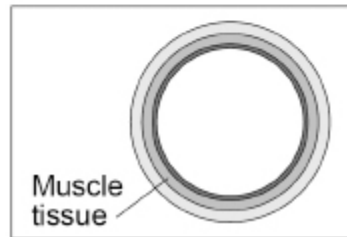
Artery



Capillary



Vein

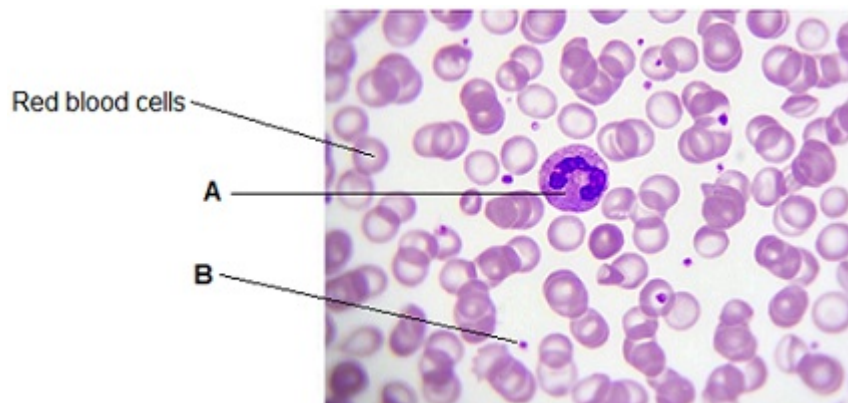


(2)

(b) Explain how the structure of an artery is related to its function.

(2)

The image below shows blood viewed through a microscope.



(c) Name **A** and **B** in the image.

A _____

B _____

(2)

(d) A red blood cell:

- has no nucleus
- contains a red pigment called haemoglobin.

Suggest how these adaptations help the red blood cell carry out its function.

No nucleus

Haemoglobin

(2)

(e) The blood components are carried around the body in the liquid part of the blood.

What is the liquid part of the blood called?

Tick (✓) **one** box.

Cell sap

Plasma

Saliva

Urine

(1)

The table below shows the results of a man's blood test.

Blood component	Patient results	Normal range
Red blood cells	4.8	4.5 to 6.5
Lymphocytes	2.6	1.0 to 4.0
Neutrophils	5.1	1.8 to 7.5
Platelets	50	140 to 400

(f) Which component of the man's blood is **not** within the normal range?

(1)

(g) Suggest a symptom the man might show.

(1)

(Total 11 marks)

3.

Lipases break down lipids.

(a) Which **two** products are formed when lipids are broken down?

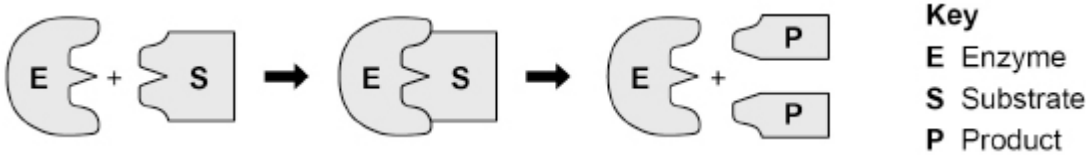
Tick (✓) **two** boxes.

- Amino acids
- Fatty acids
- Glucose
- Glycerol
- Glycogen

(2)

One model used to explain enzyme action is the 'lock and key theory'.

The diagram below shows a model of the theory.



(b) Explain the 'lock and key theory' of enzyme action.

Use information from the diagram above in your answer.

(3)

(c) There are many different types of lipase in the human body.

Why does each different type of lipase act on only **one** specific type of lipid molecule?

Students investigated the presence of starch and glucose in the leaves of geranium plants.

This is the method used.

- 1 Place two identical geranium plants on a bench near a sunny window for two days.
- 2 After two days:
 - leave one plant near the window for two more days.
 - place one plant in a cupboard with no light for two more days.
- 3 Remove one leaf from each plant.
- 4 Crush each leaf to extract the liquid from the cells.
- 5 Test the liquid from each leaf for glucose and for starch.

(1)

(d) Describe how the students would find out if the liquid from the leaf contained glucose.

(3)

(e) Describe how the students would find out if the liquid from the leaf contained starch.

(2)

The table below shows the students' results.

Test	Leaf from plant kept in light for four days	Leaf from plant kept in light for two days and then no light for two days
Glucose	Strong positive	Weak positive
Starch	Positive	Negative

(f) Explain why the leaf in the light for four days contained both glucose and starch.

(2)

(g) Explain why the leaf left in a cupboard with no light for two days did contain glucose but did **not** contain starch.

(3)

- (h) Suggest **one** way the students could develop the investigation to find out more about glucose and starch production in plants.

(1)

(Total 17 marks)

4.

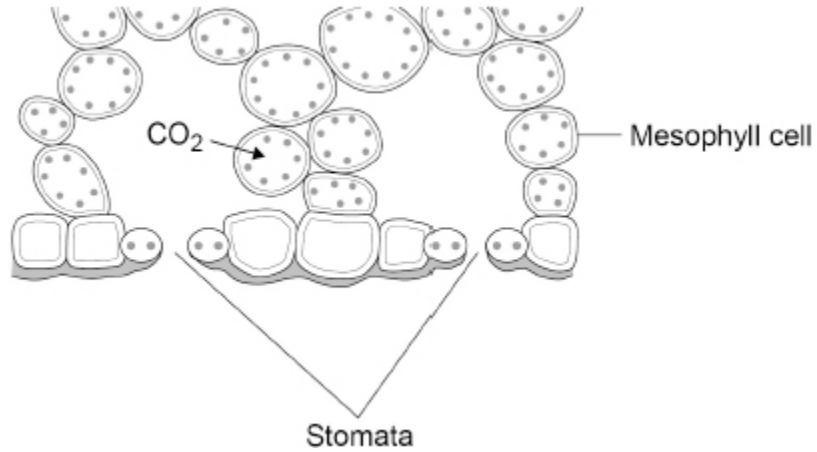
Diffusion is an important process in animals and plants.

- (a) What is meant by the term diffusion?

(2)

(b) **Figure 1** shows part of a leaf.

Figure 1



Molecules of carbon dioxide diffuse from the air into the mesophyll cells.

Which **two** changes will increase the rate at which carbon dioxide diffuses into the mesophyll cells?

Tick (✓) **two** boxes.

Decreased number of chloroplasts in the cells

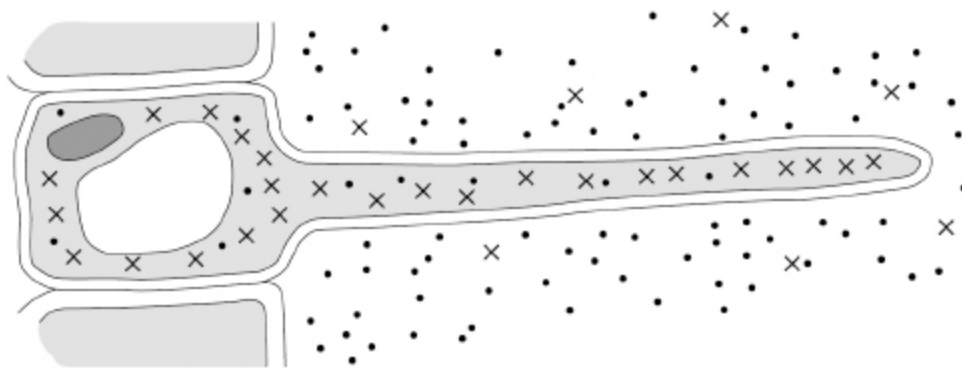
Decreased surface area of cells in contact with the air

Increased carbon dioxide concentration in the air

Increased number of stomata that are open

Increased oxygen concentration in the air

(2)



Key

•• Water molecules

×× Nitrate ions

(d) Name the process by which water molecules enter the root hair cell.

(1)

(e) Nitrate ions need a different method of transport into the root hair cell.

Explain how the nitrate ions in **Figure 3** are transported into the root hair cell.

Use information from **Figure 3** in your answer.

Name of process _____

Explanation _____

(3)

(Total 14 marks)

5.

Data from 'The Million Women' survey in the UK was collected for over 15 years.

Scientists analysed the data to study the effect of consuming alcohol on liver disease.

The scientists:

- included 400 000 women who regularly consumed alcohol
- included 400 000 women who did **not** consume alcohol
- excluded women who already had a liver disease.

(a) Age and gender were two factors controlled in this analysis.

Many other factors were also controlled.

Suggest **two** other factors which the scientists would have controlled.

1 _____

2 _____

(2)

The data was analysed for:

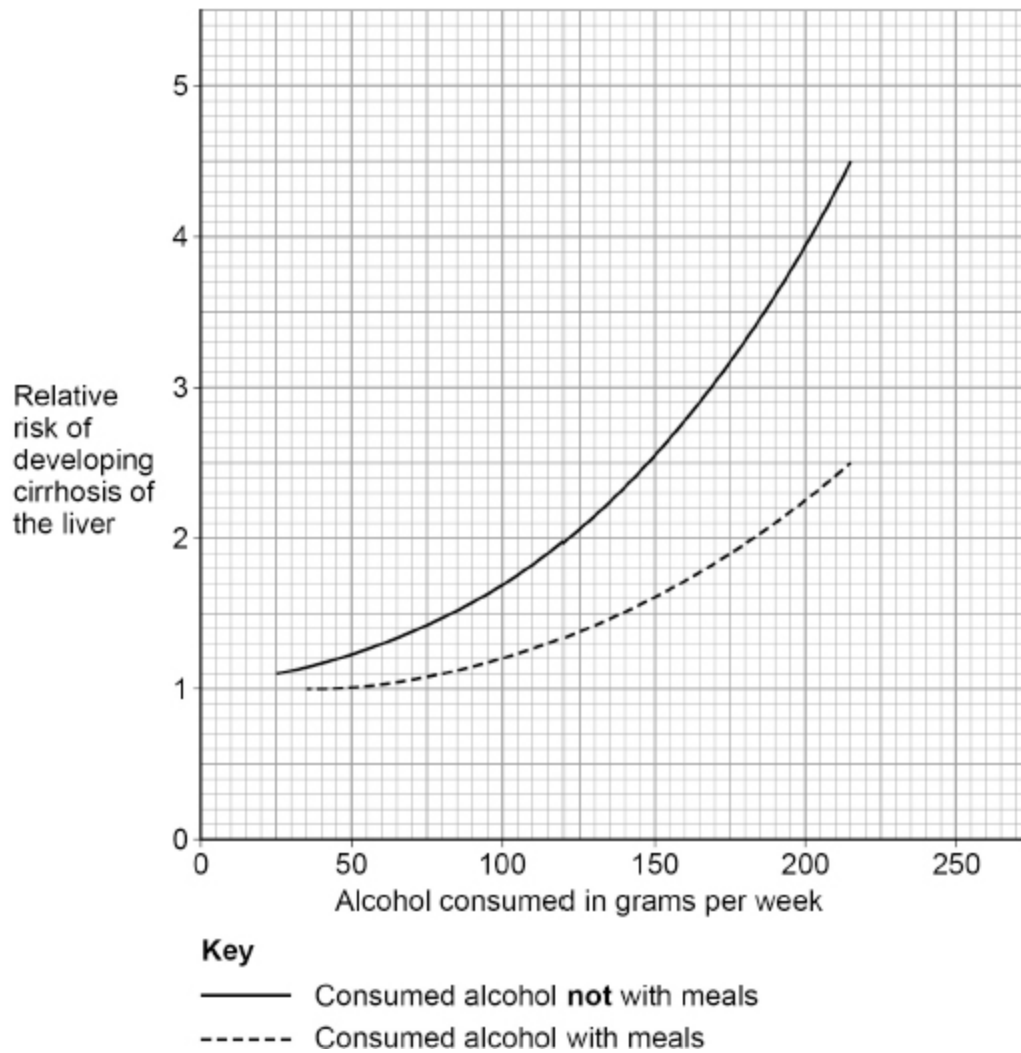
- women who drank alcohol with meals
- women who drank alcohol **not** with meals
- women who did **not** drink alcohol.

During the survey approximately 1500 women developed a liver disease called cirrhosis of the liver.

Scientists calculated the relative risk of developing cirrhosis of the liver for each group who consumed alcohol.

A relative risk of 1.0 means there was no statistical difference between the groups who did consume alcohol and the group who did **not** consume alcohol.

The below graph shows a summary of the results.



(b) A woman drinks 150 g of alcohol per week **not** with meals.

The woman decides to change to drinking 150 g of alcohol per week with meals.

Calculate the percentage decrease in relative risk of developing cirrhosis of the liver for this woman.

Percentage decrease = _____ %

(2)

(c) One glass of wine contains 12 g of alcohol.

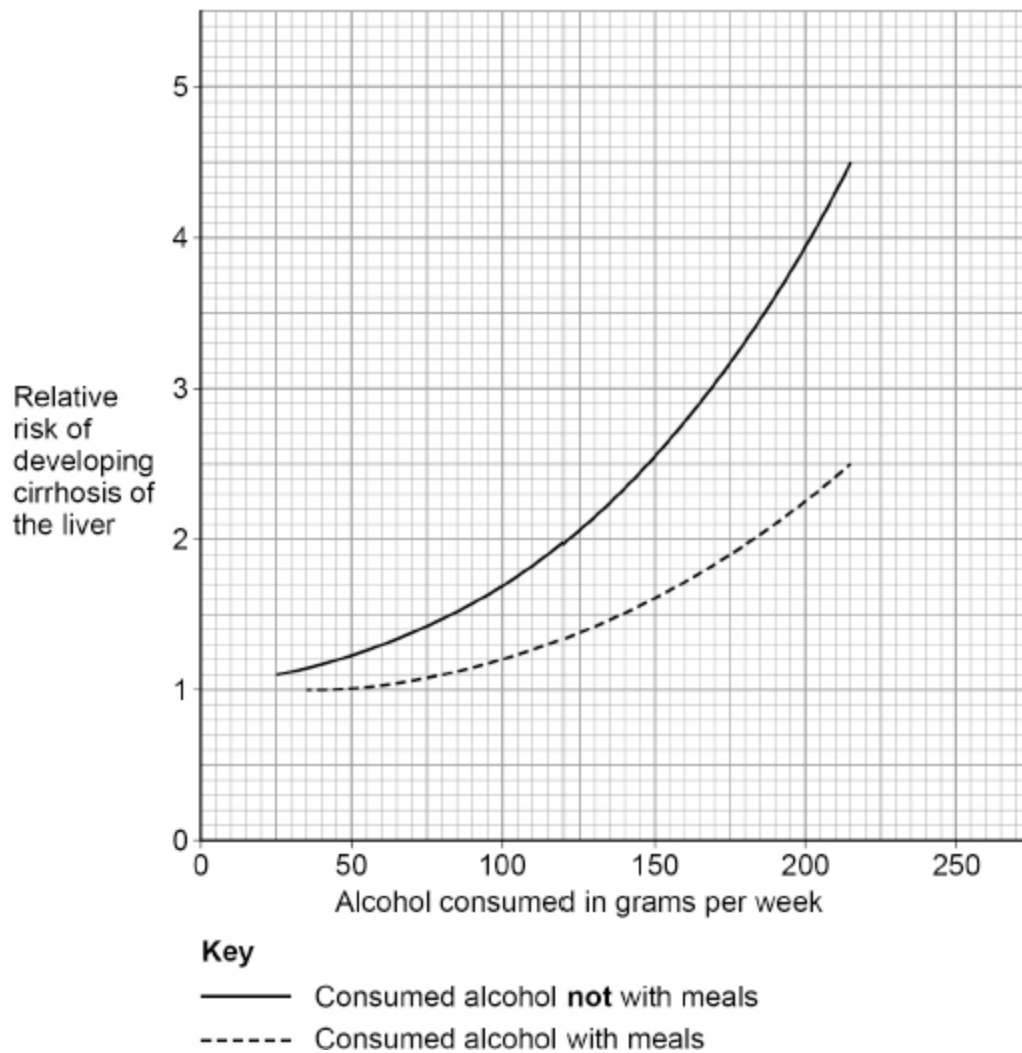
A different woman drinks two glasses of wine each day with her meals.

Calculate the relative risk of developing cirrhosis of the liver for this woman.

Relative risk = _____

(2)

The graph is repeated below.



- (d) Consuming alcohol with meals instead of not with meals decreases the relative risk of developing cirrhosis of the liver.

Give **two** other conclusions about the relative risk of developing cirrhosis of the liver related to alcohol consumption.

Use data from the graph in your answer.

1 _____

2 _____

(2)

- (e) Suggest **two** reasons why the data is considered to be valid.

1 _____

2 _____

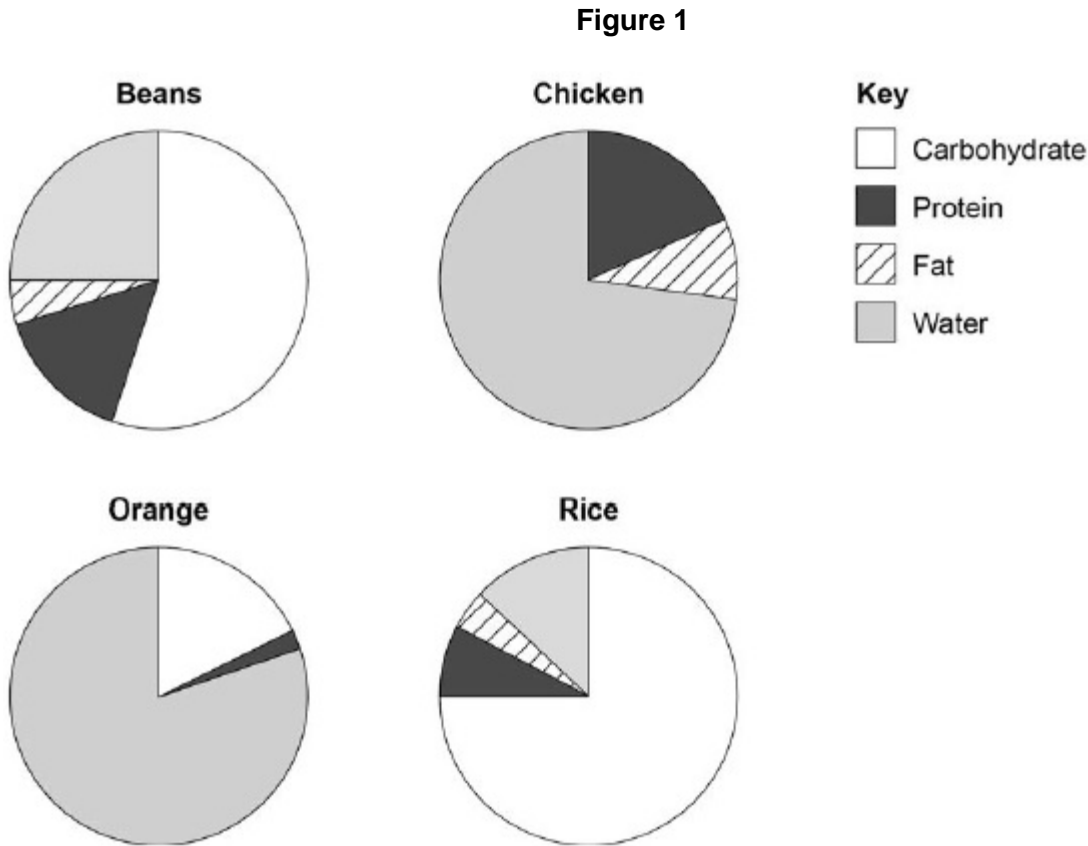
(2)

- (f) Suggest **one** aspect of the survey which might reduce validity.

(1)

6. Many foods contain carbohydrates.

Figure 1 shows information about four different foods.



(a) Which food contains the highest percentage of carbohydrate?

Tick (✓) **one** box.

- Beans
- Chicken
- Orange
- Rice

(1)

(b) Estimate the percentage of water found in beans.

Percentage = _____ %

(1)

(c) Look at **Figure 1**.

Why would eating only beans provide a more balanced diet than eating only chicken?

(1)

(d) Sugars are produced when enzymes break down starch.

What is the name of the enzyme which breaks down starch to produce sugars?

Tick (✓) **one** box.

Amylase

Bile

Lipase

Protease

(1)

(e) Which chemical could be used to test for glucose?

Tick (✓) **one** box.

Benedict's reagent

Biuret reagent

Iodine solution

Sulfuric acid

(1)

(f) What colour change would be seen in a positive test for glucose?

From blue to _____ .

(1)

(g) People with diabetes have difficulty controlling the concentration of glucose in their blood.

The blood of four people was tested.

Table 1 shows the results.

Table 1

Person	Concentration of glucose in blood in arbitrary units
A	4.2
B	6.9
C	7.1
D	5.1

Table 2 shows the information used to help decide if a person has diabetes.

Table 2

Concentration of glucose in blood in arbitrary units	Conclusion
<5.6	No diabetes
5.6 to 7.0	Mild diabetes
>7.0	Severe diabetes

Which person has severe diabetes?

Tick (✓) **one** box.

A

B

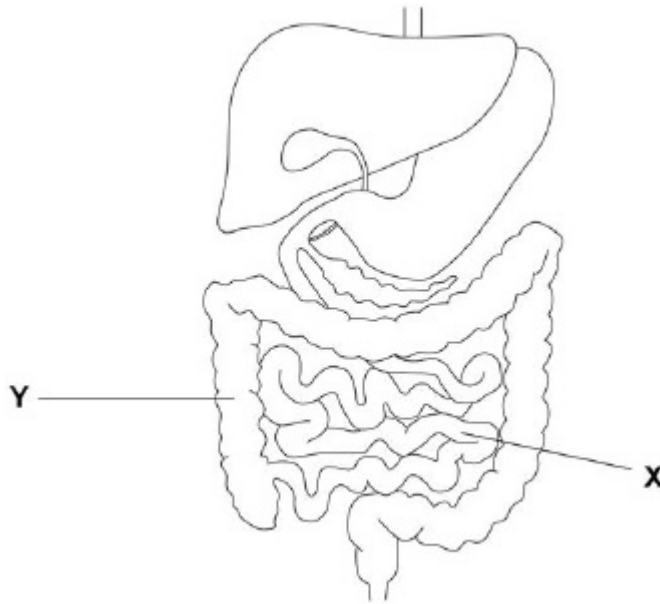
C

D

(1)

Figure 2 shows part of the human digestive system.

Figure 2



(h) Glucose is absorbed into the bloodstream in part X.

Name part X.

(1)

(i) Complete the sentences.

Choose answers from the box.

active transport	digestion	excretion
osmosis	respiration	

Some glucose is absorbed into the bloodstream against the concentration gradient by the process of _____.

Water moves out of part Y and into the bloodstream by the process of _____.

(2)

(Total 10 marks)

Mark schemes

- 1.** (a) increased (at first) 1
- until 4 minutes **or** 50 breaths per minute 1
- (then) stayed constant (from 4 minutes **or** at 50 breaths per minute) 1
- (b) 175 (beats per minute) 1
- (c) 140 (beats per minute) 1
- (d) because his rate is lower than the maximum safe rate
allow ecf for incorrect values in question (b) and question (c) 1

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

5–6

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

3–4

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

1–2

No relevant content

0

Indicative content

- heart rate increased
 - to increase blood flowing to muscles / lungs
 - to provide more oxygen (to muscles)
 - to provide more glucose (to muscles)
 - to remove carbon dioxide more quickly (from the muscles / blood)
 - to remove lactic acid more quickly (from the muscles)
- breathing rate increased
 - supplies more oxygen / air to lungs
 - so more oxygen to blood
 - more carbon dioxide removed
- more oxygen to muscles
 - needed for (increased) respiration
 - to release / provide energy
 - for muscle contraction
- anaerobic respiration occurs
 - due to lack of oxygen
 - which causes a build-up of lactic acid
 - oxygen debt
 - muscle fatigue / pain

To reach **Level 3**, there must be reference to heart rate, breathing rate and respiration

[12]

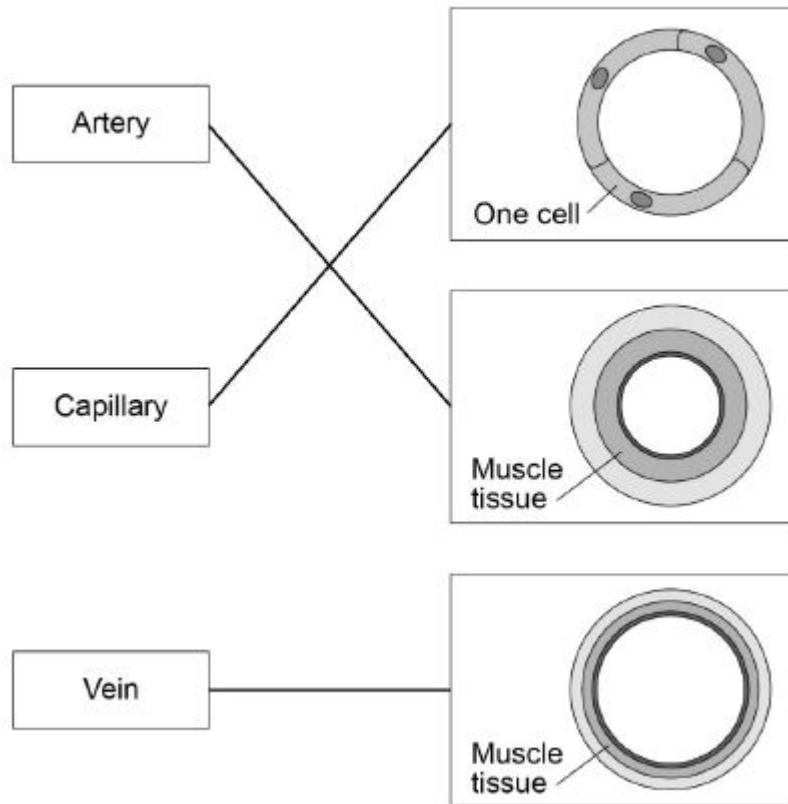
2.

(a) all lines correct = 2 marks

1 or 2 lines correct = 1 mark

Type of blood vessel

Structure of blood vessel



additional line from a box on the left negates the credit for that box

2

(b) any **one** from:

- thick(er) (muscle) walls / tissue (1)

to push blood (all) around the body (1)

allow to withstand high (blood) pressure

*do **not** accept to pump blood (all) around the body*

or

- thick(er) elastic walls / tissue (1)

to maintain / withstand high (blood) pressure

or to retain / regain shape (1)

or

- narrow lumen (1)

to maintain high (blood) pressure (1)

2

- (c) (A) – white (blood) cell(s)
allow any named white (blood) cell(s) 1
- (B) – platelet(s) 1
- (d) (no nucleus) more space for haemoglobin / oxygen
allow to carry more oxygen 1
- (has haemoglobin) to bind / carry oxygen
ignore carries carbon dioxide 1
- (e) plasma 1
- (f) platelets 1
- (g) any **one** from:
- (continued) bleeding
allow described
allow blood does not clot (at cuts)
 - (more) bruising
allow ecf from answer to question (f)
- 1
[11]
- 3.** (a) fatty acids 1
- glycerol 1

- (b) enzyme binds to the substrate because they are complementary (shapes)
allow enzyme joins to the substrate because they fit together exactly
allow enzyme joins to the substrate because the substrate fits the active site
*ignore reference to specificity do **not** accept same shape* 1
- (so) substrate is broken down (into products)
allow (so) substrate splits (into products)
ignore products are formed, unqualified 1
- (so) products are released **or** enzyme is not changed
allow enzyme is not used up
*allow reference to activation energy for either marking point 2 **or** marking point 3* 1
- (c) each active site has a specific shape (so only fits one type of lipid molecule)
allow each active site is a different shape
*do **not** accept reference to the substrate having an active site* 1
- (d) add Benedict's (solution / reagent to the liquid) 1
- boil / heat
allow any temperature of 65 °C or above 1
- (if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick) red 1
- (e) add iodine solution / reagent (to the liquid)
allow add a drop of iodine
ignore iodine unqualified 1
- (if starch is present) it changes colour to blue / black (from yellow / orange / brown) 1
- (f) glucose from photosynthesis
*do **not** accept starch made in photosynthesis* 1
- (excess) glucose converted to starch
allow (excess) glucose is stored as starch 1

- (g) starch (stores) have been converted to glucose
ignore reference to residual glucose from previous photosynthesis 1
- (so the glucose can be) used for respiration / (named) metabolic reactions
or (so the glucose can be) used to release energy
*do **not** accept idea of energy being produced / created / made* 1
- (because) there is no light to make (new / more) glucose by photosynthesis 1

- (h) any **one** from:
- test roots / stems of plants (in the light and dark)
*do **not** accept reference to changing the independent variable*
allow test other parts of the plants
 - test other species of plant
allow test other types of plant
 - measure the concentrations of glucose **and** starch
ignore mass / amount
 - vary the time in the dark / light
 - test variegated leaves
allow any other valid extension ignore repeats

1
[17]

4.

- (a) movement / spreading out of molecules / particles
allow movement / spreading out of (named) substances / chemicals / gases / liquids
ignore reference to membranes / cells 1

from (an area of) high(er) concentration to (an area of) low(er) concentration
allow down / with the concentration gradient
ignore along / across the concentration gradient
*do **not** accept movement from / to a concentration gradient* 1

- (b) increased carbon dioxide concentration in the air 1
- increased number of stomata that are open 1

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

5–6

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

3–4

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

1–2

No relevant content

0

Indicative content

- (many) alveoli
 - provide a large(r) surface area (: volume)
- capillaries are thin
 - **or** alveoli / capillary walls are thin **or** one cell thick
 - **or** capillaries are close to the alveoli
 - which provides short diffusion path (for oxygen / carbon dioxide)
- breathing (mechanism) moves air in and out **or** lungs are ventilated
 - to bring in (fresh) oxygen
 - to remove carbon dioxide
 - to maintain a concentration / diffusion gradient
- large capillary network (around alveoli) **or** good blood supply
 - to remove oxygen(ated blood) quickly
 - to bring carbon dioxide to the lungs quickly
 - to maintain a concentration / diffusion gradient

(d) Osmosis

allow diffusion

1

(e) active transport

1

(because) energy is needed

1

(to move nitrate ions) from a low(er) concentration (in the soil) to a high(er) concentration (in the root / cell)

allow (to move nitrate ions) against / up the concentration gradient

*allow (because) there is a lower concentration (of nitrate ions) in the soil **or** (because) there is a higher concentration (of nitrate ions) in the root / cell*

ignore reference to amount / number of nitrate ions

ignore along / across the concentration gradient

*do **not** accept if reference to molecules / atoms moving*

1

[14]

5.

(a) any **two** from:

ignore genetic factors

- BMI / morphology / obesity level
*allow mass / weight **and** height*
- smoking habits
- diet
allow previous drinking habits
- medication
allow medical conditions
allow drug use
- family history of liver disease
- fitness levels
allow level of exercise
- ethnicity
allow race
- area of UK they live in

2

(b) $2.55 - 1.60 (= 0.95)$

allow $1.60 - 2.55 (= -0.95)$

allow value for with meals in range 1.60 to 1.65 (for 1.60)

1

$(\frac{0.95}{2.55} \times 100 =)$

$37 (.2549019608...) (%)$

allow answer correctly calculated from values in ranges 1.60 to 1.65 and 2.50 to 2.60

allow $-37(.2549019608...)(%)$

1

(c) $12 \times 2 \times 7 = 168$ (g/week)

1

1.8

allow in range 1.8-1.9

*allow correct reading from a calculation that omits the 2
or the 7*

*do **not** accept if a unit is given*

1

(d) any **two** from:

- consuming alcohol increases the RR (with / without meals) **and** supporting data

allow risk for RR throughout

allow data in terms of number of glasses of wine

*allow increasing alcohol consumption increases the RR
at an increasing rate*

- consuming less than 50 g/week of alcohol with meals does not increase the RR

allow any value between 35 and 60 g / week

- even (small amounts of alcohol at) 25 g / week increases the RR if not with meals

2

(e) any **two** from:

- large number in survey

- long term / 15 year survey

allow 800 000 in survey

if neither mark awarded allow large study

- well controlled

allow many controls

2

- (f) any **one** from:
- people underestimate / overestimate alcohol consumption
allow people lie about alcohol consumption
or *people lie about other named control variables*
 - people may change (lifestyle / drinking) habits over time
 - some people may drink all their weekly alcohol at once
ignore survey only tested women

1

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

3-4

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

1-2

No relevant content

0

Indicative content

Responses may refer to either total or partial liver failure

- no bile made (in the liver)
 - fats / lipids are not emulsified
 - surface area of fats / lipids not increased
 - pH of small intestine will not be alkaline / neutralised
 - enzymes (in small intestine) will not work effectively **or** (named) food not digested / absorbed
 - so may lose weight
- lactic acid not broken down / oxidised
 - accumulation of lactic acid in blood / body
 - lactic acid is toxic **or** body will be poisoned
 - oxygen debt higher / prolonged
 - so muscle pain / fatigue
- proteins / amino acids will not be broken down (in liver)
 - (amino acids) not deaminated
 - amino acids not made into urea **or** will not form ammonia
 - (however) any ammonia formed is toxic
 - so accumulation of amino acids in blood / body
- liver does not break down / remove other toxins (like alcohol)
 - toxins accumulate in blood / body
 - body will be poisoned
 - so pain **or** jaundice **or** swollen liver **or** portal hypertension occurs
- glycogen stores will not be formed
 - cannot control blood glucose
 - so hyperglycaemia / hypoglycaemia / diabetes / coma may occur

[15]

6.	(a) rice	1
	(b) 25 (%)	1
	<i>allow an answer between 23 and 27 (%)</i>	
	<i>ignore ¼ / 0.25</i>	
	(c) (beans) contain all (four) food groups	1
	<i>allow converse for chicken</i>	
	<i>allow chicken contains no / less carbohydrate or beans</i>	
	<i>contain carbohydrate</i>	
	<i>allow beans contain more nutrients</i>	
	<i>ignore references to water / fat / protein</i>	
	(d) amylase	1
	(e) Benedict's reagent	1
	(f) (brick) red / green / yellow / orange / brown	1
	(g) C	1
	(h) small intestine	1
	<i>allow ileum</i>	
	<i>ignore intestine unqualified</i>	
	<i>do not accept large intestine / duodenum</i>	
	(i) active transport	1
	osmosis	1
		[10]