AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE BIOLOGY

H

Higher Tier Paper 1H

Tuesday 12 May 2020 Afternoon Time allowed: 1 hour 45 minutes

Materials

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

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- *Do all rough work in this book.* Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

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

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Do not write outside the box

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

0 1 This question is about photosynthesis.

0 1 . 1 Complete the word equation for photosynthesis.

[2 marks]

carbon dioxide + water → glucose + oxygen

0 1 . 2 Describe how energy for the photosynthesis reaction is gained by plants.

[2 marks]

light energy is absorbed by chlorophyll found within chloroplasts

Students investigated the effect of temperature on the rate of photosynthesis.

The students shone light from a lamp onto pondweed and measured the volume of oxygen produced per hour.

Table 1 shows the results.

Table 1

Temperature in °C	Rate of photosynthesis in cm^3/hour			
	Test 1	Test 2	Test 3	Mean
20	18.5	19.3	19.5	X
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

Do not write outside the box

0 1 . 3 Calculate mean value **X**.

[2 marks]

$X = \frac{18.5 + 19.3 + 19.5}{3} = \frac{57.3}{3}$

X = 19.1 cm^3/hour

The students identified one anomalous result in **Table 1**.

0 1 . 4 Draw a ring around the anomalous result in **Table 1**.

[1 mark]

0 1 . 5 Suggest **one** possible cause of the anomalous result.

[1 mark]

Value from the scale was mis read

0 1 . 6 How did the students deal with the anomalous result?

[1 mark]

did not use it in the calculation of the mean

0 1 . 7 Give **one** factor the students should have kept constant in this investigation.

[1 mark]

Light intensity

Do not write outside the box

Table 1 is repeated below.

Table 1

Temperature in °C	Rate of photosynthesis in cm^3/hour			
	Test 1	Test 2	Test 3	Mean
20	18.5	19.3	19.5	X
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

0 1 . 8 Why did the rate of photosynthesis decrease from 35 °C to 45 °C?

[1 mark]

Enzymes start to denature which changes the shape of their active site.

Do not write outside the box

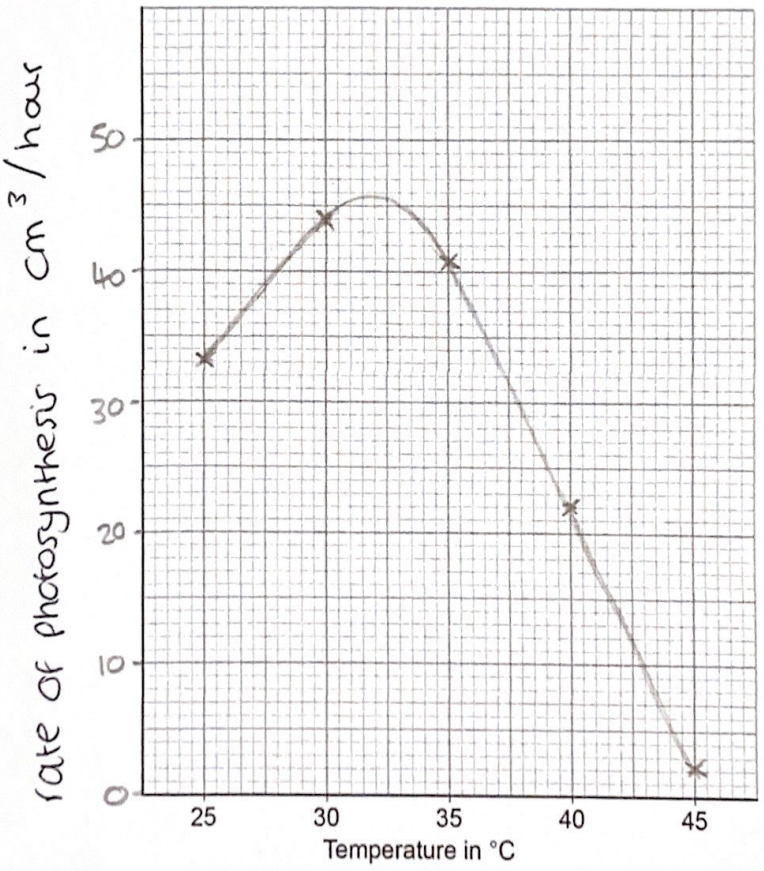
0 1 . 9 Complete **Figure 1** using data from **Table 1**.

You should:

- label the y-axis
- use a suitable scale for the y-axis
- plot the mean data from **Table 1** for temperatures from 25 °C to 45 °C
- draw a line of best fit.

[5 marks]

Figure 1



16

Turn over for the next question

Do not write outside the box

0 2 Diffusion is an important process in animals and plants.

0 2 . 1 What is meant by the term diffusion?

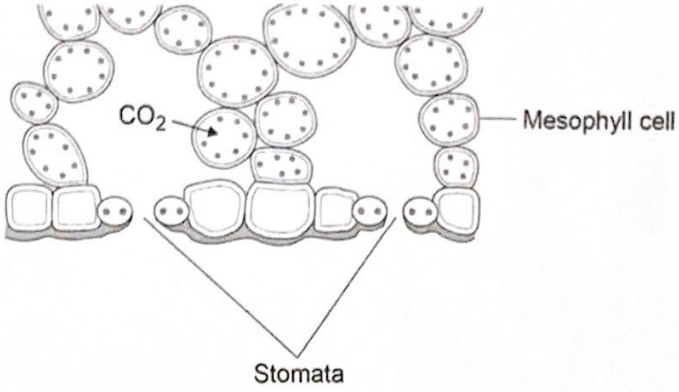
[2 marks]

The net movement of particles from an area of high concentration to low concentration, down the concentration gradient.

Do not write outside the box

0 2 . 2 **Figure 2** shows part of a leaf.

Figure 2



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?

[2 marks]

Tick (✓) **two** boxes.

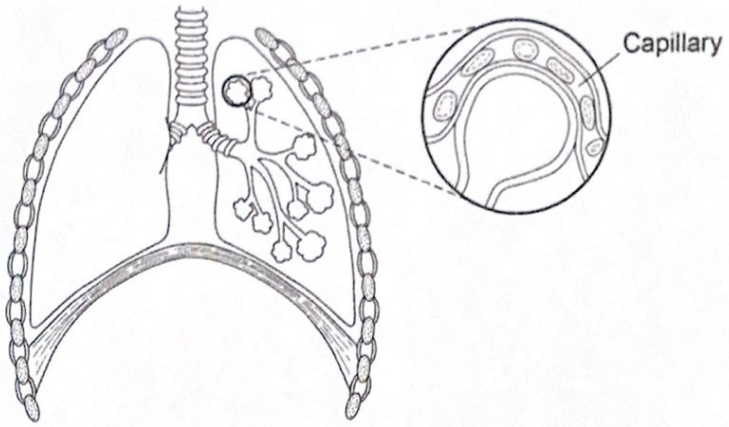
- Decreased number of chloroplasts in the cells ☐
- Decreased surface area of cells in contact with the air ☐
- Increased carbon dioxide concentration in the air ☑
- Increased number of stomata that are open ☑
- Increased oxygen concentration in the air ☐

Do not write outside the box

0 2 . 3 Diffusion also happens in the human lungs.

Figure 3 shows the human breathing system.

Figure 3



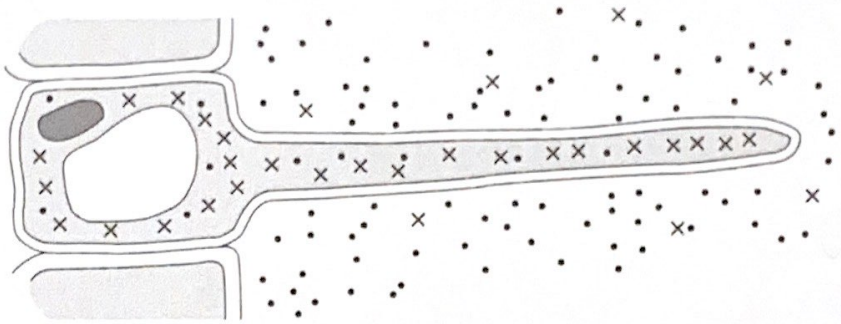
Explain how the human lungs are adapted for efficient exchange of gases by diffusion.
[6 marks]

The lungs contain many air sacs called alveoli which is where gas is exchanged between the blood and air. Alveoli provide a large surface area for absorption of oxygen and release of carbon dioxide. The alveoli are surranded by a large network of thin capillaries which provide a short diffusion path for oxygen and carbon dioxide. The large capillary networks also help to maintain a concentration gradient as they allow for speedy removal of oxygen from the air and carbon dioxide from the blood. The concentration gradient is also maintained by the mechanism of breathing as fresh oxygen is continuously brought in and carbon dioxide is continuously removed.

Do not writ outside th box

Figure 4 shows a root hair cell.

Figure 4



Key

⋰ Water molecules

×⁄× Nitrate ions

0 2 . 4 Name the process by which water molecules enter the root hair cell.

[1 mark]

Osmosis

0 2 . 5 Nitrate ions need a different method of transport into the root hair cell.

Explain how the nitrate ions in **Figure 4** are transported into the root hair cell.

Use information from **Figure 4** in your answer.

[3 marks]

Name of process Active transport

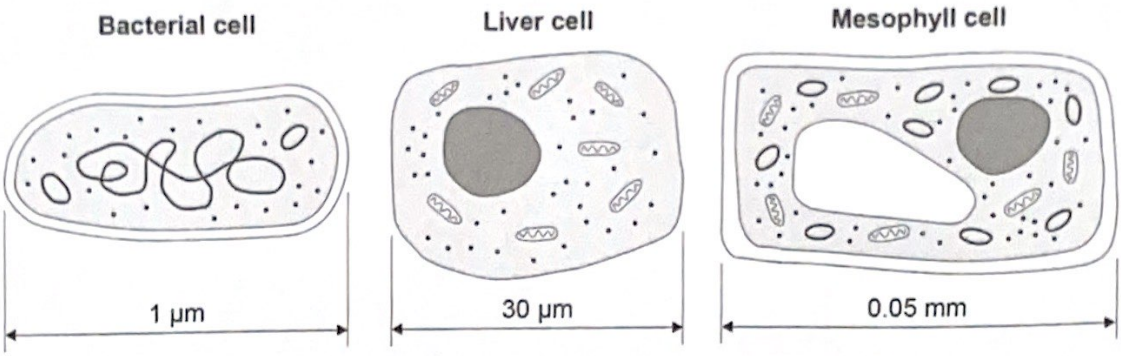
Explanation Energy is required to move the ~~nitrate~~ nitrate ions from an ~~one~~ area of lower concentration (soil) to a higher concentration (in the root cells).

14

Do not write outside the box

0 3 **Figure 5** shows three types of cell.

Figure 5



0 3 . 1 Give **two** similarities between the prokaryotic cell and the eukaryotic cells in **Figure 5**.

[2 marks]

1 All have cytoplasm

2 All have a cell membrane

0 3 . 2 Give **three** differences between the prokaryotic cell and the eukaryotic cells in **Figure 5**.

[3 marks]

1 Prokaryotic cells are smaller

2 Prokaryotic cells have no mitochondria, but eukaryotic cells do.

3 Prokaryotic cell has a single loop of DNA which is not held in a nucleus.

Do not write outside the box

0 3 . 3 Calculate the ratio of the size of the bacterial cell to the size of the mesophyll cell.

[2 marks]

1 µm : 0·05 mm 0·05 x 1000 = 50

1 µm : 50 µm

Ratio = 1 : 50

0 3 . 4 Name the type of cell division that produces genetically identical body cells for growth and repair.

[1 mark]

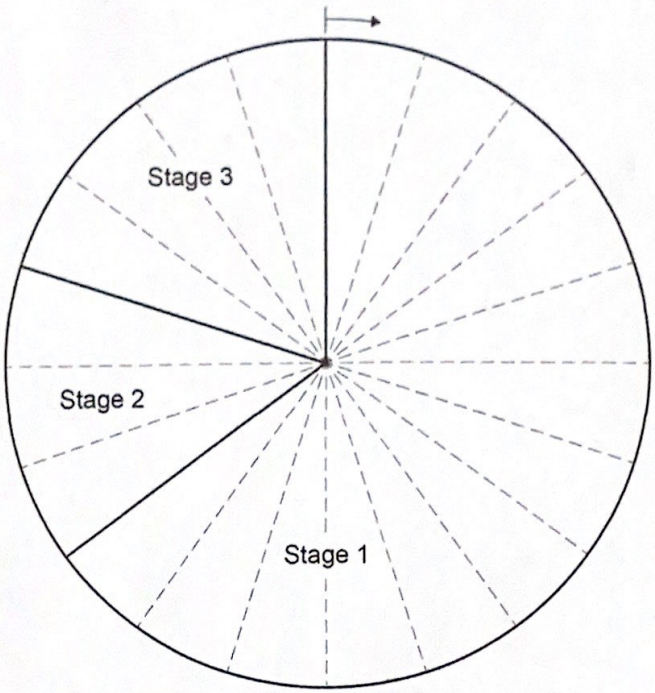
mitosis

Question 3 continues on the next page

Do not write outside the box

Figure 6 shows a cell cycle.

Figure 6



0 3 . 5 What percentage of the time for one cell cycle is represented by stage 2 and stage 3 together?

[1 mark]

Tick (✓) **one** box.

7% ☐ 35% ☑ 40% ☐ 65% ☐

Do not write outside the box

0 3 . 6 Describe what happens during each stage of the cell cycle.

[4 marks]

Stage 1 DNA duplicates and ribosomes and mitochondria replicate.

Stage 2 one set of chromosomes pulled apart from the other to opposite ends of the cell.

Stage 3 The cytoplasm and cell membrane divides to form 2 separate cells

13

Turn over for the next question

Do not write outside the box

0 4 . 1 Lipases break down lipids.

Which **two** products are formed when lipids are broken down?

[2 marks]

Tick (✓) **two** boxes.

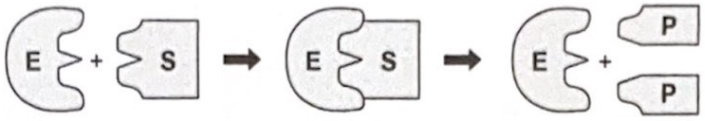
- Amino acids ☐
- Fatty acids ☑
- Glucose ☐
- Glycerol ☑
- Glycogen ☐

Do not write outside the box

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

Figure 7 shows a model of the theory.

Figure 7



Key
E Enzyme
S Substrate
P Product

0 4 . 2 Explain the 'lock and key theory' of enzyme action.

Use information from **Figure 7** in your answer.

[3 marks]

The enzymes active site is complementary to the substrate so they bind together. The substrate gets broken down into products which are released. The enzyme does not get changed.

0 4 . 3 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?

[1 mark]

Each active site has a specific shape so will only fit one type of lipid molecule.

Do not write outside the box

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.

0 4 . 4 Describe how the students would find out if the liquid from the leaf contained glucose.

[3 marks]

First they would add benedict's solution to the sample and heat it. If the sample contains glucose they will observe a colour change from blue to yellow / orange / red.

0 4 . 5 Describe how the students would find out if the liquid from the leaf contained starch.

[2 marks]

They would add iodine solution to the liquid and if starch is present it changes colour to blue / black.

Do not write outside the box

Table 2 shows the students' results.

Table 2

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

0 4 . 6 Explain why the leaf in the light for four days contained both glucose and starch.

[2 marks]

The leaf will contain glucose that has been made in photosynthesis and starch which was made from excess glucose made in photosynthesis.

0 4 . 7 Explain why the leaf left in a cupboard with no light for two days did contain glucose but did **not** contain starch.

[3 marks]

The plant has used up its starch stores and have converted them to glucose which is used for respiration to release energy. As there is no light, photosynthesis cannot happen and so new glucose molecules cannot be made and starch stores must be used.

0 4 . 8 Suggest **one** way the students could develop the investigation to find out more about glucose and starch production in plants.

[1 mark]

Test other species of plant

17

0 5 Many plants have evolved defence mechanisms.

Figure 8 shows part of a gorse plant and part of a deadly nightshade plant.

Figure 8

Gorse plant

Deadly nightshade plant

0 5 . 1 The gorse plant has evolved to have sharp thorns.

What type of defence response are thorns?

[1 mark]

mechanical

0 5 . 2 How do thorns defend the gorse plant?

[1 mark]

To deter herbivores from eating it.

0 5 . 3 The deadly nightshade plant has poisonous berries.

What type of defence response are poisonous berries?

[1 mark]

Chemical

Do not write outside the box

0 5 . 4 A scientist noticed that in one area the gorse plants had yellow leaves and had stunted growth.

One reason for yellow leaves and stunted growth is a deficiency of nitrate ions in the soil.

Explain **two** other possible reasons for the yellow leaves and stunted growth.

Do **not** refer to nitrate ions in your answer.

[5 marks]

Reason 1 Infected by a pathogen

Explanation Can cause leaves to become discoloured so less photosynthesis occurs and so not enough glucose is made to make proteins for growth.

Reason 2 Lack of ~~light~~ magnesium ions

Explanation Magnesium ions are needed to make chlorophyll in the leaves so lack of magnesium ions means there is not enough chlorophyll for photosynthesis and not enough glucose is made to release energy for growth.

Question 5 continues on the next page

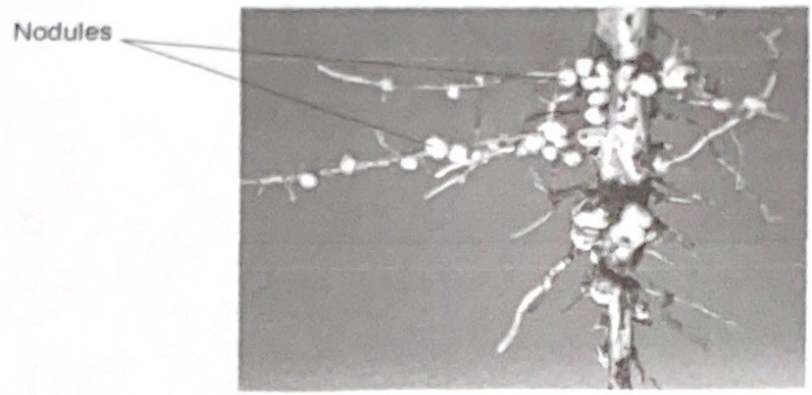
The gorse plant has nodules on its roots.

The nodules are part of the living root tissue.

Bacteria which convert nitrogen gas into soluble nitrate ions live in the nodule tissue.

Figure 9 shows the nodules on the roots.

Figure 9



0 5 . 5 Suggest how the nodules benefit the bacteria.

[2 marks]

The bacteria obtain glucose from the plant that can be used for respiration.

0 5 . 6 Explain how the nodules benefit the gorse plant.

[2 marks]

The gorse plant obtains nitrate ions from the nodules which the plant needs to make amino acids and therfore proteins

Do not write outside the box

0 5 . 7 For many years drugs have been extracted from plants.

Which plant material was chewed as a painkiller?

[1 mark]

Tick (✓) **one** box.

- Blackcurrant berries ☐
- Foxglove leaves ☐
- Rose petals ☐
- Willow bark ☑

13

Turn over for the next question

0 6 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.

0 6 . 1 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.

[2 marks]

1 BMI

2 Diet

Question 6 continues on the next page

The data was analysed for:

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

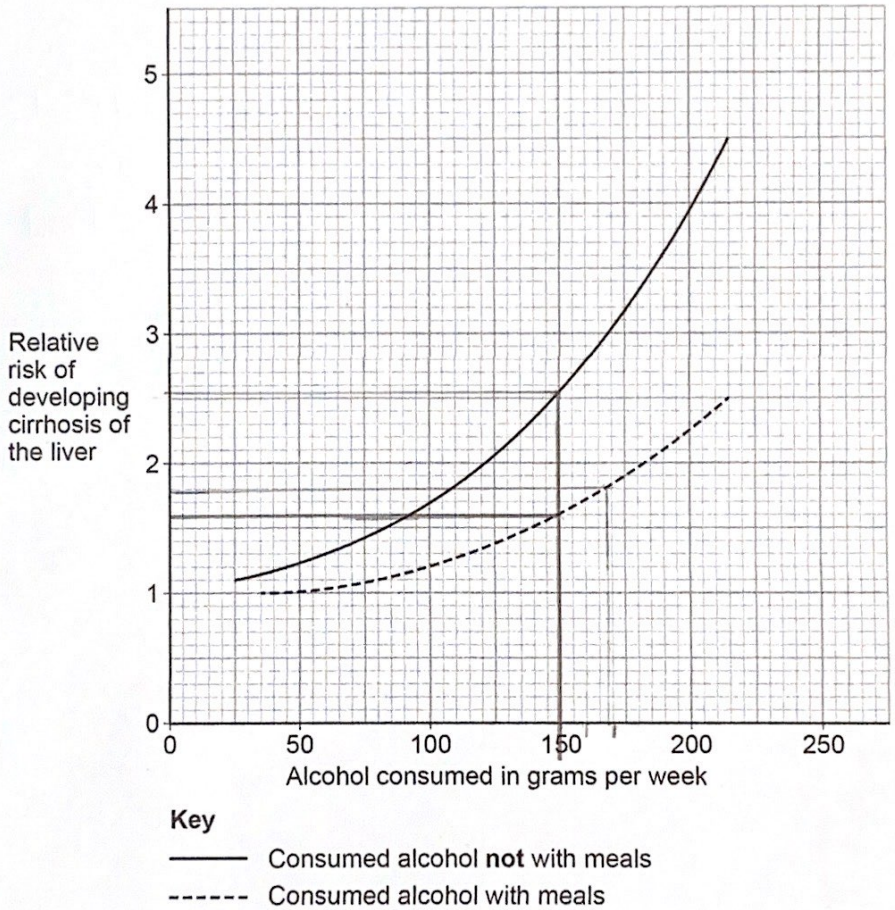
During the survey approximately 1500 women developed a liver disease called cirrhosis of the liver.

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.

Figure 10 shows a summary of the results.

Figure 10



Do not write outside the box

0 6 . 2 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.

[2 marks]

$2.55 - 1.6 = 0.95$

$\frac{0.95}{2.55} \times 100 = 37.25490$

Percentage decrease = 37 %

0 6 . 3 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.

[2 marks]

$12 \times 2 = 24$ g per day

$24 \times 7 = 168$ g per week

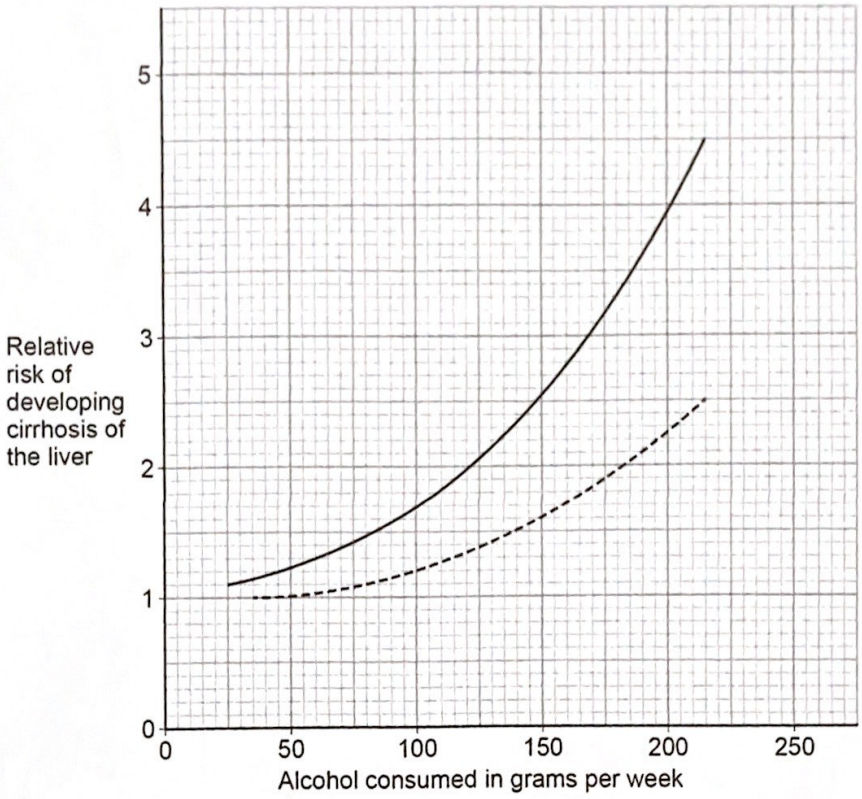
Relative risk = 1.8

Question 6 continues on the next page

Do not write outside the box

Figure 10 is repeated below.

Figure 10



0 6 . 4 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 **Figure 10** in your answer.

[2 marks]

1 Consuming less than 50 g of alcohol per week with meals does not increase the relative risk of developing cirrhosis.

2 Even small amounts of alcohol (25 g per week) increases the Relative risk if not consumed with meals.

Do not write outside the box

0 6 . 5 Suggest **two** reasons why the data is considered to be valid.

[2 marks]

1 There was a large number of participants in the survey

2 The survey has many controls.

0 6 . 6 Suggest **one** aspect of the survey which might reduce validity.

[1 mark]

People may overestimate or underestimate their alcohol consumption.

0 6 . 7 Cirrhosis of the liver leads to liver failure.

Describe the effects of liver failure on the human body.

[4 marks]

If the liver doesn't make bile then fats are not emulsified so the surface area of the lipids is not increased. The pH of the small intestine will not be neutralised so enzymes will work ineffectively and person may lose weight due to food not being properly digested and absorbed. Lactic acid is broken down in the liver so if liver is not functioning correctly there will be an accumulation of lactic acid which is toxic and can cause muscle pain and fatigue and the oxygen debt will be prolonged.

15

Turn over for the next question

Do not write outside the box

0 7 Monoclonal antibodies (mAbs) are usually made using mouse lymphocytes.

Candida albicans infection produces serious symptoms in patients with a poor immune system.

Recently scientists have produced mAbs to *Candida albicans* using human lymphocytes produced naturally after an infection.

0 7 . 1 *Candida albicans* lives in the throat of infected patients.

A sample is taken from the throat of a patient with a suspected *Candida albicans* infection.

The sample is transferred onto a microscope slide.

Describe how the mAbs and a fluorescent dye could be used to see any *Candida albicans* pathogens on the slide.

[3 marks]

Firstly, bind fluorescent dye to the mAbs. Then ~~pour~~ put the mAbs that are bound to the dye on the slide with the throat sample. Then the slide should be rinsed and put under a microscope. The mAbs will bind to the candida albicans and show up under the microscope due to the attatched fluorescent dye.

Do not write outside the box

In a laboratory the human lymphocyte mAbs were injected into animals infected with *Candida albicans*.

The mAbs caused increased phagocytosis of the *Candida albicans* pathogens.

Doctors intend to start a trial to give the mAbs to patients severely ill with *Candida albicans*.

0 7 . 2 Explain how increased phagocytosis of the *Candida albicans* pathogen will help the patient.

[2 marks]

More canadian albican pathogens will be engulfed and killed by the white blood cells so there will be less damage to cells.

Question 7 continues on the next page

Do not write outside the box

0 7 . 3 It has been shown that this mAbs treatment is effective in the laboratory using both:

- infected tissue culture cells
- infected live animals.

The mAbs treatment for *Candida albicans* is now ready for clinical trials on people.

Describe how the clinical trials should be carried out.

[6 marks]

The first stage would be to give the treatment to healthy volunteers at a low ~~dose~~ dose to test that its safe and to check for any major side effects. Then the treatment can be given to patients with the disease. This stage of the trial tests for the optimal ~~dos~~ dose of the drug and to see whether it actually works in treating the patient. It also checks for any further side effects. The process should be done in a double blind trial where neither the patients or doctors know who has the mAbs and who has the placebo drug. This ensures the results are reliable ~~and~~ and accurate. The trials should last a long time in order to test full effects and it should be ~~treated~~ tested on many different people to see if efficacy is linked to other factors such as age, gender etc.

Do not write outside the box

0 7 . 4 Scientists have also used human lymphocytes to make mAbs to other pathogens and to some types of cancer cells.

Suggest **one** reason why these new mAbs have been more successful in treating diseases in humans than mAbs made using mice.

[1 mark]

The body is less likely to reject the mAbs from humans than from mice.

12

END OF QUESTIONS