ALEC REED ACADEMY

Mastery Booklet **(Biology)**

(Paper 1)

Name : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date Given : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

These booklets are a consolidation of your learning. They should be used in the following way – You should attempt the questions WITHOUT looking at the answers. Then mark your questions with **Green pen** and add any missing marks you missed.

*THIS WILL IMPROVE YOUR GRADES…!!*

**Year 11 GCSE Intervention Support 2019-20**



**These are your science exam dates for your**

**Paper 1**

**Biology 1…. …12th May 2020**

**Chemistry 1….. 14th May 2020**

**Physics 1…… 20th May 2020**

**These are your science exams for your**

**Paper 2**

**Biology2 1stJune 2020**

**Chemistry 2 10th June 2020**

**Physics 2 12th June 2020**

**IMPORTANT:** This is not instead of revision at home. You should still do your own revision. This is just to help you with the toughest parts.

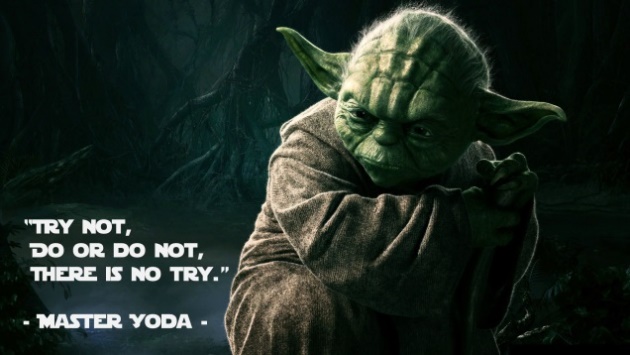
We know you have a lot to revise for and preparing for your exams can be stressful so here is a tool to help you.

**STEP 1: You have finished your (B1, C1, and P1) year 9-11 learning so you can target all the areas you want support with.**

**HOW TO USE THIS BOOKLET**

You know best. What your strengths and target areas are so please can you pick the topics you want most help with.

**Tips:**

**Revision Tips**

**1. Plan to revise. Don’t sit down without knowing what to do, it feels awful.**

Try this…. “Right I am going to do 30 minutes on radioactivity. I will list 10 key facts, one idea I find tough and try 1 past paper question.”

So plan your tasks and topics. It really helps. Ask for help with making a revision plan.

2. **Avoid distractions.** Revise with a friend so you don’t think about what they are doing. Avoid revising when really tired or hungry.

3. **Reward yourself.** “If I do an hour or two this morning then I can go out this afternoon”.

4. **Make stuff.** Put up posters, make flash cards or revision cards. Post-it your room with key ideas. Keep what you’ve made to help you realise you are working well.

5. **Practice past paper questions**. You have been provided with a free book of these and they are one of the best things you can do. Remember to B.U.G. (**B**ox the keyword, **U**nderline important info, **G**o through it twice).

**Revision tools**

**1.** Use Sam Learning. The centre code is TA6CT1 **https://www.samlearning.com/ Use your revision guide to help with the tasks/tests.**

**2. Don’t just read your revision guide.** Make lists of keywords then test yourself to see if you can describe the keywords. Practice drawing key diagrams from memory. Use the question pages in the revision guides.

**3.** Google **“AQA Science A past papers”** for year 10 topics. Google **“AQA science past papers”** for year 11 stuff.Lots to choose from.

**4. GCSE Bitesize** has recently been given a makeover and now has lots of helpful videos linked to the tests and tasks.

**5. Check out www.getrevising.co.uk.** Free revision planner tool and many free resources. For a small monthly fee you can download other people’s revision materials for AQA science.

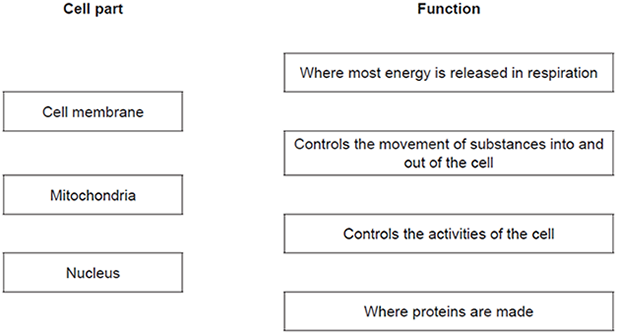
**6. Phone apps.** App store search cgp revision guides, they are fairly cheap if you want an on the go revision guide.

7. YOUTUBE The “mygcse science” youtube channel has really lovely walkthrough commentaries with pictures for all your B/C/P topics. Have a look.

**Q1.** Living organisms are made of cells.

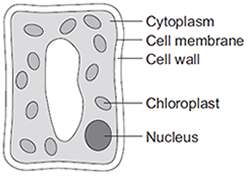
(a)     Animal and plant cells have several parts. Each part has a different function.

Draw **one** line from each cell part to the correct function of that part.



**(3)**

(b)     The diagram below shows a cell from a plant leaf.



Which **two** parts in the diagram above are **not** found in an animal cell?

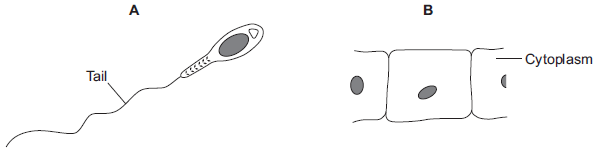
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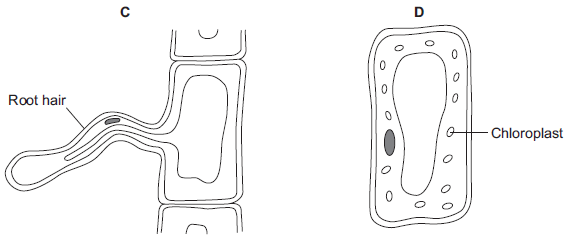
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**(2)**

**(Total 5 marks)**

**Q2.**The diagrams show four types of cell, **A**, **B**, **C** and **D**.Two of the cells are plant cells and two are animal cells.





(a)     (i)      Which **two** of the cells are plant cells? Tick () **one** box.

|  |  |
| --- | --- |
| **A** and **B** |  |
| **A** and **D** |  |
| **C** and **D** |  |

**(1)**

(ii)     Give **one** reason for your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(b)     (i)      Which cell, **A**, **B**, **C** or **D**, is adapted for swimming?    

**(1)**

(ii)     Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis?    

**(1)**

(c)     Cells **A**, **B**, **C** and **D** all use oxygen. For what process do cells use oxygen?

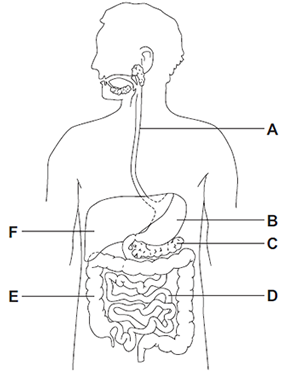
Draw a ring around **one** answer.

|  |  |  |
| --- | --- | --- |
| **osmosis** | **photosynthesis** | **respiration** |

**(1)**

**(Total 5 marks)**

**Q3.** The digestive system breaks down food into small molecules. The small molecules can be absorbed into the blood. The diagram below shows the human digestive system.



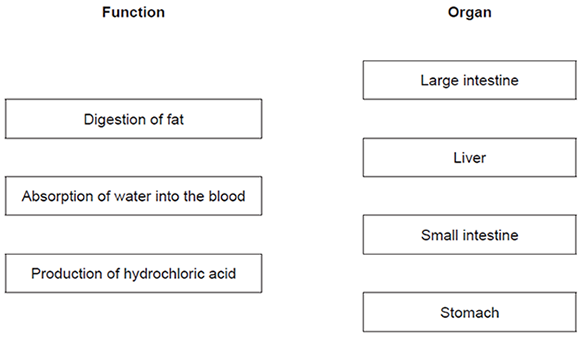
(a)     (i)      Which letter, **A**, **B**, **C**, **D**, **E** or **F**, shows each of the following organs?

|  |  |
| --- | --- |
| Write **one** letter in each box. |  |
| large intestine |  |
| small intestine |  |
| stomach |  |

**(3)**

(ii)     Different organs in the digestive system have different functions.

Draw **one** line from each function to the organ with that function.



**(3)**

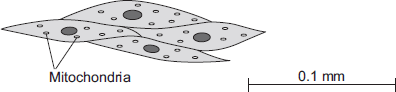
(b)     Glucose is absorbed into the blood in the small intestine. Most of the glucose is absorbed by diffusion. How does the glucose concentration in the blood compare to the glucose concentration in the small intestine?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |  |
| The concentration in the blood is higher. |  |
| The concentration in the blood is lower. |  |
| The concentration in the blood is the same. |  |

**(1)**

**(Total 7 marks)**

**Q4.** The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a)     Describe the function of muscle cells in the wall of the stomach.

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**(2)**

(b)     **Figure above** is highly magnified. The scale bar in **Figure above** represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of **Figure above**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Magnification = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ times

**(2)**

(c)     The muscle cells in **Figure above** contain many mitochondria. What is the function of mitochondria?

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**(2)**

(d)      The ribosomes cannot be seen in **Figure above**.

(i)      What is the function of a ribosome?

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**(1)**

(ii)     Suggest why the ribosomes **cannot** be seen through a light microscope.

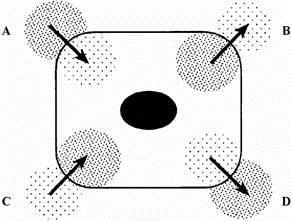
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**(1)**

**(Total 8 marks)**

**Q5.** (a)     The diagram shows four ways in which molecules may move into and out of a cell. The dots show the concentration of molecules.



The cell is respiring aerobically.  
Which arrow, **A**, **B**, **C** or **D**, represents:

(i)      movement of oxygen molecules;                 \_\_\_\_\_\_\_\_\_\_

(ii)     movement of carbon dioxide molecules?     \_\_\_\_\_\_\_\_\_\_

**(2)**

(b)     Name the process by which these gases move into and out of the cell.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(c)     Which arrow, **A**, **B**, **C** or **D**, represents the active uptake of sugar molecules by the cell?

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Explain the reason for your answer.

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**(2)**

**(Total 5 marks)**

**Q6.** Explain how the human circulatory system is adapted to:

•        supply oxygen to the tissues

•        remove waste products from tissues.

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**(Total 6 marks)**

**Q7.** A student investigated the effect of different sugar solutions on potato tissue.This is the method used.

1.        Add 30 cm3 of 0.8 mol dm−3 sugar solution to a boiling tube.

2.        Repeat step **1** with equal volumes of 0.6, 0.4 and 0.2 mol dm−3 sugar solutions.

3.        Use water to give a concentration of 0.0 mol dm−3.

4.        Cut five cylinders of potato of equal size using a cork borer.

5.        Weigh each potato cylinder and place one in each tube.

6.        Remove the potato cylinders from the solutions after 24 hours.

7.        Dry each potato cylinder with a paper towel.

8.        Reweigh the potato cylinders.

The table below shows the results.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Concentration of sugar solution in mol dm−3** | **Starting mass in g** | **Final mass in g** | **Change of mass in g** | **Percentage (%) change** |
| 0.0 | 1.30 | 1.51 | 0.21 | 16.2 |
| 0.2 | 1.35 | 1.50 | 0.15 | **X** |
| 0.4 | 1.30 | 1.35 | 0.05 | 3.8 |
| 0.6 | 1.34 | 1.28 | −0.06 | −4.5 |
| 0.8 | 1.22 | 1.11 | −0.11 | −9.0 |

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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Percentage change in mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ %

**(2)**

(b)     Why did the student calculate the percentage change in mass as well as the change in grams?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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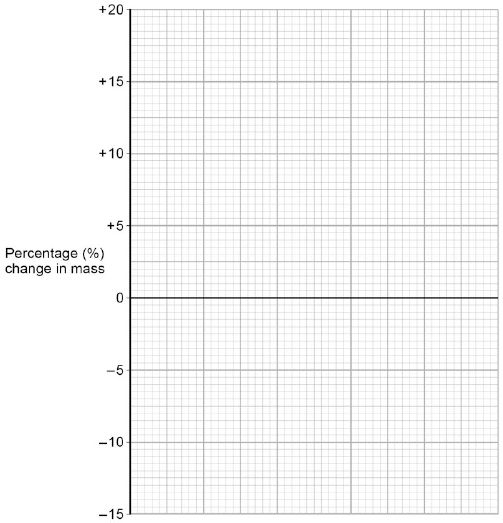
**(1)**

(c)     Complete the graph using data from the table above.

•        Choose a suitable scale and label for the *x*-axis.

•        Plot the percentage (%) change in mass.

•        Draw a line of best fit.



**(4)**

(d)     Use your graph to estimate the concentration of the solution inside the potato cells.

Concentration = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mol dm−3

**(1)**

(e)     The results in the table above show the percentage change in mass of the potato cylinders. Explain why the percentage change results are positive **and** negative.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**

(f)     Suggest **two** possible sources of error in the method given above.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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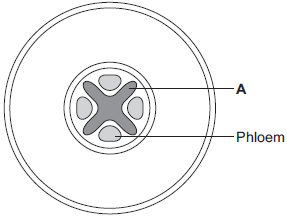
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

**(Total 13 marks)**

**Q8.** The diagram below shows a cross-section of a plant root. The transport tissues are labelled.



(a)     (i)      What is tissue **A**? Draw a ring around the correct answer.

**cuticle                epidermis                xylem**

**(1)**

(ii)     Name **two** substances transported by tissue **A**.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(b)     Phloem is involved in a process called translocation.

(i)      What is translocation?

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**(1)**

(ii)     Explain why translocation is important to plants.

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**(2)**

(c)     Plants must use active transport to move some substances from the soil into root hair cells.

(i)      Active transport needs energy.

Which part of the cell releases most of this energy?

Tick (✓) **one** box.

|  |  |
| --- | --- |
| mitochondria |  |
| nucleus |  |
| ribosome |  |

**(1)**

(ii)     Explain why active transport is necessary in root hair cells.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

**(Total 9 marks)**

**Q9. In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Diffusion is an important process in animals and plants. The movement of many substances into and out of cells occurs by diffusion. Describe why diffusion is important to animals and plants. In your answer you should refer to:

•        animals

•        plants

•        examples of the diffusion of named substances.

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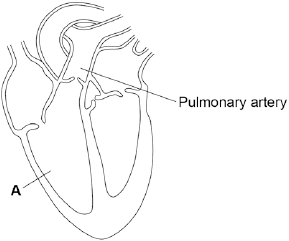
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**(Total 6 marks)**

**Q1. 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)**

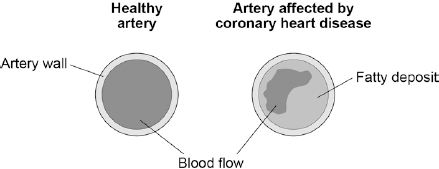
(c)     Circle a valve on **Figure 1**.

**(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. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(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. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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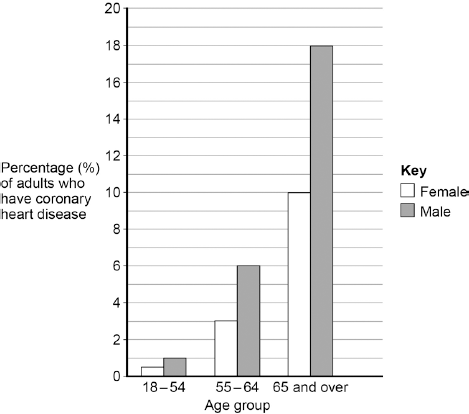
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(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)**

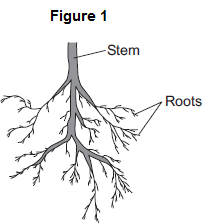
(h)     Which is the correct conclusion for the data in **Figure 3**?

|  |  |
| --- | --- |
| 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)**

**Q2.** Plants need different substances to survive. **Figure 1** shows the roots of a plant.



(a)     (i)      Mineral ions are absorbed through the roots.

Name **one** other substance absorbed through the roots.

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**(1)**

(ii)     The plant in **Figure 1** has a higher concentration of mineral ions in the cells of its roots than the concentration of mineral ions in the soil.

Which **two** statements correctly describe the absorption of mineral ions into the plant’s roots?

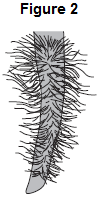
Tick () **two** boxes.

|  |  |
| --- | --- |
| The mineral ions are absorbed by active transport. |  |
| The mineral ions are absorbed by diffusion. |  |
| The mineral ions are absorbed down the concentration gradient. |  |
| The absorption of mineral ions needs energy. |  |

**(2)**

(iii)    The plant in **Figure 1** has roots adapted for absorption.

**Figure 2** shows a magnified part of a root from **Figure 1.**



Describe how the root in **Figure 2** is adapted for absorption.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

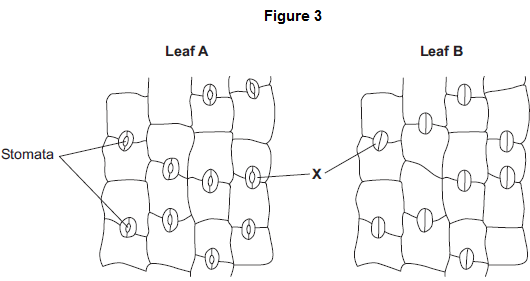
(b)     The leaves of plants have stomata. What is the function of the stomata?

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**(1)**

(c)     **Figure 3** shows the underside of two leaves, **A** and **B**, taken from a plant in a man’s house.



(i)      In **Figure 3**, the cells labelled **X** control the size of the stomata. What is the name of the cells labelled **X**? Tick () **one** box.

|  |  |
| --- | --- |
| Guard cells |  |
| Phloem cells |  |
| Xylem cells |  |

**(1)**

(ii)     Describe how the appearance of the stomata in leaf **B** is different from the appearance of the stomata in leaf **A**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(iii)    The man forgets to water the plant.

What might happen to the plant in the next few days if the stomata stay the same as shown in leaf **A** in **Figure 3**?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

**(Total 9 marks)**

**Q3.** (a)     **List A** gives four structures in the human body. **List B** gives the functions of some structures in the body.Draw a straight line from each structure in **List A** to the correct function in **List B**.

|  |  |  |
| --- | --- | --- |
| **List A – Structure** |  | **List B – Function** |
|  |  | Surround and protect the lungs |
| Alveoli |  |  |
|  |  | Filter the blood |
| Veins |  |  |
|  |  | Carry blood towards the heart |
| Villi |  |  |
|  |  | Absorb digested food |
| Ribs |  |  |
|  |  | Allow oxygen to enter the blood |

**(4)**

(b)     Draw a ring around the correct answer to complete the sentence.

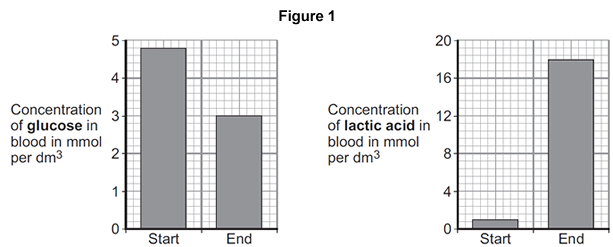
|  |  |
| --- | --- |
|  | diffusion. |
| In the lungs, oxygen enters the blood from the air by | filtration. |
|  | respiration. |

**(1)**

**(Total 5 marks)**

**Q4.** An athlete ran as fast as he could until he was exhausted.

(a)     **Figure 1** shows the concentrations of glucose and of lactic acid in the athlete’s blood at the start and at the end of the run.



(i)      Lactic acid is made during anaerobic respiration. What does anaerobic mean?

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**(1)**

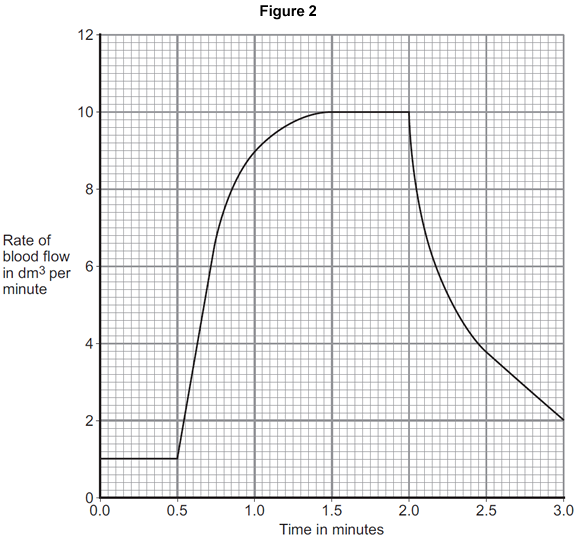
(ii)     Give evidence from **Figure 1** that the athlete respired anaerobically during the run.

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**(1)**

(b)     **Figure 2** shows the effect of running on the rate of blood flow through the athlete’s muscles.



(i)      For how many minutes did the athlete run?

Time = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ minutes

**(1)**

(ii)     Describe what happens to the rate of blood flow through the athlete’s muscles during the run. Use data from **Figure 2** in your answer.

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**(2)**

(iii)     Explain how the change in blood flow to the athlete’s muscles helps him to run.

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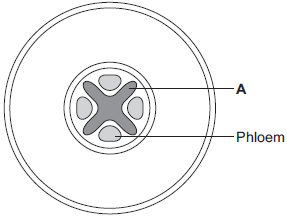
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**(4)**

**(Total 9 marks)**

**Q5.** The diagram below shows a cross-section of a plant root. The transport tissues are labelled.



(a)     (i)      What is tissue **A**? Draw a ring around the correct answer.

**cuticle                epidermis                xylem**

**(1)**

(ii)     Name **two** substances transported by tissue **A**.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(b)     Phloem is involved in a process called translocation.

(i)      What is translocation?

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**(1)**

(ii)     Explain why translocation is important to plants.

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**(2)**

(c)     Plants must use active transport to move some substances from the soil into root hair cells.

(i)      Active transport needs energy. Which part of the cell releases most of this energy? Tick (✓) **one** box.

|  |  |
| --- | --- |
| mitochondria |  |
| nucleus |  |
| ribosome |  |

**(1)**

(ii)     Explain why active transport is necessary in root hair cells.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

**(Total 9 marks)**

**Q6.** (a)     A food contains protein. Describe, in as much detail as you can, what happens to this protein after the food is swallowed.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(4)**

(b)     The table shows the activity of lipase on fat in three different conditions.

|  |  |
| --- | --- |
| CONDITION | UNITS OF LIPASE ACTIVITY PER MINUTE |
| Lipase + acid solution | 3.3 |
| Lipase + weak alkaline solution | 15.3 |
| Lipase + bile | 14.5 |

          Explain, as fully as you can, the results shown in the table.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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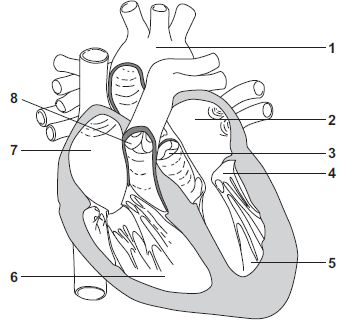
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**(3)**

**(Total 7 marks)**

**Q7.** The diagram in **Figure 1** shows a section through the human heart, seen from the front.

**Figure 1**

****

(a)     Draw a ring around the correct answer to complete each sentence.

|  |  |  |  |
| --- | --- | --- | --- |
| (i) | The wall of the heart is made mostly of | epithelial  glandular  muscular | tissue. |

**(1)**

(ii)    The resting heart rate is controlled by the pacemaker.

|  |  |
| --- | --- |
| The pacemaker is located at position | **1**.  **6**.  **7**. |

**(1)**

(iii)   If a person’s heart rate is irregular, the person may be fitted with an artificial pacemaker.

|  |  |
| --- | --- |
| The artificial pacemaker is | an electrical device.  a pump.  a valve. |

**(1)**

(b)     (i)      Write a number, **2**, **5**, **6** or **7**, in **each** of the three boxes to answer this question. Which chamber of the heart:

|  |  |
| --- | --- |
| pumps oxygenated blood to the head and body |  |
| receives deoxygenated blood from the head and body |  |
| receives oxygenated blood from the lungs? |  |

**(3)**

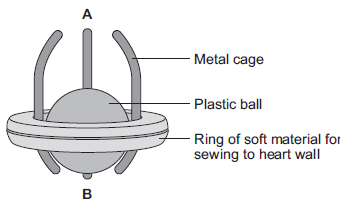
(ii)     Give the number, **3**, 4 or **8**, of the valve that closes when the blood pressure in the aorta is greater than the blood pressure in the left ventricle.

Write the correct answer in the box.    

**(1)**

(c)     The diagram in **Figure 2** shows one type of artificial heart valve. The plastic ball is in the closed position.

**Figure 2**

****

This type of artificial valve could be used to replace a faulty valve in the heart.

(i)      What is the function of valves in the heart?

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**(1)**

(ii)     The artificial valve could be used to replace valve **4** shown in **Figure 1**.

The artificial valve opens to let blood through when the ball is moved towards **A**.

Which end of the valve, **A** or **B**, should point towards chamber **5**?

Explain your answer.

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**(3)**

(d)     (i)      The artificial heart valve may cause blood clots to form on its surface. Describe what happens during blood clotting.

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**(2)**

(ii)     Read the information in the passage.

|  |
| --- |
| Replacing a damaged heart valve can dramatically improve the blood circulation and the supply of oxygen to the body’s tissues. The operation to replace a heart valve is a long one during which the patient’s blood goes through a bypass machine. Sometimes the artificial valve can fail to work. If the surface of the valve becomes rough, small blood clots can form on its surface then break away and be carried around the body by the blood. |

Evaluate the advantages and disadvantages of artificial heart valves.

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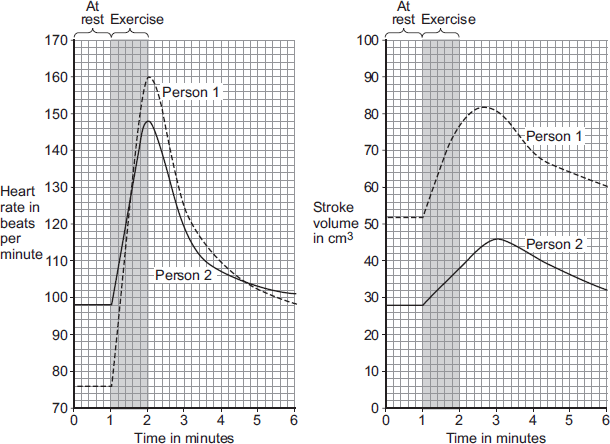
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**(4)**

**(Total 17 marks)**

**Q8.** During exercise, the heart beats faster and with greater force.The ‘heart rate’ is the number of times the heart beats each minute. The volume of blood that travels out of the heart each time the heart beats is called the ‘stroke volume’.

In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise. The graph below shows the scientists’ results.



(a)     The ‘cardiac output’ is the volume of blood sent from the heart to the muscles each minute.

              Cardiac output = Heart rate × Stroke volume

At the end of the exercise, **Person 1**’s cardiac output = 160 × 77 = 12 320 cm3 per minute.

Use information from **Figure above** to complete the following calculation of **Person 2**’s cardiac output at the end of the exercise.

At the end of the exercise:

**Person 2**’s heart rate        = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

**Person 2**’s stroke volume = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3

**Person 2**’s cardiac output = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3 per minute

**(3)**

(b)     **Person 2** had a much lower cardiac output than **Person 1.**

(i)      Use information from **Figure above** to suggest the **main** reason for the lower cardiac output of **Person 2**.

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**(1)**

(ii)     **Person 1** was able to run much faster than **Person 2**.

Use information from **Figure above** and your own knowledge to explain why.

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**(5)**

**(Total 9 marks)**

**Q9.** (a)     Complete the table to give one site where digestive substances are made.

|  |  |
| --- | --- |
| **Digestive substance** | **One site of production** |
| bile |  |
| amylase |  |
| lipase |  |
| protease |  |

**(4)**

(b)     Describe **two** ways that the mouth can break down starchy foods.

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**(2)**

(c)     Describe how the liver helps to digest fats.

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**(2)**

**(Total 8 marks)**

**Q10.** A group of pupils investigated the digestion of fat by the enzyme lipase.

(a)     What **two** substances are produced when fats are digested?

Tick () **two** box.

|  |  |
| --- | --- |
| Glucose |  |
| Fatty acids |  |
| Glycerol |  |
| Amino acids |  |

**(2)**

In the investigation:

•     the pupils set up five test tubes

•     each tube contained 1 cm3 of fat and 10 cm 3 of lipase solution

•     each tube was kept at a different temperature for 24 hours.

(b)     (i)     Give **one** control variable in this investigation.

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**(1)**

(ii)      What was the independent variable being investigated?

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**(1)**

(c)     The pH of the solution in each tube was tested at the beginning of the investigation and after 24 hours.

The results of the pupils’ investigation are shown in the table.

|  |  |  |  |
| --- | --- | --- | --- |
| **Tube** | **Temperature  in °C** | **pH at the beginning** | **pH after 24 hours** |
| 1 | 0 | Neutral | Neutral |
| 2 | 20 | Neutral | ‘Weak’ acid |  |
| 3 | 40 | Neutral | ‘Strong’ acid |
| 4 | 60 | Neutral | ‘Weak’ acid |
| 5 | 80 | Neutral | Neutral |

One pupil said, “We might **not** have found the best temperature for the lipase to work”.

What more could they do to find the best temperature?

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**(2)**

(d)     The pupils then placed **Tube 1** into a water-bath kept at 40 °C.  
The tube was left in the water-bath for 24 hours.

(i)      What pH would you expect the contents of the tube to be after the extra 24 hours?

Tick () **one** box.

|  |  |
| --- | --- |
| Neutral |  |
| ‘Strong’ acid |  |
| ‘Weak’ acid |  |

**(1)**

(ii)      Give the reason for your answer.

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**(1)**

**(Total 8 marks)**

**Q11.** After a meal rich in carbohydrates, the concentration of glucose in the small intestine changes.

The table below shows the concentration of glucose at different distances along the small intestine.

|  |  |
| --- | --- |
| **Distance along the small intestine in cm** | **Concentration of glucose in mol dm−3** |
| 100 | 50 |
| 300 | 500 |
| 500 | 250 |
| 700 | 0 |

(a)     At what distance along the small intestine is the glucose concentration highest?

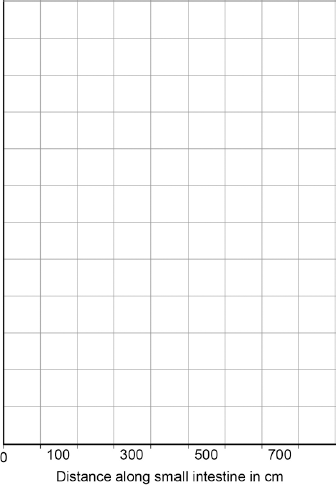
      \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm

**(1)**

(b)     Use the data in the table to plot a bar chart on the graph below.

•        Label the *y*-axis.

•        Choose a suitable scale.



**(4)**

(c)     Look at the graph on the previous page.

Describe how the concentration of glucose changes as distance increases along the small intestine.

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**(2)**

(d)     Explain why the concentration of glucose in the small intestine changes between 100 cm and 300 cm.

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**(2)**

(e)     Explain why the concentration of glucose in the small intestine changes between 300 cm and 700 cm.

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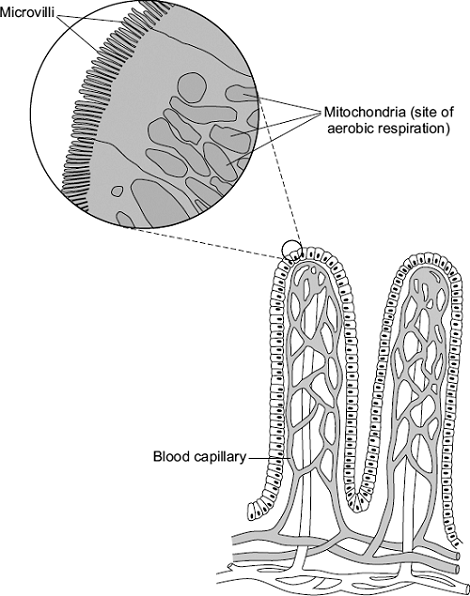
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**(3)**

**(Total 12 marks)**

**Q12.** The villi of the small intestine absorb the products of digestion.

The diagram shows two villi. It also shows parts of some of the surface cells of a villus, as seen with an electron microscope.



Describe and explain how the villi are adapted to maximise the rate of absorption  
of the products of digestion.

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**(Total 5 marks)**

**Q1.** Microorganisms cause infections.The human body has many ways of defending itself against microorganisms.

(a)     Describe **two** ways the body prevents the entry of microorganisms.

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(b)     In 2014 the Ebola virus killed almost 8000 people in Africa. Drug companies have developed a new drug to treat Ebola.

Explain what testing must be done before this new drug can be used to treat people.

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**(6)**

**(Total 8 marks)**

**Q2.** The MMR vaccine is used to protect against measles.

(a)     Apart from measles, which **two** other diseases does the MMR vaccine protect against?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     Read the information.

|  |
| --- |
| Measles is a dangerous disease caused by a virus .Normally, MMR vaccinations are given at 1 year old and again at 4 years old. Each vaccination is 90% effective in protecting against the measles virus. In April 2013, there were 630 cases of measles in children aged 4 and over in a small area of the UK. Of these cases, 504 children had not been vaccinated against MMR at all and only a few had been given a second vaccination. |

(i)      Calculate the percentage of the children who caught measles in April 2013 who had **not** been vaccinated against MMR.

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Percentage = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(ii)     Suggest **one** advantage to the population as a whole of children having the second MMR vaccination.

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**(1)**

(c)     (i)      What does a vaccine contain?

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**(1)**

(ii)     Explain how a vaccination prevents infection.

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**(3)**

(d)     (i)      Antibiotics can only be used to treat some infections. Explain why antibiotics **cannot** be used to treat measles.

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**(2)**

(ii)     Why do antibiotics become less useful at treating an infection if the antibiotic is overused?

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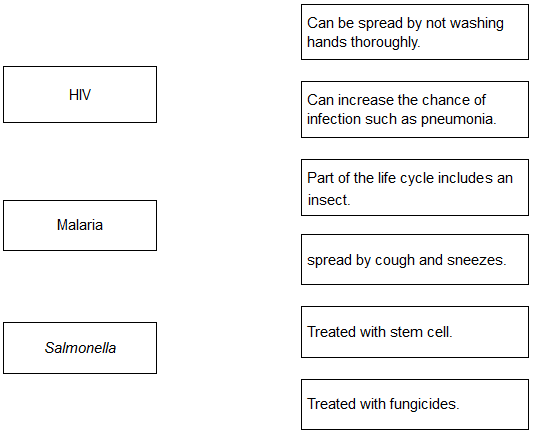
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**(1)**

**(Total 11 marks)**

**Q3.** Microorganisms can cause disease.

(a)     Draw **one** line from each disease to the correct description.



**(3)**

(b)     Gonorrhoea is a sexually transmitted disease. A bacterium causes gonorrhoea. What are the symptoms of gonorrhoea?

|  |  |
| --- | --- |
| Tick **two** boxes. |  |
| Headache |  |
| Pain when urinating |  |
| Rash |  |
| Vomiting |  |
| Yellow discharge |  |

**(2)**

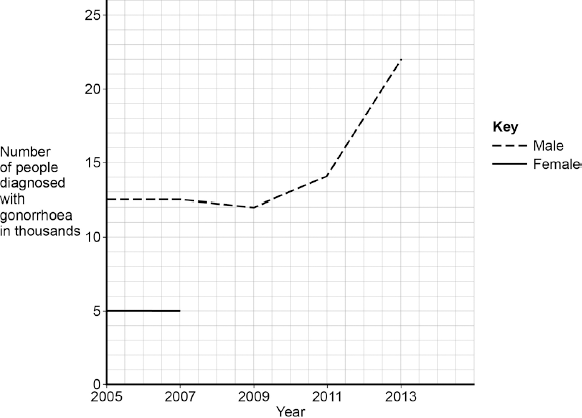
(c)     The table below shows the number of people in the UK diagnosed with gonorrhoea in different years.

|  |  |  |
| --- | --- | --- |
|  | **Number of people diagnosed  with gonorrhoea in thousands** | |
| **Year** | **Female** | **Male** |
| 2005 | 5.0 | 12.5 |
| 2007 | 5.0 | 12.5 |
| 2009 | 5.5 | 12.0 |
| 2011 | 6.0 | 14.0 |
| 2013 | 7.5 | 22.0 |

Use the data in the table to complete the graph below.

•        The numbers for males have already been plotted.

•        Only some of the numbers for females have been plotted.



**(3)**

(d)     Describe the patterns in the numbers of males and females with gonorrhoea from 2005 to 2013. Use the data in the graph.

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**(3)**

(e)     Gonorrhoea is treated with an antibiotic. HIV is another sexually transmitted disease.

Explain why prescribing an antibiotic will **not** cure HIV.

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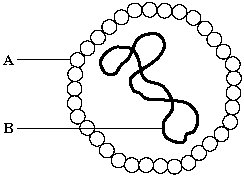
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**(2)**

**(Total 13 marks)**

**Q4.** Hepatitis B is a liver disease caused by a virus. The virus is found in body fluids such as blood, saliva and urine. Diagram **1** shows the structure of the virus in cross section.

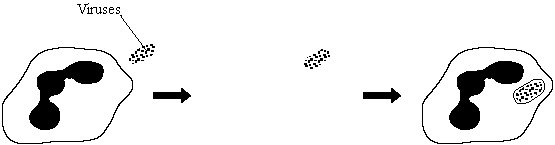


**Diagram 1**

(a)     The human body has several natural defences against viruses. Some of these prevent viruses from entering the body. Others act once the viruses have entered.

(i)      Diagram **2** shows a white blood cell attacking a group of viruses.

         Complete diagram **2** by drawing the 2nd stage.



**1st stage**                            **2nd stage**                                    **3rd Stage**

**Diagram 2**

**(1)**

(ii)     What type of chemical is released by some white blood cells to attack viruses?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     Hepatitis B is more likely to be spread among people who share needles when they inject drugs. Use information given at the beginning of this question to explain why this is so.

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**(2)**

**(Total 4 marks)**

**Q5.** Viruses and bacteria cause diseases in humans.

(a)     Draw a ring around the correct word to complete the sentence.

|  |  |  |
| --- | --- | --- |
|  |  | algae. |
|  | Organisms that cause disease are called | pathogens. |
|  |  | vaccines. |

**(1)**

(b)     In August 2011 the United Nations gave a warning that there was a new strain of the bird flu virus in China. Bird flu may kill humans. The new strain of the bird flu virus could cause a *pandemic* very quickly.

(i)      What is a *pandemic*?

Tick () **one** box.

|  |  |
| --- | --- |
| A disease affecting the people all over one country. |  |
| A disease affecting hundreds of people |  |
| A disease affecting people in many countries. |  |

**(1)**

(ii)     The swine flu virus is carried by pigs. The bird flu virus is likely to spread much more quickly than the swine flu virus. Suggest **one** reason why.

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**(1)**

                            This notice is from a doctor’s surgery.

|  |  |
| --- | --- |
|  | **Unfortunately, antibiotics will NOT get rid of your flu.** |

(c)     (i)      Why will antibiotics **not** get rid of flu?

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**(1)**

(ii)     The symptoms of flu include a sore throat and aching muscles.

What would a doctor give to a patient to relieve the symptoms of flu?

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**(1)**

(iii)    It is important that antibiotics are **not** overused. Explain why. Use words from the box to complete the sentence.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **antibody** | **bacteria** | **immune** | **resistant** | **viruses** |

Overuse of antibiotics might speed up the development

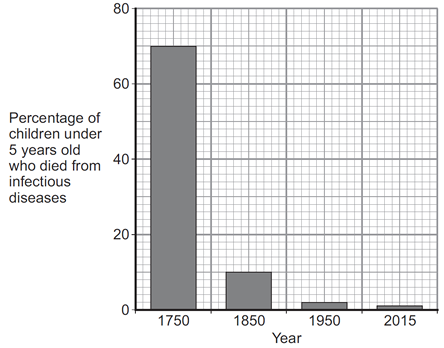
of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ strains of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

**(Total 7 marks)**

**Q6.** Pathogens are microorganisms that cause infectious diseases.

(a)    The graph shows the percentage of children under 5 years old who died from infectious diseases, in the UK, in four different years.



(i)      Between 1750 and 1850 vaccinations were also developed.

What is in a vaccine?

|  |  |
| --- | --- |
| Tick (✔) **one** box. |  |
| large amounts of dead pathogens |  |
| large amounts of live pathogens |  |
| small amounts of dead pathogens |  |

**(1)**

(ii)      The advances in medicine had an effect on death rate. Describe the effect these advances had between 1750 and 1850. To gain full marks you should include data from the graph above.

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**(2)**

(b)    Antibiotics were developed in the 1940s. Antibiotics kill bacteria.

(i)      Which **one** of the following is an antibiotic? Draw a ring around the correct answer.

**cholesterol**                      **penicillin**                      **thalidomide**

**(1)**

(ii)      The use of antibiotics has **not** reduced the death rate due to all diseases to zero. Suggest **two** reasons why.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(c)     In school laboratories, bacteria should be grown at a maximum temperature of 25 °C. Give **one** reason why companies testing new antibiotics grow bacteria at 37 °C.

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**(1)**

**(Total 7 marks)**

**Q7.** The influenza virus damages the cells lining the respiratory tract causing sore throats.Coughing and sneezing spread the virus.

(a)     Give the correct term for this method of spreading an infection.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     In an immunisation programme such as that for MMR (Measles, Mumps and Rubella), suggest why it is essential for a large proportion of the child population to be vaccinated in order to protect the few individuals who are unable to be vaccinated.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(c)     In some modern influenza vaccines the protein surface sub-units are separated from the virus coat and used for the vaccine. This stimulates an effective immune response in the same way as inactive pathogens.

(i)      Explain how this immunity is produced in the body following vaccination, and how further illness from the same virus is prevented.

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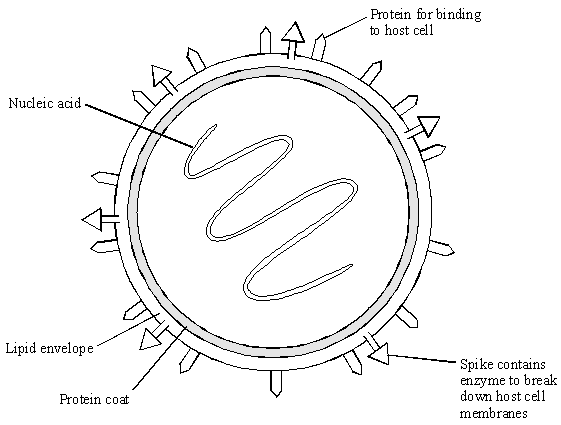
**(4)**

(ii)     This type of immunity resulting from an influenza injection is described

         as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ immunity.

**(1)**

(d)     The diagram shows the structure of an influenza virus.



        Influenza epidemics can arise because the nucleic acid of the virus frequently changes. This results in changes in the virus structure and so a new strain of the virus is formed. A person who has had influenza or who has been vaccinated may not be immune to the new strain.

Explain why this is so, using the diagram of the influenza virus structure and your knowledge of immunity.

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**(3)**

**(Total 10 marks)**

**Q8.** Antibiotics can be used to protect our bodies from pathogens.

(a)     What is a pathogen?

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**(1)**

(b)     Bacteria may become resistant to antibiotics.How can doctors reduce the number of bacteria that become resistant to antibiotics?

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**(2)**

(c)     Scientists grow microorganisms in industrial conditions at a higher temperature than is used in school laboratories.

(i)      Which temperature would be most suitable for growing bacteria in industrial conditions? Draw a ring around the correct answer.

|  |  |  |
| --- | --- | --- |
| **25 °C** | **40 °C** | **100 °C** |

**(1)**

(ii)    What is the advantage of using the temperature you gave in part (c)(i)?

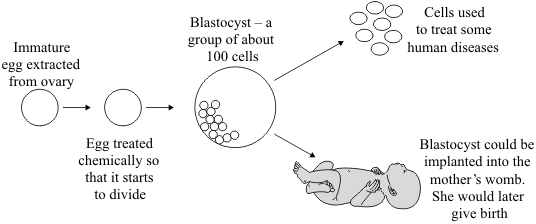
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**(1)**

**(Total 5 marks)**

**Q9.** The diagram shows how an immature egg could be used either to produce cells to treat some human diseases or to produce a baby.



          Scientists may be allowed to use this technique to produce cells to treat some human diseases, but not to produce babies. Using information from the diagram, suggest an explanation for this.

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**(Total 4 marks)**

**Q10.** Stem cells can be collected from human embryos and from adult bone marrow.  
Stem cells can develop into different types of cell.The table gives information about using these two types of stem cell to treat patients.

|  |  |
| --- | --- |
| **Stem cells from human embryos** | **Stem cells from adult bone marrow** |
| It costs £5000 to collect a few cells. | It costs £1000 to collect many cells. |
| There are ethical issues in using embryo stem cells. | Adults give permission for their own bone marrow to be collected. |
| The stem cells can develop into most other types of cell. | The stem cells can develop into only a few types of cell. |
| Each stem cell divides every 30 minutes. | Each stem cell divides every four hours. |
| There is a low chance of a patient’s immune system rejecting the cells. | There is a high chance of a patient’s immune system rejecting the cells. |
| More research is needed into the use of these stem cells. | Use of these stem cells is considered to be a safe procedure. |

Scientists are planning a new way of treating a disease, using stem cells. Use **only** the information above to answer these questions.

(a)     Give **three** advantages of using stem cells from embryos instead of from adult bone marrow.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**

(b)     Give **three** advantages of using stem cells from adult bone marrow instead of from embryos.

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**(3)**

**(Total 6 marks)**

**Q11.** Read the information about stem cells.

|  |
| --- |
| Stem cells are used to treat some human diseases.Stem cells can be collected from early embryos. These stem cells have not begun to differentiate, so they could be used to produce any kind of cell, tissue or organ. The use of embryonic stem cells to treat human diseases is new and, for some diseases, trials on patients are happening now.Stem cells can also be collected from adult bone marrow. The operation is simple but may be painful. Stem cells in bone marrow mainly differentiate to form blood cells. These stem cells have been used successfully for many years to treat some kinds of blood disease. Recently there have been trials of other types of stem cell from bone marrow. These stem cells are used to treat diseases such as heart disease. |

Evaluate the use of stem cells from embryos or from adult bone marrow for treating human diseases. You should give a conclusion to your evaluation.

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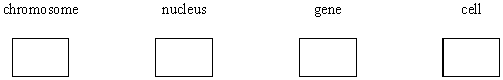
**(Total 5 marks)**

**Q12.** (a)     How many pairs of chromosomes are there in a body cell of a human baby?

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**(1)**

(b)     Place the following in order of size, **starting with the smallest,** by writing  
numbers **1** – **4** in the boxes underneath the words.



**(1)**

(c)     For a baby to grow, its cells must develop in a number of ways.

          Explain how each of the following is part of the growth process of a baby.

(i)      Cell enlargement

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**(1)**

(ii)     The process of cell division by mitosis

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**(3)**

(d)     Why is cell specialisation (differentiation) important for the development and growth of a healthy baby from a fertilised egg?

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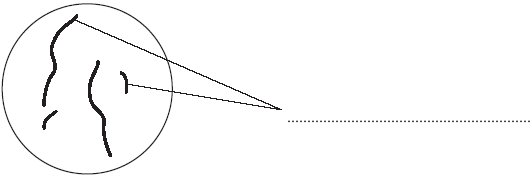
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**(2)**

**(Total 8 marks)**

**Q13. Diagram 1** shows the nucleus of a body cell as it begins to divide by mitosis.

**Diagram 1**

****

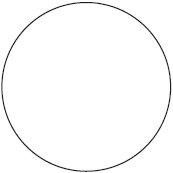
(a)     Use a word from the box to label **Diagram 1**.

|  |
| --- |
| **alleles**             **chromosomes**             **gametes** |

**(1)**

(b)     Complete **Diagram 2** to show what the nucleus of one of the cells produced by this mitosis would look like.

**Diagram 2**



**(1)**

(c)     Stem cells from a recently dead embryo can be grown in special solutions.Some facts about stem cells are given below.

•    Stem cells from an embryo can grow into any type of tissue.

•    Stem cells may grow out of control, to form cancers.

•    Large numbers of stem cells can be grown in the laboratory.

•    Stem cells may be used in medical research or to treat some human diseases.

•    Patients treated with stem cells need to take drugs for the rest of their life to prevent rejection.

•    Collecting and growing stem cells is expensive.

          Use **only** the information above to answer these questions.

(i)      Give **two** advantages of using stem cells.

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**(2)**

(ii)     Give **two** disadvantages of using stem cells.

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**(2)**

**(Total 6 marks)**

**Q14.** (a)     A healthy diet should be balanced.What is meant by a balanced diet?

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**(2)**

(b Cholesterol has important functions in the body. Some cholesterol is produced by the liver. Cholesterol is needed in the body to make the hormone oestrogen.

(i)      Name the organ in the body which produces oestrogen.

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**(1)**

(ii)     What effect does oestrogen have on the female reproductive cycle?

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**(1)**

(iii)    Oestrogen is a naturally occurring steroid hormone.

Give **one** artificial use of a steroid hormone in the body.

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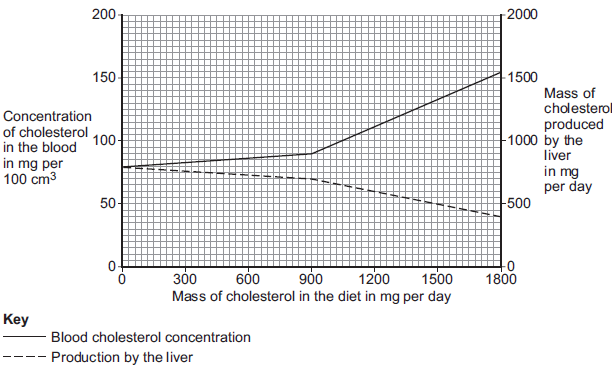
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**(1)**

(c)     The graph below shows the effect of the mass of cholesterol in the diet on:

•        the concentration of cholesterol in the blood

•        the mass of cholesterol produced by the liver.



Describe the effect of increasing the mass of cholesterol in the diet on the mass of cholesterol produced by the liver. To gain full marks you should include data from the graph in your answer.

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**(2)**

(d)     Large amounts of cholesterol in the diet switch off the production of an enzyme called reductase, in the liver. An increase of the enzyme reductase increases the production of cholesterol by the liver.

(i)      Which part of a liver cell is responsible for controlling the production of reductase?

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**(1)**

(ii)     High blood cholesterol concentrations increase the likelihood of heart and circulatory diseases. Doctors can prescribe statins to control the concentration of cholesterol in the blood. Suggest how statins work.

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**(1)**

**(Total 9 marks)**

**Q1.** Anaerobic respiration happens in muscle cells and yeast cells.The equation describes anaerobic respiration in muscle cells.

**glucose**      **lactic acid**

(a)     How can you tell from the equation that this process is anaerobic?

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**(1)**

(b)     Exercise **cannot** be sustained when anaerobic respiration takes place in muscle cells. Explain why.

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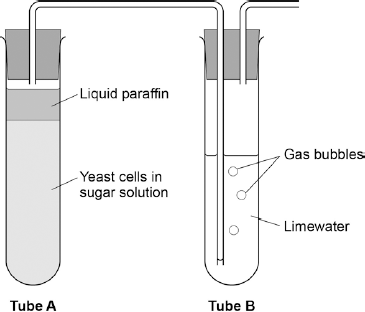
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**(2)**

(c)     The diagram below shows an experiment to investigate **anaerobic** respiration in yeast cells.



What gas will bubble into Tube **B**?

|  |  |
| --- | --- |
| Tick **one** box. |  |
| Carbon dioxide |  |
| Nitrogen |  |
| Oxygen |  |
| Water vapour |  |

**(1)**

(d)     Describe how you could use tube **B** to measure the rate of the reaction in tube **A**.

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**(2)**

(e)     Anaerobic respiration in yeast is also called fermentation.

Fermentation produces ethanol.

Give **one** use of fermentation in the food industry.

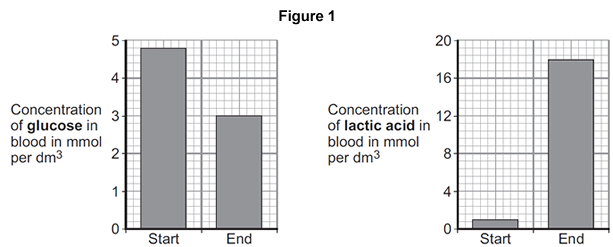
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**(1)**

**(Total 7 marks)**

**Q2.** An athlete ran as fast as he could until he was exhausted.

(a)     **Figure 1** shows the concentrations of glucose and of lactic acid in the athlete’s blood at the start and at the end of the run.



(i)      Lactic acid is made during anaerobic respiration. What does anaerobic mean?

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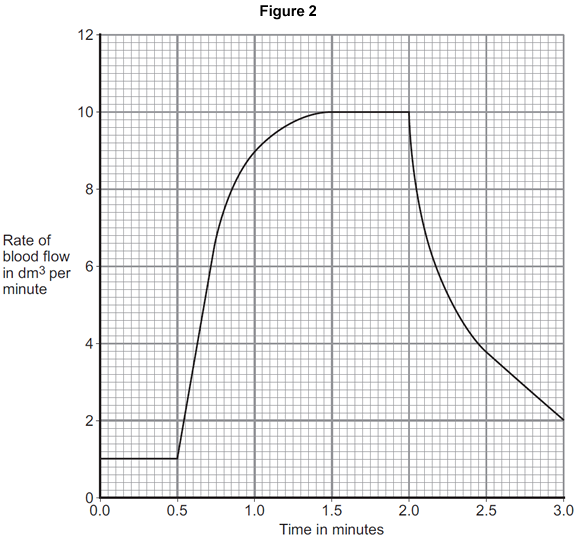
(ii)     Give evidence from **Figure 1** that the athlete respired anaerobically during the run.

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**(1)**

(b)     **Figure 2** shows the effect of running on the rate of blood flow through the athlete’s muscles.



(i)      For how many minutes did the athlete run?

Time = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ minutes

**(1)**

(ii)     Describe what happens to the rate of blood flow through the athlete’s muscles during the run. Use data from **Figure 2** in your answer.

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**(2)**

(iii)     Explain how the change in blood flow to the athlete’s muscles helps him to run.

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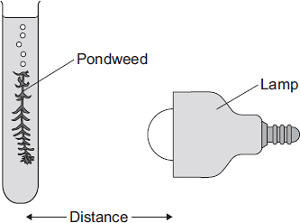
**(4)**

**(Total 9 marks)**

**Q3.** Some students investigated the effect of light intensity on the rate of photosynthesis.

They used the apparatus shown in **Diagram 1**.

**Diagram 1**



The students:

•        placed the lamp 10 cm from the pondweed

•        counted the number of bubbles of gas released from the pondweed in 1 minute

•        repeated this for different distances between the lamp and the pondweed.

(a)     The lamp gives out heat as well as light. What could the students do to make sure that heat from the lamp did **not** affect the rate of photosynthesis?

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**(1)**

(b)     The table shows the students’ results.

|  |  |  |
| --- | --- | --- |
|  | **Distance in cm** | **Number of bubbles per minute** |
|  | 10 | 84 |
|  | 15 | 84 |
|  | 20 | 76 |
|  | 40 | 52 |
|  | 50 | 26 |

(i)      At distances between 15 cm and 50 cm, light was a limiting factor for photosynthesis. What evidence is there for this in the table?

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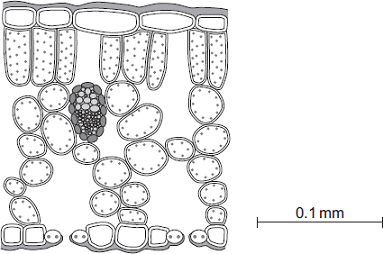
(ii)     Give **one** factor that could have limited the rate of photosynthesis when the distance was between 10 cm and 15 cm.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(c)     *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.* **Diagram 2** shows a section through a plant leaf.

**Diagram 2**



Describe the structure of the leaf and the functions of the tissues in the leaf.

You should use the names of the tissues in your answer.

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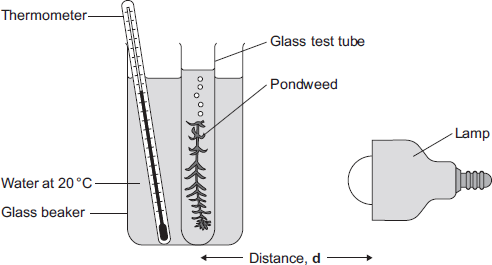
**(Total 9 marks)**

**Q4.** (a)     Complete the equation for photosynthesis. Draw a ring around each correct answer.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | hydrogen |  | alcohol |  |  |
| Carbon dioxide | + | nitrogen | light energy | glucose | + | oxygen |
|  |  | water |  | methane |  |  |

**(2)**

Some students investigated the effect of light intensity on the rate of photosynthesis in pondweed. The diagram shows the apparatus the students used.



The closer the lamp is to the pondweed, the more light the pondweed receives. The students placed the lamp at different distances, **d**, from the pondweed. They counted the number of bubbles of gas released from the pondweed in 1 minute for each distance.

(b)     A thermometer was placed in the glass beaker. Why was it important to use a thermometer in this investigation?

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**(3)**

(c)     The students counted the bubbles four times at each distance and calculated the correct mean value of their results.The table shows the students’ results.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Distance d in cm** | **Number of bubbles per minute** | | | | |
| **1** | **2** | **3** | **4** | **Mean** |
| 10 | 52 | 52 | 54 | 54 | 53 |
| 20 | 49 | 51 | 48 | 52 | 50 |
| 30 | 32 | 30 | 27 | 31 | 30 |
| 40 | 30 | 10 | 9 | 11 |  |

(i)      Calculate the mean number of bubbles released per minute when the lamp was 40 cm from the pondweed.

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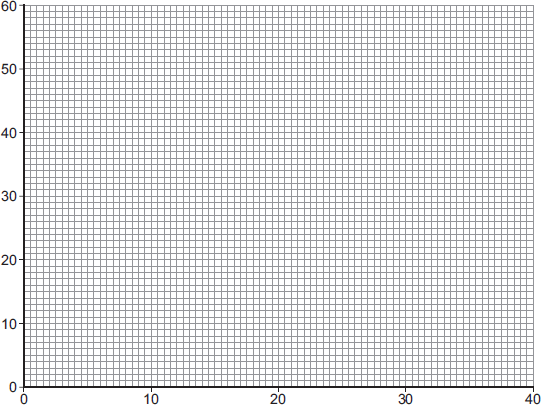
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Mean number of bubbles at 40 cm = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(ii)     On the graph paper below, draw a graph to show the students’ results:

•        add a label to the vertical axis  
•        plot the **mean values** of the number of bubbles  
•        draw a line of best fit.



                  Distance **d** in cm

**(4)**

(iii)    One student concluded that the rate of photosynthesis was inversely proportional to the distance of the lamp from the plant. Does the data support this conclusion? Explain your answer.

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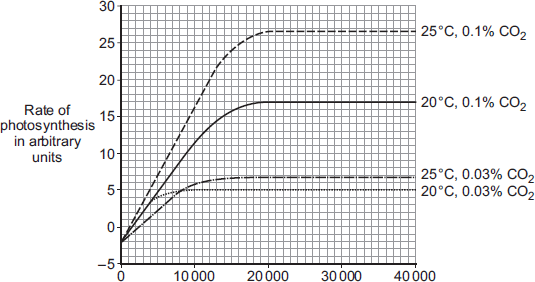
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**(2)**

(d)     Light intensity, temperature and concentration of carbon dioxide are factors that affect the rate of photosynthesis. Scientists investigated the effects of these three factors on the rate of photosynthesis in tomato plants growing in a greenhouse. The graph below shows the scientists’ results.

  
Light intensity in lux

A farmer in the UK wants to grow tomatoes commercially in a greenhouse.

The farmer read about the scientists’ investigation.

During the growing season for tomatoes in the UK, natural daylight has an intensity higher than 30 000 lux.

The farmer therefore decided to use the following conditions in his greenhouse during the day:

•        20°C

•        0.1% CO2

•        no extra lighting.

Suggest why the farmer decided to use these conditions for growing the tomatoes. You should use information from the scientists’ graph in your answer.

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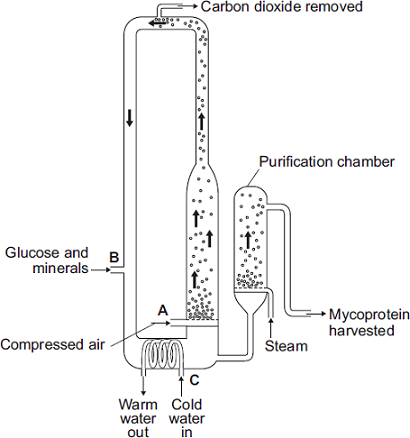
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**(4)**

**(Total 17 marks)**

**Q5.** The diagram shows a fermenter. This fermenter is used for growing the fungus   
*Fusarium*.*Fusarium* is used to make mycoprotein.



(a)     Bubbles of air enter the fermenter at **A**. Give **two** functions of the air bubbles.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(b)     Why is glucose added to the fermenter?

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**(1)**

(c)     The fermenter is prevented from overheating by the cold water flowing in through the heat exchanger coils at **C**. Name the process that causes the fermenter to heat up.

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**(1)**

(d)     It is important to prevent microorganisms other than *Fusarium* growing in the fermenter.

(i)      Why is this important?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(ii)     Suggest **one** way in which contamination of the fermenter by microorganisms could be prevented.

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**(1)**

(e)     Human cells cannot make some of the amino acids which we need. We must obtain these amino acids from our diet. The table shows the amounts of four of these amino acids present in mycoprotein, in beef and in wheat.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name of  amino acid** | **Amount of amino acid per 100 g  in mg** | | | **Daily amount  needed by a  70 kg human  in mg** |
| **Mycoprotein** | **Beef** | **Wheat** |
| Lysine | 910 | 1600 | 300 | 840 |
| Methionine | 230 | 500 | 220 | 910 |
| Phenylalanine | 540 | 760 | 680 | 980 |
| Threonine | 610 | 840 | 370 | 490 |

A diet book states that mycoprotein is the best source of amino acids for the human diet. Evaluate this statement. Remember to include a conclusion in your evaluation.

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**(4)**

**(Total 10 marks)**

**Q6.** One factor that may affect body mass is *metabolic rate*.

(a)     (i)      What is meant by *metabolic rate* ?

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**(1)**

(ii)     Metabolic rate is affected by the amount of activity a person does. Give **two** other factors that may affect a person’s metabolic rate.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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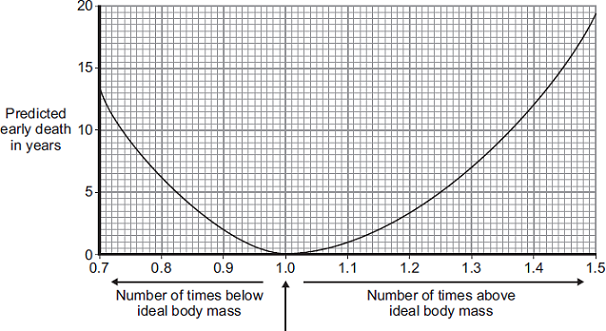
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**(2)**

(b)     Predicted early death is the number of years that a person will die before the mean age of death for the whole population.

The predicted early death of a person is affected by their body mass. Scientists have calculated the effect of body mass on predicted early death.

The graph shows the results of the scientists’ calculations.



**Ideal body mass**

The number of times above or below ideal body mass is given by the equation:



In the UK the mean age of death for women is 82. A woman has a body mass of 70 kg. The woman’s ideal body mass is 56 kg.

(i)      Use the information from the graph to predict the age of this woman when she dies.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Age at death = \_\_\_\_\_\_\_\_\_\_\_ years

**(2)**

(ii)     The woman could live longer by changing her lifestyle. Give **two** changes she should make.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

**(Total 7 marks)**

**Q7.** (a)    Complete the equation for photosynthesis.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ + water   \_\_\_\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

(b)     The rate of photosynthesis in a plant depends on several factors in the environment.

These factors include light intensity and the availability of water.

Describe and explain the effects of **two** **other** factors that affect the rate of photosynthesis.

You may include one or more sketch graphs in your answer.

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**(5)**

**(Total 8 marks)**

**Q8. Figure 1** shows an athlete running on a treadmill.

**Figure 1**

****

After running for several minutes, the athlete’s leg muscles began to ache.  
This ache was caused by a high concentration of lactic acid in the muscles.

(a)     The equation shows how lactic acid is made.

glucose  lactic acid (+ energy)

Name the process that makes lactic acid in the athlete’s muscles.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

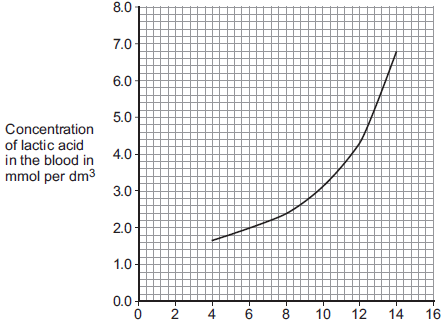
(b)     Scientists investigated the production of lactic acid by an athlete running at different speeds. In the investigation:

•        the athlete ran on the treadmill at 4 km per hour

•        the scientists measured the concentration of lactic acid in the athlete’s blood after 2 minutes of running.

The investigation was repeated for different running speeds.**Figure 2** shows the scientists’ results.

**Figure 2**

****                             Treadmill speed in km per hour

(i)      How much more lactic acid was there in the athlete’s blood when he ran at 14 km per hour than when he ran at 8 km per hour?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Answer = \_\_\_\_\_\_\_\_\_\_\_\_\_ mmol per dm3

**(2)**

(ii)     Why is more lactic acid made in the muscles when running at 14 km per hour than when running at 8 km per hour?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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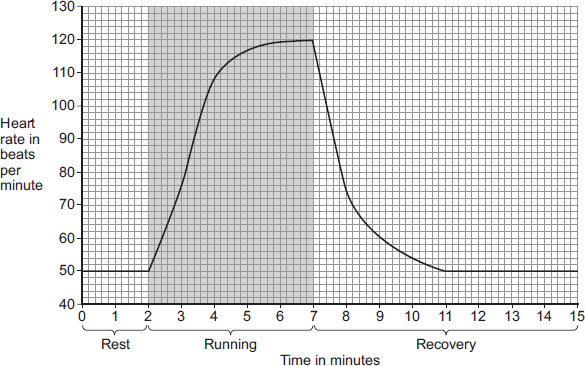
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**(3)**

**(Total 6 marks)**

**Q9.** A student ran on a treadmill for 5 minutes.The speed of the treadmill was set at 12 km per hour.The graph below shows the effect of the run on the student’s heart rate.



(a)     (i)       What was the student’s heart rate at rest?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

**(1)**

(ii)     After the end of the run, how long did it take for the student’s heart rate to return to the resting heart rate?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ minutes

**(1)**

(b)     During the run, the student’s muscles needed larger amounts of some substances than they needed at rest.

(i)      Which **two** of the following substances were needed in larger amounts during the run? Tick () **two** boxes.

|  |  |
| --- | --- |
| carbon dioxide |  |
| glucose |  |
| lactic acid |  |
| oxygen |  |
| protein |  |

**(2)**

(ii)     Why are the two substances you chose in part **(b)(i)** needed in larger amounts during the run? Tick () **one** box.

|  |  |
| --- | --- |
| To help make more muscle fibres |  |
| To release more energy |  |
| To help the muscles to cool down |  |

**(1)**

(c)     After exercise, a fit person recovers faster than an unfit person.

Let the student’s heart rate at the end of exercise = **a**.

Let the student’s heart rate after 2 minutes of recovery = **b**.

The table below shows how the difference between **a** and **b**, (**a** − **b**), is related to a person’s level of fitness.

|  |  |
| --- | --- |
| **(a − b)** | **Level of fitness** |
| < 22 | Unfit |
| 22 to 52 | Normal fitness |
| 53 to 58 | Fit |
| 59 to 65 | Very fit |
| > 65 | Top athlete |

What is the student’s level of fitness? Use information from the graph and the table.

**a** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

**b** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

(**a − b**) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

Level of fitness = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

(d)     The student repeated the run with the treadmill set at 16 km per hour.

The student’s heart rate took 3 minutes longer to return to the normal resting rate than when running at 12 km per hour.

Give reasons why it took longer to recover after running faster.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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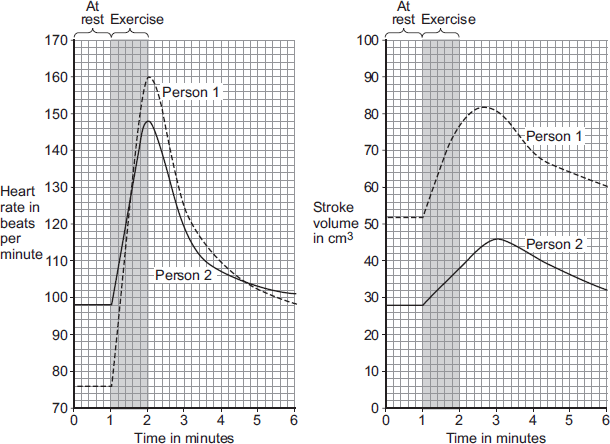
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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(4)**

**(Total 12 marks)**

**Q10.** During exercise, the heart beats faster and with greater force.The ‘heart rate’ is the number of times the heart beats each minute.The volume of blood that travels out of the heart each time the heart beats is called the ‘stroke volume’.In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise.The graph below shows the scientists’ results.



(a)     The ‘cardiac output’ is the volume of blood sent from the heart to the muscles each minute.

              Cardiac output = Heart rate × Stroke volume

At the end of the exercise, **Person 1**’s cardiac output = 160 × 77 = 12 320 cm3 per minute.

Use information from **Figure above** to complete the following calculation of **Person 2**’s cardiac output at the end of the exercise. At the end of the exercise:

**Person 2**’s heart rate        = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beats per minute

**Person 2**’s stroke volume = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3

**Person 2**’s cardiac output = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm3 per minute

**(3)**

(b)     **Person 2** had a much lower cardiac output than **Person 1.**

(i)      Use information from **Figure above** to suggest the **main** reason for the lower cardiac output of **Person 2**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     **Person 1** was able to run much faster than **Person 2**.

Use information from **Figure above** and your own knowledge to explain why.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(5)**

**(Total 9 marks)**

**Q11.** Photosynthesis uses carbon dioxide to make glucose.

(a)     (i)      Complete the equation for photosynthesis.

carbon dioxide + \_\_\_\_\_\_\_\_\_\_\_\_\_ glucose + \_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(ii)     What type of energy does a plant use in photosynthesis?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

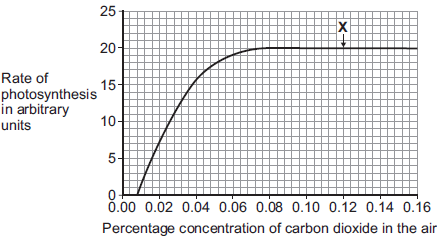
**(1)**

(iii)    Which part of a plant cell absorbs the energy needed for photosynthesis?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     The graph shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20 °C.



(i)      What is the maximum rate of photosynthesis of the tomato plants shown in the graph?

\_\_\_\_\_\_\_\_\_\_\_\_\_ arbitrary units

**(1)**

(ii)     At point **X**, carbon dioxide is **not** a limiting factor of photosynthesis.

Suggest **one** factor that is limiting the rate of photosynthesis at point **X**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(c)     A farmer plans to grow tomatoes in a large greenhouse.

The concentration of carbon dioxide in the atmosphere is 0.04%.  
The farmer adds carbon dioxide to the greenhouse so that its concentration is 0.08%.

(i)      Why does the farmer use 0.08% carbon dioxide? Tick () **one** box.

|  |  |
| --- | --- |
| To increase the rate of growth of the tomato plants |  |
| To increase the rate of respiration of the tomato plants |  |
| To increase water uptake by the tomato plants |  |

**(1)**

(ii)    Why does the farmer **not** use a concentration of carbon dioxide higher than 0.08%? Tick () **two** boxes.

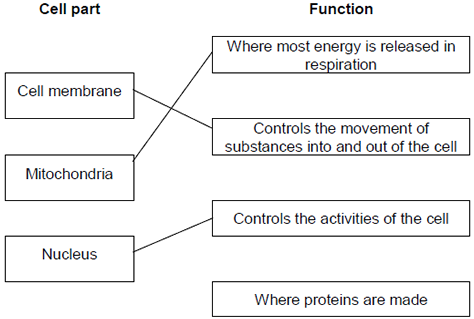
|  |  |
| --- | --- |
| Because it would cost more money than using 0.08% |  |
| Because it would decrease the temperature of the greenhouse |  |
| Because it would not increase the rate of photosynthesis of the tomato plants any further |  |
| Because it would increase water loss from the tomato plants |  |

**(2)**

**(Total 9 marks)**

**Mark schemes**

**Q1.**

(a)    

*extra lines cancel*

**3**

(b)     Cell wall *in either order*

**1**

Chloroplast *allow (permanent) vacuole*

**1**

**[5]**

**Q2.** (a)     (i)      **C** and **D** *no mark if more than one box is ticked*

**1**

(ii)     any **one** from: *do* ***not*** *allow if other cell parts are given in a list*

•        (have) cell wall(s)

•        (have) vacuole(s)

**1**

(b)     (i)      **A**

*apply list principle*

**1**

(ii)     **D**

*apply list principle*

**1**

(c)     respiration

*apply list principle*

**1**

**[5]**

**Q3.** (a)     (i)    large intestine = **E**

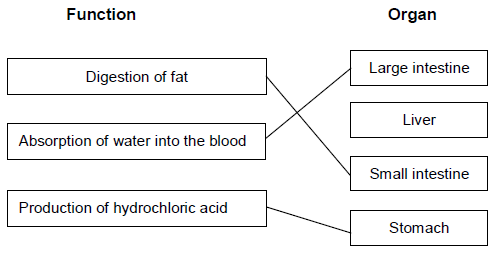
**1**

small intestine = **D**

**1**

stomach = **B**

**1**

(ii)     

*extra lines cancel*

**3**

(b)    The concentration in the blood is lower.

**1**

**[7]**

**Q4.** (a)     contract / shorten

*ignore relax*

*do* ***not*** *allow expand*

**1**

to churn / move / mix food

*accept peristalsis / mechanical digestion*

*ignore movement unqualified*

**1**

(b)     400

*acceptable range 390-410*

*allow 1 mark for answer in range of 39 to 41*

*allow 1 mark for answer in range of 3900 to 4100*

**2**

(c)     to transfer energy for use

*allow to release / give / supply / provide energy*

*do* ***not*** *allow to ‘make’ / ߢproduce’ / ‘create’ energy*

*allow to make ATP*

*ignore to store energy*

**1**

by (aerobic) respiration **or** from glucose

*do* ***not*** *allow anaerobic energy released* ***for*** *respiration = max 1 mark*

**1**

(d)     (i)      to make protein / enzyme

*ignore ‘antibody’ or other named protein*

**1**

(ii)     too small / very small

*allow light microscope does not have sufficient magnification / resolution*

*allow ribosomes are smaller than mitochondria*

*ignore not sensitive enough*

*ignore ribosomes are transparent*

**1**

**[8]**

**Q5.** (a)     (i)      A

(ii)     B

*for 1 mark each*

**2**

(b)    diffusion *(reject osmosis)   
for one mark*

**1**

(c)    C  
because uptake against a concentration / diffusion gradient  
(*reject* osmosis)

(if C not given, then idea of movement essential)

*for 1 mark each*

**2**

**[5]**

**Q6.Level 3 (5–6 marks):**

A detailed and coherent explanation is provided with most of the relevant content, which demonstrates a comprehensive understanding of the human circulatory system . The response makes logical links between content points.

**Level 2 (3–4 marks):**

The response is mostly relevant and with some logical explanation. Gives a broad understanding of the human circulatory system. The response makes some logical links between the content points.

**Level 1 (1–2 marks):**

Simple descriptions are made of the roles of some of the following: heart function, gas exchange, named blood vessels, named blood cells. The response demonstrates limited logical linking of points.

**0 marks:**

No relevant content.

**Indicative content**

•        dual / double circulatory system which means that it has higher blood pressure and a greater flow of blood to the tissues

•        heart made of specialised (cardiac) muscle cells which have long protein filaments that can slide past each other to shorten the cell to bring about contraction for pumping blood

•        heart pumps blood to lungs in pulmonary artery so that oxygen can diffuse into blood from air in alveoli

•        blood returns to heart via pulmonary vein where muscles pump blood to the body via aorta

•        oxygen carried by specialised cells / RBCs which contain haemoglobin to bind oxygen and have no nucleus so there is more space available to carry oxygen

•        arteries carry oxygenated blood to tissues where capillaries deliver oxygen to cells for respiration and energy release

•        thin walls allow for easy diffusion to cells

•        large surface area of capillaries to maximise exchange

•        waste products removed eg CO2 diffuse from cells into the blood plasma

•        blood goes back to the heart in veins which have valves to prevent backflow

•        cardiac output can vary according to demand / is affected by adrenaline

accept annotated diagrams

**[6]**

**Q7.** (a)     (0.15 / 1.35) × 100

**1**

11.1 (%) *allow 11.1 (%) with no working shown for* ***2*** *marks*

**1**

(b)     to allow results to be compared

**or**

they had different masses at the start

**1**

(c)     axis correct scale and labelled

**1**

5 points correctly plotted *allow ecf from* ***05.1***

*allow* ***1*** *mark for 4 points correctly plotted*

**2**

line of best fit

**1**

(d)     0.5 *allow 0.45–0.55*

**1**

(e)     (0.0 to 0.4) water moves into cells

**1**

(0.6 to 0.8) water leaves cells

**1**

by osmosis

**1**

(f)      any **two** from:

•        concentration of solutions

•        drying of chips

•        accuracy of balance

•        evaporation from tubes

**2**

**[13]**

**Q8.** (a)     (i)      xylem

**1**

(ii)     water

**1**

minerals / ions / named example(s) *ignore nutrients*

**1**

(b)     (i)      movement of (dissolved) sugar

*allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)*

*allow nutrients / substances / food molecules if sufficiently qualified*

*ignore food alone*

**1**

(ii)     sugars are made in the leaves

**1**

so they need to be moved to other parts of the plant for respiration / growth / storage

**1**

(c)     (i)      mitochondria

**1**

(ii)     for movement of minerals / ions *Do not accept ‘water’*

**1**

against their concentration gradient

**1**

**[9]**

**Q9.** 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 apply a ‘best-fit’ approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1 – 2 marks)**

An example is given of a named substance **or**a process  
**or**there is an idea of why diffusion is important eg definition.

**Level 2 (3 – 4 marks)**

At least one example of a substance is given  
**and**correctly linked to a process in either animals or plants.

**Level 3 (5 – 6 marks)**

There is a description of a process occurring in either animals or plants that is correctly linked to a substance  
**and**a process occurring in the other type of organism that is correctly linked to a substance.

**examples of points made in the response**

**Importance of diffusion:**

•        to take in substances for use in cell processes

•        products from cell processes removed

**Examples of processes and substances:**

•        for gas exchange / respiration: O2 in / CO2 out

•        for gas exchange / photosynthesis: CO2 in / O2 out

•        food molecules absorbed: glucose, amino acids, etc

•        water absorption in the large intestine

•        water lost from leaves / transpiration

•        water absorption by roots

•        mineral ions absorbed by roots

***extra information***

***Description of processes might include:***

*•        movement of particles / molecules / ions*

*•        through a partially permeable membrane*

*•        (movement of substance) down a concentration gradient*

*•        osmosis: turgor / support / stomatal movements*

**[6]**

**Mark schemes**

**Q1.**

(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]**

**Q2.**

(a)     (i)      water / H2O

*accept oxygen*

*allow H2O*

*do* ***not*** *allow H2O or H2O*

**1**

(ii)     the mineral ions are absorbed by active transport

**1**

the absorption of mineral ions needs energy

**1**

(iii)    have (many root) hairs

**1**

(which) give a large surface area (for absorption)

**1**

(b)     carbon dioxide in

**or**

oxygen out

**or**

control water loss

*accept gas exchange*

*ignore gases in and out*

*ignore gain / lose water*

**1**

(c)     (i)      guard cells

**1**

(ii)     (stomata are) closed

*allow there is no gap / space*

**1**

(iii)    plant will wilt / droop

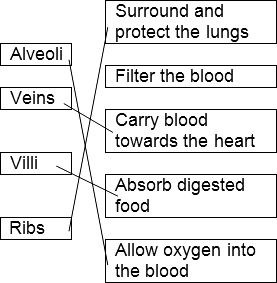
*ignore die*

**1**

**[9]**

**Q3.**

(a)



*4 correct =* ***4*** *marks*

*3 correct =* ***3*** *marks*

*2 correct =* ***2*** *marks*

*1 correct =* ***1*** *mark*

*extra line from a structure cancels the mark*

**4**

(b)     diffusion

**1**

**[5]**

**Q4.**

(a)     (i)    without oxygen

*allow not enough oxygen*

*ignore air*

*ignore production of CO2*

*ignore energy*

**1**

(ii)     more / high / increased lactic acid (at end)

*allow approximate figures (to show increase)*

*ignore reference to glucose*

**1**

(b)     (i)      1.5

*allow only 1.5 / 1½ / one and a half*

**1**

(ii)     increases at first **and** levels off

*ignore subsequent decrease*

**1**

suitable use of numbers eg

rises to 10 / by 9 (dm3 per min)

**or**

increases up to 1.5 (min) / levels off after 1.5 (min) (of x axis timescale)

*allow answer in range 1.4 to 1.5*

**or**

after the first minute (of the run)

**1**

(iii)     supplies (more) oxygen

**1**

supplies (more) glucose

**1**

*need ‘more/faster’ once only for full marks*

*allow removes (more) CO2 / lactic acid / heat as an alternative for either marking point one* ***or*** *two,* ***once*** *only*

for (more) respiration

**1**

releases (more) energy (for muscle contraction)

*do* ***not*** *allow energy production or for respiration*

**1**

**[9]**

**Q5.**

(a)     (i)      xylem

**1**

(ii)     water

**1**

minerals / ions / named example(s) *ignore nutrients*

**1**

(b)     (i)      movement of (dissolved) sugar

*allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)*

*allow nutrients / substances / food molecules if sufficiently qualified*

*ignore food alone*

**1**

(ii)     sugars are made in the leaves

**1**

so they need to be moved to other parts of the plant for respiration / growth / storage

**1**

(c)     (i)      mitochondria

**1**

(ii)     for movement of minerals / ions *Do not accept ‘water’*

**1**

against their concentration gradient

**1**

**[9]**

**Q6.**

(a)     digested / broken down / made soluble by protease enzyme  
in stomach

in small intestine / from stomach / from pancreas  
into amino acids  
amino acids / small molecules absorbed into blood

*any four for 1 mark each*

**4**

(b)     *ideas that*lipase / enzyme works best in alkaline / neutral conditions  
acid denatures or inactivates enzyme / inhibits enzyme activity  
bile emulsifies fat / bile produces larger surface area of fats / bile alkaline  
for enzyme to work on / which increase activity of enzymes

*any three for 1 mark each*

**3**

**[7]**

**Q7.** (a)     (i)      muscular

**1**

(ii)     **7**

**1**

(iii)    an electrical device

**1**

(b)     (i)      in sequence:

**5**

**1**

**7**

**1**

**2**

**1**

(ii)     **3**

**1**

(c)     (i)      prevent backflow (of blood) / allow flow in only one direction / in the correct direction

**1**

(ii)     **A**

*no mark, but max* ***2*** *marks if incorrect*

**2** / atrium contracts / pressure in **2** increases

**1**

blood pushes ball (down / towards ventricle / towards **5** )

*allow this point even if valve in wrong part of heart*

**1**

(opens valve which) allows blood into **5** / ventricle

***or*** *converse points re closing the valve*

**1**

(d)     (i)      involvement of platelets / eg platelets ‘trigger’ clotting process / release enzyme(s) / release ‘clotting factors’

**1**

fibrinogen to fibrin  
**or**meshwork formed (which traps blood cells)

**1**

(ii)     any **four** from:

*to gain* ***4*** *marks candidates should include at least:*

***one*** *advantage and* ***one*** *disadvantage*

**Advantages**

(improved circulation / O2 supply) provides:

•        more cell respiration

•        more energy released

•        (more) active life / not so tired / more physical activity

**Disadvantages**

•        danger of surgery / operation

•        infection from surgery / operation

•        valve may need replacing

•        clots may form and block blood vessels

*may need to take anti-coagulants – eg warfarin*

•        clots may cause heart attacks / strokes

**4**

**[17]**

**Q8.** (a)     5624

***allow 2 marks*** *for:*

*•        correct HR = 148* ***and*** *correct SV = 38 plus wrong answer / no answer*

***or***

*•        only one value correct* ***and*** *ecf for answer* ***allow 1 mark*** *for:*

*•        incorrect values* ***and*** *ecf for answer*

***or***

*•        only one value correct*

**3**

(b)     (i)      **Person 2** has low(er) stroke volume / SV / described

*eg* ***Person 2*** *pumps out smaller volume each beat*

*do* ***not*** *allow* ***Person 2*** *has lower heart rate*

**1**

(ii)     **Person 1** sends more blood (to muscles / body / lungs)

**1**

(which) supplies (more) oxygen

**1**

(and) supplies (more) glucose

**1**

(faster rate of) respiration **or** transfers (more) energy for use

*ignore aerobic / anaerobic*

*allow (more) energy release*

*allow aerobic respiration transfers / releases more energy (than anaerobic)*

*do* ***not*** *allow makes (more) energy*

**1**

removes (more) CO2 / lactic acid / heat *allow less oxygen debt*

**or** less lactic acid made  
**or** (more) muscle contraction / less muscle fatigue

*if no other mark awarded,*

*allow person 1 is fitter (than person 2) for max 1 mark*

**1**

**[9]**

**Q9.** (a)     liver

**1**

          mouth or salivary glands **or**duodenum **or** small intestine **or**pancreas

**1**

          Pancreas *accept duodenum* ***or*** *ileum* ***or****small intestine* *do* ***not*** *accept stomach*

**1**

          stomach **or** duodenum **or** ileum **or**small intestine **or** pancreas

**1**

(b)     teeth breakdown food *accept chewing*

**1**

          amylase **or** saliva (breaks down starch)

**1**

(c)     produces bile (salts)

**1**

          emulsifies (fat) **or** produces droplets **or** disperses fat)

**1**

**[8]**

**Q10.** (a)      fatty acids

**1**

glycerol

**1**

(b)    (i)      any **one** from:

•     (same) amount / 1cm3 fat

•     (same) amount / 10cm3 lipase / enzyme

•     (kept for) 24 hours **or** (same length of) time

**1**

(ii)     temperature *allow heat / warmth*

**1**

(c)     (carry out experiments) using more temperatures / smaller intervals

*ignore repeat unqualified do not accept longer time*

**1**

between 20 and 60 °C / around 40 °C

*accept extra single temperature in range 20 °C – 60 °C but cannot be 20 °C, 40 °C or 60 °C*

**1**

(d)     (i)       ‘strong’ acid

**1**

(ii)     enzyme works / not destroyed / not denatured / not damaged

*do* ***not*** *accept enzyme not killed*

*accept any indication that the fat is digested*

*accept same as tube 3 / tube at 40 °C*

*accept optimum temperature / at or near body temperature*

**1**

**[8]**

**Q11.** (a)     300

**1**

(b)     suitable scale on *y*-axis

**1**

label *y*-axis

**1**

4 bars drawn correctly *allow* ***1*** *mark for 3 correct bars*

**2**

(c)     increases from 50 to 500

**1**

then decreases from 500 to 0

**1**

(d)     carbohydrates broken down / digested into sugars

**1**

broken down by carbohydrase or amylase

**1**

(e)     absorption of glucose

**1**

into blood

**1**

by active transport

*allow diffusion*

**1**

**[12]**

**Q12.**

D – *many* microvilli (1)  
Ex – provide large surface area (1)

***five*** *points made*

*max* ***3*** *descriptions*

*max* ***3*** *explanations*

D – *many* capillaries / *good* blood supply (1)  
Ex – maintain concentration / diffusion gradient **or** quickly removes food (1)

D – thin wall / one cell thick surface / capillaries near surface (1)

*allow villi are thin*

*ignore villi are one cell thick*

Ex – short distance for food to travel (1)

D – *many mitochondria (1)*Ex – provide energy / ATP for active uptake / transport (1)

**[5]**

**Mark schemes**

**Q1.** (a)     any **two** from:

•        acid in the stomach kills pathogens in food

•        skin forms a barrier / produces antimicrobial secretions

•        hairs in the nose trap (particles which may contain) pathogens

•        trachea / bronchi has mucus which traps pathogens

**or**

         bronchi have cilia which waft mucus to throat to be swallowed

**2**

(b)     **Level 3 (5–6 marks):**

A clear, logical and coherent answer, with no significant redundancy. The student understands the process and links this to reasons for clinical trials.

**Level 2 (3–4 marks):**

A partial answer with errors and ineffective reasoning or linkage.

**Level 1 (1–2 marks):**

One or two relevant points but little linkage of points or logical reasoning.

**0 marks:**

No relevant content.

**Indicative content**

•        pre-clinical trials of the new drug on cells / tissues / live animals

•        to test toxicity, dosage and efficacy

•        clinical trials / test on healthy volunteers and Ebola patients at very low doses

•        so that you can monitor for safety / side effects

•        and only then do trials to find the optimum dosage and test for efficacy

•        double blind trial / use of placebo

•        which does not contain the new drug

•        random allocation of Ebola patients to groups

•        so no one knows who has placebo / the new drug

•        peer review of data

•        to help prevent false claims

**6**

**[8]**

**Q2.** (a)     mumps

*in either order rubella / German measles*

*both needed for the mark*

*ignore measles unqualified*

**1**

(b)     (i)      80(.0)

*allow* ***1*** *mark for * ***or*** *0.8*

**2**

(ii)     less chance of epidemic / pandemic

**or**

less chance of spread of disease / measles / mumps / rubella

*allow idea of herd immunity (increased protection for those who are not vaccinated)*

*ignore less chance of getting the disease* ***or*** *to eradicate the disease*

**1**

(c)     (i)      dead / inactive pathogens / viruses / bacteria

*allow antigens / proteins from pathogens / viruses / bacteria*

*ignore microorganisms*

**1**

(ii)     white blood cells produce antibodies

**1**

antibodies produced rapidly (on re-infection) **or** response rapid (on re-infection)

*allow ecf if antibodies incorrectly identified in first marking point*

**1**

these antibodies kill pathogens / viruses / bacteria

*do* ***not*** *accept idea that original antibodies remain in blood and kill pathogens*

**1**

(d)     (i)      antibiotics don’t kill viruses *allow antibiotics only kill bacteria*

**1**

(because measles) virus / pathogen lives inside cells

*allow antibiotics do not work inside cells* ***or*** *killing virus / pathogen would kill / damage cell*

**1**

(ii)     (bacteria / pathogens) develop resistance (to antibiotic)

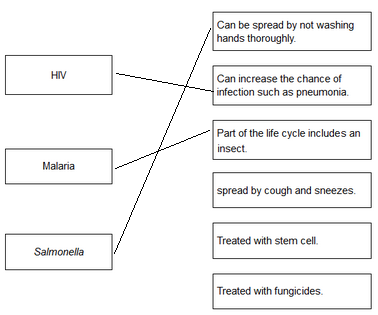
*ignore reference to immunity*

*ignore viruses develop resistance*

**1**

**[11]**

**Q3.** (a)



*each extra line negates a mark*

**4**

(b)     pain when urinating

**1**

yellow discharge

**1**

(c)     three correct plots *allow* ***1*** *mark for two correct plots*

**2**

correctly drawn line

**1**

(d)     any **three** from:

•        (fairly) level / steady up to 2009

*allow numbers of males fall (slightly)* ***and*** *females rise (slightly) up to 2009*

•        (there is a) rise after 2009

•        males are (always) higher than females

•        males rising faster than females

*allow overall increase (from 2005 to 2013)*

**3**

(e)     HIV is a virus

**1**

(and) antibiotics are only effective against bacteria

**or**

antibiotics do not kill viruses

*allow viruses live inside cells*

**1**

**[13]**

**Q4.** (a)     (i)      diagram shows extensions of intact cell membrane around viruses

**1**

(ii)     antibodies

*allow enzymes re (ii)  
allow interferon  
ignore antitoxins / proteins*

**1**

(b)     virus is transferred

**1**

          (virus in) blood / body fluids – transfer (via needles)

**1**

**[4]**

**Q5.** (a)    pathogens

**1**

(b)     (i)      A disease affecting people in many countries

**1**

(ii)     birds fly / migrate *accept converse*

OR

human contact with birds more likely

*birds not contained / difficult to control movement*

OR

there are more birds (than pigs)

**1**

(c)    (i)      antibiotics (only) kill bacteria *ignore flu is caused by a virus unqualified*

OR

antibiotics don’t kill viruses *ignore virus resistant / immune*

**1**

(ii)     painkillers

*accept any correct named painkiller, eg aspirin or paracetamol*

*allow antivirals / Tamiflu*

*ignore medicine / tablets*

**1**

(iii)    resistant

**1**

bacteria

**1**

*in this order*

**[7]**

**Q6.** (a)     (i)      small amounts of dead pathogens

**1**

(ii)      decrease

**1**

by 60 (%)

*allow from 70(%) to 10(%) allow other correct data treatment*

**1**

(b)     (i)      penicillin

**1**

(ii)      any **two** from:

•        antibiotics only kill bacteria

*allow antibiotics do not kill viruses*

•        some bacteria are resistant (to antibiotics)

*allow MRSA not killed by antibiotics*

•        (correct) antibiotics not always used

*allow course not completed*

•        deficiency disease(s) not caused by bacteria **or** cannot be treated by antibiotics

•        inherited disease(s) not caused by bacteria **or** cannot be treated by antibiotics

•        ‘lifestyle’ diseases not caused by bacteria **or** cannot be treated by antibiotics

*eg heart disease / cancer*

*if no other mark given allow* ***1*** *mark for not all diseases are caused by bacteria* ***or*** *some diseases are caused by viruses*

**2**

(c)     bacteria grow faster

*allow this is body temp (at which pathogens grow)*

**1**

**[7]**

**Q7.** (a)     droplet infection **or** aerosol infection

*do* ***not*** *accept airborne accept airborne droplets*

**1**

(b)     so there is no large group which could catch the infection/pass on the infection

*converse – if large numbers can’t pass it on the virus is less likely to reach those few who are susceptible*

**1**

(c)     (i)      any **four** of the following points:-

*example of a 3 mark answer: Lymphocytes produce specific antibodies…...*

comment on specificity applied to antibodies or lymphocytes

(recognition by) lymphocytes;

(white cells) make antibodies;

antibodies destroy/neutralise the virus/antigen/protein subunit;

*do* ***not*** *accept antibodies KILL viruses*

*accept white blood cells replicate*

*accept some white cells form memory cells/live a long time;*

*accept subsequent infection results in very rapid antibody production;*

**max 4**

(ii)     active;

**1**

(d)     any **three** of the following points

*Structure change in:*protein for binding to host cell;

*accept changes in surface proteins (of protein coat)*

spike containing enzyme;

*changes in antigen*

*Fit:* existing/circulating/old antibodies don’t match new virus strain shape/new antigen/new binding protein;

*Wrong antibodies:* injection does not stimulate antibodies against all strains/different antigens; *accept wrong antibodies for 1 mark*

**max 3**

**[10]**

**Q8.** (a)     microorganism / bacteria / virus / fungus that causes (infectious) disease

**1**

(b)     reduce / stop use of (current) antibiotics

**1**

(reduce / stop use) for non-serious / mild / viral infections

*allow ensure course is completed allow use of variety of antibiotics*

**1**

(c)     (i)      40 °C

**1**

(ii)     any **one** from:

•        microorganisms grow / reproduce / work / act faster

•        results / product acquired sooner

**1**

**[5]**

**Q9.** any **four** from:

•        cells used to treat diseases do not go on to produce a baby

•        produces identical cells for research

•        cells would not be rejected allow cells can form different types of cells

•        (immature) egg contains only genetic information / DNA /  
genes / chromosomes from mother **or** there is only one parent

•        asexual / no mixing of genetic material / no sperm involved /  
no fertilisation **or** chemical causes development

•        baby is a clone

•        reference to ethical / moral / religious issues

*allow ethically wrong****NB*** *cloning is illegal gains* ***2*** *marks ignore unnatural*

•        risk of damage to the baby *in correct context*

**[4]**

**Q10.**

(a)     comparisons are **not** required but should be credited  
 accept a clear indication of the statement even if incomplete

can develop into most other types of cell

**1**

each cell divides every 30 minutes

**1**

low chance of rejection by the patient’s immune system

**1**

(b)     any **three** from:

•        cheaper / only costs £1000 *this* ***must*** *be comparative ignore costs £1000*

•        can collect many (stem) cells

•        adults give permission for their own bone marrow to be collected

*comparisons are not required but should be credited*

•        safe

**3**

**[6]**

**Q11.** Marks should **not** be awarded for simply copying the information provided  
A mark may be awarded for a comparison between treatments if the answer only involves copied information

any **four** from:

*For all* ***4*** *marks to be awarded, there must be at least 1 pro and 1 con*

embryo stem cells – examples of

pros

•        can treat a wide variety / lots of diseases / problems

•        many available / plentiful

•        using them better than wasting them

•        painless

cons

•        (possible) harm / death to embryo

•        (relatively) untested / unreliable / may not work

*allow long term effects not known****or*** *may be more risky*

•        embryo can’t be ‘asked’ / ‘embryo rights’ idea

adult bone marrow stem cells – examples of

pros

•        no ethical issues (in collection) **or** permission given

•        quick recovery

•        (relatively) safe

*allow does not kill (donor) / low risk*

•        well tried / tested / know they work

cons

•        operation hazards eg infection

•        few types of cell / tissue produced **or** few diseases / problems treated

•        painful so may deter donors

**4**

Conclusion to evaluation: A reasoned conclusion from the evidence

**1**

**[5]**

**Q12.**

(a)     23

**1**

(b)     chromosome     nucleus      gene     cell

2                    3             1          4

**1**

(c)     (i)      any **one** from

(cells which are bigger) take up more space

(cells) have to get bigger **or** mature to divide

**1**

(ii)     chromosomes duplicate **or**make exact copies of self *accept forms pairs of chromatids*

**1**

nuclei divide *accept chromatids* ***or*** *chromosomes separate*

**1**

identical (daughter) cells formed

*accept for example, skin cells make more skin cells* ***or*** *cells are clones*

**1**

(d)     any **two** from

*Differentiation mark*babies need **or** are made of different types of cells **or** cells that have  
different functions

*accept different cells are needed for different organs*

*Division or specialisation mark*as fertilised egg starts to divide each cell specialises to form a part of the body

*accept specialised cells make different parts of the body*

*Growth mark*specialised cells undergo mitosis to grow further cells

*accept cells divide* ***or*** *reproduce to form identical cells*

**2**

**[8]**

**Q13.** (a)     chromosomes

**1**

(b)     diagram showing four separate chromosomes two long and two short  
(as in diagram 1)

*allow each chromosome shown as two joined chromatids  
do* ***not*** *allow if chromosomes touching each other*

**1**

(c)     (i)      any **two** from:

•        can grow into any type of tissue / named tissue

•        used in medical research

•        used to treat human diseases

•        large numbers can be grown

**2**

(ii)     any **two** from:

•        expensive

•        grow out of control / ref cancers

•        may be rejected

•        need for drugs (for rest of life)

**2**

**[6]**

**Q14.** (a)     any **two** from:

•        right amount of nutrients **or** different / all foods

•        right amount of energy

•        for (individual) needs

*‘right amount’ only needed once for both marks to be awarded*

**2**

(b)     (i)      ovaries / ovary

*allow placenta*

**1**

(ii)     any **one** from:

•        inhibits follicle stimulating hormone / FSH production

•        inhibits maturation of eggs

*ignore ref to site of production of FSH*

*allow stimulates LH production* ***or*** *stimulates preparation of womb lining*

**1**

(iii)    any **one** from:

•        stimulate muscle growth

•        used in (oral) contraceptives

**1**

(c)     small (rate of) decrease then bigger (rate of) decrease

**1**

idea that change of rate (of decrease) at 900 (mg per day)

*If no other mark awarded allow* ***1*** *mark for decrease*

**1**

(d)     (i)      gene(s) / nucleus / chromosome(s) / DNA

*allow ribosome*

**1**

(ii)     reduces production of cholesterol (by liver)

*allow idea of switching off gene for reductase (production)*

*allow switch off / reduce / inhibit reductase (production)*

*allow reduces absorption of cholesterol (by intestine)*

*allow statins (might) breakdown / destroy cholesterol*

**1**

**[9]**

**Mark schemes**

**Q1.**

(a)     no oxygen (is used)

**1**

(b)     muscles become fatigued / stop contracting

**1**

because not enough energy is transferred

**1**

(c)     carbon dioxide

**1**

(d)     count the bubbles

**or**

measure volume of gas

**1**

in a given time

**1**

(e)     brewing / bread making

*allow other suitable use of fermentation in food industry*

**1**

**[7]**

**Q2.**

(a)     (i)    without oxygen *allow not enough oxygen*

*ignore air*

*ignore production of CO2*

*ignore energy*

**1**

(ii)     more / high / increased lactic acid (at end)

*allow approximate figures (to show increase)*

*ignore reference to glucose*

**1**

(b)     (i)      1.5 *allow only 1.5 / 1½ / one and a half*

**1**

(ii)     increases at first **and** levels off *ignore subsequent decrease*

**1**

suitable use of numbers eg

rises to 10 / by 9 (dm3 per min)

**or**

increases up to 1.5 (min) / levels off after 1.5 (min) (of x axis timescale)

*allow answer in range 1.4 to 1.5*

**or**

after the first minute (of the run)

**1**

(iii)     supplies (more) oxygen

**1**

supplies (more) glucose

**1**

*need ‘more/faster’ once only for full marks*

*allow removes (more) CO2 / lactic acid / heat as an alternative for either marking point one* ***or*** *two,* ***once*** *only*

for (more) respiration

**1**

releases (more) energy (for muscle contraction)

*do* ***not*** *allow energy production or for respiration*

**1**

**[9]**

**Q3.** (a)    any **one** from:*ignore ‘check temperature’*

•        add a water bath

•        heat screen

•        use LED

•        low energy bulb / described

**1**

(b)    (i)      rate / number of bubbles decreases

*accept converse with reference to increasing light* ***or*** *shorter distance*

**or**

less oxygen / gas released

*ignore reference to rate of photosynthesis*

**1**

(ii)     temperature / CO2 (concentration)

*accept ‘it was too cool’* ***or*** *not enough CO2*

*accept number of chloroplasts / amount of chlorophyll*

*allow heat*

*allow CO2*

*do* ***not*** *allow CO2*

**1**

(c)     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](file:///D:\Gained%20Time\resources\AG_BL\menus\Markingguidance.pdf), and apply a ‘best-fit’ approach to the marking.

**0 marks**No relevant content.

**Level 1 (1-2 marks)**There is a brief description of at least 1 tissue **or** at least 1 function of an indicated part of the leaf.

The account lacks clarity or detail.

**Level 2 (3-4 marks)**There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.

**Level 3 (5-6 marks)**There is a detailed description of most of the structures and their functions.

**Examples of responses:**

•        epidermis

•        cover the plant

•        mesophyll / palisade

•        photosynthesises

•        phloem

•        xylem

•        transport.

**The following points are all acceptable but beyond the scope of the specification:**

•        (waxy) cuticle – reduce water loss

•        epidermis – no chloroplasts so allows light to penetrate

•        stomata / guard cells – allow CO2 in (and O2 out) **or** controls water loss

•        palisade (mesophyll) – many chloroplasts to trap light

– near top of leaf for receiving more light

•        spongy (mesophyll) – air spaces for rapid movement of gases

**6**

**[9]**

**Q4.**(a)     LHS = water

**1**

RHS = glucose

**1**

(b)     any **three** from:

•        (measure) temperature

*ignore reference to fair test*

•        to check that the temperature isn’t changing

•        rate of reaction changes with temperature

•        temperature is a variable that needs to be controlled

*allow lamp gives out heat*

**3**

(c)     (i)      10

*correct answer =* ***2*** *marks*

*allow* ***1*** *mark for:  *

*allow* ***1*** *mark for correct calculation without removal of anomalous result ie 15*

**2**

(ii)     graph:

*allow ecf from* ***(c)(i)***

label on y-axis as ‘number of bubbles per minute’

**1**

**three** points correct = **1** mark

*allow ± 1 mm*

**four** points correct = **2** marks

**2**

line of best fit = smooth curve

**1**

(iii)    as distance increases, rate decreases – pro

*allow yes between 20 – 40*

**1**

but should be a straight line / but line curves – con / not quite pro

*allow not between 10 – 20*

*if line of best fit is straight line, allow idea of poor fit*

**1**

(d)     any **four** from:

•        make more profit / cost effective

•        raising temp. to 25 °C makes very little difference at 0.03% CO2

•        (at 20 °C) with CO2 at 0.1%, raises rate

•        (at 20 °C with CO2 at 0.1%) → >3x rate / rises from 5 to 17

•        although 25 °C → higher rate, cost of heating not economical

•        extra light does not increase rate / already max. rate with daylight

*accept ref to profits c.f. costs must be favourable*

**4**

**[17]**

**Q5.** (a)    circulating / mixing / described **or** temperature maintenance

**1**

supply oxygen  
**or** for aerobic conditions  
**or** for faster respiration

*do* ***not*** *allow oxygen for anaerobic respiration*

**1**

(b)     energy supply / fuel / use in respiration

*do* ***not*** *allow just food / growth*

*ignore reference to aerobic / anaerobic*

**or** material for growth / to make mycoprotein

**1**

(c)     respiration

*allow exothermic reaction allow catabolism*

*ignore metabolism ignore aerobic / anaerobic*

**1**

(d)    (i)      any **one** from:

•        compete (with *Fusarium*) for food / oxygen **or** reduce yield of *Fusarium*

•        make toxic waste products or they might cause disease / pathogenic **or** harmful to people / to *Fusarium*

*do* ***not*** *allow harmful unqualified*

**1**

(ii)     steam / heat treat / sterilise fermenter (before use)

***not*** *just clean*

**or**steam / heat treat / sterilise  
glucose / minerals / nutrients / water (before use)  
**or**filter / sterilise air intake  
**or**check there are no leaks

*allow sterilisation unqualified* ***not*** *just use pure glucose*

**1**

(e)     any **three** from:

•        beef is best or beef is better than mycoprotein

•        mycoprotein mainly better than wheat

•        more phenylalanine in wheat than in mycoprotein

*allow equivalent numerical statements*

•        but no information given on other amino acids / costs / foods

**3**

overall conclusion:

statement is incorrect because  
**either**it would be the best source for vegetarians  
**or**for given amino acids, beef is the best source  
**or**three foods provide insufficient data to draw a valid conclusion

**1**

**[10]**

**Q6.**

(a)     (i)      rate of chemical reactions (in the body)

**1**

(ii)     any **two** from:

•        heredity / inheritance / genetics

•        proportion of muscle to fat **or** (body) mass

*allow (body) weight / BMI*

•        age / growth rate

•        gender

*accept hormone balance or environmental temperature*

*ignore exercise / activity*

**2**

(b)    (i)      77

*correct answer with or without working gains* ***2*** *marks*

*allow* ***1*** *mark for 70 / 56* ***or*** *1.25* ***or*** *5*

**2**

(ii)     increase exercise *accept a way of increasing exercise*

**1**

reduce food intake *accept examples such as eat less fat / sugar*

*allow go on a diet* ***or*** *take in fewer calories*

*ignore lose weight*

*ignore medical treatments such as gastric band / liposuction*

**1**

**[7]**

**Q7.** (a)    LHS – carbon dioxide / CO2

*allow CO2 ignore CO2*

**1**

RHS *in either order*

glucose / carbohydrate / sugar *allow starch* *allow C6H12O6 / C6H12O6 ignore C6H12O6*

**1**

Oxygen *allow O2 / O2* *ignore O2 / O*

**1**

(b)     any **five** from:

•        factor 1: CO2 (concentration)

•        effect - as CO2 increases so does rate and then it levels off or shown in a graph

•        explanation:  
(graph increases) because CO2 is the raw material or used in photosynthesis / converted to organic substance / named eg  
**or**(graph levels off) when another factor limits the rate.

*accept points made via an annotated / labelled graph*

•        factor 2: temperature

*allow warmth / heat*

•        effect – as temperature increases, so does the rate and then it decreases or shown in a graph

*allow ‘it peaks’ for description of both phases*

•        explanation:  
(rise in temp) increases rate of chemical reactions / more kinetic energy

*allow molecules move faster / more collisions*

**or**(decreases) because the enzyme is denatured.

*context must be clear = high temperature*

*allow other factor plus effect plus explanation:*

*eg light wavelength / colour / pigments / chlorophyll / pH / minerals / ions / nutrients / size of leaves*

*2nd or 3rd mark can be gained from correct description and explanation*

**5**

**[8]**

**Q8.** (a)     anaerobic respiration*allow phonetic spelling*

**1**

(b)     (i)      4.4

*4.2, 4.3, 4.5 or 4.6 with figures in tolerance (6.7 to 6.9 and 2.3 to 2.5) and correct working gains 2 marks*

*4.2, 4.3, 4.5 or 4.6 with no working shown or correct working with one reading out of tolerance gains 1 mark*

*correct readings from graph in the ranges of 6.7 to 6.9* ***and*** *2.3 to 2.5 but no answer / wrong answer gains 1 mark*

**2**

(ii)     more energy is needed / used / released

*do* ***not*** *allow energy production*

(at 14 km per hour) *ignore work*

**1**

not enough oxygen (can be taken in / can be supplied to muscles)

*allow reference to oxygen debt*

*do* ***not*** *allow less / no oxygen*

**1**

so more anaerobic respiration (to supply the extra energy) **or** more glucose changed to lactic acid *allow not enough aerobic respiration*

**1**

**[6]**

**Q9.** (a)     (i)      50

**1**

(ii)     4 *accept 3.9 − 4.0*

**1**

(b)     (i)      glucose

**1**

oxygen

**1**

(ii)     to release more energy

**1**

(c)     correct readings from graph:

a = 120

b = 60 *allow 60 - 61*

**1**

calculation correct for candidate’s figures: e.g. a − b = 60

**1**

level of fitness correct for candidate’s figures: e.g. very fit

**1**

(d)     any **four** from:

•        higher heart rate (at 16 km / h) (so takes longer to slow to normal)

•        more energy needed

•        not enough O2 supplied / more O2 needed / reference to O2-debt

•        (more) anaerobic respiration

•        (more) lactic acid made / to be broken down / to remove / to oxidise

•        higher blood flow needed to deliver (the required amount of) oxygen.

*‘more’ must be given at least once for full marks do not allow more energy produced*

*allow higher blood flow to remove lactic acid / remove (additional) CO2*

**4**

**[12]**

**Q10.** (a)     5624 ***allow 2 marks*** *for:*

*correct HR = 148* ***and*** *correct SV = 38 plus wrong answer / no answer*

***or***

*only one value correct* ***and*** *ecf for answer*

***allow 1 mark*** *for:*

*incorrect values* ***and*** *ecf for answer only one value correct*

**3**

(b)     (i)      **Person 2** has low(er) stroke volume / SV / described

*eg* ***Person 2*** *pumps out smaller volume each beat do* ***not*** *allow* ***Person 2*** *has lower heart rate*

**1**

(ii)     **Person 1** sends more blood (to muscles / body / lungs)

**1**

(which) supplies (more) oxygen

**1**

(and) supplies (more) glucose

**1**

(faster rate of) respiration **or** transfers (more) energy for use

*ignore aerobic / anaerobic allow (more) energy release*

*allow aerobic respiration transfers / releases more energy (than anaerobic)*

*do* ***not*** *allow makes (more) energy*

**1**

removes (more) CO2 / lactic acid / heat *allow less oxygen debt*

**or** less lactic acid made  
**or** (more) muscle contraction / less muscle fatigue

*if no other mark awarded, allow person 1 is fitter (than person 2) for max 1 mark*

**1**

**[9]**

**Q11.** (a)     (i)      LHS = water*accept H2O**do* ***not*** *accept H2O / H2O*

**1**

RHS = oxygen *accept O2* *do* ***not*** *accept O / O2 / O2*

**1**

(ii)     light / sunlight *ignore solar / sun / sunshine*

*do* ***not*** *allow thermal / heat*

**1**

(iii)    chloroplasts *allow chlorophyll*

**1**

(b)     (i)      20

**1**

(ii)     any **one** from:

•        light (intensity)

•        temperature.

**1**

(c)     (i)      To increase the rate of growth of the tomato plants

**1**

(ii)     Because it would cost more money than using 0.08%

**1**

Because it would not increase the rate of photosynthesis of the tomato plants any further

**1**

**[9]**