AQA GCSE Biology

Paper 1: Cell Biology, Organisation, Infection & Response, Bioenergetics

Higher Tier — Combined Science · Time: 1 hour 15 minutes · Total: 70 marks

Higher Tier — Combined Science

Name:	
Centre number:	**Candidate number:**

- Answer **ALL** questions.
- Use black ink or black ball-point pen.
- Write your answers in the spaces provided.
- The marks for questions are shown in brackets.
- Total marks: 70
- Questions marked ★ are Higher Tier only.

Question 1

(a) Which of the following structures is found in a bacterial cell but NOT in a human liver cell?

[1 mark]

Tick **ONE** box.

- ☐ A. Ribosome
- ☐ B. Mitochondrion
- ☐ C. Plasmid
- ☐ D. Cell membrane

(b) A student observes a cell under a light microscope. The cell has a large permanent vacuole, chloroplasts and a cell wall. Which type of cell is this?

[1 mark]

Tick **ONE** box.

- ☐ A. Animal cell
- ☐ B. Plant cell
- ☐ C. Bacterial cell
- ☐ D. Fungal cell

(c) Which process requires energy from ATP?

[1 mark]

Tick **ONE** box.

- ☐ A. Diffusion
- ☐ B. Osmosis
- ☐ C. Active transport

☐ D. Facilitated diffusion

(d) Which of the following is the correct word equation for aerobic respiration?

[1 mark]

Tick **ONE** box.

☐ A. Glucose + carbon dioxide → oxygen + water

☐ B. Glucose + oxygen → carbon dioxide + water

☐ C. Carbon dioxide + water → glucose + oxygen

☐ D. Glucose → lactic acid + carbon dioxide

Total for Question 1 ☐

Question 2

Mitochondria are found in nearly all eukaryotic cells. Scientists use electron microscopes to study their internal structure.

(a) Give TWO reasons why an electron microscope is more suitable than a light microscope for studying the internal structure of a mitochondrion.

[2 marks]

(b) A student draws a cell under the microscope. The image of a cell is 54 mm long. The actual length of the cell is 0.03 mm. Calculate the magnification. Show your working.

[2 marks]

(c) Convert 0.03 mm to micrometres (μm).

[1 mark]

Total for Question 2 ☐

Question 3

Cystic fibrosis (CF) is a genetic disorder caused by a faulty recessive allele (f). A couple who are both carriers of cystic fibrosis (Ff) are expecting a child.

(a) What is meant by the term "carrier" in the context of cystic fibrosis?

[1 mark]

(b) Use a Punnett square to calculate the probability that this child will have cystic fibrosis. Show your working.

[3 marks]

(c) Cystic fibrosis causes thick, sticky mucus to build up in the lungs. Explain why this increases the risk of bacterial lung infections.

[2 marks]

Total for Question 3

Question 4

A student investigates the effect of enzyme concentration on the rate of digestion of starch by amylase. She measures the time taken for the blue-black colour of iodine to disappear at different enzyme concentrations.

Figure 1: Results graph — time vs enzyme concentration

(a) State why iodine solution turns blue-black.

[1 mark]

(b) Explain the shape of the graph. Include in your answer what happens to the rate of reaction as enzyme concentration increases.

[3 marks]

(c) Give TWO variables the student should control to make this a fair test.

[2 marks]

★ **Higher Tier**

(d) ★ Explain, using the induced fit model, how the enzyme amylase catalyses the breakdown of starch.

[2 marks]

Total for Question 4

Question 5

The diagram below shows the structure of the heart.

Figure 2: Cross-section of the human heart

(a) Describe the flow of blood through the heart. Include the names of the chambers and vessels in your answer.

[3 marks]

(b) Explain why the left ventricle has a thicker muscular wall than the right ventricle.

[2 marks]

(c) Describe how coronary heart disease develops and explain how statins are used to reduce the risk.

[3 marks]

★ Higher Tier

(d) ★ A patient's heart rate is 72 beats per minute and their stroke volume is 70 cm^3. Calculate their cardiac output. Give the unit.

[2 marks]

Total for Question 5

Question 6

Scientists investigated the spread of a new strain of influenza. They recorded the number of new cases per week over a 12-week period.

(a) Influenza is caused by a virus. Explain why antibiotics cannot be used to treat influenza.

[1 mark]

(b) Explain how vaccination with the influenza vaccine protects a person from future influenza infection.

[4 marks]

(c) Explain why a new influenza vaccine must be developed each year.

[2 marks]

★ Higher Tier

(d) ★ Describe how monoclonal antibodies can be used to treat cancer. Include in your answer how they are produced.

[3 marks]

Total for Question 6

Question 7

Photosynthesis is the process by which plants produce glucose from carbon dioxide and water.

(a) Write the balanced symbol equation for photosynthesis.

[2 marks]

(b) A student investigates the effect of light intensity on the rate of photosynthesis in pondweed. She moves a lamp to different distances and counts oxygen bubbles per minute. Describe how she should control other variables and explain why this is necessary.

[4 marks]

(c) The student finds that doubling the light intensity from 50 to 100 arbitrary units increases the rate, but doubling from 200 to 400 arbitrary units has almost no effect. Explain this observation.

[3 marks]

(d) State FOUR ways in which a plant uses the glucose produced by photosynthesis.

[2 marks]

Total for Question 7

Question 8

A student carried out a required practical to investigate the effect of different concentrations of sucrose solution on potato chips. The results are shown in the table below.

(a) The table shows the student's results.

[0 marks]

Sucrose concentration (mol/dm³)	Initial mass (g)	Final mass (g)	% change in mass
0.0 (water)	2.50	2.73	+9.2%
0.2	2.48	2.55	+2.8%
0.4	2.51	2.51	0.0%
0.6	2.49	2.34	–6.0%
0.8	2.52	2.18	–13.5%

(b) Explain why the potato chips in pure water (0.0 mol/dm³) gained mass.

[2 marks]

(c) Determine the concentration of sucrose at which there is no net movement of water into or out of the potato cells. Explain your answer.

[1 mark]

(d) Explain what happens to a potato cell when it is placed in a 0.8 mol/dm³ sucrose solution.

[3 marks]

★ **Higher Tier**

(e) ★ Calculate the percentage change in mass for the potato chip placed in 0.6 mol/dm³ sucrose solution. Show your working. (Use figures from the table.)

[2 marks]

Total for Question 8

Question 9

(a) Describe the role of the digestive system in the breakdown and absorption of proteins. Name the enzyme involved and the products of digestion.

[4 marks]

(b) Explain how the small intestine is adapted for the efficient absorption of the products of digestion.

[3 marks]

Total for Question 9

Question 10

This question is about anaerobic and aerobic respiration.

(a) Write the word equation for anaerobic respiration in human muscle cells.

[1 mark]

(b) A sprinter runs 400 m and then continues to breathe heavily for 10 minutes after the race. Explain, using the term oxygen debt, why this happens.

[4 marks]

★ **Higher Tier**

(c) ★ Compare aerobic and anaerobic respiration in terms of oxygen requirement, products and energy released per molecule of glucose.

[3 marks]

Total for Question 10

Question 11

(a) ★ Quality of written communication (QWC) question. A student claims that "good personal hygiene and vaccination are the two most effective ways of reducing the spread of communicable diseases." Evaluate this claim. In your answer you should consider: the types of pathogen that cause communicable diseases; the ways in which they spread; and the effectiveness of hygiene and vaccination compared with other control measures.

[6 marks]

Total for Question 11

END OF QUESTIONS · Total marks: 83