Advanced Subsidiary GCE Biology

F211 Cells, Exchange and Transport - High banded Candidate style answer

Introduction

OCR has produced these candidate style answers to support teachers in interpreting the assessment criteria for the new GCE specifications and to bridge the gap between new specification release and availability of exemplar candidate work.

This content has been produced by senior OCR examiners, with the input of Chairs of Examiners, to illustrate how the sample assessment questions might be answered and provide some commentary on what factors contribute to an overall grading. The candidate style answers are not written in a way that is intended to replicate student work but to demonstrate what a "good" or "excellent" response might include, supported by examiner commentary and conclusions.

As these responses have not been through full moderation and do not replicate student work, they have not been graded and are instead, banded "medium" or "high" to give an indication of the level of each response.

Please note that this resource is provided for advice and guidance only and does not in any way constitute an indication of grade boundaries or endorsed answers.

1 The table below compares features of typical eukaryotic and prokaryotic cells.

(a)(i) Complete the table by placing one of the following, as appropriate, in each empty box of the table.

- **a tick (✓)**
- **a cross (×)**
- **the words 'sometimes present'**

Some of the boxes have been completed for you.

[4]

Candidate style answer	*Examiner's commentary*
	An excellent answer. The candidate recognises that flagella, the slightly more obscure feature of those listed, is not always present in prokaryotes

	eukaryotic cell	prokaryotic cell
cell wall	sometimes present	✓
nuclear envelope	✓	×
Golgi apparatus	✓	×
ribosomes	✓	✓
flagellum	sometimes present	*sometimes present*

(ii) Outline the roles of the Golgi apparatus and the ribosomes. **[2]**	
Candidate style answer	*Examiner's commentary*
Golgi apparatus *Adds carbohydrate to the protein* Ribosomes *Used for protein synthesis*	An answer that shows that the candidate not only realises that proteins are modified in the Golgi apparatus but has detailed knowledge about this modification.

(b) Fig. 1.1 is a diagram of a mammalian sperm cell

Fig. 1.1

Explain how the structure of the sperm cell is specialised for carrying out its role. **[3]**

Candidate style answer	*Examiner's commentary*
Its tail beats and contains a large number of mitochondria to provide the energy so that the sperm can swim. The nucleus in the head contains the genetic material and the head is slightly pointed to help it to penetrate the egg.	An answer that shows knowledge and understanding of sperm function and movement. Some comment about the role of the acrosome would have improved this response.

(c)(i) Explain the meaning of the term *tissue*. **[2]**	
Candidate style answer	*Examiner's commentary*
A group of cells that are specialised and work together for a particular function.	A good definition of the term, conveying clearly the idea of the cells in a tissue working together to perform a particular function.

(ii) Name <u>one</u> example of a plant tissue. **[1]**	
Candidate style answer	*Examiner's commentary*
Xylem	A suitable and accurate response.

2 Fig. 2.1 represents the structure of a plasma (cell surface) membrane.

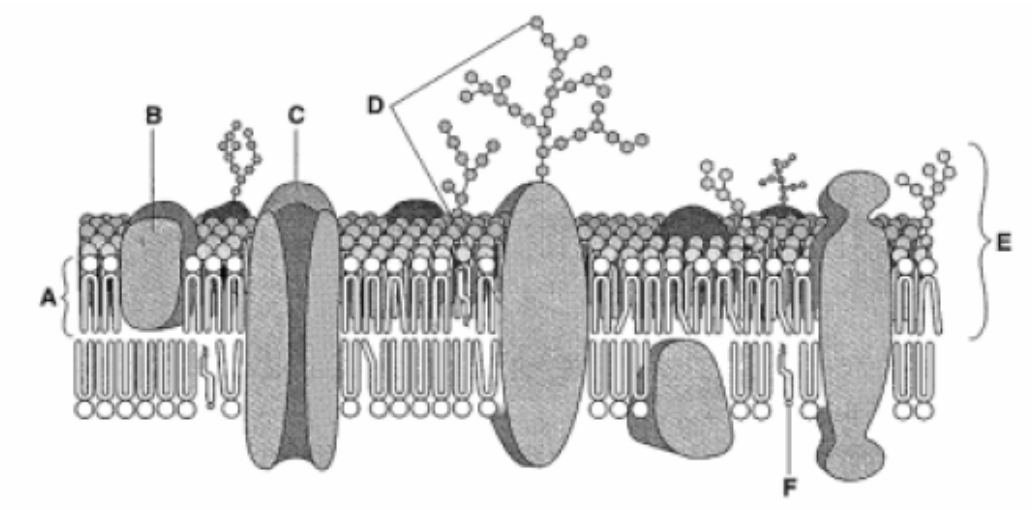


Fig. 2.1

(a)(i) Name molecules *A, B* and *F*.
In your answer you should spell the names of the molecules correctly. [3]

Candidate style answer	*Examiner's commentary*
A phospholipid *B protein* *F cholesterol*	All molecules identified correctly and spelt.

(ii) *E* represents the width of the plasma (cell surface) membrane in a typical animal cell.
State the approximate width of the membrane. [1]

Candidate style answer	*Examiner's commentary*
7×10^{-9} m	Correct measurement, expressed in a suitable manner.

(b)(i) Describe the structure of molecule *A*. [2]

Candidate style answer	*Examiner's commentary*
The phospholipid has a polar head, which is made up of the phosphate group and a non-polar tail, made up of the fatty acid chains. The fatty acid chains can be saturated or unsaturated. So the head is hydrophilic and the tail is hydrophobic.	An example of a comprehensive answer that is not only correct but also tries to incorporate all relevant information that might be credited in an answer.

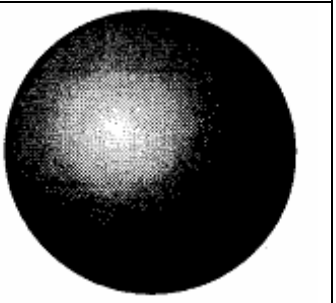
(ii) State one function of molecule C. **[1]**	
Candidate style answer	*Examiner's commentary*
Allows large and charged molecules through the membrane by facilitated diffusion or active transport.	A response that, while it is comprehensive, still only covers one function.

(iii) Molecule *D* is a glycoprotein. This molecule consists of a protein embedded in the membrane with a branched carbohydrate chain projecting out from the surface of the cell. **Outline <u>three</u> roles of glycoproteins in membranes.** **[3]**	
Candidate style answer	*Examiner's commentary*
1 antigen for cell recognition *2 binding site for antibodies* *3 forms bonds with water molecules to stabilise the membrane*	A role needs to indicate what the molecule is doing rather than what it is. These responses do this.

3(a) A student investigated how the surface area of a single-celled organism is related to its volume. The student used two spheres, A and B, as models of two organisms. The surface area and volume of each sphere was calculated.

The results are shown in Table 3.1.

Table 3.1

	sphere **A**	sphere **B**
		
diameter / cm	1	3
surface area / cm^2	3.14	28.27
volume / cm^3	0.52	14.14

(i) The student calculated the surface area:volume ratio of sphere B as 2:1.

Calculate the surface area:volume ratio of sphere A.

Show your working. **[2]**

Candidate style answer	*Examiner's commentary*
3.14 *0.52 6.03846 : 1* *Answer = 6 : 1*	Answered correctly and correct working shown. It is always worth making sure that the working is shown, in case a silly mistake results in a total loss of marks. The answer is given to an appropriate number of decimal places.

(ii) How does the surface area:volume ratio of sphere B differ from that of sphere A? **[1]**

Candidate style answer	*Examiner's commentary*
Ratio for B is smaller. Ratio for A is 6:1 and for B is 2:1. So B is 3x smaller.	A complete answer that has made good use of the figures supplied and calculated.

(iii) Single-celled organisms generally have a surface-area to volume ratio more like that of sphere A than sphere B.
Explain why. [2]

Candidate style answer	*Examiner's commentary*
Cells need to take up oxygen for respiration and to get rid of waste gases such as carbon dioxide and need a large surface area to do that. The cells do this by diffusion and if the SA:volume ratio isn't big enough then they can't get enough oxygen in and carbon dioxide out.	This answer shows good understanding. It could be improved by expanding on the idea that a small SA:volume ratio means that diffusion is too slow for the cells' needs.

(b) The lungs in the mammalian body are well developed to allow effective exchange of gases.
Describe the features of the lungs that make them effective organs for the exchange of gases.
In your answer, you should use appropriate technical terms, spelt correctly. [5]

Candidate style answer	*Examiner's commentary*
The lungs have a large surface area as they are made up of a large number of alveoli, which are tiny little sacs that are covered by blood capillaries. The walls of the alveoli are very thin so that the diffusion distance is small. The surface is moist for diffusion and so there is a layer of water on the alveolar wall. In between the alveoli is elastic tissue which allows the lungs to expand when we breathe in and then recoil for the lungs to expel the air when we breathe out.	This answer is concise and includes many of the relevant features.

(c) Fig. 3.1 shows the trace from a spirometer. A spirometer is a device designed to measure the volume of air entering and leaving the lungs. A chamber in the spirometer contains soda lime to absorb the carbon dioxide released by respiration. The measurements shown were recorded from a healthy 17-year-old student at rest.

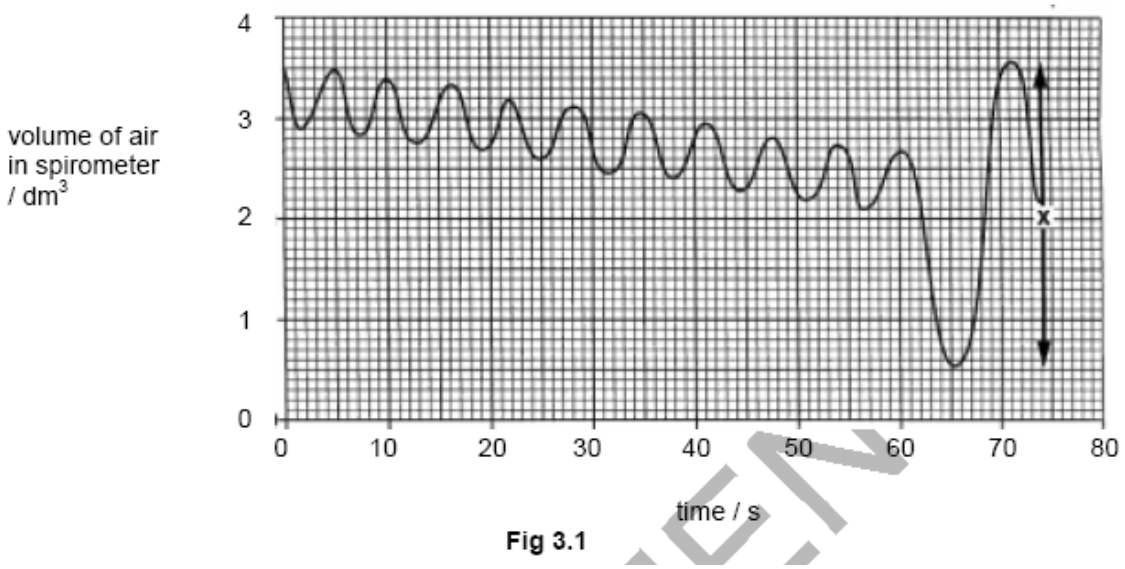


Fig 3.1

(i) Explain why the volume of air in the spirometer drops slowly over the first minute. [2]

Candidate style answer	*Examiner's commentary*
Carbon dioxide that is breathed out is absorbed by the soda lime. Oxygen is being breathed in for respiration and carbon dioxide is produced.	This answer contains the required information for the marks but could have been improved by re-ordering the sentences so that the information was presented in a more logical sequence.

(ii) After one minute, the student was asked to breathe in as deeply as possible and then breathe out as much as possible. The resulting change in the trace is shown in Fig. 3.2 as X.

State the term given to measurement X. [1]

Candidate style answer	*Examiner's commentary*
Total capacity	Although this response gives a fairly accurate representation of the meaning of the term, it is not the recognised term.

4 The transport system in mammals is a double circulatory system driven by a pump (the heart).

(a) Explain what is meant by a *double circulatory system*. [2]

Candidate style answer	*Examiner's commentary*
The blood goes through the heart twice in one circuit of the body. It goes from the heart to the lungs and then back through the heart before travelling to the rest of the body.	The candidate understands the principle and has clarified the idea of 'circuit' (being quite close to the term 'circulatory') with an explanation.

(b) Fig. 4.1 gives information about the relative thickness of the walls of three chambers of the heart:

- left ventricle
- right ventricle
- right atrium

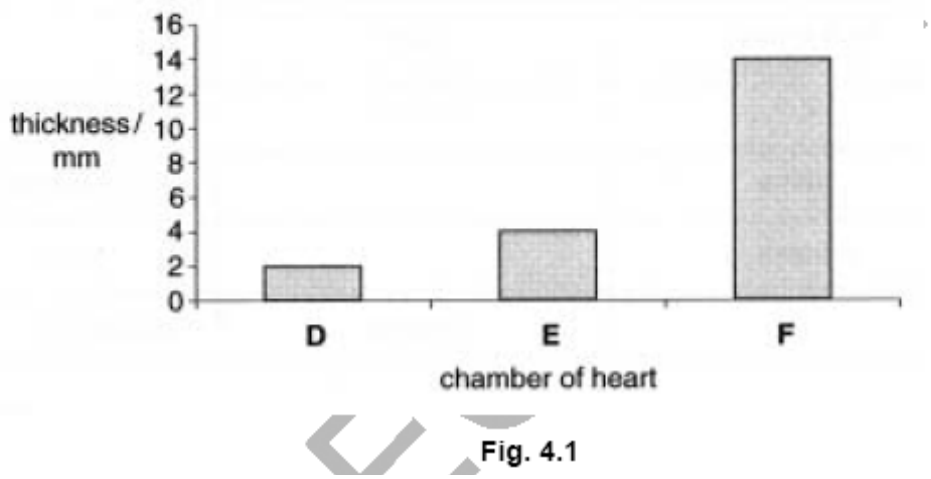


Fig. 4.1

(i) State which of these chambers are identified by the letters D, E and F. [3]

Candidate style answer	*Examiner's commentary*
D right atrium *E right ventricle* *F left ventricle*	All chambers have been identified correctly.

(ii) Explain, with reference to its function, why the wall of chamber F is much thicker than the walls of chambers D and E. [3]

Candidate style answer	*Examiner's commentary*
The left ventricle has to pump blood all over the body and so it needs to be made of thick muscle to contract with enough force to push the blood that distance. The right ventricle only needs to pump blood to the lungs and so can be thinner. The right atrium wall is very thin as the blood only needs to travel from the atrium into the ventricle. This is inside the heart.	A competent and comprehensive answer, linking the ideas of the thickness of the muscle to the amount of force required to propel the blood and the distance that the blood needs to travel.

(c) Use the most appropriate terms to complete the paragraph below about the role of haemoglobin in the mammalian blood. [5]

Candidate style answer	*Examiner's commentary*
Haemoglobin, a pigment found in the blood of mammals, has an important role in the transport of respiratory gases. Each haemoglobin molecule contains haem groups. In the lungs, oxygen binds with the atom of …*iron*…. in each haem group. The maximum number of molecules of oxygen that can be carried by one molecule of haemoglobin is …*four*… . In areas like muscle tissue where the partial pressure of oxygen is low, oxygen dissociates from the haem group. This dissociation is increased by the presence of carbon dioxide; this is called the …*Bohre*… …*shift*… . Most of the carbon dioxide produced in respiring tissues diffuses into the red blood cells where the enzyme …*carbonic*… …*anhydrase*… catalyses a reaction leading to the production of hydrogen ions and hydrogen carbonate ions. The hydrogen ions combine very readily with haemoglobin to form a compound known as … *haemoglobinic acid* … . The effect of this is to increase the release of oxygen from haemoglobin.	Careful reading is required for 'gap fill' questions. This candidate has noted that the number of oxygen molecules was required rather than the number of atoms. The candidate has made a typical mis-spelling of Bohr, although a phonetic spelling will be acceptable in this case.

5 Transpiration is the loss of water from plants by evaporation. Fig. 5.1 shows a potometer, an apparatus used to <u>estimate</u> transpiration rates. Transpiration itself is not measured directly by a potometer.

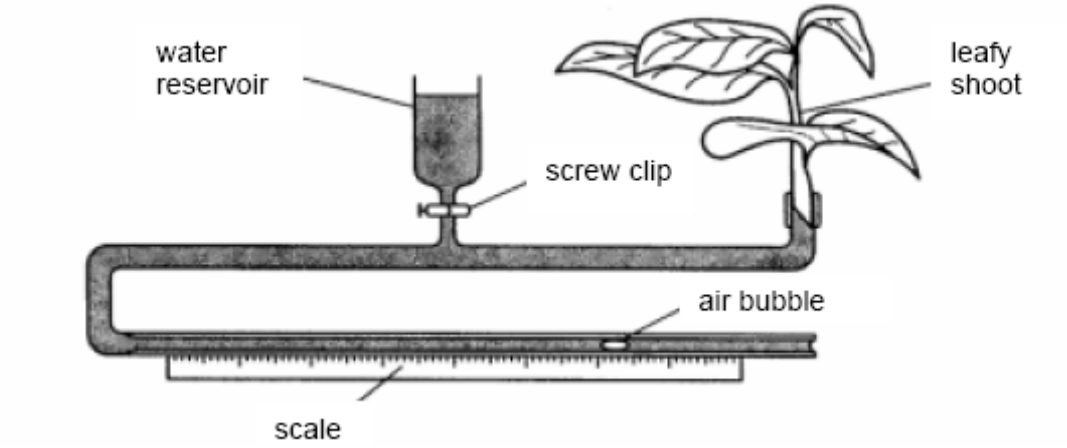


Fig. 5.1

(a) State what is measured by this apparatus. [1]

Candidate style answer	*Examiner's commentary*
The amount of water that is taken up by the plant.	A clear and concise answer.

(b) Describe how the apparatus should be set up to ensure that valid measurements can be made. [7]

Candidate style answer	*Examiner's commentary*
First you take a leafy shoot (as the water is going to be lost from the leaves). Cut the end of the stem at an angle to increase the surface area. Then fill the potometer and put it under water to stop any air bubbles getting trapped in the next step. Keeping it under water, firmly put the twig into the apparatus. Seal the joint with vaseline if necessary. When you are ready to start measuring, make a note of the position of the bubble. After a set time, make a note of the new position. You can adjust the position of the bubble by opening the screw clip by the reservoir. You can then work out the volume of water taken up if you know the diameter of the tube and can compare it with other plants or other conditions.	This answer indicates that the candidate has practical experience of setting up a potometer. The sequence of events is logical and indicates sound knowledge and understanding.

(c) A student investigated the transpiration rates of two different plants, *A* and *B*. The results of the investigation are shown in Table 5.1.

Table 5.1

reading	estimate of transpiration rate / arbitrary units	
	plant **A**	plant **B**
1	45	107
2	39	99
3	41	106
4	46	101
5	38	103
mean	42	*103*

(i) Calculate the mean estimated transpiration rate for plant B.
Express your answer to the nearest whole number and write it in the shaded box in Table 5.1. [1]

Candidate style answer	*Examiner's commentary*
107 + 99 + 106 + 101 + 103 = 516 *516 = 103.2 = 103* *5*	The candidate has correctly calculated the mean, shown all working and has noted that the answer was required to the nearest whole number.

(ii) The student prepared a temporary slide of a transverse section through one of the leaves. Fig. 5.2 shows a diagram the student drew of the lower epidermis from one of the leaves.

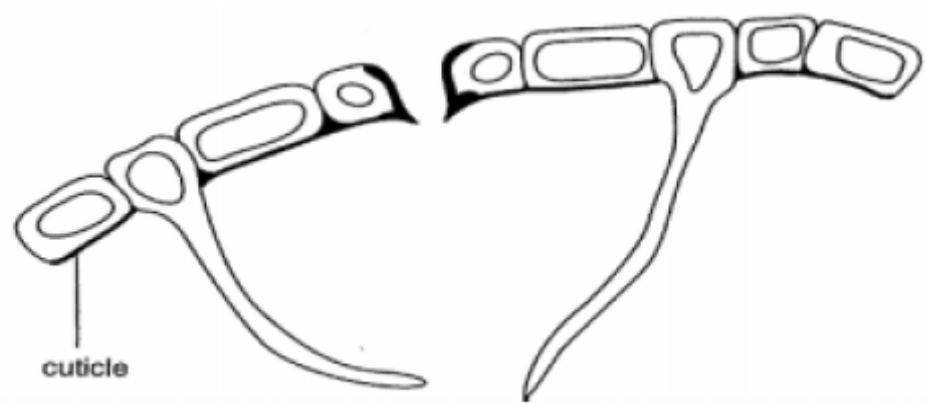


Fig. 5.2

State from which plant, *A* or *B*, the leaf was taken. Explain your answer. [3]

Candidate style answer	*Examiner's commentary*
Plant *A* Explanation *Plant A isn't transpirating very much so it isn't losing much water vapour. It has little hairs to stop it from escaping from the leaf and has a cuticle on the lower surface of the leaf. Leaves only usually have a cuticle on the upper surface. The hairs are around the stomata and trap the water vapour so that it forms a humid layer around the stomata.*	Three marks are available for this question, but as the choice is just between plant A and B, there is no mark for choosing the correct plant. All three marks are available for the explanation. This candidate's answer is a little disorganised, with ideas not being dealt with in a logical sequence.

Overall banding: High

The answers to these questions indicate good understanding of many of the principles being tested. There are a few gaps in knowledge and some expression that could be improved upon.