Advanced Subsidiary GCE Biology

F211 Cells, Exchange and Transport - Medium 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

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

Examiner's commentary

A competent answer, but the candidate does not have sufficient knowledge about flagella, the slightly more obscure feature of those listed. On a general note, candidates should not use 'hybrid' ticks (ticks with a single line across the longer right hand side arm) as they are ambiguous – if a tick is to be altered, then it should be clearly crossed out and the intended answer freshly written.

(ii) Outline the roles of the Golgi apparatus and the ribosomes. [2]	
Candidate style answer	*Examiner's commentary*
Golgi apparatus *Sorts and packages things* Ribosomes *Used for protein synthesis*	An answer that shows that the candidate has the required basic knowledge. However, the response to the role of the Golgi apparatus is lacking in precision. A more specific comment about modifying protein or an example of such a modification would have improved this answer.

(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 so that the sperm can swim. The nucleus is in the head so that it can fertilise the egg. It has lots of mitochondria to give energy for swimming.	An answer that shows knowledge and understanding of sperm movement. The comment about the nucleus does not really emphasise the specialisation; it just states where the nucleus is located and what it does. Some comment about the shape of the head or 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 collection of cells that are specialised to do a job.	An adequate definition of the term. Definition of tissue should try to give 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*
Vascular tissue.	The example given is a typical mistake, the candidate assuming that the addition of the word 'tissue' automatically means that vascular tissue is a tissue.

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

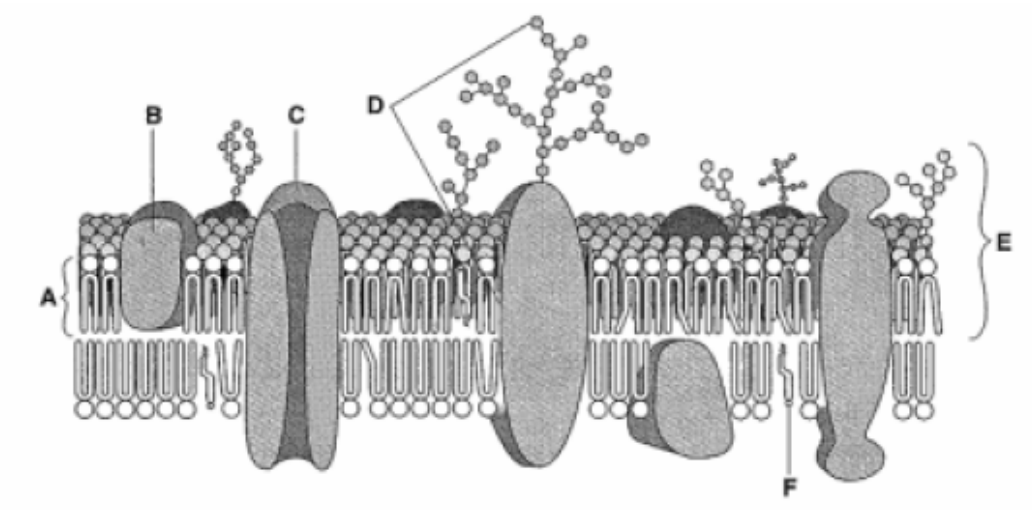


Fig. 2.1

(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 bilayer *B protein* *F phospholipid monolayer*	A - As 'phospholipid' forms part of the answer to A, the candidate knows which molecule is involved. But the addition of 'bilayer' indicates either that the candidate does not realise that 'bilayer' is not part of a molecule or that the candidate assumed that the label included both layers of phospholipids. F – The candidate is unable to identify cholesterol and has guessed at monolayer, possibly as the molecule looks a bit like a phospholipid but with only one 'tail'.

(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 μm	The correct number is given but with the wrong units (even though nm and μm are both small). Candidates often find the idea of anything smaller than 1cm to be confusing.

(b)(i) Describe the structure of molecule *A*.	**[2]**
Candidate style answer	*Examiner's commentary*
Has a polar head and a non-polar tail. So the head is hydrophobic and the tail is hydrophilic.	An example of an answer that tries to impress, but the candidate is incorrect in how the terms hydrophilic and hydrophobic have been used. This is an answer that contradicts the original correct statements and so neither will score. If the response had simply been the first sentence, then it would have scored marks. If a candidate is unsure about whether the facts are correct, then it might be better to keep the answer simple rather than risking making contradictory statements.

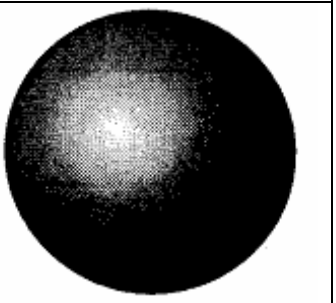
(ii) State one function of molecule C.	**[1]**
Candidate style answer	*Examiner's commentary*
Lets charged molecules through the membrane.	An adequate response that might have been improved by giving a suitable example or stating the mechanism.

(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 cell recognition *2 binding site* *3 antigen* *4 makes the membrane stable*	A role really needs to indicate what the molecule is doing rather than what it is. Answer 1 just about does this; answer 2 needs to be qualified with what will bind to this site; answer 3 is repeating the idea of answer 1 but again is not providing enough information. Answer 4 was added by the candidate. As the question asked for three roles, the first three only will be marked.

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* *Answer = ... 6.03846 : 1.....*	Correct working is shown but the answer is given to an inappropriate number of decimal places. Candidates should look at the information given in the question, whether in the text or in a table. The figure for the calculation given in the stem of this question is 2:1, so the candidate should have given the answer as 6:1.

(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.	An incomplete answer. As the candidate had just calculated SA:vol ratio, this should have been quoted in the answer (an error carried forward would have been applied if the calculation had been wrong).

(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 to keep them alive and need a large surface area to do that.	This answer shows basic understanding. However, it could be improved by referring to diffusion or expanding on why the large SA:vol ratio is essential.

(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 are very good for gas exchange because they have a large surface area. They are made up of lots of alveoli, which are tiny little sacs that are covered by blood capillaries. The cell walls are very thin so that the gases don't have far to travel. The surface must be moist for diffusion and so there is a layer of water on the wall. As you breathe in, the air goes down the windpipe. Here, there are goblet cells that produce mucous and tiny hairs called cilia are waving around. These trap the dust and dirt and stop it from going down into the lungs. As you breathe in, the lungs expand and as you breathe out, the lungs contract. The oxygen goes into the blood and then forms oxyhaemoglobin to carry the oxygen to all parts of the body. When you breathe out the air goes back up the windpipe and out through the nose and mouth.	This answer is typical of one where the candidate has started off on the correct lines but has then lost direction a little. The answer does not really focus on the question set. There is some ambiguity in reference to the walls – the candidate has referred to cell walls rather than alveolar walls. The question is really looking for features of the lungs rather than the events of inspiration and expiration. The features in this answer are included incidentally.

(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.

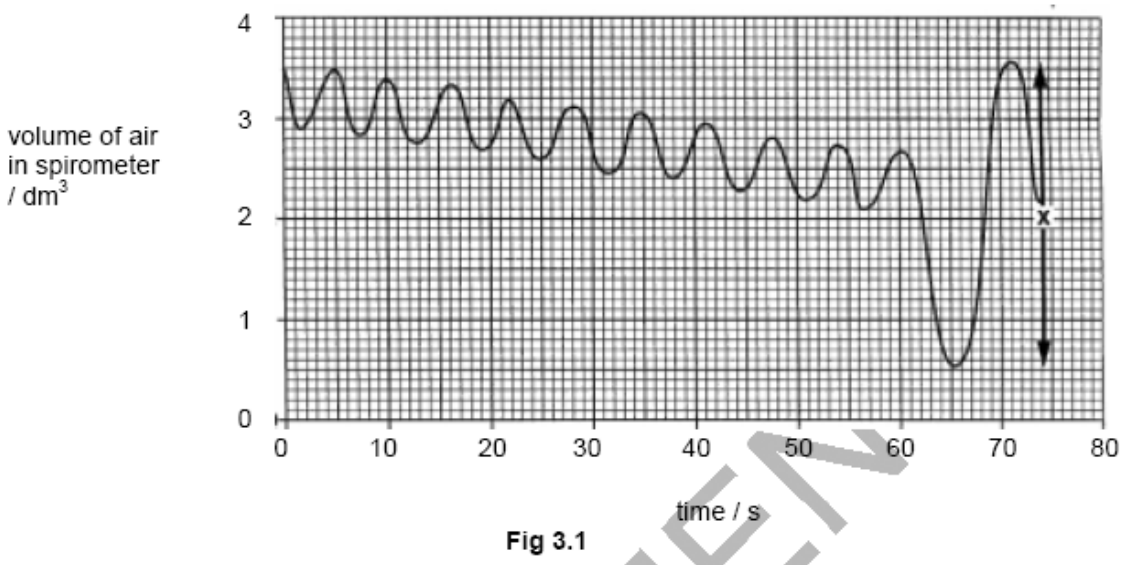


Fig 3.1

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

Candidate style answer	*Examiner's commentary*
This is because some of the gases are going out. Carbon dioxide is absorbed by the soda lime.	This answer shows that the candidate has read the question and has picked up on the fact that the soda lime absorbs the carbon dioxide. However, no mention is made of respiration and the idea of oxygen being taken in for respiration and the subsequent release of carbon dioxide would have gained a further mark.

(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*
3.1	This shows that the candidate did not read the question carefully, concentrated on the word 'measurement' and so read the value of X from the graph rather than stating the term that it represents.

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 circulation of the body.	The candidate understands the principle but should try to avoid using 'circulation' in the answer as it is too close to 'circulatory' and that part of the term is therefore not being explained. Further clarification to include mention of the pulmonary supply and that to the rest of the body would have improved the answer.

(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

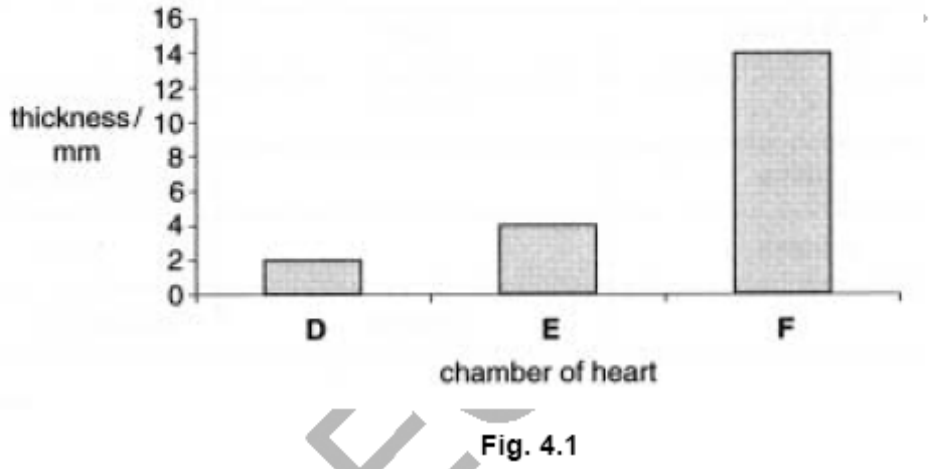


Fig. 4.1

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

Candidate style answer	*Examiner's commentary*
D right ventricle *E right atrium* *F left ventricle*	The candidate has recognised that the left ventricle will have the thickest wall. However, the answer shows no understanding that the ventricle walls are thicker than the walls of the atria.

(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 thick to withstand the pressure. The others don't have to do this so they can be thinner.	In line with the answer to (b)(i), the candidate has some idea of the significance of the thickness of the wall of the left ventricle but does not explain its importance in generating enough pressure to pump the blood through the body effectively. The answer would be improved if reference was made to the pressure required to propel the blood from the atrium to the ventricle or into the pulmonary circulation. The question is posed in terms of a comparison but the answer has not made this comparison.

(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 ...*eight*... . 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 ...*Bore*... ...*shift*... . Most of the carbon dioxide produced in respiring tissues diffuses into the red blood cells where the enzyme ...*carbonic*... ...*hydrogenase*... 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 ...*carboxyhaemoglobin*... ... . The effect of this is to increase the release of oxygen from haemoglobin.	Careful reading is required for 'gap fill' questions. This candidate has given the maximum number of atoms of oxygen rather than the number of molecules. The answer shows a typical mis-spelling of Bohr, although a phonetic spelling will be acceptable in this case. Also typical is the incorrect name for carbonic anhydrase, as is the reflex to give the answer to any compound involving haemoglobin and molecules/ions other than oxygen as carboxyhaemoglobin.

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.

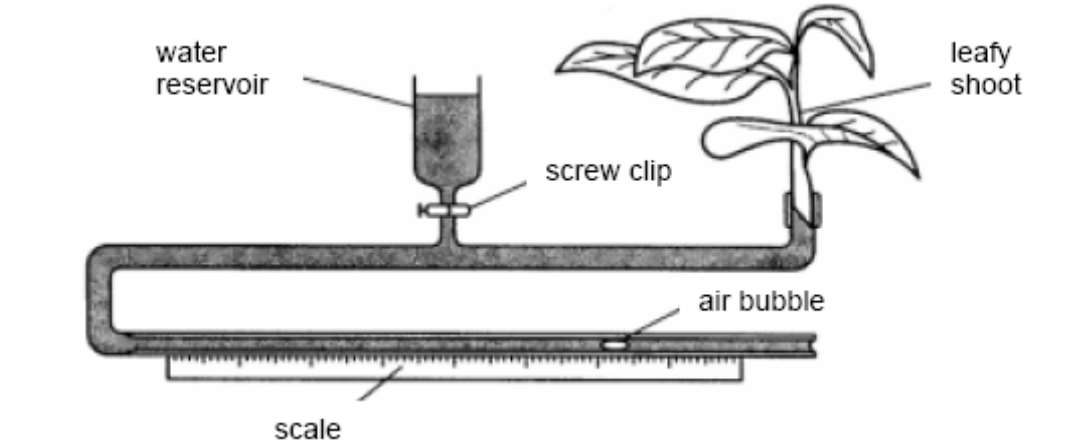


Fig. 5.1

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

Candidate style answer	*Examiner's commentary*
The amount of water that the plant takes up to use and keep alive and will be lost from the leaves.	This answer is trying to give too much detail, and in doing so obscures the simple idea that it is the amount of water taken up by the plant rather than the amount used or the amount lost from the leaves.

(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 have to get a plant shoot that has leaves on it. But not too many leaves as then the whole thing would work too quickly. Cut the end of the stem so that it is fresh to take in water. Then fill the potometer and put the stem into the end. You mustn't have any air bubbles or locks in the system, so all this must be done in a big sink full of water so that everything is under water. Where the stem goes into the potometer you should cover the joint with vaseline to stop water coming out or air going in. When you are ready to start measuring, make sure that the bubble is far enough along the scale so that when the time is up the bubble won't have gone beyond the scale and can't be measured. You can adjust the position of the bubble by opening the screw clip by the reservoir.	This answer indicates that the candidate has practical experience of setting up a potometer. Comments such as the number of leaves on the shoot, setting up under water, sealing the joint with vaseline and the position of the bubble at the start all indicate some lessons learnt by experience. The sequence of events is reasonably good although a bit more explanation or detail at each stage would improve the answer.

(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*
103.2 = 103	The candidate has correctly calculated the mean 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.

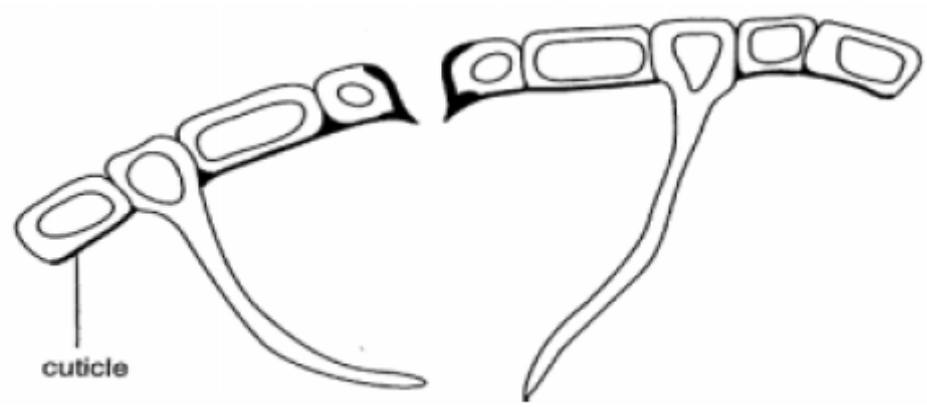


Fig. 5.2

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

Candidate style answer	*Examiner's commentary*
Plant *A* Explanation *It isn't losing much water because the little hairs trap the water and stop it from escaping from the leaf.*	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 answer has only two main ideas, so it cannot score maximum marks. The hairs are correctly identified but a common error is to state that water is being trapped. Candidates should be referring to water vapour in relation to transpiration.

Overall banding: Good

The answers to these questions indicate good basic understanding of many of the principles being tested. There are some gaps in knowledge and some misconceptions. Some marks have been lost because of carelessness in expressing ideas or not reading the questions carefully enough.