

**Advanced Subsidiary GCE  
BIOLOGY**

## F211 QP

Unit F211: Cells, Exchange and Transport

**Specimen Paper**

Candidates answer on the question paper.

Time: 1 hour

Additional Materials:

Scientific calculator

Candidate  
Name

Centre  
Number

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Candidate  
Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use a scientific calculator.
- You are advised to show all the steps in any calculations.
- The total number of marks for this paper is **60**.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	12	
2	10	
3	13	
4	13	
5	12	
<b>TOTAL</b>	<b>60</b>	

This document consists of **14** printed pages and **2** blank pages.

Answer **all** the questions.

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.

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

(ii) Outline the roles of the Golgi apparatus and the ribosomes.

Golgi apparatus .....

.....

..... [4]

Ribosomes.....

..... [2]

(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]

(c)(i) Explain the meaning of the term *tissue*.

.....  
.....  
..... [2]

(ii) Name **one** example of a plant tissue.

..... [1]

[Total: 12]

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[Turn over

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

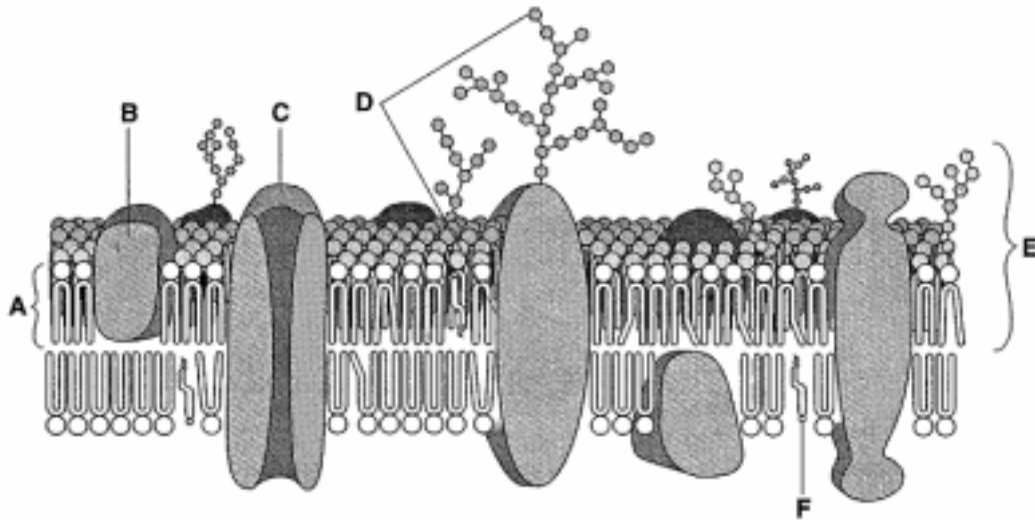


Fig. 2.1

(a) (i) Name molecules A, B and F.

In your answer you should spell the names of the molecules correctly.

A ..... [3]  
 B .....  
 F.....

(ii) E represents the width of the plasma (cell surface) membrane in a typical animal cell.

State the approximate width of the membrane.

..... [1]

(b) (i) Describe the structure of molecule A.

..... [2]  
 .....

(ii) State **one** function of molecule C.

..... [1]  
 .....

(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 **three** roles of glycoproteins in membranes.

- 1.....  
.....
- 2.....  
.....
- 3.....  
.....

[3]

[Total: 10]



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[Turn over

- 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 <b>A</b>	sphere <b>B</b>
		
diameter / cm	1	3
surface area / cm <sup>2</sup>	3.14	28.27
volume / cm <sup>3</sup>	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.

Answer = ..... [2]

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

..... [1]

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

Explain why.

.....  
 .....  
 .....  
 .....  
 ..... [2]



- (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.

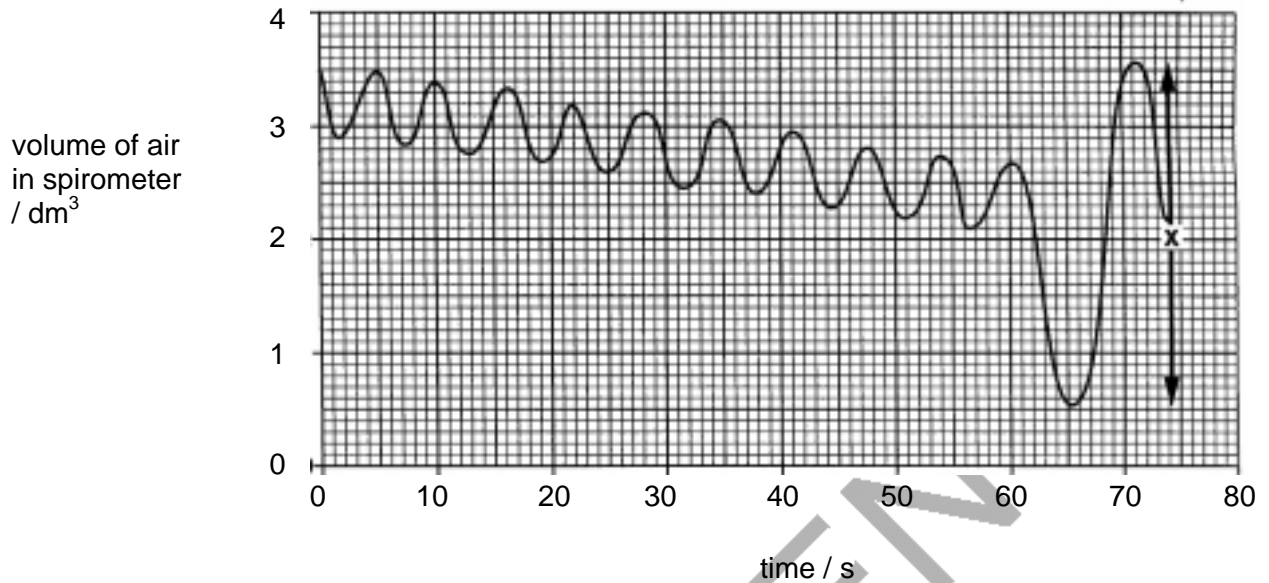


Fig 3.1

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

.....

.....

.....

..... [2]

- (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]

[Total: 13]



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

.....  
 .....  
 .....  
 ..... [2]

(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

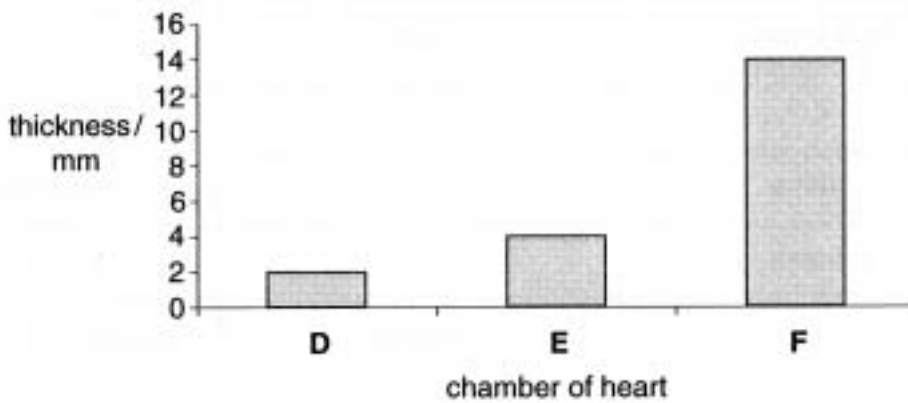


Fig. 4.1

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

D.....  
 E.....  
 F..... [3]

(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]

[Turn over

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

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 ..... in each haem group. The maximum number of molecules of oxygen that can be carried by one molecule of haemoglobin is ..... . 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 ..... . Most of the carbon dioxide produced in respiring tissues diffuses into the red blood cells where the enzyme ..... 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 ..... . The effect of this is to increase the release of oxygen from haemoglobin.

[5]

[Total: 13]

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- (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.

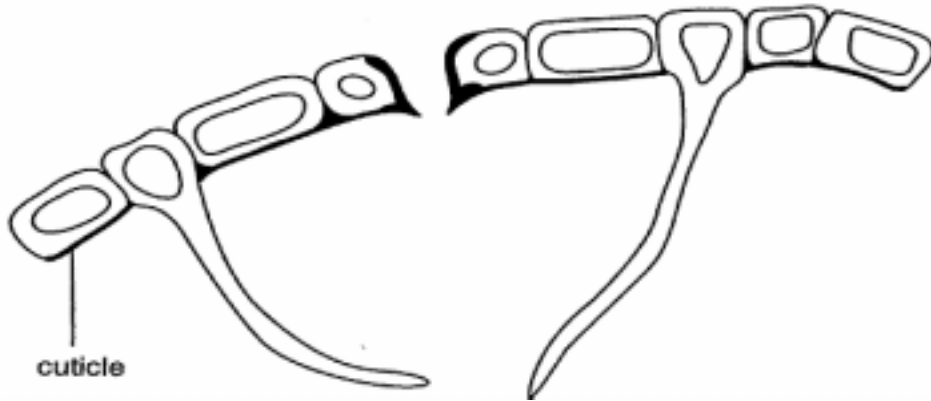


Fig. 5.2

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

Plant.....

Explanation.....

.....  
 .....  
 .....

[3]

[Total: 12]

Paper Total [60]

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The maximum mark for this paper is 60.

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Question Number	Answer			Max Mark
1(a) (i)		eukaryotic cell	prokaryotic cell	[4]
	cell wall			
	nuclear envelope		x;	
	Golgi apparatus	✓;		
	ribosomes	✓;		
flagellum		sometimes present;		
(ii)	<p><i>Golgi apparatus</i> repackage / transport, proteins; add carbohydrate group to protein; <span style="float: right;"><i>max 1</i></span></p> <p><i>ribosome</i> site of protein synthesis;</p>			[2]
(b)	<p>flagellum for movement; chromosomes / DNA, in haploid nucleus / AW, for fertilising egg cell; head / cap / acrosome, shaped for penetrating egg cell (membrane); (many) mitochondria for energy / ATP, for movement;</p>			max [3]
(c)(i)	<p>group of cells; of one or more types; <b>A</b> 'common origin' with intercellular material/connective tissue / AW; (specialised) to perform particular function(s); <b>R</b> job</p>			max [2]
(ii)	<p><i>1 mark for any suitable named tissue e.g.</i> xylem / phloem / epidermis / mesophyll / palisade / spongy mesophyll / chlorenchyma / etc./ meristem / cambium / suitable named tissue;</p> <p><b>R</b> leaf tissue / root tip / vascular tissue alone / xylem vessels / sieve tubes</p>			[1]
<b>Total</b>				<b>[12]</b>

Question Number	Answer	Max Mark
2(a)(i)	<b>A</b> phospholipid; <b>B</b> protein; <b>F</b> cholesterol;	[3]
(ii)	7nm; <b>A</b> correct conversion to other units	[1]
(b)(i)	hydrophilic / polar/AW, head; hydrophobic / non-polar / AW tail; AVP; e.g. ref. saturated and unsaturated fatty acids	max [2]
(ii)	allow, small / charged, molecules through membrane ;	[1]
(iii)	stabilises membrane structure by forming hydrogen bonds with water molecules; antigens for cell recognition; binding sites, for, chemicals/ drugs / hormones / neurotransmitters/ antibodies /T cells; receptors for cell signalling / triggers chemical reactions inside cell;	max [3]
<b>Total</b>		<b>[10]</b>

Question Number	Answer	Max Mark
3(a)(i)	<p><i>award both marks for correct answer</i></p> <p><u>3.14</u> ; 0.52</p> <p>6:1;</p>	[2]
(ii)	<p>ratio for sphere <b>B</b> is three times smaller; ora</p> <p><i>allow ecf if wrong calculation in (a) (i)</i></p>	[1]
(iii)	<p><i>any two from the following:</i></p> <p>living cells need to take in oxygen/ nutrients and remove (metabolic) waste;</p> <p>ref. passive processes / diffusion;</p> <p>rate of diffusion too slow if SA:V ratio too small;</p> <p><i>credit any five descriptions from the following:</i></p>	max [2]
(b)	<p>many alveoli to produce large surface area;</p> <p>barrier, thin / only two cells thick;</p> <p>good blood supply / many capillaries;</p> <p>to carry dissolved gases to and from the alveoli;</p> <p>ventilation / air movement to refresh the air in the alveoli;</p> <p>(contains) elastic tissue to stretch and recoil to help expel air;</p>	[5]
(c)(i)	<p>oxygen is used in respiration;</p> <p>carbon dioxide is released ( in respiration);</p> <p>carbon dioxide is absorbed (by soda lime);</p>	[2]
(ii)	vital capacity;	[1]
<b>Total</b>		<b>[13]</b>

Question Number	Answer	Max Mark
4(a)	(blood flows) twice through the heart / AW; for one circuit / cycle (of the whole body) / AW; <b>A</b> for one heart beat ref pulmonary and systemic systems / to lungs and to (rest of) body; <b>R</b> systematic	max [2]
(b) (i)	<b>D</b> right atrium <b>E</b> right ventricle <b>F</b> left ventricle	[3]
(ii)	provides more, force / pressure, to pump blood around body; longer distance compared with distance right ventricle has to pump blood; or right atrium; AVP; e.g. detail of pulmonary circulation  <i>accept letters D, E and F if used in place of names of chambers of heart</i>	max [3]
(c)	iron / Fe; four / 4; Bohr, effect / shift; carbonic anhydrase; haemoglobin acid; <b>A</b> reduced haemoglobin <b>A</b> HHb	[5]
<b>Total</b>		<b>[13]</b>

Question Number	Answer	Max Mark
5 (a)	water uptake / AW; R <i>water used</i>	[1]
(b)	<p>1 cut (healthy) shoot under water (to stop air entering xylem vessels);</p> <p>2 cut shoot at a slant (to increase surface area);</p> <p>3 check apparatus is full of water / is air bubble free / no air locks;</p> <p>4 insert shoot into apparatus under water / AW;</p> <p>5 remove potometer from water and ensure , airtight / watertight, joints around shoot;</p> <p>6 dry leaves / AW; <span style="float: right;"><i>max 4</i></span></p> <p>7 keep , condition(s) / named condition(s) , constant;</p> <p>8 allow time for shoot to acclimatise / AW;</p> <p>9 shut screw clip;</p> <p>10 keep ruler fixed and record position of air bubble on scale; R <i>'move bubble to end' ideas</i></p> <p>11 start timing and, measure / calculate, distance moved per unit time / AW; <span style="float: right;"><i>max 3</i></span></p>	max [7]
(c)(i)	103; R <i>decimals</i>	[1]
(ii)	<p>plant A</p> <p>hairs around stoma;</p> <p>trap, moisture / water vapour;</p> <p>reduces the water potential gradient;</p> <p>so transpiration rate is reduced;</p>	max [3]
<b>Total</b>		<b>[12]</b>

Paper Total [60]

## Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)(i)	4			4
1(a)(ii)	2			2
1(b)		3		3
1(c)(i)	2			2
1(c)(ii)	1			1
2(a)(i)	3			3
2(a)(ii)	1			1
2(b)(i)	2			2
2(b)(ii)	1			1
2(b)(iii)	3			3
3(a)(i)		2		2
3(a)(ii)		1		1
3(a)(iii)		2		2
3(b)	5			5
3(c)(i)		2		2
3(c)(ii)		1		1
4(a)		2		2
4(b)(i)		3		3
4(b)(ii)		3		3
4(c)		5		5
5(a)	1			1
5(b)	3		4	7
5(c)(i)		1		1
5(c)(ii)		3		3
<b>Totals</b>	<b>28</b>	<b>28</b>	<b>4</b>	<b>60</b>
<b>Targets</b>	<b>28</b>	<b>28</b>	<b>4</b>	<b>60</b>

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