OCR
RECOGNISING ACHIEVEMENT

SPECIMEN

Advanced GCE

BIOLOGY

Unit F214: Communication, Homeostasis and Energy

Specimen Paper

F214 QP

Candidates answer on the question paper.
Additional Materials:

Scientific calculator

Time: 1 hour

Candidate Name	

Centre Number						Candidate Number				

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.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- 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	**8**	
2	**9**	
3	**10**	
4	**14**	
5	**11**	
6	**8**	
TOTAL	**60**	

This document consists of **15** printed pages and **1** blank page.

Answer **all** the questions.

1 The pancreas contains endocrine tissue. Fig. 1.1 shows an electronmicrograph of a section of pancreatic endocrine tissue.

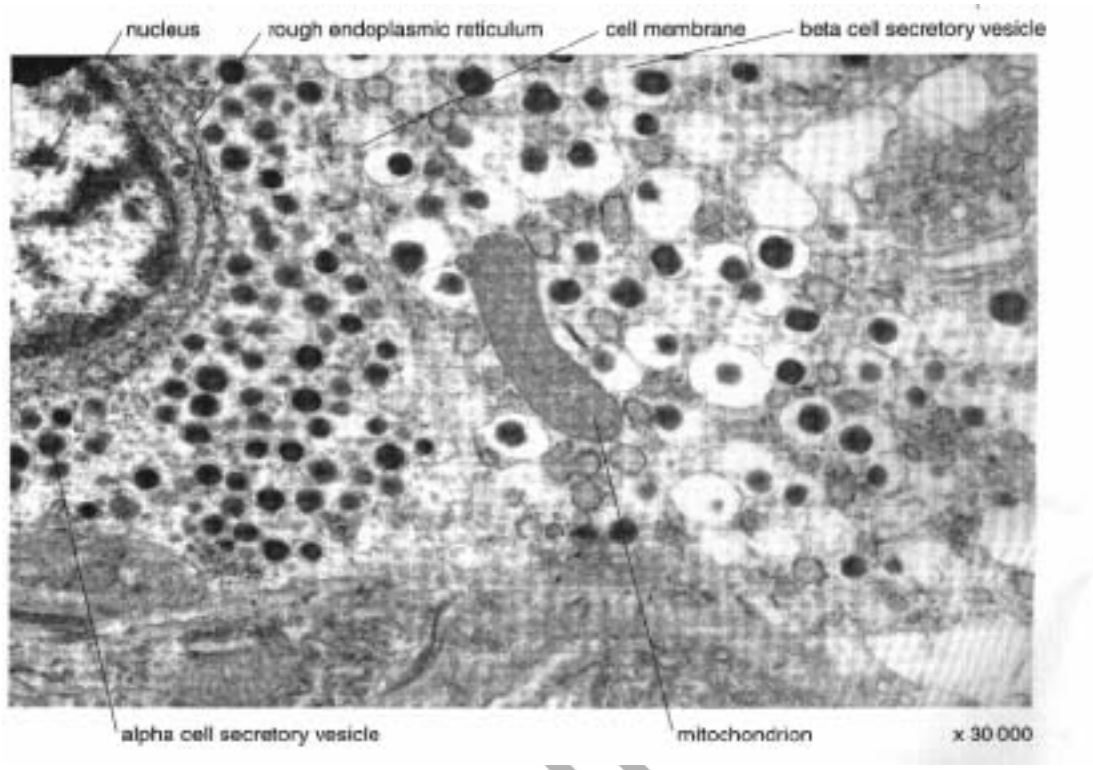

Fig. 1.1

(a) Name the endocrine tissue shown in Fig. 1.1.

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

(b) Name the hormone present in the secretory vesicles of alpha cells.

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

(c) During vigorous exercise, the blood glucose concentration falls.

Describe the changes that take place to make sure that the blood glucose concentration does not fall to a dangerous level.

In your answer, you should use appropriate technical terms, spelled correctly.

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..... **[6]**

[Total: 8]

[Turn over

2 The light-dependent stage of photosynthesis takes place on thylakoid membranes in chloroplasts. These membranes surround the thylakoid space (lumen) and are arranged into stacks known as grana. Fig. 2.1 is a diagram showing the arrangement of photosystems in the thylakoid membrane, and summarising the processes that take place there.

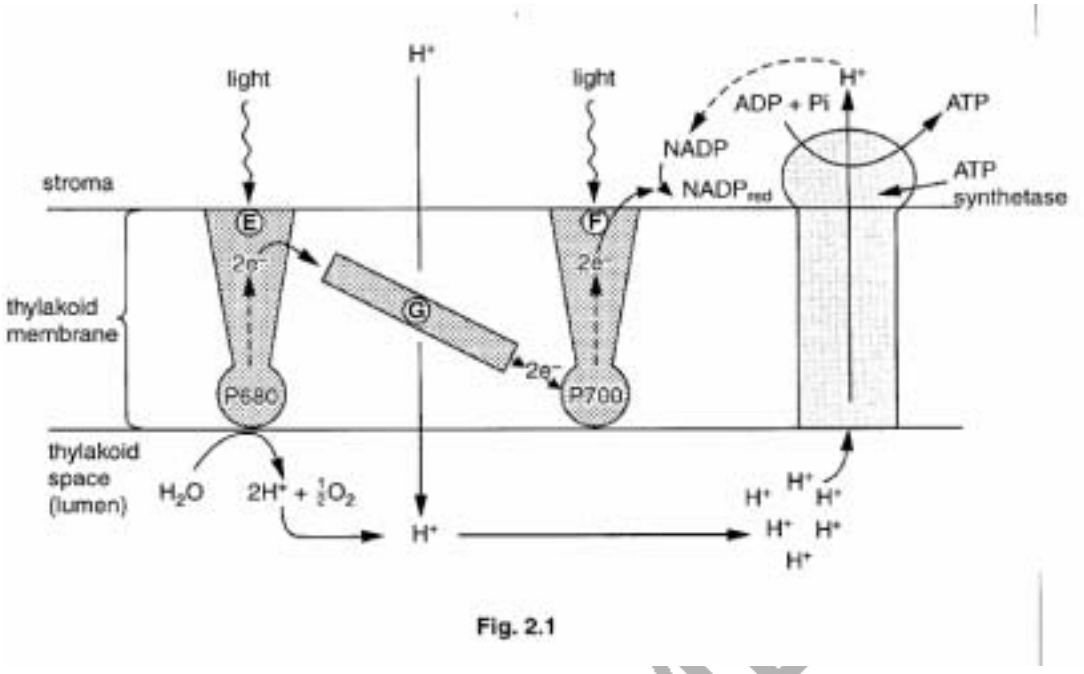

Fig. 2.1

(a) **(i)** Name the pigment represented by P680 and P700.

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

(ii) Name the **type** of molecule represented by **G**.

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

(b) Explain, **using the information in Fig. 2.1**, why the pH of the thylakoid space (lumen) is lower than that of the stroma **and** what significance this has for ATP production.

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.....**[4]**

(c) Herbicides (weedkillers) interfere with electron transport by accepting electrons.

Suggest how this causes plants to die.

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.....**[3]**

[Total: 9]

[Turn over

3 (a) Define the term *excretion*.

.....

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

(b) Table 3.1 shows the mass of different substances excreted by a volunteer during two 24 hour periods. During the first 24 hour period, the volunteer was fed a protein-deficient diet**;** during the second 24 hour period, the volunteer was fed a protein-rich diet. All other variables were kept constant.

Table 3.1

	mass of substance excreted / g	
substance excreted	protein-deficient diet	protein-rich diet
urea	2.20	14.70
uric acid	0.09	0.18
ammonium ions	0.04	0.49
creatinine	0.60	0.58

(i) Calculate the percentage increase in urea excreted when the volunteer switched from a protein-deficient to a protein-rich diet. Show your working.

Answer = ...% **[2]**

(ii) Describe how excess protein is converted into urea.

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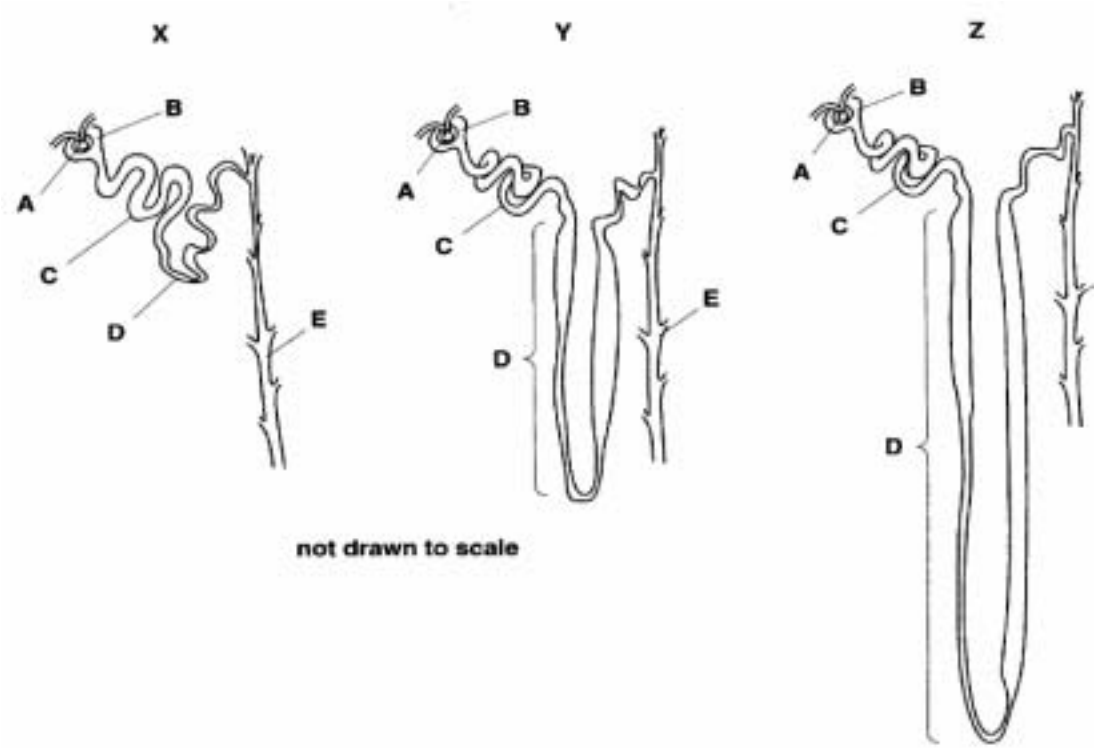
..... **[3]**

Fig. 3.1 shows diagrams of nephrons from the kidneys of three different mammals, **X**, **Y** and **Z**.



	X	Y	Z
name of mammal	beaver	house mouse	desert living gerbil
water potential of urine	high	low	very low

Fig. 3.1

(c) Explain the relationship between the length of the section D in the nephrons and the water potential of the urine each mammal produces.

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..... **[3]**

[Total: 10]

[Turn over

4 Fig. 4.1 shows the relationship between various metabolic processes in yeast

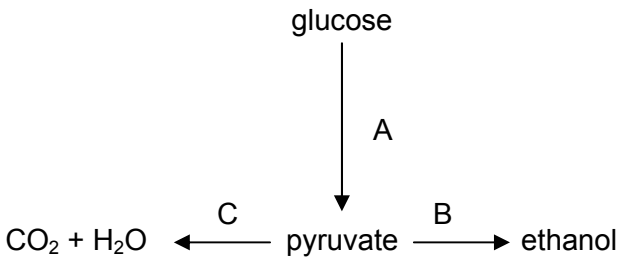

Fig. 4.1

(a) **(i)** Identify the three metabolic processes.

A .....

B .....

C ..... **[3]**

(ii) State the letter of the pathway in which acetyl coenzyme A is required.

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

(iii) State the letter of the pathway in which ATP is utilised.

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

(b) In an investigation yeast cells were homogenised (broken up) and the resulting homogenate centrifuged. Portions containing only nuclei, ribosomes, mitochondria and cytosol (residual cytoplasm) were each isolated. Samples of each portion, and of the complete homogenate, were incubated in four ways:

1 With glucose.

2 With pyruvate.

3 With glucose and cyanide.

4 With pyruvate and cyanide.

Cyanide inhibits carriers in the electron transport chain, such as cytochromes.

After incubation, the presence or absence of carbon dioxide and lactate in each sample was determined.

The results are summarised in Table 4.2.

✘ = absent ✓ = present ✓ = a little

Table 4.2

	samples of homogenate									
	complete		nuclei only		ribosomes only		mitochondria only		cytosol	
	carbon dioxide	ethanol	carbon dioxide	ethanol	carbon dioxide	ethanol	carbon dioxide	ethanol	carbon dioxide	ethanol
1 glucose	✓	✓	✘	✘	✘	✘	✘	✘	✓	✓
2 pyruvate	✓	✓	✘	✘	✘	✘	✓	✘	✓	✓
3 glucose and cyanide	✓	✓	✘	✘	✘	✘	✘	✘	✓	✓
4 pyruvate and cyanide	✓	✓	✘	✘	✘	✘	✘	✘	✓	✓

(i) Explain why more carbon dioxide is produced when the complete homogenate is incubated with just glucose or pyruvate than when cyanide is present.

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..... **[3]**

(ii) Explain why carbon dioxide is produced when mitochondria are incubated with pyruvate but **not** when incubated with glucose.

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..... **[3]**

(iii) Explain why, in the presence of cyanide, ethanol production can still occur.

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..... **[3]**

[Total: 14]

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5 (a) Fig. 5.1 is a diagram of a neurone.

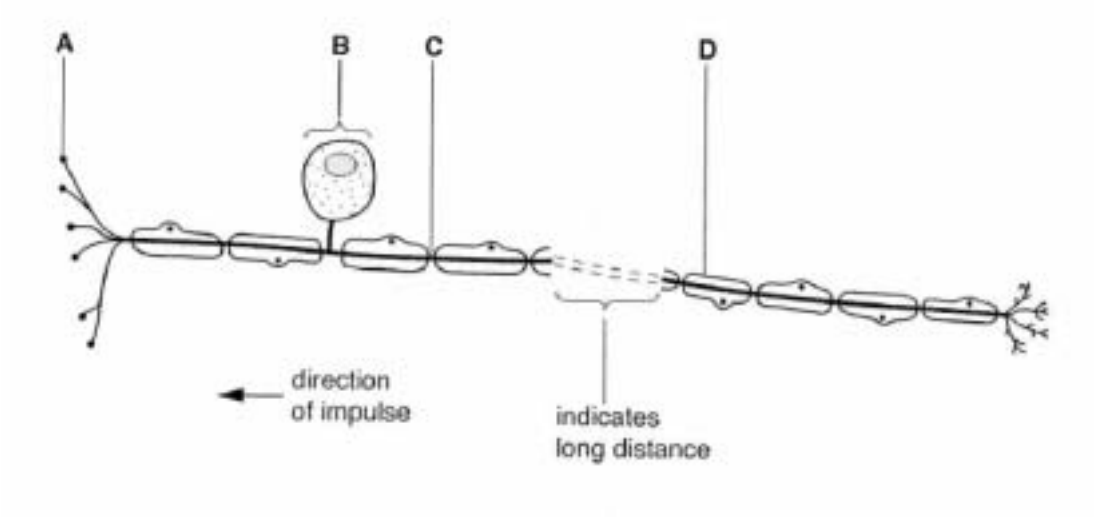

Fig. 5.1

Name the structures **A** and **B**.

A .....

B ..... **[2]**

Fig. 5.2 shows a recording of the potential difference across the membrane of an axon as an action potential is transmitted.

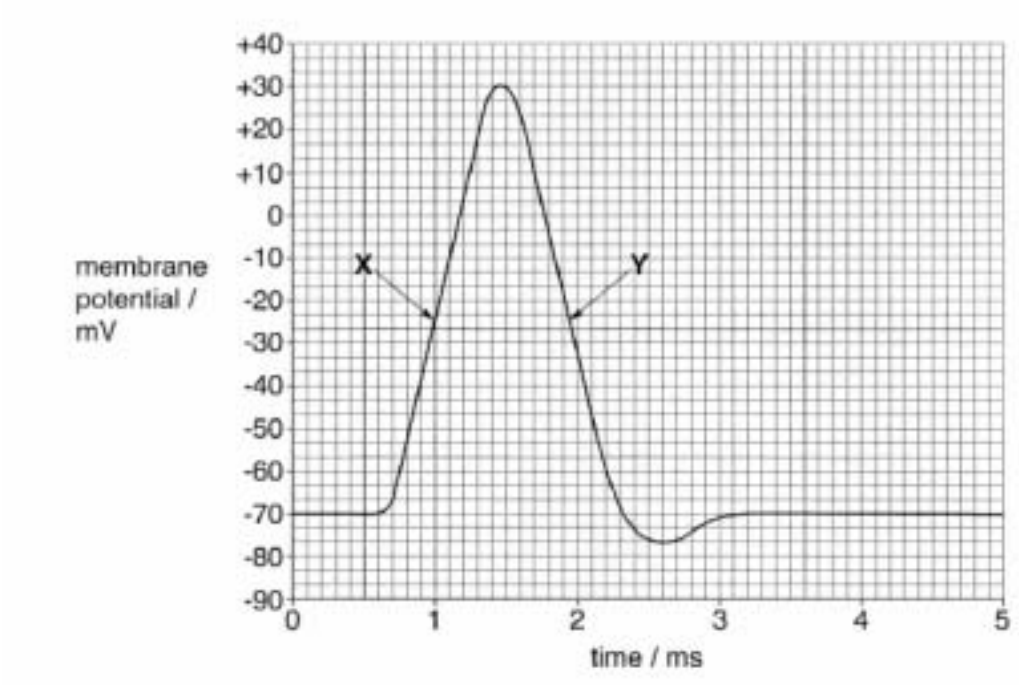

Fig. 5.2

(b) Describe the events taking place in the neurone during stages **X** and **Y**.

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..... **[4]**

Table 5.3 shows how the speed of conduction of an action potential varies with the diameter of myelinated and non-myelinated axons in different organisms.

Table 5.3

organism	type of axon	axon diameter / μm	speed of conduction / ms^{-1}
crab	non-myelinated	30	5
squid	non-myelinated	500	25
cat	myelinated	20	100
frog	myelinated	16	32

(c) Describe the effect of myelination on the rate of conduction of an action potential **and** explain how this effect is achieved.

In your answer, you should use appropriate technical terms, spelled correctly.

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..... **[5]**

[Total: 11]

[Turn over

6 (a) (i) State what is meant by the term respiratory substrate.

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

The equation below shows aerobic respiration of compound **A**.

$$C_{55}H_{100}O_6 + 77O_2 \longrightarrow 55CO_2 + 50H_2O$$

compound A

The respiratory quotient (RQ) is defined as:

$$RQ = \frac{\text{volume of } CO_2 \text{ released}}{\text{volume of } O_2 \text{ absorbed}}$$

(ii) Calculate the RQ for this reaction. Show your working.

Answer = ...**[2]**

(iii) Compound **A** is a fat.

Suggest what the RQ of a carbohydrate, such as glucose, might be.

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

(b) Fig. 6.1 is a diagram of a respirometer. A respirometer can be used to measure the oxygen uptake of living organisms.

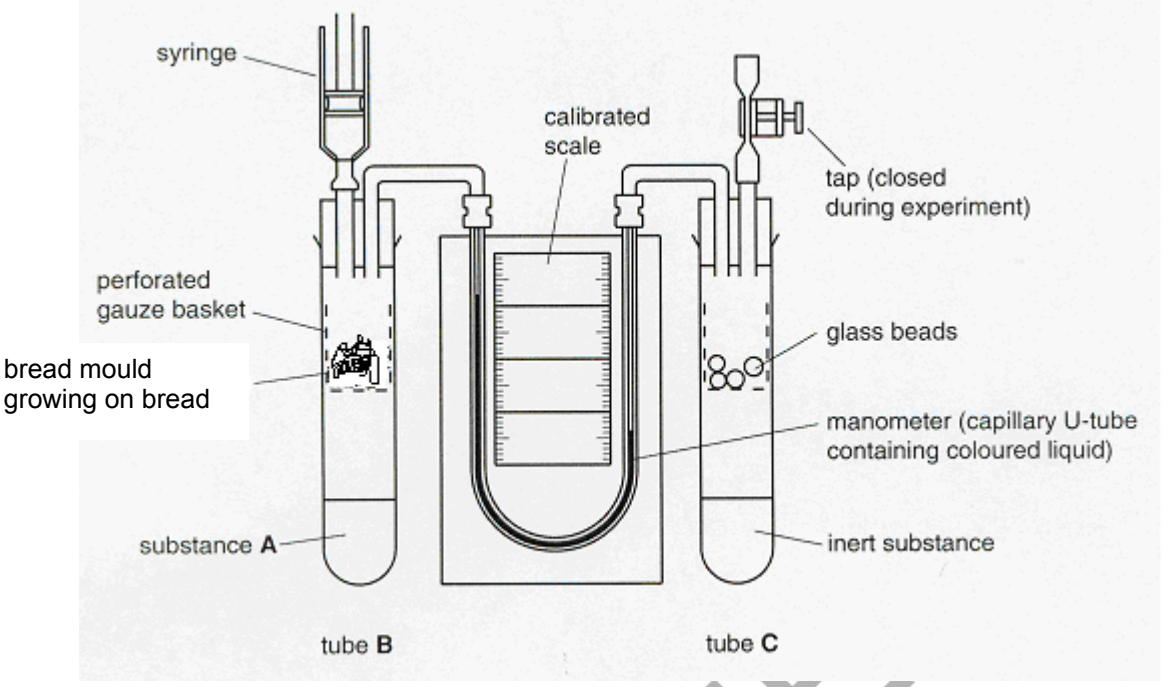

Fig. 6.1

Describe how the apparatus shown in Fig. 6.1 could be used to determine the **rate** of respiration of the bread mould, *Mucor*.

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..... **[4]**

[Total: 8]

Paper Total [60]

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

BIOLOGY F214 MS

Unit F214: Communication, Homeostasis and Energy

Specimen Mark Scheme

The maximum mark for this paper is **60**.

Question Number	Answer	Max Mark
1(a)	islets of Langerhans;	[1]
(b)	glucagon;	[1]
(c)	1 fall detected by, pancreas / islets of Langerhans / alpha cells / beta cells; 2 fall inhibits insulin, secretion / production; 3 stimulates, secretion / production, of glucagon (by alpha cells); 4 into blood; 5 binds to <u>receptor</u> on, liver cell / hepatocyte; 7 stimulates conversion of glycogen to glucose / glycogenolysis; 8 <u>gluconeogenesis</u> / detail of gluconeogenesis; 9 glucose into blood stream;	[6]
	Total	[8]
2(a) (i)	chlorophyll; treat refs to a and b as neutral	[1]
(a) (ii)	electron carrier / cytochrome / protein / electron acceptor / ferredoxin / plastoquinone;	[1]
(b)	hydrogen ions are moved into the thylakoid space by action of electron carriers; higher concentration of / more, hydrogen ions / protons reduces the pH; **R** *hydrogen, H* **A** *hydrogen ions produced in lumen* hydrogen ions, move / diffuse, down concentration gradient ; across / through, (thylakoid) membrane / from lumen to stroma; through ATP synthetase / synthase / protein channel / stalked particles; generates ATP; AVP; e.g. ref. to by <u>chemiosmosis</u> ref. to an electrochemical gradient / proton motive force	Max[4]

Question Number	Answer	Max Mark
(c)	no photophosphorylation; no ATP produced; no reduced NADP produced; no Calvin cycle / no light-independent stage; no GP to TP / no TP to RuBP; no fixation of carbon dioxide; AVP; e.g. no production of, organic molecules / named molecules **A** *autotrophic nutrition stops* **R** *food* ref to no respiratory substrate	max[3]
	Total	[9]
3(a)	removal of, unwanted / toxic / waste, products; of metabolism;	[2]
(b)(i)	*award both marks for correct answer* *evidence of 14.7 - 2.2 = 12.5 or 14.7 / 2.2 gains one calculation mark* 12.5/2.2 x 100; = 568.2 / 568 / 570;;	[2]
(ii)	protein converted to amino acids; excess amino acids undergo deamination / removal of amino group; ammonia formed; ammonia converted to urea; AVP ; e.g. ref. to <u>ornithine</u> cycle	max[3]
(c)	the longer the loop of Henle the lower the water potential (of urine); ora ions pass out from ascending limb into, medulla / tissue fluid; creating lower water potential in the medulla / AW; water reabsorbed from collecting duct in medulla ; by osmosis ; (*linked to previous marking point*) AVP; e.g. ref to countercurrent multiplier	max[3]
	Total	[10]

Question Number	Answer	Max Mark
4(a)(i)	A glycolysis; B fermentaion / anaerobic respiration / reduction of pyruvate; C aerobic respiration / Krebs cycle and oxidative phosphorylation / ETC / electron transport chain;	[3]
(ii)	C; *allow ecf from (i)*	[1]
(iii)	A; *allow ecf from (i)*	[1]
(b)(i)	(when cyanide absent) complete homogenate can fully respire the glucose/pyruvate to produce carbon dioxide ; (when cyanide is present), pyruvate does not enter the mitochondria ; some carbon dioxide produced when pyruvate is converted to ethanal ; breakdown of the glucose / pyruvate is incomplete ; ref. to anaerobic respiration ;	max[3]
(ii)	pyruvate is end product of glycolysis; pyruvate can enter mitochondria ; carbon dioxide produced in the Krebs cycle and link reaction; by, decarboxylation / decarboxylase(s); glucose cannot enter the mitochondria ; AVP ; further detail e.g. no carriers for glucose in mitochondrial membranes glycolytic enzymes not found in mitochondria portion (of homogenate) glycolytic enzymes found in, cytoplasm / cytosol	max[3]
(iii)	pyruvate is converted to ethanal in cytoplasm ; ethanal is converted to ethanol ; does not involve, cytochromoes / ETC / oxidative phosphorylation; enzymes in cytoplasm not inhibited by cyanide;	max[3]
	Total	[14]

Question Number	Answer	Max Mark
5(a)	A axon terminal / synaptic knob / synaptic bulb**;** B cell body / centron**;**	**[2]**
(b)	*at X:* sodium channels open and sodium ions move into neurone**;** potential difference rises from –70mV to30mV**;** *at Y:* potassium channels open and potassium ions move out of neurone**;** potential difference falls from 30mV to –76mV**;** AVP**;;** e.g. ref. to voltage gated channels ref to movement by diffusion / passively ref to electrochemical gradient	**[4]**
(c)	*effect:* myelinated fibres conduct more quickly than unmyelinated / AW**;** ref. to one set of comparative figures from table**;** *explanation - max 4* myelin sheath acts as (electrical) insulator**;** lack of sodium and potassium gates in myelinated region**;** depolarisation occurs at nodes of Ranvier only**;** (so) longer local circuits**;** (action potential) jumps from one node to another ***/*** saltatory conduction**;**	**[5]**
	Total	**[11]**
6(a)(i)	a biological molecule that can be broken down in respiration to release energy **;**	**[1]**
(ii)	*award both marks for correct answer* 55/77**;** 0.7 / 0.71**;**	**[2]**
(iii)	1.0 **;**	**[1]**

Question Number	Answer	Max Mark
(b)	ref. to potassium hydroxide / soda lime**;** ref. to equilibration / use syringe to set manometer fluid (level)**;** leave for suitable length of time (minimum 20 minutes) and measure distance moved by fluid**;** repeats and calculate mean**;** calculate volume of oxygen taken up per minute**;** AVP**;** e.g. ref to set-up of control tube (e.g. same mass of beads as of fungus) or (same volume of inert substance as substance A) detail of how to calculate volume of oxygen (by multiplying distance moved by fluid in capillary by 2πr)	**max[4]**
	Total	**[8]**
	Paper Total	**[60]**

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)		1		**1**
1(b)	1			**1**
1(c)	6			**6**
2(a)(i)		1		**1**
2(a)(ii)		1		**1**
2(b)	1	3		**4**
2(c)		3		**3**
3(a)	2			**2**
3(b)(i)		2		**2**
3(b)(ii)	3			**3**
3(c)		3		**3**
4(a)(i)		3		**3**
4(a)(ii)		1		**1**
4(a)(iii)		1		**1**
4(b)(i)		3		**3**
4(b)(ii)		3		**3**
4(b)(iii)		3		**3**
5(a)	2			**2**
5(b)	1	3		**4**
5(c)	3	2		**5**
6(a)(i)	1			**1**
6(a)(ii)		2		**2**
6(a)(iii)		1		**1**
6(b)			4	**4**
Totals	**20**	**36**	**4**	**60**
Targets	**20**	**36**	**4**	**60**

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