SPECIMEN

Advanced Subsidiary GCE

Applied Science

Cells and Molecules

Specimen Paper

G623

Time: 45 minutes

Candidates answer on the question paper.

Additional materials: None

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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.
- Answer **all** the questions.
- Do not write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets **[ ]** at the end of each question or part question.
- The total number if marks for this paper is **45**.
- You are advised to show all the steps in any calculations.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- This document consists of **8** pages. Any blank pages are indicated.

FOR EXAMINER'S USE	
1	
2	
3	
TOTAL	

  [Turn over

Answer **all** questions.

1 A student prepared this test on microscopy and cell structure for others in his group.

(a) Complete Table 1.1 using the most appropriate word, words or numbers.

Table 1.1

feature	student microscope	electron microscope
beam	light	
type of lens		
state of specimen	dead or alive	
maximum magnification		500 000
approximate resolution /nm		

[7]

(b) Explain the role (function) of the following cellular organelles.

(i) endoplasmic reticulum.....

.....

(ii) mitochondrion.....

.....

(iii) ribosomes.....

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

Total [13]

2 Technicians who work in medical laboratories in hospitals often need to look at blood smears.

Fig. 2.1 is a photomicrograph of blood cells.

Normal red cells are, on average, 7.2 µm in diameter.

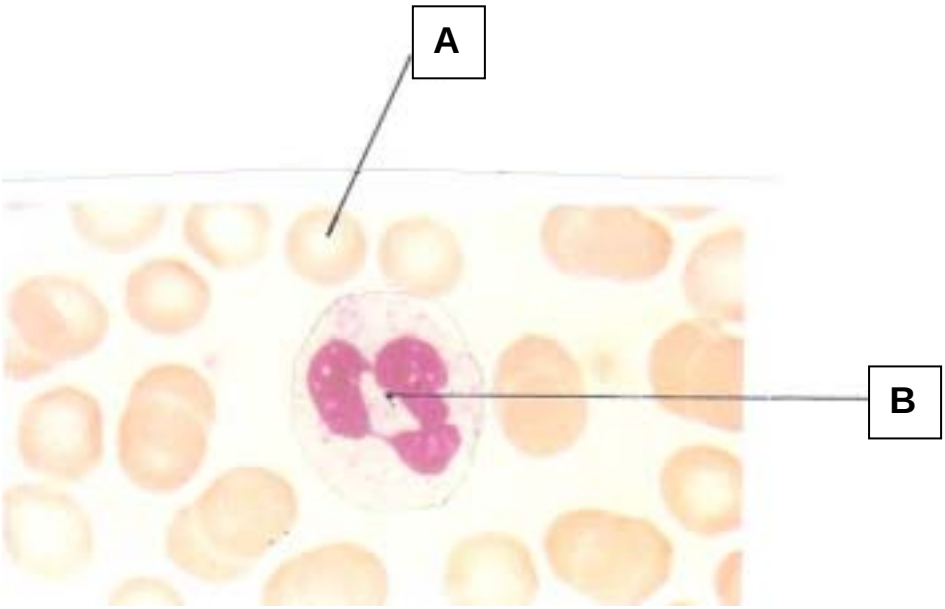

Fig. 2.1

(a) Explain the reason for the pale central area of cell **A**.

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

(b) Name cell **B** as fully as you can.

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

(c) If cell **A** is a normal, average cell with a diameter of 7.2 µm, use Fig. 2.1 to calculate the **maximum** dimension of cell **B**.

Show your working.

maximum dimension = ... µm **[3]**

(d) Technicians in laboratories may use a special slide called a haemocytometer.

(i) State what it is used for.

.....

.....

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

(ii) Describe the features of the haemocytometer which allow a technician to do this.

.....

.....

.....

.....

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

(e) A technician examined blood smears taken from two patients.

Patient **X**. Blood smear showed fewer cells of type **A**.

Patient **Y**. Blood smear contained a much higher number of cells of type **B**.

(i) Suggest **one** medical condition that could account for **each** patient's results.

Patient **X** ..... **[1]**

Patient **Y** ..... **[1]**

(ii) Use your scientific knowledge to explain your suggestion for patient **Y**.

.....

.....

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

Total [14]

3 Cystic fibrosis (CF) is caused by mutations in the gene coding for CFTR (cystic fibrosis transmembrane regulator). CFTR is a channel that permits passive chloride movement across the apical membrane of some epithelial cells.

The normal gene product is a 1480-amino acid integral (intrinsic) membrane protein. Mutations can affect the CFTR protein either quantitatively, qualitatively, or both.

The disease affects cells which produce mucus. They produce mucus that is abnormally thick and sticky. In particular, the epthelia of the respiratory tract, pancreatic ducts and the intestine are affected.

CF is a complex multisystem disease. Congestion of the lungs and blockages of the pancreatic duct and gut are common symptoms.

CF is inherited as a recessive gene.

(a) Explain, giving examples, why CF is described as a multisystem disease.

.....

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

(b) Describe the consequences of congestion of the lungs and blockage of the pancreatic duct to someone with CF.

congestion of the lungs

.....

.....

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

blockage of the pancreatic duct

.....

.....

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

(c) Using knowledge of DNA explain what is meant by the following terms: *mutation*, *coding* and *recessive*.

mutation

.....

.....

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

coding

.....

.....

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

recessive

.....

.....

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

(d) Use the fluid mosaic model to explain why CFTR is described as an integral (intrinsic) membrane protein.

.....

.....

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

(e) Discuss the moral and ethical implications of diagnostic testing for genetic disorders.

.....

.....

.....

.....

.....

.....

.....

.....

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

Total [18]

Paper Total [45]

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OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

APPLIED SCIENCE G623

Cells and Molecules

Specimen Mark Scheme

The maximum mark for this paper is **45**.

<table>
<tr><th>Question Number</th><th>Answer</th><th>Max Mark</th></tr>
<tr><td>1(a)</td><td>A student prepared this test on microscopy and cell structure for others in his group.
Complete Table 1.1 using the most appropriate word, words or numbers.
<table>
<tr><td><u>feature</u></td><td><u>student microscope</u></td><td><u>electron microscope</u></td></tr>
<tr><td>beam</td><td>light</td><td>electron (beam)</td></tr>
<tr><td>type of lens</td><td>glass</td><td>electromagnets / magnetic field</td></tr>
<tr><td>specimen</td><td>dead or alive</td><td>dead</td></tr>
<tr><td>max mag</td><td>answer in range 100 - 400</td><td>500 000</td></tr>
<tr><td>approx resolution</td><td>(lower)/ 200 nm</td><td>(higher)/ 0.5 nm</td></tr>
</table></td><td>[7]</td></tr>
<tr><td>1(b)</td><td>Explain the role (function) of the following cellular organelles.</td><td></td></tr>
<tr><td>1(b)(i)</td><td>endoplasmic reticulum
two from:
carries ribosomes;
transports protein;
makes Golgi;
makes lipids / steroids;</td><td>[2]</td></tr>
<tr><td>1(b)(ii)</td><td>mitochondrion
aerobic respiration / Kreb’s cycle / oxidative phosphorylation;
makes A.T.P;</td><td>[2]</td></tr>
<tr><td>1(b)(iii)</td><td>ribosomes
two from:
have enzymes (peptidyle transferase) to link the peptide chain;
make protein;
translation (of protein);</td><td>[2]</td></tr>
</table>

Question Number	Answer	Max Mark
2(a)	**Technicians who work in medical laboratories in hospitals often need to look at blood smears.** **Fig 2.1 is a photomicrograph of blood cells.** **Normal red cells are, on average, 7.2 µm in diameter.** **Explain the reason for the pale central area of cell A.** **A** is a concave disc / thinner (in central area) / lacks a nucleus;	**[1]**
2(b)	**Name cell B as fully as you can.** phagocytic; white blood cell / leucocyte; neutrophil = 2 marks ;;	**[2]**
2(c)	**If cell A is a normal, average cell with a diameter of 7.2 µm, use Fig 2.1 to calculate the maximum dimension of cell B.** **Show your working.** correct measurements A = 10 mm / 1 cm and B = 30 mm / 3 cm; link to 7.2 µm; calculation max dimension 21 / 22 ;	**[3]**
2(d)	**Technicians in laboratories may use a special slide called a haemocytometer.** **State what it is used for.** **Describe the features of the haemocytometer which allow a technician to do this.** two from: used for: counting cells; in set volume; two from: features of haemocytometer: grid / sets of lines; defined area/volume; marked surface of slide exactly 0.1 mm deep/volume 0.00025 mm^3;	**[2]** **[2]**
2(e)(i)	**A technician examined blood smears taken from two patients.** **Patient X. Blood smear showed fewer cells of type A.** **Patient Y. Blood smear contained a much higher number of cells of type B.** **Suggest one medical condition that could account for each patient's results** Patient X anaemia; Patient Y bacterial infection/ inflammation/ carcinoma/ lymphoma/ melanoma/ surgery/ burns/ leukaemia/ gout/ diabetic/ketoacidosis;	**[1]** **[1]**

Question Number	Answer	Max Mark
2(e)(ii)	**Use your scientific knowledge to explain your suggestion for patient Y.** phagocytic cells 'feed on'/ingest bacterial cells or dead tissues (with phagocytic to be spelled correctly) ; large numbers of bacterial cells and or dead cells present during or after infection (or another of the conditions listed in i);	**[2]**
3(a)	**Cystic fibrosis (CF) is caused by mutations in the gene coding for CFTR (cystic fibrosis transmembrane regulator). CFTR is a channel that permits passive chloride movement across the apical membrane of some epithelial cells.** **The normal gene product is a 1480-amino acid integral (intrinsic) membrane protein. Mutations can affect the CFTR protein either quantitatively, qualitatively, or both.** **The disease affects cells which produce mucus. They produce mucus that is abnormally thick and sticky. In particular, the epthelia of the respiratory tract, pancreatic ducts and the intestine are affected.** **CF is a complex multisystem disease. Congestion of the lungs and blockages of the pancreatic duct and gut are common symptoms.** **CF is inherited as a recessive gene.** **Explain, giving examples, why CF is described as a multisystem disease.** two from: because it affects more than one organ / part of the body; respiratory system / lungs; digestive system / gut / pancreatic duct / intestine / pancreas; reproductive system;	**[2]**
3(b)	**Describe the consequences of congestion of the lungs and blockage of the pancreatic duct to someone with CF.** **congestion of the lungs** three from: mucus blocks airways preventing movement of air; gas exchange impaired; (cellular) respiration impaired; breathing problems / physically difficult / persistent coughing / wheezing / asthma-like symptoms; need for regular physiotherapy / drug treatment; increased risk of lung infection; unable to take part in sports activities etc;	**[3]**

Question Number	Answer	Max Mark
3(b) cont'd	**blockage of the pancreatic duct** two from: prevents release of pancreatic juice / named pancreatic enzymes; digestion of food impaired; damage to pancreas; poor absorption; gut blockage; nutritional deficiency; symptoms similar to diabetes; poor growth; prevents neutralisation of stomach acids;	**[2]**
3(c)	**Using knowledge of DNA explain what is meant by the following terms: *mutation*, *coding* and *recessive*.** *mutation* change in the DNA / change in genetic code / abnormal gene;	**[1]**
	coding two from: base / nucleotide sequence / order; specific order; 3 DNA bases for each amino acid; codon; named bases; coding bases equivalent to gene;	**[2]**
	recessive expressed only when homozygous / expression prevented by dominant allele / owtte;	**[1]**
3(d)	**Use the fluid mosaic model to explain why CFTR is described as an integral (intrinsic) membrane protein.** two from: proteins may occur at surface of membranes or within membranes; CFTR functions as an ion channel; within the membrane; crossing the membrane/bridges the lipid bi-layer;	**[2]**

Question Number	Answer	Max Mark
3(e) 	**Discuss the moral and ethical implications of diagnostic testing for genetic disorders.** **Band mark range:** **[5 marks]** Candidate shows a high level of understanding and presents a well founded, coherent discussion. They form a judgement, with justification, as to whether, after considering the moral and ethical implications, diagnostic testing for genetic disorders should be carried out. There are few, if any, errors in spelling, punctuation and grammar. **[3-4 marks]** Candidate demonstrates an understanding of the moral and ethical implications clearly discussing their judgement but omitting relevant points of justification. There may be occasional errors in spelling, punctuation and grammar. **[1-2 marks]** Candidate shows little understanding of the moral and ethical implications with minimal justification of any judgements. Errors of grammar punctuation and spelling may be intrusive. **[0 mark]:** no response/response not worthy of credit. **Expected knowledge and understanding could include the following valid points:** possibility of error arising during testing; human rights issues including employment; insurance; mortgage facilities; whether or not to pursue elective abortion; how serious a defect has to be before selective abortion might be considered; cost-effectiveness of screening / OWTTE; if incurable / terminal do you want to know; other members of the family involved – do you tell them; do you embark on a pregnancy;	**[5]**
	Paper Total	**[45]**

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)	7	-	-	**7**
1(b)(i)	2	-	-	**2**
1(b)(ii)	2	-	-	**2**
1(b)(iii)	2	-	-	**2**
2(a)	-	1	-	**1**
2(b)	2	-	-	**2**
2(c)	-	3	-	**3**
2(d)(i)	2	-	-	**2**
2(d)(ii)	-	2	-	**2**
2(e)(i)	-	2	-	**2**
2(e)(ii)	-	2	-	**2**
3(a)	-	2	-	**2**
3(b)(i)	-	3	-	**3**
3(b)(ii)	-	2	-	**2**
3(c)(i)	-	1	-	**1**
3(c)(ii)	-	2	-	**2**
3(c)(iii)	-	1	-	**1**
3(d)	-	2	-	**2**
3(e)	-	5	-	**5**
Totals	**17**	**28**	**0**	**45**

Planning Exercise Mark Scheme

Investigation to determine the relative sugar content of Merlot and Syrah grapes.

Marking of the plan:
1 Read the material presented.
2 Then *award 1 mark* if *scientific terminology* has been used appropriately. Record using the letter Y.
3 Then re-read, this time point marking up to 24, by placing letters A to X in the margin where you see evidence of the marking criteria.
4 The same piece of evidence can be used to award one criterion only.

Marking Point	Marking Criteria	Mark	Additional notes
A	easily recognised safety procedures highlighted;	1	Evidence of something that is going to make doing the investigation sa active document, a working doc related to the plan.
B	prediction made;	1	Prediction related to task.
C	with justification;	1	Use evidence
D	description of preliminary work;	1	At least one from:
E	clear and in detail;	1	Explain how to do it.
F	reason (for doing it) explained;	1	Explain why it's necessary for c of the whole investigation.
G	clear and in detail;	1	Extra information/suitable extension.
H	at least two secondary sources of information identified;	1	State at least 2 references. Full website address needed. Full description of named text (Title, Author, Publisher.)
I	relevance explained;	1	Brief explanation as to how references helped in the planning.
J	basic practical skills and accuracy;	1	Simple method / list of instructions. Basic. 'Is it a feasible approach?'
K	sound practical skills and accuracy; (may also look for evidence of 'P' here)	1	Could someone follow the instructions unaided? Are quantities shown? Is it repeatable to appropriate degree of accuracy?

Preliminary work here

how to prepare tissue; mass of tissue to use; dilution factors, how to set up dilution series; range of dilution to consider; colour standards; investigation of

Main investigation starts here

L	range of appropriate equipment listed;	1	List of names of main items of equipment and materials needed for the investigation. Generic terms: beakers, flasks etc are OK here.
M	full range of appropriate equipment listed;	1	Qualifications noted. Indication of number of each, sp sizes, e.g. 250 cm^3 beaker, 1dm any major item is missing do no
N	appropriate number of measurements stated;	1	Mentions replicates / repeats
O	need for range of measurements stated;	1	Statement: e.g.to enable compa
P	appropriate range stated;	1	Related to prediction made.
Q	relevant variables are identified (stated); controlled variables	1	At least 2 from:
R	how variables to be controlled explained;	1	Explanation for at least 2 of the
S	one suitable method to display data;	1	One display of results e.g. Table appropriately labelled column headings
T	additional method to display data;	1	Any <u>different</u> display e.g. graph.
U	simple data handling;	1	mean / use of graph data
V	possible conclusions;	1	Statements of expectations or obs to confirm or reject prediction mad 'What would the results need to show confirm or reject the prediction?'
W	recognises sources of error;	1	At least two specific examples: equipment / materials / human er
X	suggests methods for improving accuracy and or validity;	1	Accuracy: relate to '**W**' or use of alternative technique(s). AND / OR Validity: state aspect of collected data to be compared with secondary sources.
Marks	Maximum for plan = 25	24 + *1 (scientific terminology)*	

VARIABLES: age of tissue; mass of tissue; volume of juice; temperature used for test; volume of Benedict's or equivalent reagent; concentration of reagents used;

Accuracy: precision of water bath

Validity: comparison with secondary source

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