UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY **9700/13**

Paper 1 Multiple Choice **May/June 2011**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

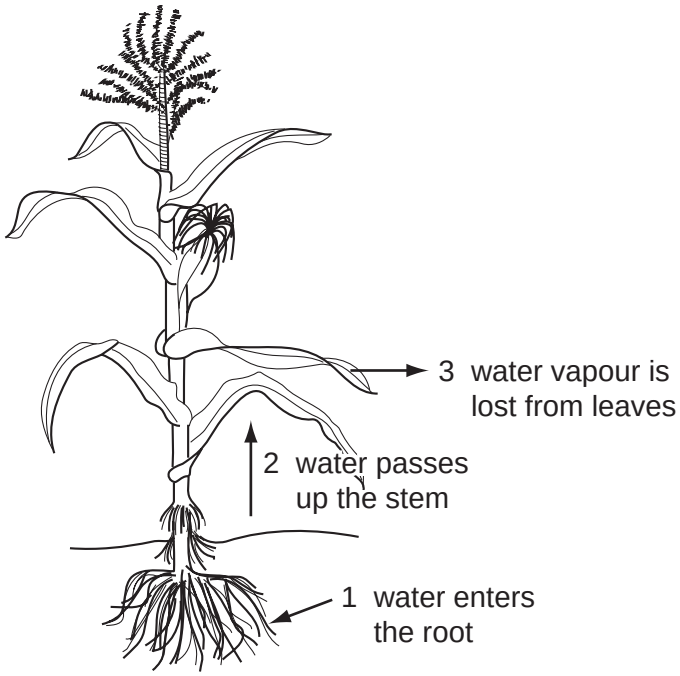
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

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

1 The diagram represents the movement of water through a plant.



Which row identifies the processes involved during the stages of water movement shown?

	cohesion and adhesion	transpiration	osmosis
A	1	2	3
B	1	3	2
C	2	1	3
D	2	3	1

2 Which xerophytic adaptations reduce the water potential gradient?

1 rolled leaves

2 hairy leaves

3 sunken stomata

4 fewer stomata

5 fleshy leaves

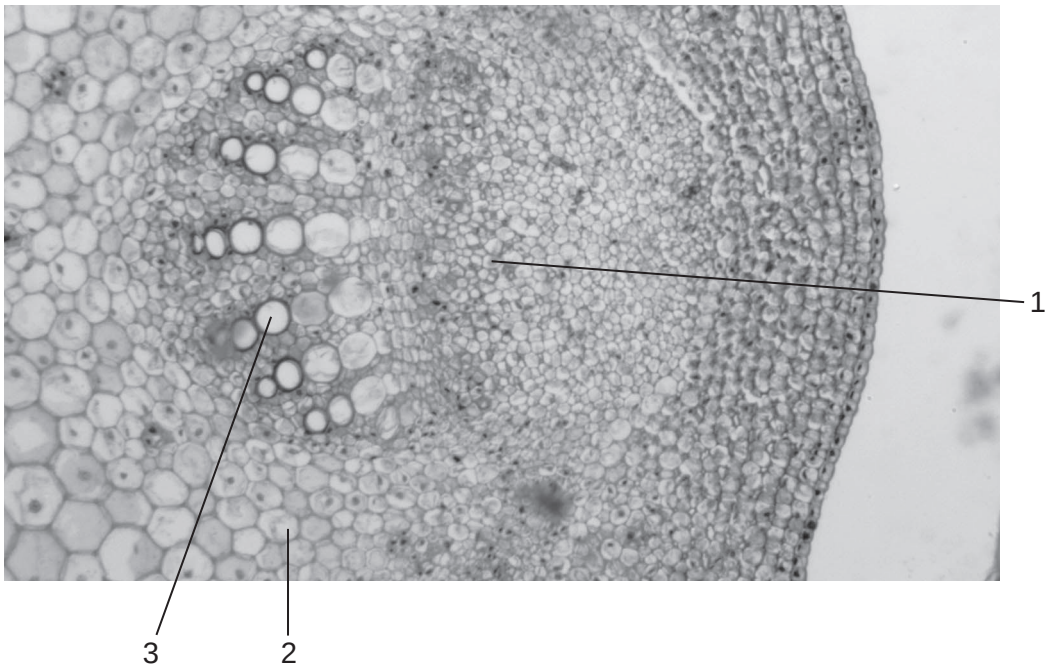
A 1, 2, 3, 4 and 5

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2, 4 and 5 only

3 The photomicrograph shows a vascular bundle.



Which describes the relationship of water potential in the labelled cells?

A cell 3 less negative than cell 1

B cell 2 less negative than cell 3

C cell 3 more negative than cells 1 and 2

D cells 1, 2 and 3 have the same water potential

4 Which row correctly identifies the structure of an artery compared with a vein seen in transverse section under a light microscope?

	outer wall of artery	layer of muscles and elastic fibres	diameter of the lumen (hollow space)
A	thicker	thicker	narrower
B	thicker	thinner	wider
C	thinner	thicker	narrower
D	thinner	thinner	wider

[Turn over

5 Which row correctly describes the events during the cardiac cycle?

	nerve impulses from atrio-ventricular node (AVN) to	nerve impulses from Purkyne tissue (PT) to	nerve impulses from sino-atrial node (SAN) to
A	SAN	the ventricles	AVN
B	PT	the atria	PT
C	PT	the ventricles	AVN
D	SAN	the atria	PT

6 What happens during ventricular diastole?

A All semilunar valves open.

B The atrio-ventricular valves open.

C The pressure in the atria rises above the pressure in the ventricles.

D The pressure in the left atrium rises more than the pressure in the right atrium.

7 What is correct for tissue fluid?

	phagocytes	platelets	protein concentration compared to blood plasma
A	✓	✓	higher
B	✗	✗	higher
C	✓	✗	lower
D	✗	✓	lower

key
✓ = present
✗ = absent

8 Which structures are present in a typical plant cell?

	centrioles	cilia	mitochondria	vacuole
A	✓	✓	✗	✗
B	✓	✗	✗	✓
C	✗	✓	✓	✗
D	✗	✗	✓	✓

key
✓ = present
✗ = absent

9 A cell organelle measures 4×10^{-1} mm in diameter.

What is the diameter in μm?

A 4×10^{1} μm **B** 4×10^{2} μm **C** 4×10^{3} μm **D** 4×10^{4} μm

10 Plant cells are stained and then viewed through a light microscope.

Which structures would be clearly visible at a magnification of ×400?

A chloroplast grana

B lysosomes

C nucleoli

D ribosomes

11 In the following table, which is the correct comparison between light and electron microscopes?

	light microscope		electron microscope	
	resolution	magnification	resolution	magnification
A	high	high	low	low
B	high	low	low	high
C	low	high	high	low
D	low	low	high	high

12 What supports the view that a membrane protein is involved in active transport?

A It allows movement of molecules across a membrane if concentration differences exist.

B It can only function if mitochondria are supplied with sufficient oxygen.

C It has a tertiary structure with a binding site with a specific shape.

D It is found in the cell surface membranes and the mitochondrial membranes.

13 What is correct for the cell surface membrane and membranes within cells?

A Both allow intracellular transport.

B Both are stabilised by glycoproteins.

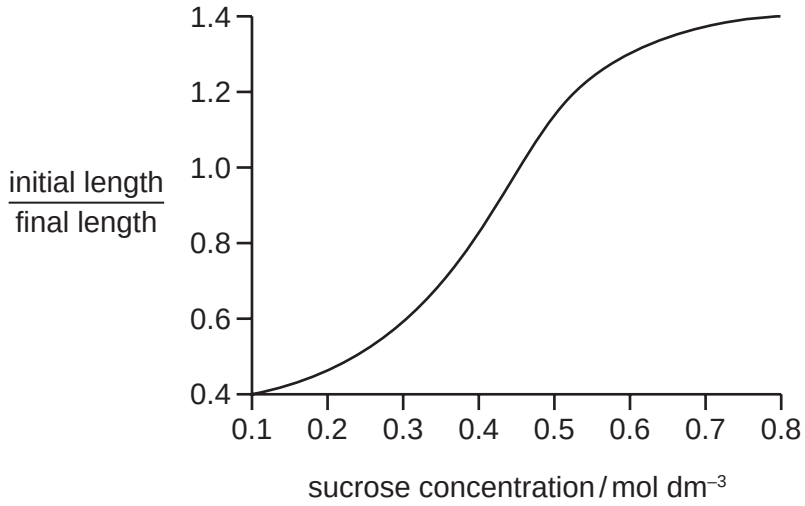
C Both have sites for enzyme attachment.

D Both protect cells from the contents of lysosomes.

[Turn over

14 Strips of plant tissue were immersed in a range of sucrose solutions of different concentrations. Their lengths were measured before immersion and after 30 minutes.

The graph shows the ratio of initial length to final length.



What is a correct description of the change in the cells and in their water potential as the sucrose concentration increases?

	change in the cells	change in the water potential
A	less turgid	more negative
B	less turgid	less negative
C	more turgid	less negative
D	more turgid	more negative

15 Which type of cell will contain the highest proportion of single membrane-bound structures?

A ciliated epithelial cell

B goblet cell

C red blood cell

D smooth muscle cell

16 A person suffering from mild emphysema stopped smoking cigarettes.

Why would this person's health improve?

A goblet cells secrete more mucus, allowing a greater number of pathogens to be trapped

B increased numbers of phagocytic macrophages arrive in the lungs

C less atheroma build-up on the inner lining of arteries, increasing lumen diameter

D less carboxyhaemoglobin produced, increasing oxygen transport by haemoglobin

17 A student was asked to describe the differences between four microscope slides of sections taken from different parts of the gas exchange system.

slide 1 not present: cartilage, glands
present: few goblet cells, ciliated epithelial cells, smooth muscle

slide 2 present: incomplete cartilage rings, glands, goblet cells, ciliated epithelial cells, smooth muscle

slide 3 not present: cartilage, glands, goblet cells, smooth muscle
present: squamous epithelial cells

slide 4 present: plates of cartilage, glands, goblet cells, ciliated epithelial cells, smooth muscle

Which is the correct identification of the parts of the gas exchange system?

	slide 1	slide 2	slide 3	slide 4
A	alveolus	bronchiole	bronchus	trachea
B	bronchiole	bronchus	alveolus	trachea
C	bronchiole	trachea	alveolus	bronchus
D	bronchus	trachea	bronchiole	alveolus

18 In the lungs, oxygen and carbon dioxide pass through cell membranes by diffusion.

Which row is correct?

	number of cell membranes diffused through by	
	oxygen from air	carbon dioxide to air
A	3	2
B	3	2 or 3
C	5	4
D	5	4 or 5

19 Which process does **not** involve making nitrogen available to plants?

A ammonification

B denitrification

C nitrification

D nitrogen fixation

20 A square metre of grassland receives about 1 047 000 kJ of solar light energy each year.

The table shows what happens to this energy.

	kJ
used in evaporation of water	523 500
transmitted to the ground	335 000
reflected by the leaves	165 000
used for growth	21 500
used for other life processes	1 500
respiratory heat losses	500

How much energy is used by the grass in photosynthesis?

A 2000 kJ **B** 19 500 kJ **C** 21 500 kJ **D** 23 500 kJ

21 During transpiration, what is the site of evaporation of water in the leaves?

A air spaces

B guard cell walls

C mesophyll cell walls

D stomata

22 Some inhibitors of enzyme reactions bind to the enzyme / substrate complex.

Which statements about this type of inhibition are correct?

1 The active site changes shape.

2 The inhibitor is non-competitive.

3 The initial rate of reaction is reduced.

4 The maximum rate of reaction (V_{max}) is increased.

A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 2, 3 and 4 only

23 Which levels of protein structure can determine the specificity of an enzyme?

1 primary

2 secondary

3 tertiary

4 quaternary

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 3 and 4 only

24 The breakdown of hydrogen peroxide to water and oxygen is catalysed by the enzyme catalase.

In an investigation into the effect of pH on the rate of reaction of catalase, potato cubes were added to hydrogen peroxide.

Which dependent variable should be recorded?

A the change in mass of the potato after a given time

B the pH of the solution at regular time intervals

C the number of potato cubes added at the start

D the volume of oxygen given off at regular time intervals

25 Which type of sugar and types of bonds are found in a DNA molecule?

	type of sugar	types of bonds
A	non-reducing	hydrogen and ionic
B	non-reducing	hydrogen and peptide
C	reducing	covalent and hydrogen
D	reducing	hydrogen and peptide

26 Which process occurs during prophase of the mitotic cell cycle in an animal cell?

A division of centromeres

B formation of chromosomes

C replication of DNA

D separation of centrioles

[Turn over

27 Which is always true of cytokinesis?

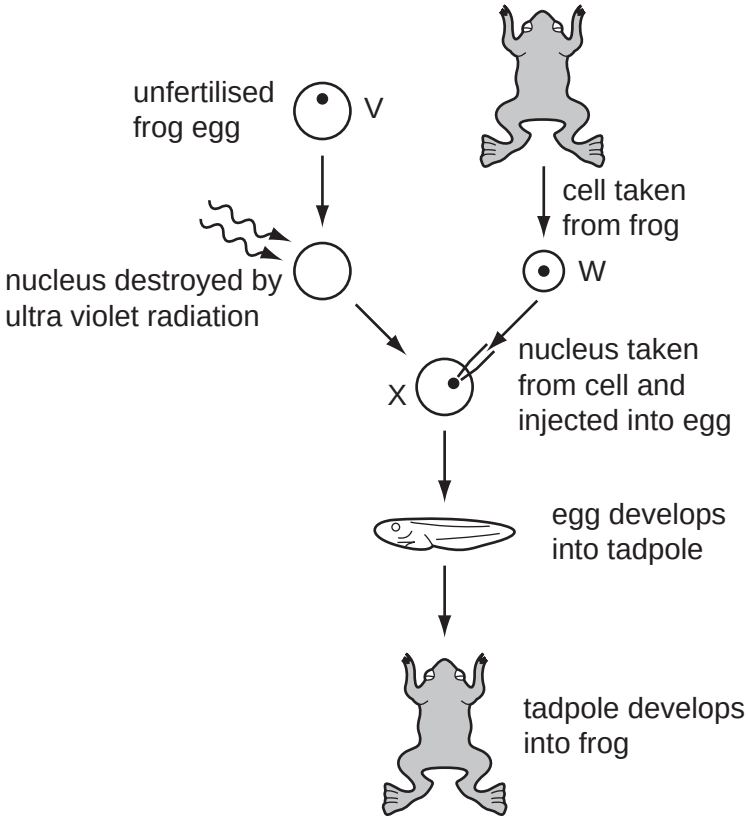
1 Cell organelles replicate.

2 Cell organelles are divided between two cells.

3 Nuclear envelope reforms.

A 1, 2 and 3 **B** 1 and 3 only **C** 2 only **D** 3 only

28 The diagram shows how genetically identical frogs can be developed from unfertilised frog eggs. The diploid number (2n) for frogs is 26.



Which combination of numbers correctly identifies the number of chromosomes in each of the types of cell in the diagram?

	V	W	X
A	13	13	26
B	13	26	13
C	13	26	26
D	26	26	13

29 The following events occur during transcription.

1 Bonds break between complementary bases.

2 Bonds form between complementary bases.

3 Sugar-phosphate bonds form.

4 Free nucleotides pair with complementary nucleotides.

Before the mRNA leaves the nucleus, which events will have occurred twice?

A 1 and 2 only **B** 1, 3 and 4 only **C** 2, 3 and 4 only **D** 1, 2, 3 and 4

30 The mechanism of action of four drugs that inhibit DNA replication is stated below.

- Aphidicholine inhibits DNA polymerase.
- Cytarabine is converted into a molecule that can substitute for a DNA nucleotide and also inhibits DNA repair mechanisms.
- Epirubicin inhibits an enzyme involved in the unwinding of DNA and separation of strands.
- Hydroxycarbamide inhibits an enzyme involved in the production of deoxyribonucleotides.

Which row correctly matches a drug to an explanation of the mechanism of action?

	explanation of mechanism of action			
	decreased pool of available nucleotides inhibits chain elongation	DNA strands not available as templates for transcription	DNA damaged during replication and cell death occurs	exposed DNA template strands unable to be copied
A	aphidicholine	epirubicin	cytarabine	hydroxycarbamide
B	epirubicin	cytarabine	hydroxycarbamide	aphidicholine
C	hydroxycarbamide	aphidicholine	epirubicin	cytarabine
D	hydroxycarbamide	epirubicin	cytarabine	aphidicholine

[Turn over

31 Four different fruit juices, **A**, **B**, **C** and **D**, were tested with Benedict's solution. A second sample of each juice was hydrolysed and tested with Benedict's solution. The table shows the masses of the precipitates formed.

Which juice contains the greatest mass of non-reducing sugar?

	mass of precipitate before hydrolysis / mg	mass of precipitate after hydrolysis / mg
A	30	55
B	55	55
C	65	85
D	70	80

32 Which rows show the chemical groups present in the biological molecules listed?

	biological molecule	presence of carboxyl (COOH) groups	presence of two or more hydroxyl (OH) groups
1	amino acid	yes	no
2	β-glucose	no	yes
3	glycerol	no	no
4	fatty acid	yes	no

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

33 Some foods contain 'hydrogenated vegetable oils'. These are unsaturated fats that have been converted to saturated fats.

Which property of the fats will have changed?

A Their hydrocarbon chains will fit together more closely.

B Their solubility in water will increase.

C They will have more double bonds in their molecules.

D They will remain liquid at room temperature.

34 Which molecular bonds will be broken by hydrolysis when a molecule of glycogen is converted to glucose?

	bonds		
	1,2	1,4	1,6
A	✓	✗	✗
B	✗	✓	✓
C	✓	✗	✓
D	✗	✓	✗

key
✓ = broken
✗ = unbroken

35 Which correctly matches the functional and structural features of cellulose, collagen, glycogen or triglyceride?

		function	structure		
			fibrous	molecule held together by hydrogen bonds	branched chains
A	cellulose triglyceride	support energy source	✓ ✗	✓ ✗	✗ ✗
B	collagen cellulose	strengthening support	✓ ✓	✓ ✗	✗ ✓
C	collagen glycogen	strengthening storage	✓ ✗	✓ ✗	✓ ✓
D	glycogen triglyceride	storage energy source	✗ ✗	✓ ✓	✓ ✗

key ✓ = true ✗ = false

[Turn over

36 Which set of statements correctly describes haemoglobin?

A	four polypeptide chains, each containing a prosthetic group	iron ions can associate with oxygen forming oxyhaemoglobin	in each chain, hydrophobic R groups of amino acids point towards the centre of the molecule	at 50 % saturation, two oxygen molecules are transported by the molecule
B	polypeptide chains interact to produce a globular chain	each chain contains a prosthetic group of amino acids surrounding an iron ion	two identical alpha chains and two identical beta chains	each chain can transport an oxygen molecule
C	polypeptide chains interact to produce an almost spherical molecule	an iron ion is present within each haem group	quaternary structure of two alpha chains and two beta chains	each molecule can transport a total of four oxygen atoms
D	polypeptide chains produce a loose helical shape, which curls to form a spherical molecule	iron ions in the molecule can bind reversibly with oxygen	in each chain, hydrophobic R groups of amino acids surround the iron ion	each molecule can transport a total of eight oxygen atoms

37 Smallpox has been eradicated, but not malaria or cholera.

Which statements correctly explain this?

1 Cholera bacteria in the intestines are not destroyed by antibiotics.

2 Plasmodium antigens change during the life cycle.

3 Smallpox antigens remain stable.

4 Vaccines only work against viruses.

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

38 Which disease is **not** likely to be passed directly from parents to child?

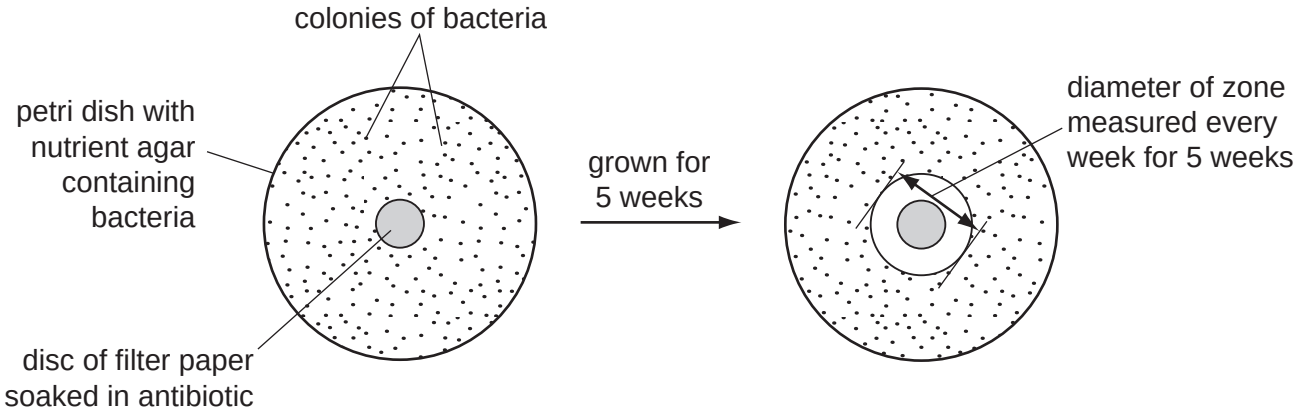
A cholera

B malaria

C sickle cell anaemia

D tuberculosis

39 The diagram shows one way of testing the effect of an antibiotic on bacteria.



The table shows the results of testing five different types of bacteria. Zones of less than 13 mm show the presence of resistant bacteria.

type of bacteria	diameter of zone / mm				
	week 1	week 2	week 3	week 4	week 5
1	24.10	21.90	19.00	17.60	14.30
2	18.60	15.40	12.20	9.00	0.00
3	17.90	12.80	12.40	11.10	10.90
4	19.40	15.30	13.20	8.10	0.00
5	22.00	21.00	20.50	20.40	20.40

Which statement can be supported by this data?

A Bacteria become more resistant to antibiotics over time.

B Only types 2, 3 and 4 of the bacteria show resistance to the antibiotic.

C The antibiotic can be used to treat all the types of bacteria.

D Type 5 of the bacteria can never become resistant to the antibiotic.

40 In an animal cell, which process is dependent upon cell surface area and which process is dependent upon cell volume?

	cell surface area	cell volume
A	carbon dioxide produced	oxygen used
B	glucose absorbed	hormones detected
C	hormones detected	carbon dioxide produced
D	oxygen used	glucose absorbed

BLANK PAGE