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

BIOLOGY (US) **9184/13**

Paper 1 Multiple Choice **May/June 2013**

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, Center number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

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.
Electronic calculators may be used.

This document consists of **16** printed pages.

1 An electron microscope has a higher resolution than a light microscope.

Which is a result of the higher resolution?

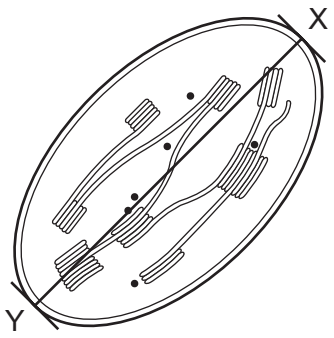
A the ability to produce larger images of cells

B the ability to see cristae in mitochondria

C the ability to see mRNA in all cells

D the ability to see the nucleus in eukaryotes

2 The diagram shows a chloroplast drawn from an electronmicrograph.



The length of the chloroplast from X to Y is 5000 nm.

What is the magnification of the drawing of the chloroplast?

A ×100 **B** ×1000 **C** ×10 000 **D** ×100 000

3 Eyepiece graticules and stage micrometers are used to measure cells.

Which is the correct reason why an eyepiece graticule is calibrated?

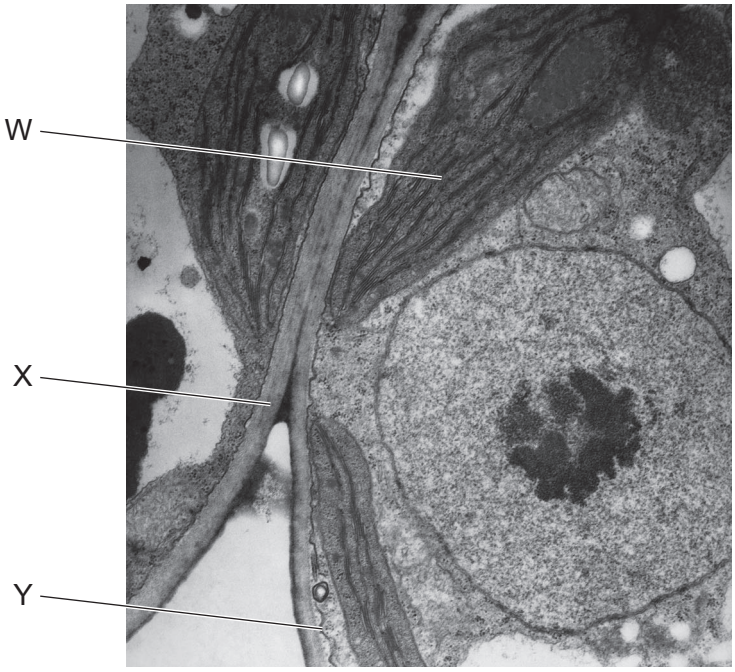
A An eyepiece graticule can be used to make measurements.

B An eyepiece graticule is magnified by the objective lens.

C An eyepiece graticule magnifies the specimen.

D An eyepiece graticule makes comparisons.

4 The electronmicrograph shows part of two cells.



Which of the labeled features enable these cells to be identified as eukaryotic?

A W only **B** X only **C** W and X only **D** W, X and Y

5 When mucus is secreted from a goblet cell in the trachea, these events take place.

1 addition of carbohydrate to protein

2 fusion of the vesicle with the plasma membrane

3 secretion of a glycoprotein

4 separation of a vesicle from the Golgi apparatus

What is the sequence in which these events take place?

A $1 \rightarrow 4 \rightarrow 2 \rightarrow 3$

B $1 \rightarrow 4 \rightarrow 3 \rightarrow 2$

C $4 \rightarrow 1 \rightarrow 2 \rightarrow 3$

D $4 \rightarrow 1 \rightarrow 3 \rightarrow 2$

6 What is a function of the smooth endoplasmic reticulum?

A antibody synthesis

B enzyme synthesis

C protein synthesis

D steroid synthesis

7 Two solutions, 1 and 2, one containing starch and sucrose, and the other containing [illegible] protein, were tested with a variety of reagents to confirm their identity.

The table shows the conclusions from the results recorded for the various tests.

Which row identifies the two solutions?

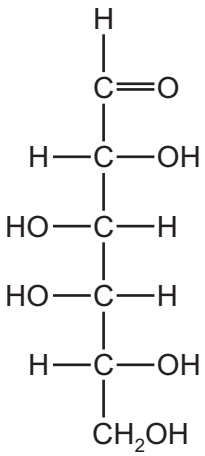
	add iodine solution		boil with Benedict's solution		boil with Benedict's solution after acid hydrolysis		add biuret solution	
	1	2	1	2	1	2	1	2
A	+	–	+	–	–	+	–	+
B	–	+	+	–	+	–	–	+
C	+	–	–	+	+	–	–	+
D	–	+	+	–	+	+	+	–

key

+ = biological molecule present

– = biological molecule absent

8 The structural formula of a carbohydrate molecule can be shown as:



Which of the molecules could be represented by this formula?

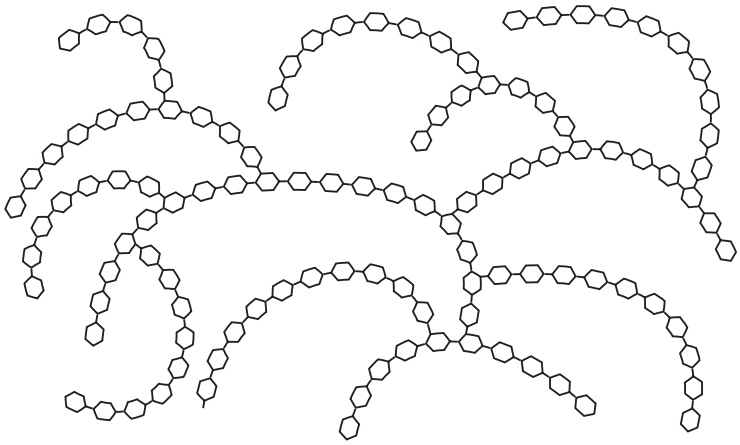
1 β-glucose

2 deoxyribose

3 ribose

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

9 The diagram shows part of a molecule of a carbohydrate formed by glucose.



What is the name of the molecule?

A amylose

B cellulose

C glycogen

D starch

10 A naturally occurring polysaccharide is a branched chain of α-glucose.

The straight parts of the molecule are linked by α-1, 6 glycosidic bonds with a small number of branches which are linked by either an α-1, 3 glycosidic bond or an α-1, 4 glycosidic bond.

Which polysaccharide has a structure **most** similar to that described?

A amylopectin

B amylose

C cellulose

D glycogen

11 Which molecule has properties that are **not** dependent on hydrogen bonds?

A cellulose

B glycogen

C hemoglobin

D water

12 What occurs during protein denaturation by extremes of pH?

1 breakage of peptide bonds leading to loss of shape of active site

2 disruption of existing ionic bonds between amino acid R-groups

3 loss of α-helical regular arrangement of amino acids

4 loss of protein tertiary structure resulting in loss of function

A 1, 2, 3 and 4

B 2, 3 and 4 only

C 1 and 3 only

D 2 and 4 only

13 When the ice on the surface of a pond melts, which changes benefit the ecosystem in the pond?

1 The melted water sinks to the bottom of the pond.

2 The water from the bottom of the pond brings dissolved minerals to the surface.

3 Warmer water dissolves more oxygen for the aerobic organisms.

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

14 How does increasing substrate concentration affect the rate of an enzyme-catalyzed reaction in the presence of a competitive inhibitor?

A The rate of the reaction decreases.

B The rate of the reaction decreases initially and then recovers.

C The rate of the reaction increases.

D The rate of the reaction is not affected.

15 Four students investigated the effect of catalase on hydrogen peroxide.

Each student started a digital clock at the beginning of the experiment and stopped the clo
25 bubbles had been counted.

The time recorded on the digital clock is shown below.

hours	minutes	seconds	hundredths
00	01	33	54

Which student recorded the results to the best level of precision for the apparatus used?

student	time recorded
A	1.34 minutes
B	1 minute 33.54 seconds
C	94 seconds
D	93.54 seconds

16 Which of the following can decrease the fluidity of the cell surface membrane?

1 double bonds between carbon atoms in the fatty acid chains

2 cholesterol

3 fatty acids having longer chains

A 1, 2 and 3

B 1 and 2 only

C 2 and 3 only

D 3 only

17 Which process would allow the movement of large protein molecules **out** of the cell?

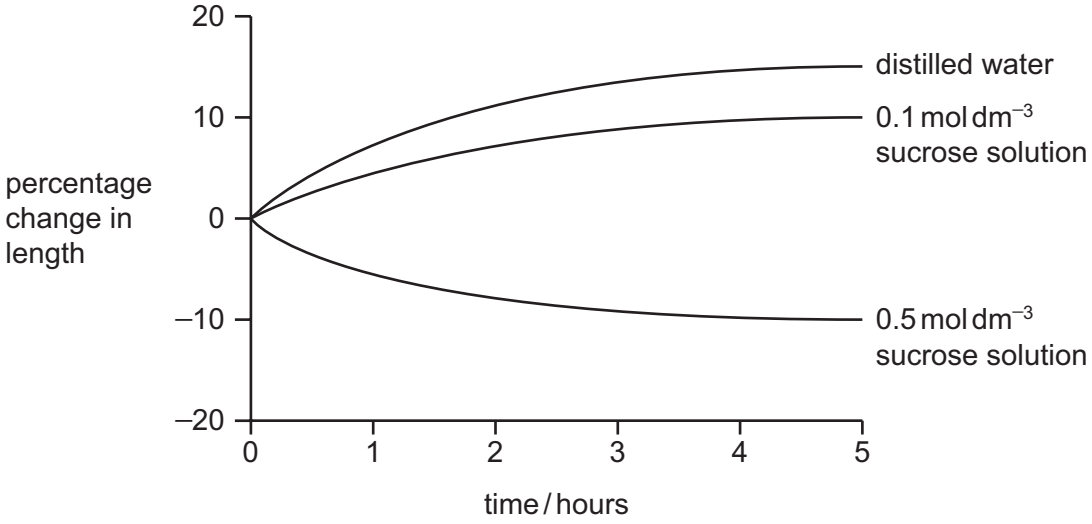
A active transport

B exocytosis

C facilitated diffusion

D phagocytosis

18 Strips of potato tissue were immersed in distilled water or in sucrose solutions of different concentrations. The graph shows the percentage change in length of the potato tissue over time.



Which row correctly shows how the water potentials of the distilled water and sucrose solutions differ from the initial water potential of the potato tissue?

	distilled water	0.1 mol dm^{-3} sucrose solution	0.5 mol dm^{-3} sucrose solution
A	less negative	less negative	more negative
B	less negative	more negative	more negative
C	more negative	less negative	less negative
D	more negative	more negative	less negative

19 Uncontrolled cell division of cancer cells forms tumours.

Which statement describes the difference between a cancer cell and a normal cell?

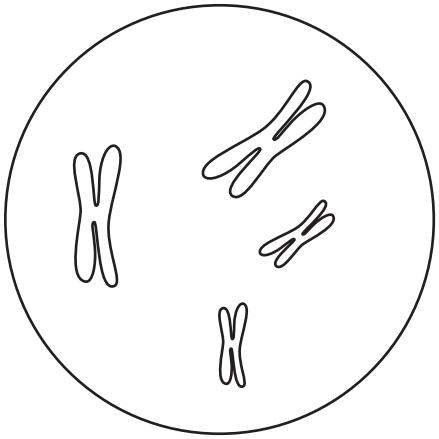
A Cancer cells do not undergo cytokinesis.

B Cancer cells do not have metaphase.

C Cancer cells have a shorter interphase.

D Only cancer cells have mutated DNA.

20 The diagram shows a cell nucleus in prophase of mitosis.



Which statement describes the chromosomes found in each daughter nucleus immediately following division of this cell by mitosis?

A 2 chromosomes, each consisting of 2 chromatids

B 4 chromosomes, each consisting of 2 chromatids

C 8 chromosomes, each containing 1 molecule of DNA

D 4 chromosomes, each containing 1 molecule of DNA

21 Gene mutations in either the *BRCA1* or the *BRCA2* genes are responsible for the majority of hereditary breast cancer in humans.

The proteins produced by the two genes migrate to the nucleus where they interact with other proteins, such as those produced by the tumour suppressor gene, *p53* and the DNA repair gene, *RAD51*.

Which combination of gene activity is most likely to result in breast cancer?

	gene		
	BRCA1 or *BRCA2*	*p53*	*RAD51*
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✗	✗

key

✓ = gene produces normal protein

✗ = gene produces abnormal protein or no protein

22 One gene provides the code for the production of which molecule?

A amino acid

B DNA

C nucleotide

D polypeptide

23 A polypeptide has the amino acid sequence glycine – arginine – lysine – serine.

The table gives possible tRNA anticodons for each amino acid.

amino acid	tRNA anticodons
arginine	UCC GCG
glycine	CCA CCU
lysine	UUC UUU
serine	AGG UCG

Which sequence of bases on DNA would code for the polypeptide?

A CCACGCAAGAGC

B CCTTCCTTCTCG

C GGAAGGAAAAGC

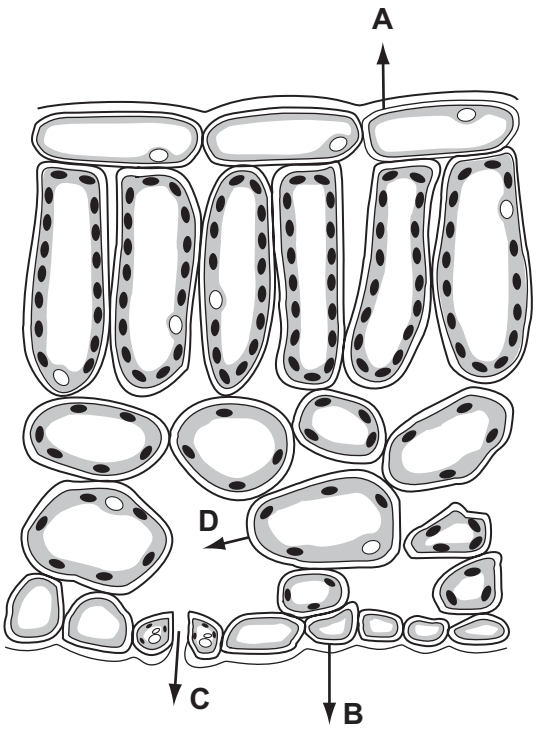
D GGTTGGTTGTGC

24 What is the **minimum** number of hydrogen bonds in a length of DNA containing 700 nucleotides?

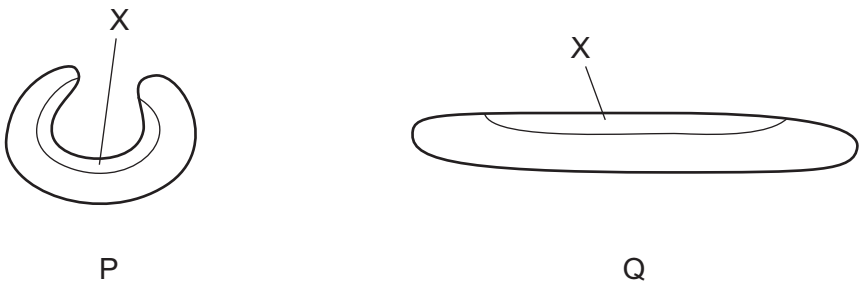
A 350 **B** 700 **C** 1050 **D** 1400

25 The diagram shows part of a transverse section of a leaf.

Where does evaporation of water occur during transpiration?



26 The diagram shows a xerophytic leaf in different conditions, P and Q.



Which statements describe the difference between the cells in layer X in conditions P and Q?

1 More negative water potential in P than Q.

2 More cells plasmolyzed in P.

3 Cells less turgid in Q.

4 Water potential becomes zero in Q.

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

27 A potometer can be used to measure transpiration rates in a plant.

Why is the plant stem cut under water before attaching to the potometer?

A to maintain the turgidity of the xylem vessels

B to prevent collapse of the xylem vessels

C to stop air entering the xylem vessels

D to stop water loss from the xylem vessels

28 Three solutions, with different water potentials (ψ) are listed.

1 cortex cell solution

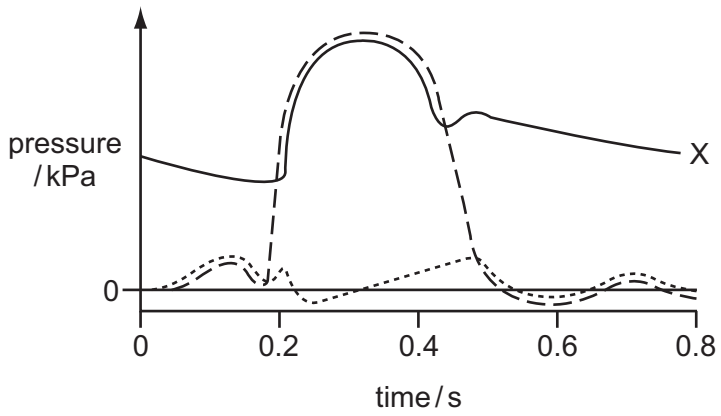
2 endodermal cell solution

3 root hair cell solution

Which row has the solutions in order from the least negative ψ to the most negative ψ?

	highest ψ	⟶	lowest ψ
A	1	2	3
B	2	1	3
C	3	2	1
D	3	1	2

29 The diagram shows the pressure changes in various structures of the **right side** of the heart during the cardiac cycle.



Which structure is represented by letter X?

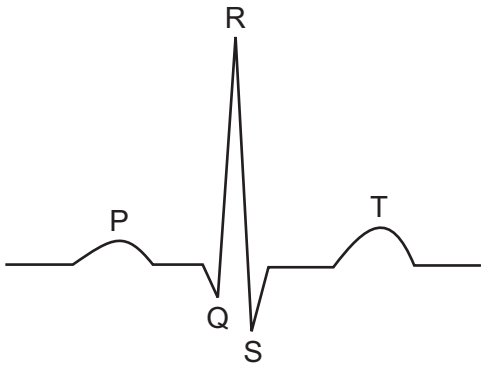
A pulmonary artery

B right atrium

C right ventricle

D vena cava

30 The trace represents the electrical activity of the heart during a single heart beat.



Which letters identify the flow of current through the atria and the recovery of the ventricle walls?

A P and R **B** P and T **C** Q and R **D** Q and S

31 Which row describes the changes in the properties of hemoglobin as a result of the Bohr effect?

	affinity for oxygen by haemoglobin	oxygen dissociates from haemoglobin
A	higher	less readily
B	higher	more readily
C	lower	less readily
D	lower	more readily

32 Humans have a double circulation system.

What does the term ‘double circulation’ mean?

A The blood circulates separately in the two sides of the heart.

B The blood passes twice through the heart during one complete circulation.

C The heart has two of each chamber; atria and ventricles.

D The heart beat has a double sound caused by the two sets of valves closing.

33 The photomicrograph shows a section through part of a bronchus wall.

What is the function of the tissue labeled X?

A contracts to constrict the airway

B helps to widen the airway after an allergic reaction

C produces mucus to trap dust particles and bacteria

D supports the airway to prevent collapse

34 Why is the inner lining of the bronchiole folded?

A to allow for expansion during breathing

B to facilitate gaseous exchange

C to increase the surface area

D to trap foreign particles

35 What are the effects of carbon monoxide and nicotine on the cardiovascular system?

	carbon monoxide	nicotine
A	combines with hemoglobin	increases blood pressure
B	combines with hemoglobin	reduces heart rate
C	reduces blood pressure	increases heart rate
D	reduces heart rate	combines with hemoglobin

36 Some antibiotics are used in animal feed to reduce disease.

What explains why these antibiotics should **not** be used in the treatment of human disease?

A Humans may be allergic to these antibiotics.

B Human cells may stop responding to these antibiotics.

C Pathogenic bacteria may develop resistance to these antibiotics.

D Useful gut bacteria may be killed by these antibiotics.

37 Which statement about both B-lymphocytes and T-lymphocytes is correct?

A They become active only when a specific antibody binds to their surface receptor.

B They divide to form clones when meeting an antitoxin in a cell.

C They produce memory cells to respond to an antigen when exposed in the future.

D They release hormone-like cytokines which stimulate release of antibodies.

38 Which uses energy to produce its own food supply from inorganic compounds?

A autotroph

B consumer

C heterotroph

D saprotroph

39 Two different ecosystems, X and Y, were compared. Both ecosystems are the same [illegible] both have the same climate. The results of the comparison are shown in the table below.

ecosystem X	ecosystem Y
greater number of trophic levels	fewer number of trophic levels
lower proportion of decomposers	higher proportion of decomposers
dominant producer is smaller and non-woody	dominant producer is larger and woody
has a smaller fluctuation in environmental temperature	has a larger fluctuation in environmental temperature
has less oxygen	has more oxygen

Using the information in the table, which statements are a valid suggestion concerning X and Y?

1 A greater percentage of primary producers are likely to be consumed by primary consumers in X than in Y.

2 X could be a marine aquatic ecosystem and Y could be a terrestrial ecosystem.

3 Energy losses between trophic levels are likely to be lower for X than for Y.

4 There is likely to be a higher rate of photosynthesis and production of organic matter in X than in Y.

A 2 and 4 only

B 1, 2 and 3 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

40 The diagram shows the flow of energy in a food web.

Which represents the decomposers?