



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

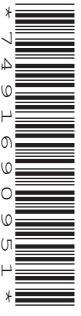
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**BIOLOGY (US)**

**9184/21**

Paper 2 Structured Questions AS

**October/November 2013**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Center number, candidate number and name on all the work you hand in.  
Write in dark blue or black ink.  
You may use a pencil for any diagrams, graphs or rough working.  
Do **not** use red ink, staples, paper clips, highlighters, glue or correction fluid.  
**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.  
Electronic calculators may be used.  
You may lose marks if you do not show your working or if you do not use appropriate units.

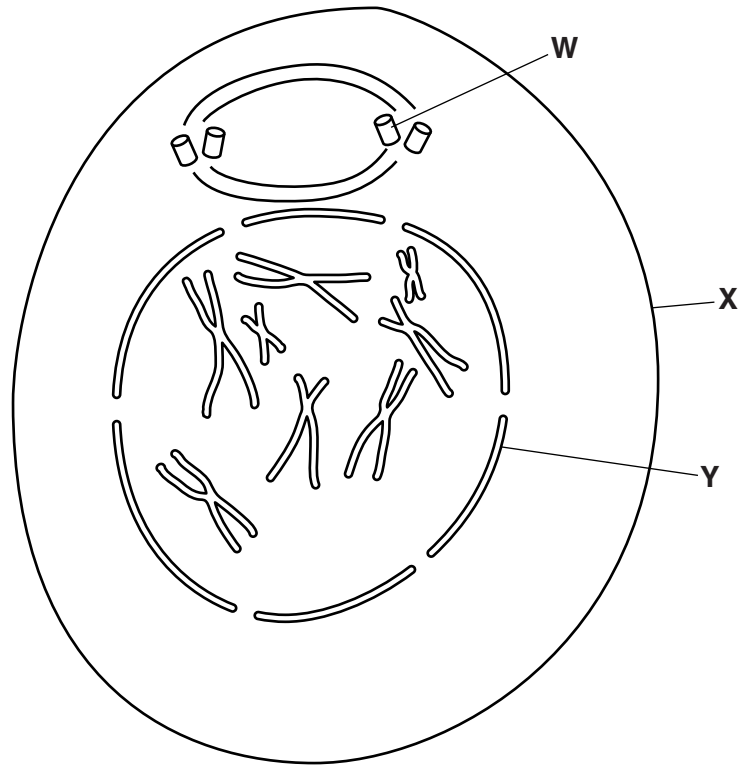
At the end of the examination, fasten all your work securely together.  
The number of marks is given in brackets [ ] at the end of each question or part question.

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



Answer **all** the questions.

- 1 Fig. 1.1 shows a cell of a female fruit fly, *Drosophila melanogaster*, during a stage of mitosis.



**Fig. 1.1**

- (a) (i) Name the stage of mitosis shown in Fig. 1.1.

.....[1]

- (ii) Shade a pair of homologous chromosomes.

[1]

- (iii) Name the structure labeled **W** and state its function.

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



- 2 (a) Table 2.1 shows eight ions that are biologically important.

**Table 2.1**

ammonium ( $\text{NH}_4^+$ )	<b>A</b>
hydrogen ( $\text{H}^+$ )	<b>B</b>
hydrogen carbonate ( $\text{HCO}_3^-$ )	<b>C</b>
iron ( $\text{Fe}^{2+}$ )	<b>D</b>
magnesium ( $\text{Mg}^{2+}$ )	<b>E</b>
nitrate ( $\text{NO}_3^-$ )	<b>F</b>
phosphate ( $\text{PO}_4^{3-}$ )	<b>G</b>
sulfate ( $\text{SO}_4^{2-}$ )	<b>H</b>

Choose one ion to match each of the following statements. In each case write **one** letter from Table 2.1. You may use each letter (**A** to **H**) once, more than once or not at all.

- (i) A component of polynucleotides.

.....[1]

- (ii) Ion produced by enzyme activity inside red blood cells.

.....[1]

- (iii) Ion used in the production of all amino acids in chloroplasts.

.....[1]

- (iv) Ion that diffuses through carrier proteins with sucrose into companion cells in phloem tissue.

.....[1]

- (v) Component of heme group in hemoglobin that binds oxygen.

.....[1]







**Question 3 starts on page 8**

- 3 (a) Tuberculosis (TB) and chronic obstructive pulmonary disease (COPD) are diseases that affect the lungs.

With reference to TB and COPD, explain how infectious diseases differ from noninfectious diseases.

.....

.....

.....

.....

.....[2]

Macrophages are large phagocytic cells that are found in many tissues including alveolar tissue in the lungs. They provide the main means of defense against pathogens in this tissue.

Fig. 3.1 is a drawing made from an electron micrograph showing part of a capillary and two alveoli, with a macrophage.

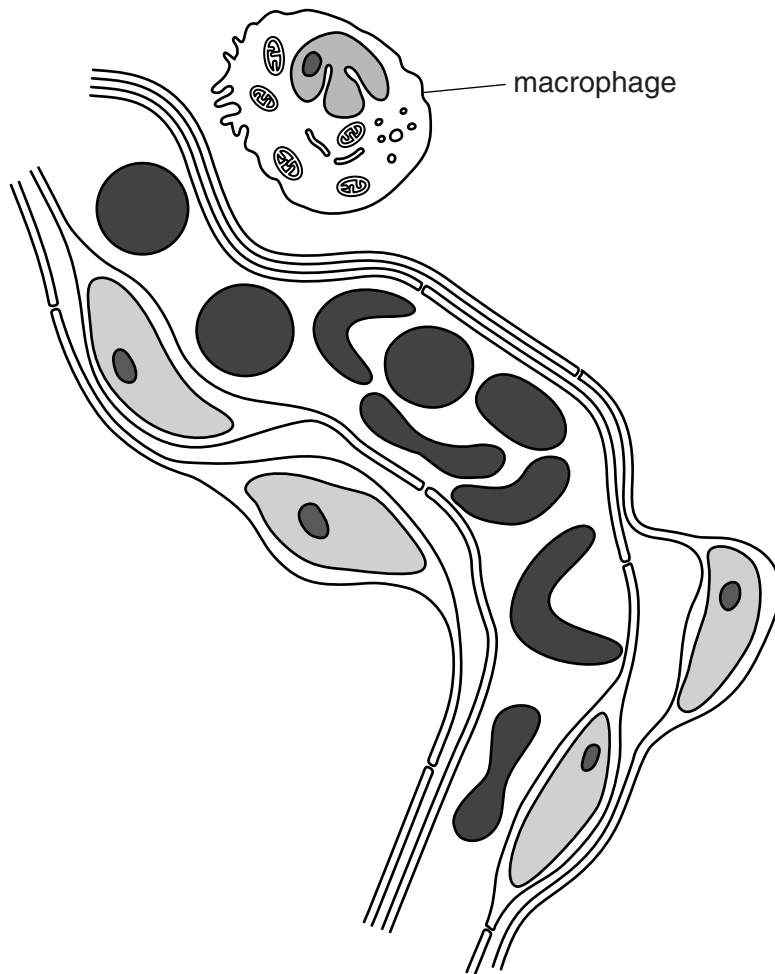


Fig. 3.1









(b) (i) Suggest why cholesterol is packaged into lipoproteins before release from cells into the blood.

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

(ii) Explain why cells of the body need to be supplied with cholesterol.

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

(c) Cholesterol is also packaged into vesicles by the SER and then secreted from the cell into small fluid-filled spaces between the liver cells. These spaces form ducts that drain into the gallbladder to form bile.

Suggest how cholesterol is secreted into ducts, such as the duct in Fig. 4.1.

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

(d) State **one** function of the Golgi apparatus **other than** the packaging of substances into vesicles for transport.

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

[Total: 9]

- 5 Table 5.1 shows the triplets of bases on the template polynucleotide of DNA for some amino acids.

Table 5.1

amino acid		DNA triplets
glutamic acid	(glu)	CTT CTC
histidine	(his)	GTA GTG
leucine	(leu)	GAA GAG GAT GAC
proline	(pro)	GGA GGG GGT GGC
threonine	(thr)	TGA TGG TGT TGC
valine	(val)	CAA CAG CAT CAC

Fig. 5.1 shows the base sequences in DNA and mRNA for the first seven amino acids of the  $\beta$  chain of hemoglobin.

DNA	CAC	.....	GAC	TGA	GGA	CTC	CTC
mRNA	GUG	CAC	CUG	.....	CCU	GAG	GAG
$\beta$ chain	val	his	.....	thr	pro	glu	glu

Fig. 5.1

- (a) (i) Use Table 5.1 to complete Fig. 5.1. [3]

- (ii) State the term used to describe the sequence of amino acids in a polypeptide.

.....[1]



- 6 In some ecosystems, certain species fulfil important roles in maintaining biodiversity in communities. These species are often known as keystone species.

The sea otter, *Enhydra lutris*, is found in waters of the northern and eastern coasts of the Pacific, where it occupies a niche as a predator. These coastal waters are rich in kelp communities. Kelp are very large seaweeds that form 'underwater forests'.

In the 19<sup>th</sup> century the sea otter was hunted for its fur, with the result that populations decreased. A consequence of this reduction in numbers was the disappearance of much of the kelp. Conservation measures in the 20<sup>th</sup> century restored the numbers of sea otters.

Fig. 6.1 shows the food web for this ecosystem.

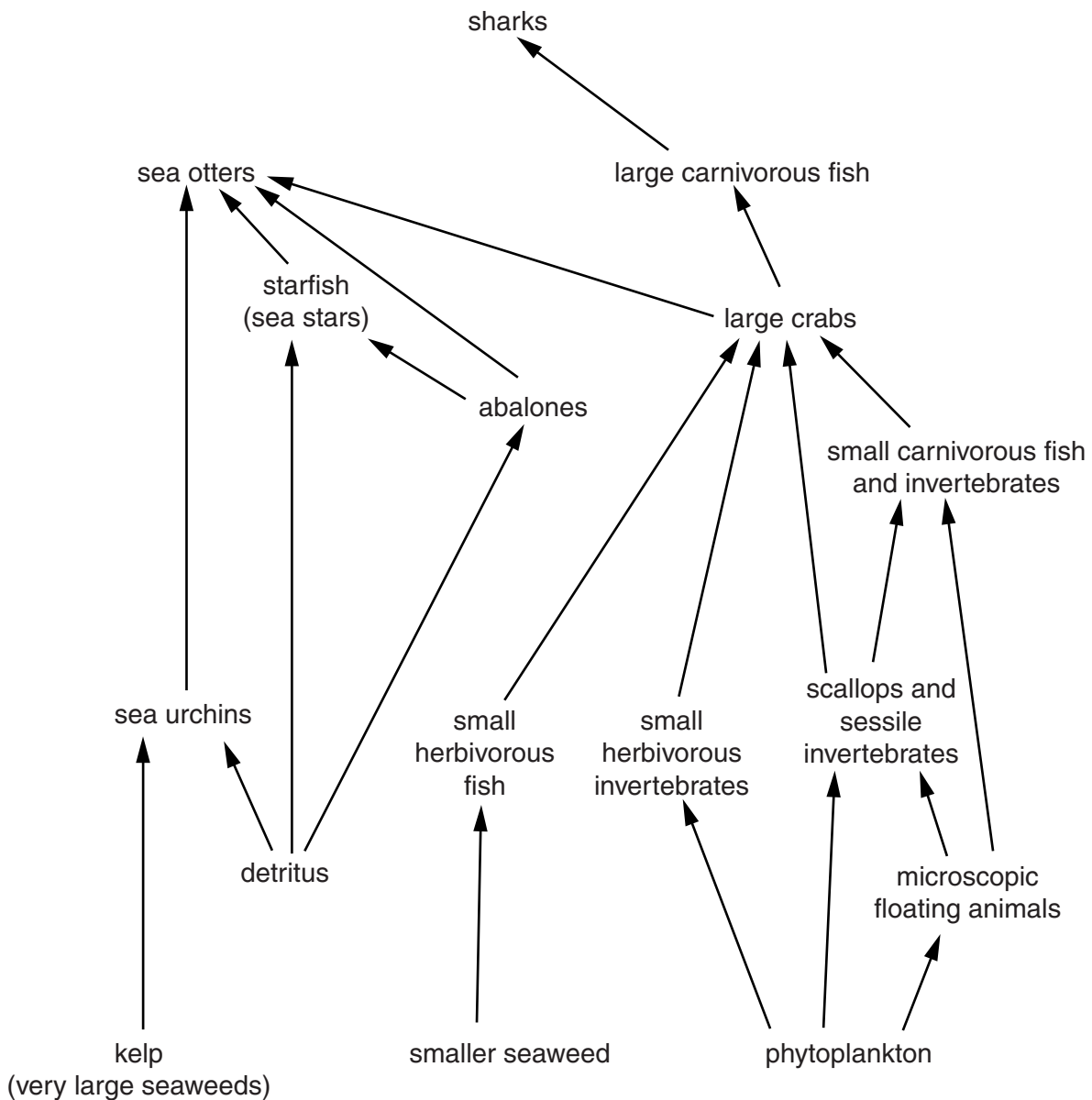


Fig. 6.1



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Fig. 4.1 © DON W. FAWCETT/SCIENCE PHOTO LIBRARY.

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