Surname		Centre Number	Candidate Number
Other Names			2

GCE A level

WJEC CBAC

1074/01

BIOLOGY – BY4

P.M. MONDAY, 13 June 2011

1¾ hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	10	
2	10	
3	12	
4	14	
5	9	
6	15	
7	10	
Total	**80**	

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

The quality of written communication will affect the awarding of marks.

1. The diagram below shows a molecule of ATP.
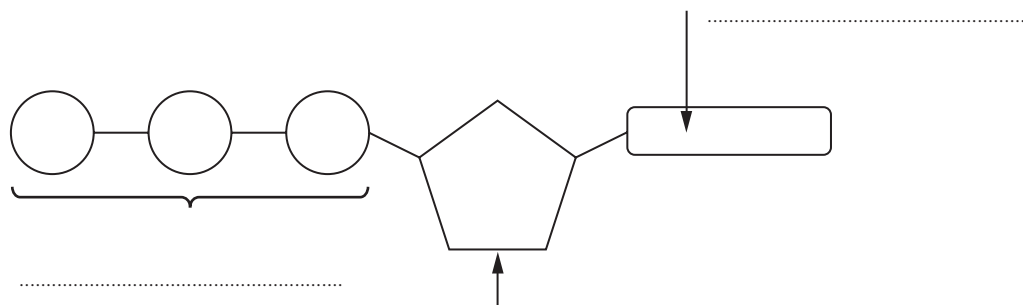
(a) (i) Label the component parts of the molecule. [2]

(ii) Give the full name of the molecule. [1]

....

(b) (i) In the spaces indicated below, use drawings similar to the one above to show the changes that this molecule undergoes in cells. [1]

Energy in
(from respiration)

Energy out
(eg. for muscle
contraction)
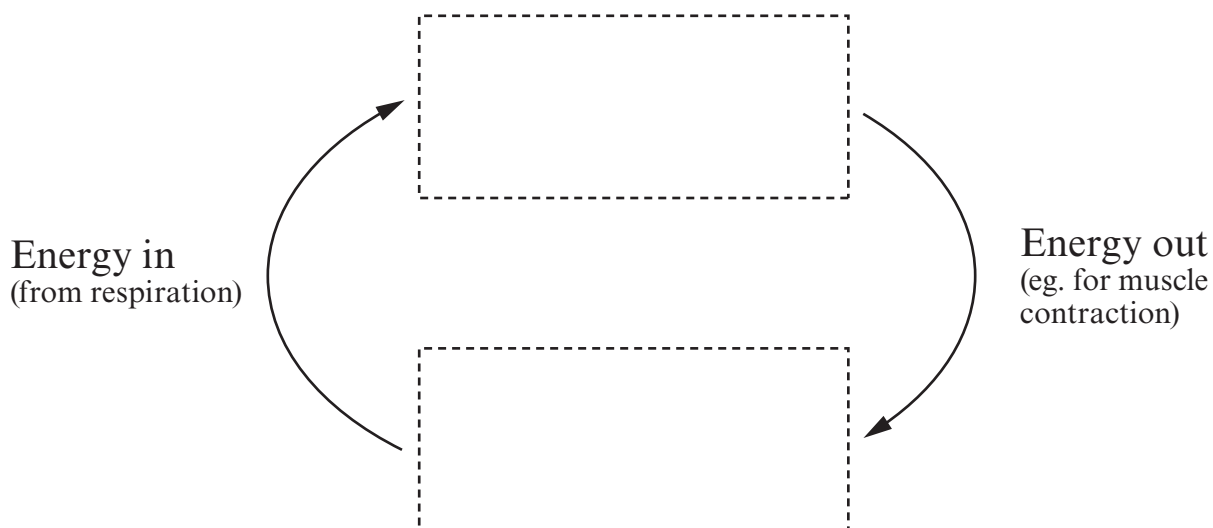
(ii) Apart from muscle contraction, name **one** *other* process in cells which requires energy. [1]

....

(c) There are four main stages in the production of ATP by **aerobic** respiration.

(i) Complete the table below to show where the listed stages take place and how many molecules of ATP and reduced cofactor are produced from one molecule of glucose. [2]

Stage	Precise location in cell	Number of molecules of ATP	Number of molecules of $NADH_2$	Number of molecules of $FADH_2$
Glycolysis	cytoplasm	2 (net)	2	0
Link reaction				
Krebs cycle				

(ii) Name the fourth stage and give its precise location in the cell. [1]

Name of stage ....

Precise location in the cell ....

....

(iii) State the number of ATP molecules this stage produces for one molecule of each type of reduced cofactor. [1]

$NADH_2$ ....

$FADH_2$ ....

(d) Complete the word equation below to show the products of **anaerobic** respiration in yeast cells. [1]

$NADH_2$ ....

Glucose ⟶ .... + ...

(Total 10 marks)

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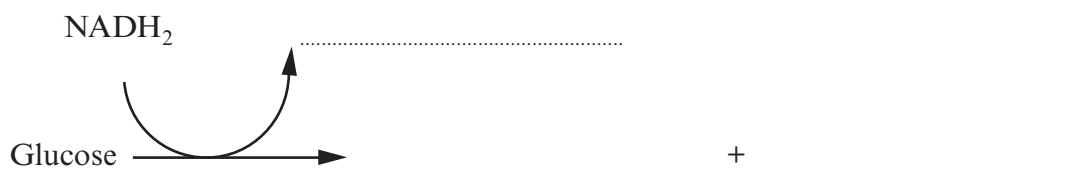
2. Calvin did experiments on a series of reactions which is now called the light independent stage of photosynthesis. The diagram shows one such experiment. The apparatus was set up as shown and brightly illuminated. The clock was started on the introduction of radioactive hydrogen carbonate ions.
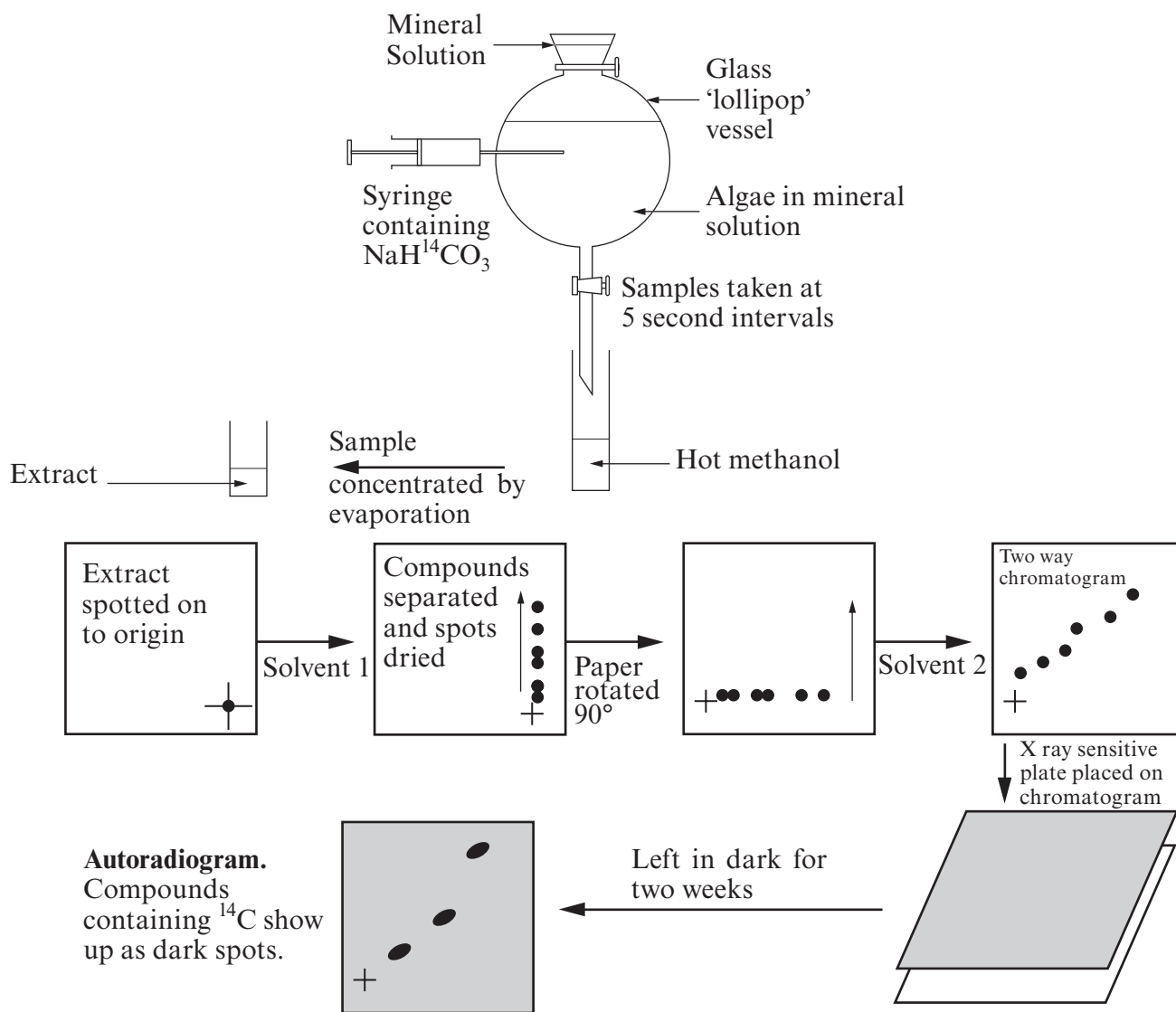
Autoradiograms from one such experiment are shown below:

After 5 seconds	After 10 seconds	After 30 seconds
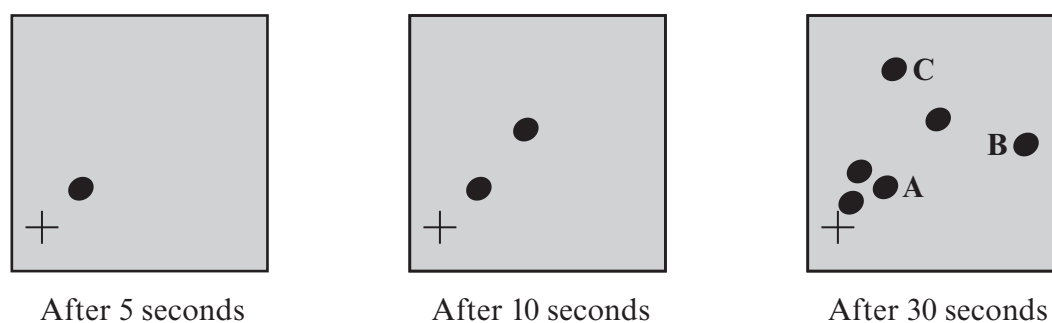
(a) What is the main difference between these three autoradiograms? [1]

....

....

(b) To identify the substances represented by the dark spots, Calvin made autoradiograms of known substances. He then compared their positions with those of the dark spots. The results of some of these are shown below.

Glycine	Glucose	Triose phosphate
Glyceraldehyde-3-phosphate (GP)	**Malic acid**	**Ribulose bisphosphate (RuBP)**
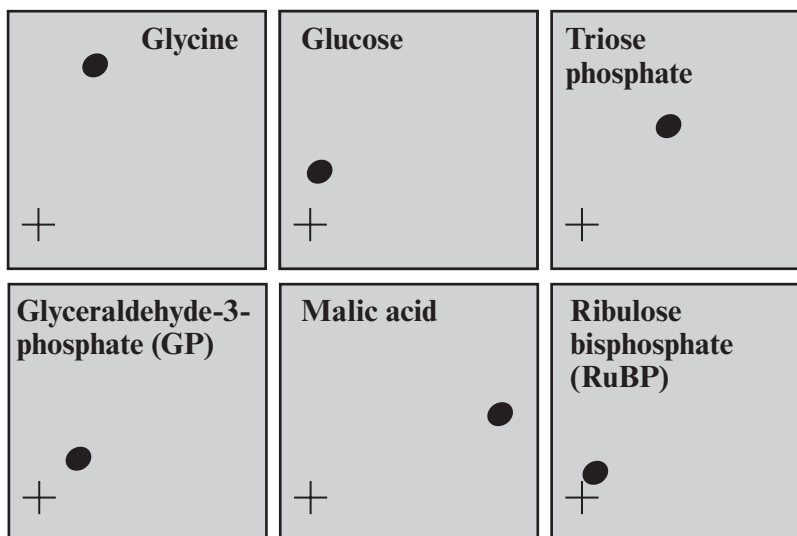
Use these autoradiograms and the ones shown in part *(a)* to identify compounds represented by spots **A-C**. [1]

Spot	Name of compound
A	
B	
C	

(c) Use the autoradiograms to determine which were the first and second substances formed. [2]

First ....

Second ....

(d) Glycine is an amino acid. Which chemical element would have been needed in the mineral solution in order for the algae to have made this compound? [1]

....

(e) Calvin worked out that the ribulose bisphosphate is regenerated so that the reactions are in the form of a cycle, which is summarised below:

Carbon dioxide (CO_2)

Ribulose bisphosphate (RuBP)

Glyceraldehyde-3-phosphate (GP)

X

Y

....

....

....

....

Triose phosphate (TP)

Glucose
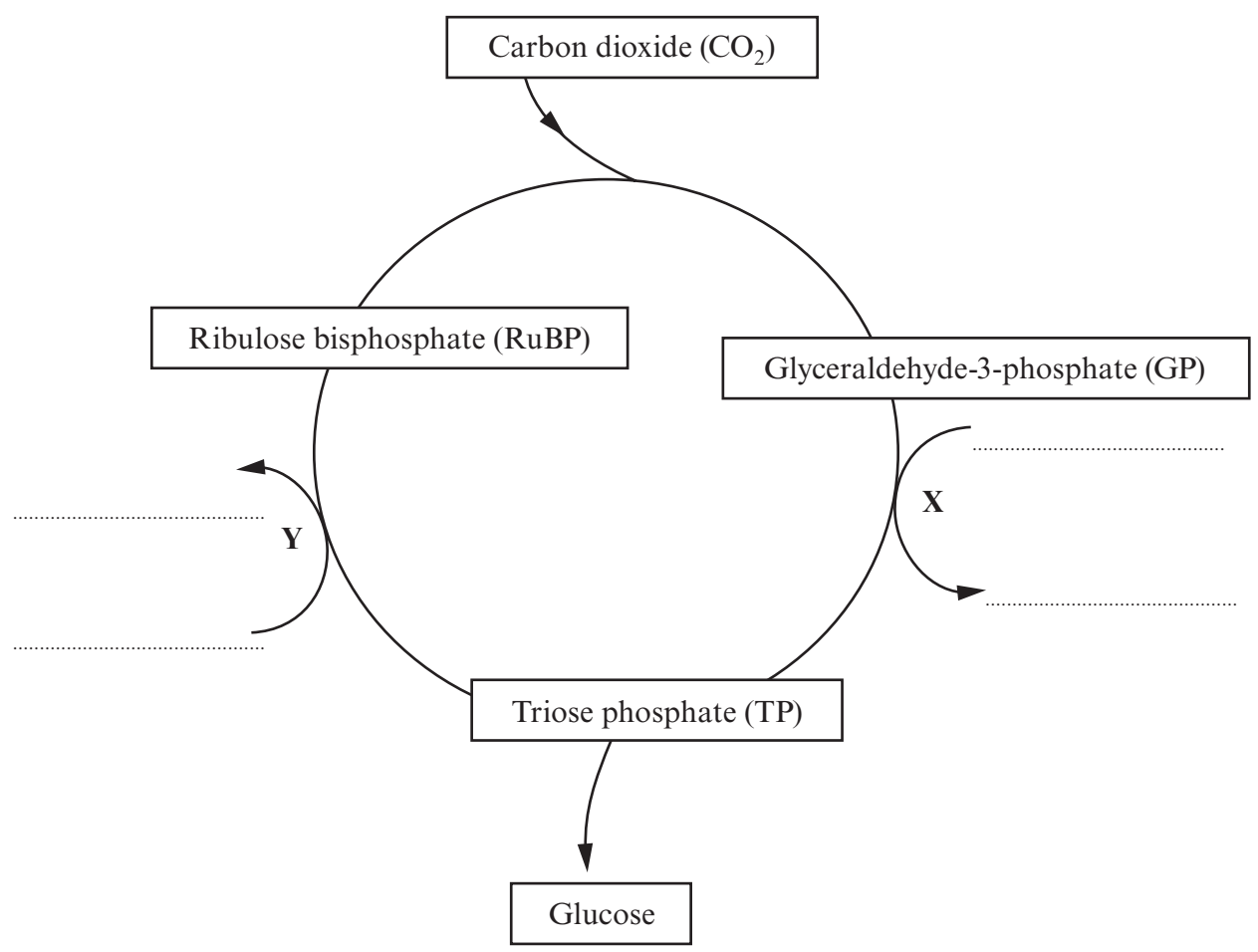
Compound **X** is a hydrogen carrier and compound **Y** is the universal energy currency in cells.

(i) Complete the diagram to show how compounds **X** and **Y** change during the cycle.
[2]

(ii) Which series of reactions provides the compounds **X** and **Y** in chloroplasts? [1]

....

(iii) State precisely where the production of **X** occurs in chloroplasts. [1]

....

(f) How many molecules of triose phosphate would be needed to synthesise three molecules of glucose? [1]

....

(Total 10 marks)

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3. *(a)* The equipment shown in the diagram below is used to measure electrical potential across the membrane of squid giant axons.

amplifier

Cathode
Ray
Oscilloscope

Micro-electrodes

axon
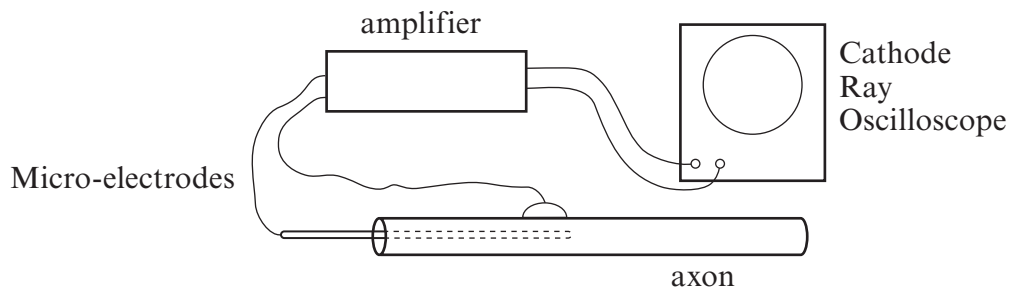
(i) Use the grid below to draw a typical action as it would appear on the screen of the cathode ray oscilloscope. [2]

80

60

40

20

0   1.0   2.0   3.0   mS

–20

– 40

– 60

–80

mV
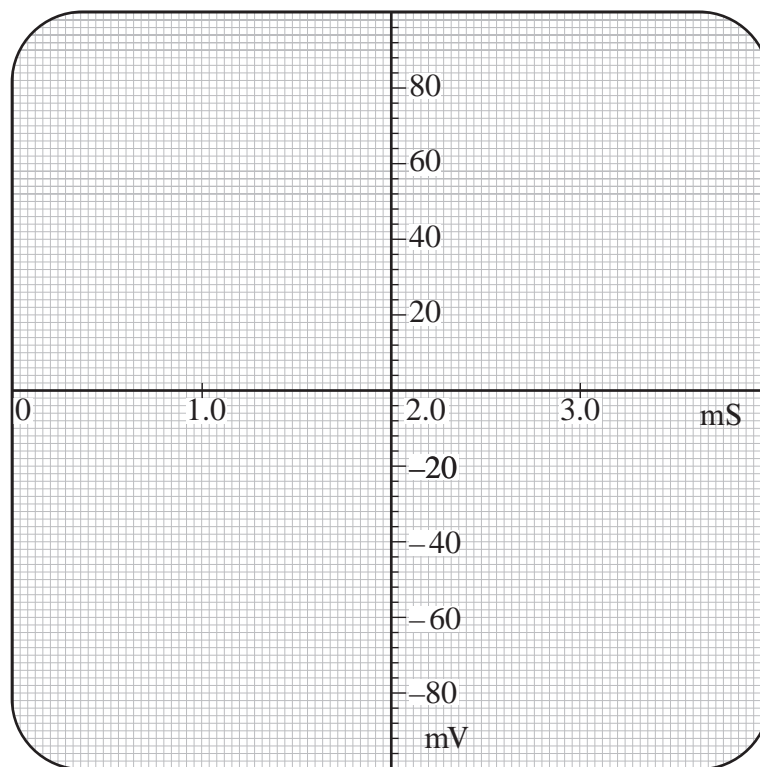
(ii) Label your Action Potential to show, depolarisation and repolarisation. [1]

(b) The diagram below shows the structural components of the axon membrane that are responsible for the potentials measured in part *(a)*.

Na^+/K^+ pump Na^+ channel K^+ channel
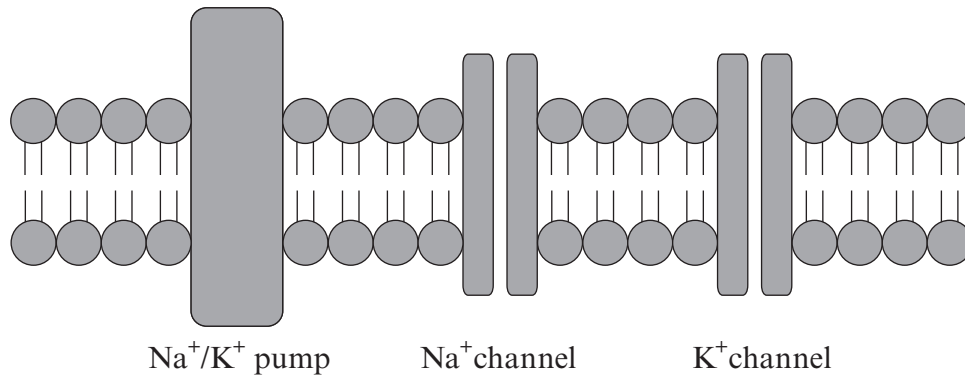
(i) From which type of biological molecules are the following made?

pumps and channels .... [1]

the bilayer .... [1]

(ii) With reference to the diagram, describe how the following events are brought about. [4]

Resting Potential ....

....

....

Depolarisation ....

....

....

(c) Explain how impulses are transmitted across a synapse. [3]

....

....

....

....

....

(Total 12 marks)

Turn over.

10

4. Following the Haiti earthquake in 2010 there was an outbreak of cholera. A web site describes the cause as follows:

'**Cholera** is caused by the bacterium *Vibrio cholerae* – a curved bacillus each with one flagellum. The genus *Vibrio* is a member of the family Vibrionaceae, which include Gram-negative, motile, facultative anaerobes that utilize glucose as a source of energy.
The bacteria are typically spread by contaminated drinking water.'

(a) Describe what is meant by the following terms used in the article:

(i) Bacillus, [1]

....

(ii) Gram-negative, [2]

....

....

(iii) Facultative anaerobes. [2]

....

....

(b) Scientists might be able to determine the extent of contamination by counting the number of bacterial cells in water samples.

(i) What is the difference between a total count and a viable count? [1]

....

....

(ii) Both techniques involve serial dilution.
Annotate the diagram below to explain how you would obtain a series of ten fold dilutions of the drinking water sample. [3]

Sterile
graduated
pipette

Sample
of
drinking
water

1   2   3   4
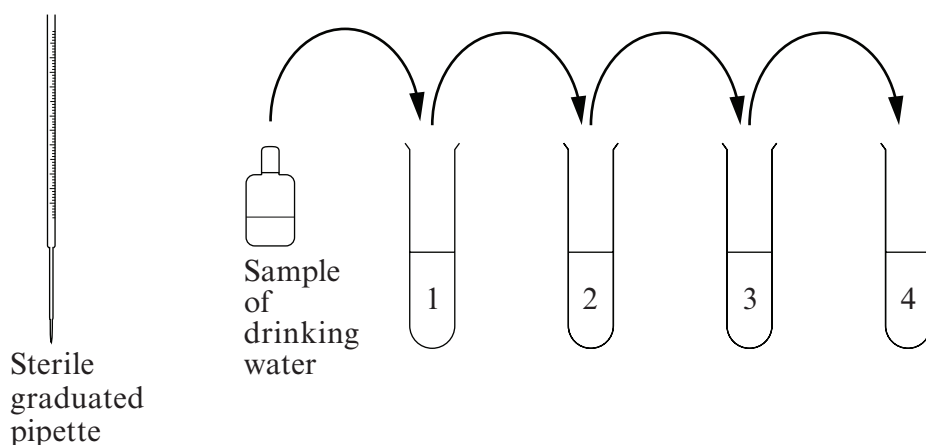
(iii) If 1 cm^3 of the drinking water sample contained 80 000 living bacterial cells, how many bacterial cells would there be in 0.5 cm^3 of the liquid in tube 4, after this technique had been completed? [1]

....

(iv) How would you use the dilutions produced to carry out a viable count? [4]

....

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(Total 14 marks)

Turn over.

5. The diagram below shows the growth curve for a population of a simple organism such as yeast.
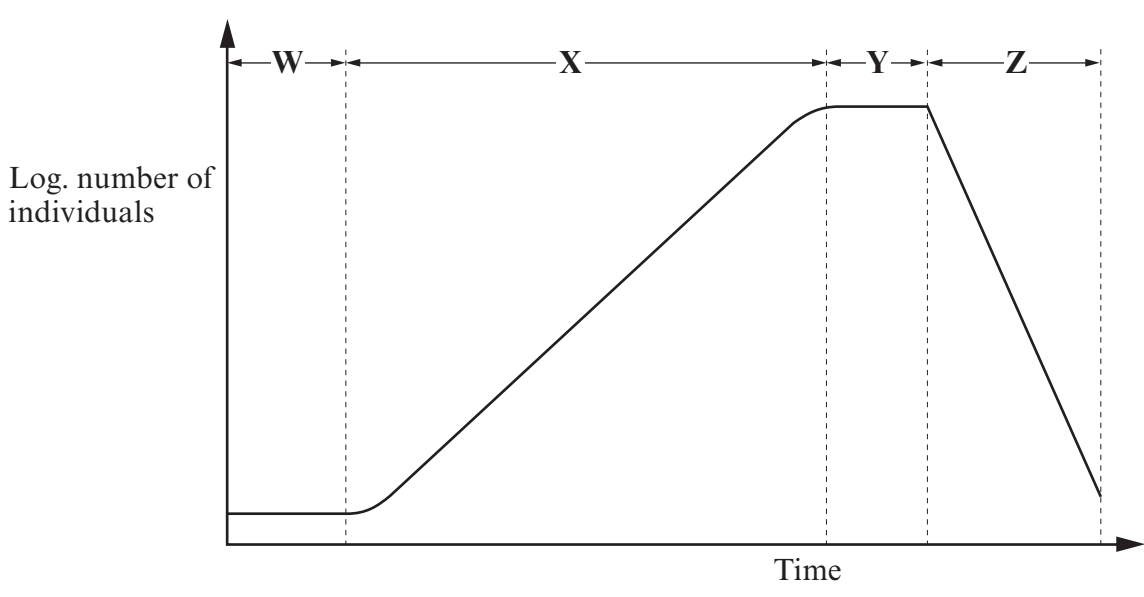
(a) Name the phases of growth **W-Z**. [2]

W ....

X ....

Y ....

Z ....

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(b) The growth for more complex organisms may be given by the formula;
    Population growth = (Births + Immigrations) – (Deaths + Emigrations)
    A growth curve for such a population is shown with a solid line below.
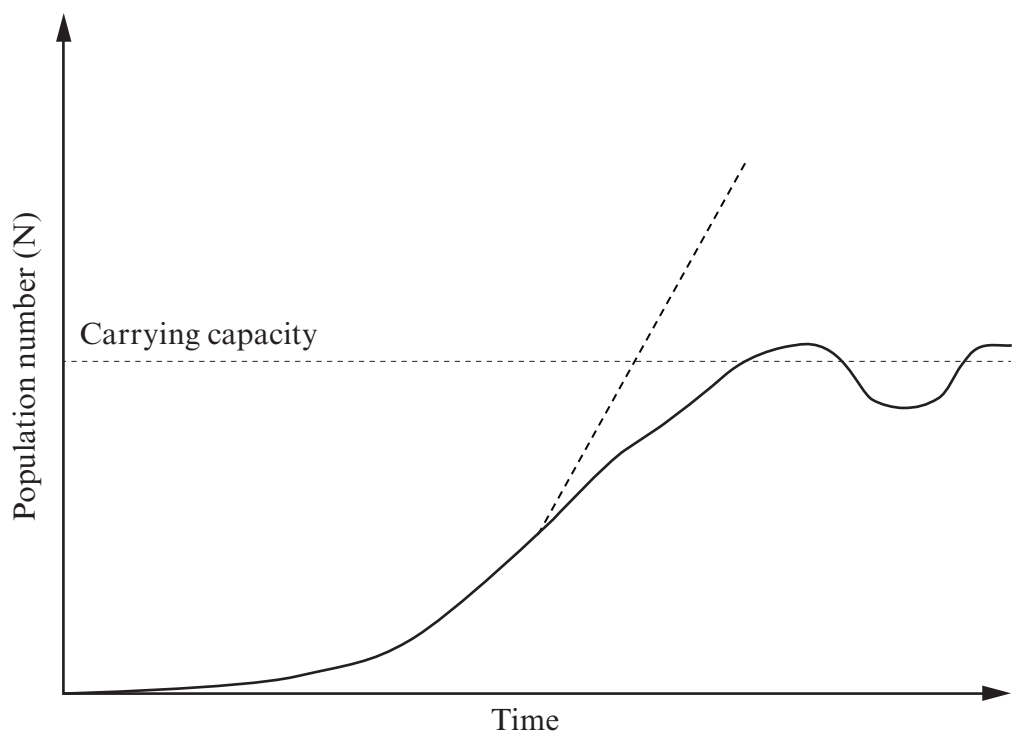
(i) Draw an arrow labelled D on the solid line to show **one** phase where (Deaths + Emigrations) exceeds (Births + Immigrations). [1]

(ii) Explain the term *carrying capacity*. [2]

....

....

....

(iii) State **two** examples of **density dependent** factors that can affect the carrying capacity of an ecosystem. [2]

....

....

(iv) State **one** example of a density independent factor. [1]

....

(v) On the graph, extend the dashed line to show what is likely to happen to a population whose size substantially exceeds the carrying capacity. [1]

(Total 9 marks)

Turn over.

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6. *(a)* Name the functional unit of the mammalian kidney shown in the diagram. [1]

....
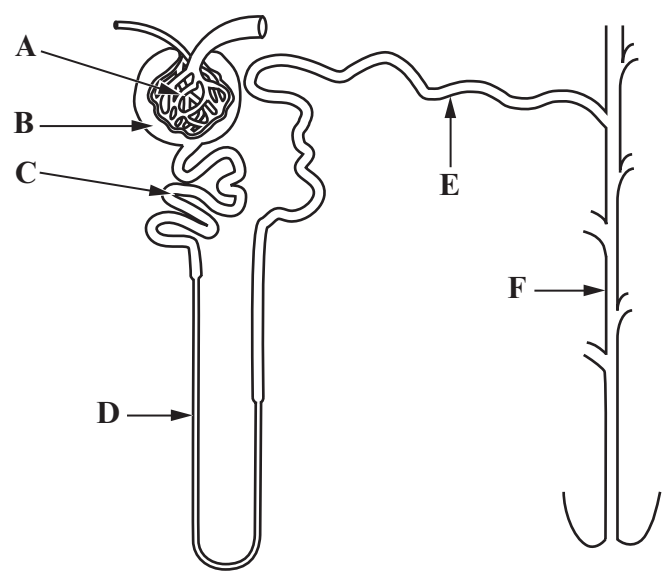
(b) (i) Name the parts labelled **A-F**. [3]

A ....

B ....

C ....

D ....

E ....

F ....

(ii) State the function of part **D**. [1]

....

(iii) How is part **D** adapted in the kidneys of desert mammals such as the kangaroo rat? [1]

....

(c) Parts **E** and **F** have restricted permeability which is subject to hormonal control.

(i) Which hormone controls the permeability of parts **E** and **F**? [1]

....

(ii) Which part of the mammal's body releases this hormone into the blood? [1]

....

(iii) Use your answer to parts (i) and (ii) to identify, on the diagram of the Osmoregulatory
Feedback Loop below [1]

(I) the detector; ....

(II) the effector. ....

(iv) Complete the diagram below, of an Osmoregulatory Feedback Loop, to explain
the mechanism for adjusting urine during osmoregulation. [3]

Concentration of body fluid

detector (I)

increased   decreased

co-ordinator

more hormone released   less hormone released
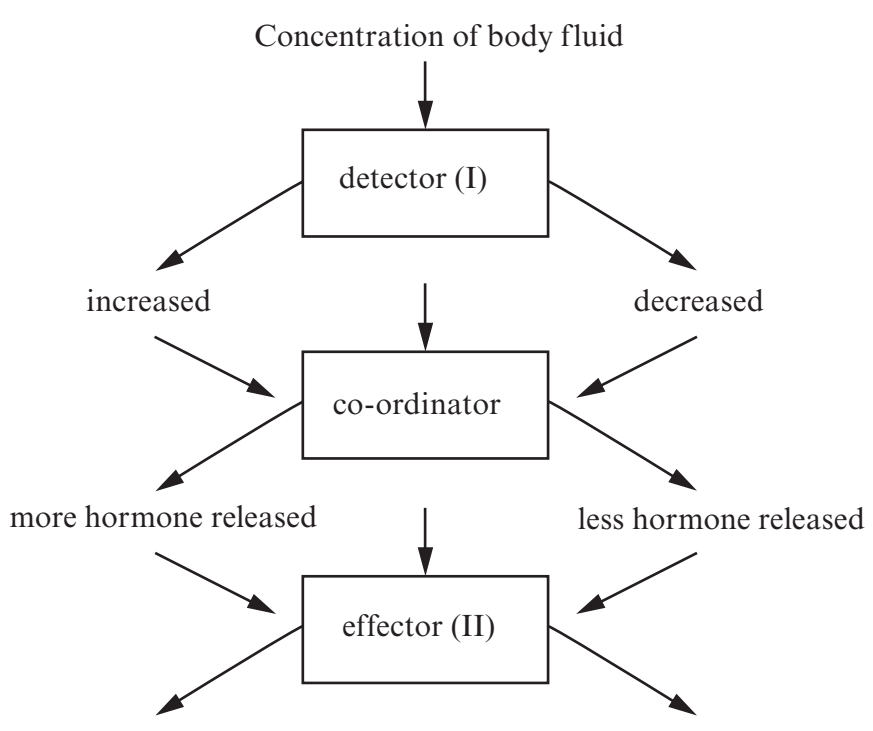
effector (II)

.... How hormone changes the effector ....

.... How concentration of urine changes ....

.... How volume of urine changes ....

Concentration of body fluid returns to normal

Turn over.

(d) (i) The environment in which an animal lives plays a part in excretion of nitrogenous waste. Mammals release it as urea. In what form is it released in the following?[2]

(I) Freshwater fish ....

(I) Insects ....

(ii) Suggest **one** advantage to insects of excreting nitrogenous waste in this form.   [1]

....

....

(Total 15 marks)

7. Answer **one** of the following questions.

Any diagrams included in your answers must be fully annotated.

Either, *(a)* Describe the nitrogen cycle, include the form that nitrogen takes in each part and the roles of bacteria (giving names wherever possible).   [10]

Or *(b)* Describe how the principles of a batch culture fermenter are applied in the industrial production of penicillin.   [10]

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Turn over.

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Examiner
only

(Total 10 marks)