

Surname	Centre Number	Candidate Number
Other Names		2



GCE A level

1074/02

HUMAN BIOLOGY – HB4

P.M. MONDAY, 13 June 2011

1¾ hours

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	10	
2	5	
3	17	
4	14	
5	9	
6	15	
7	10	
Total	80	

1074
020001

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.

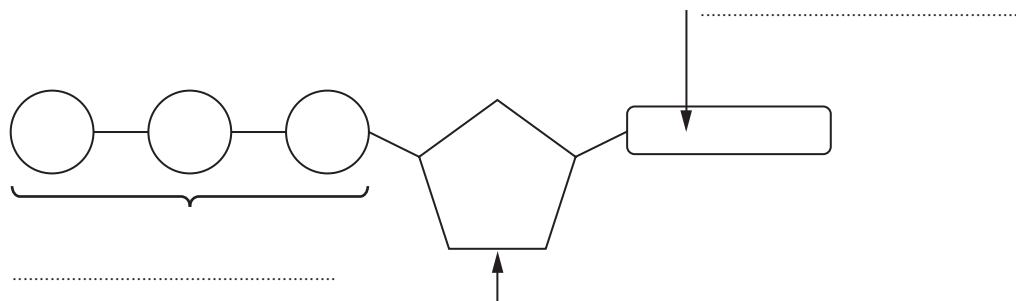
INFORMATION FOR CANDIDATES

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.

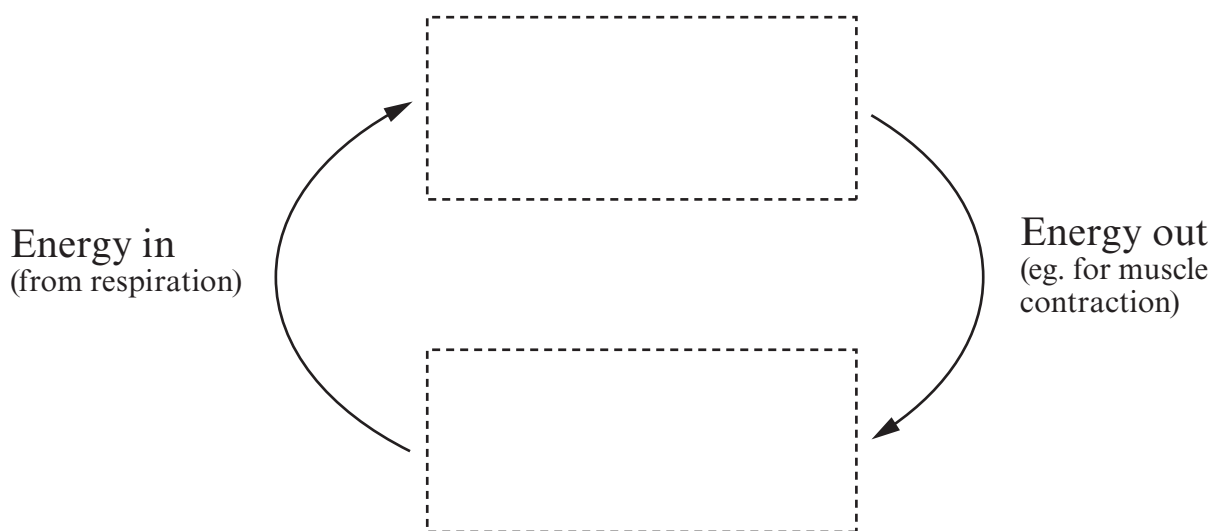
1. The diagram below shows a molecule of ATP.



(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]



(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

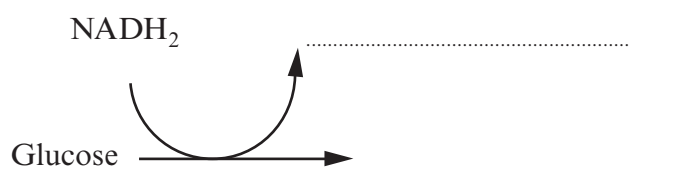
Precise location in the cell

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

NADH_2

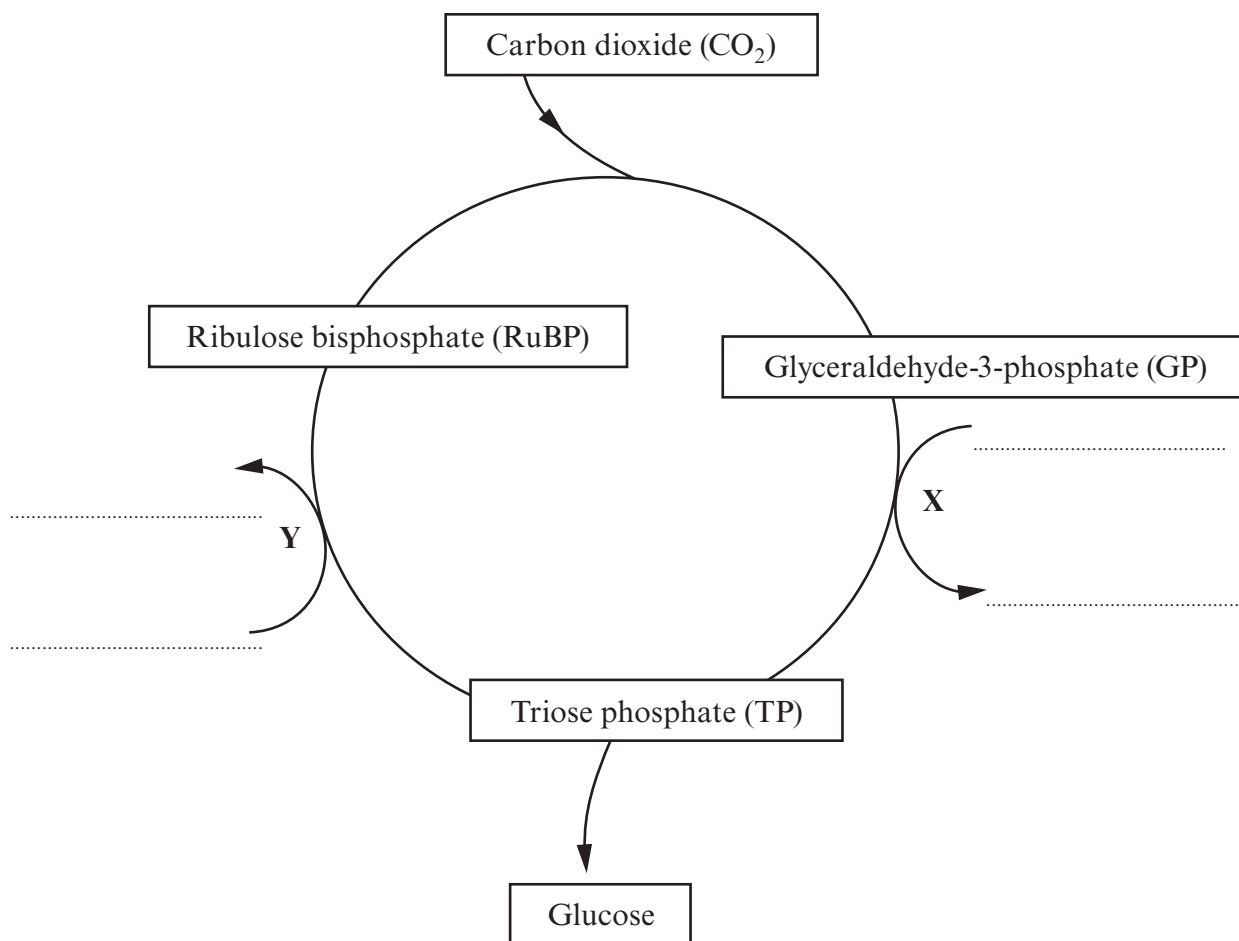
FADH_2

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



(Total 10 marks)

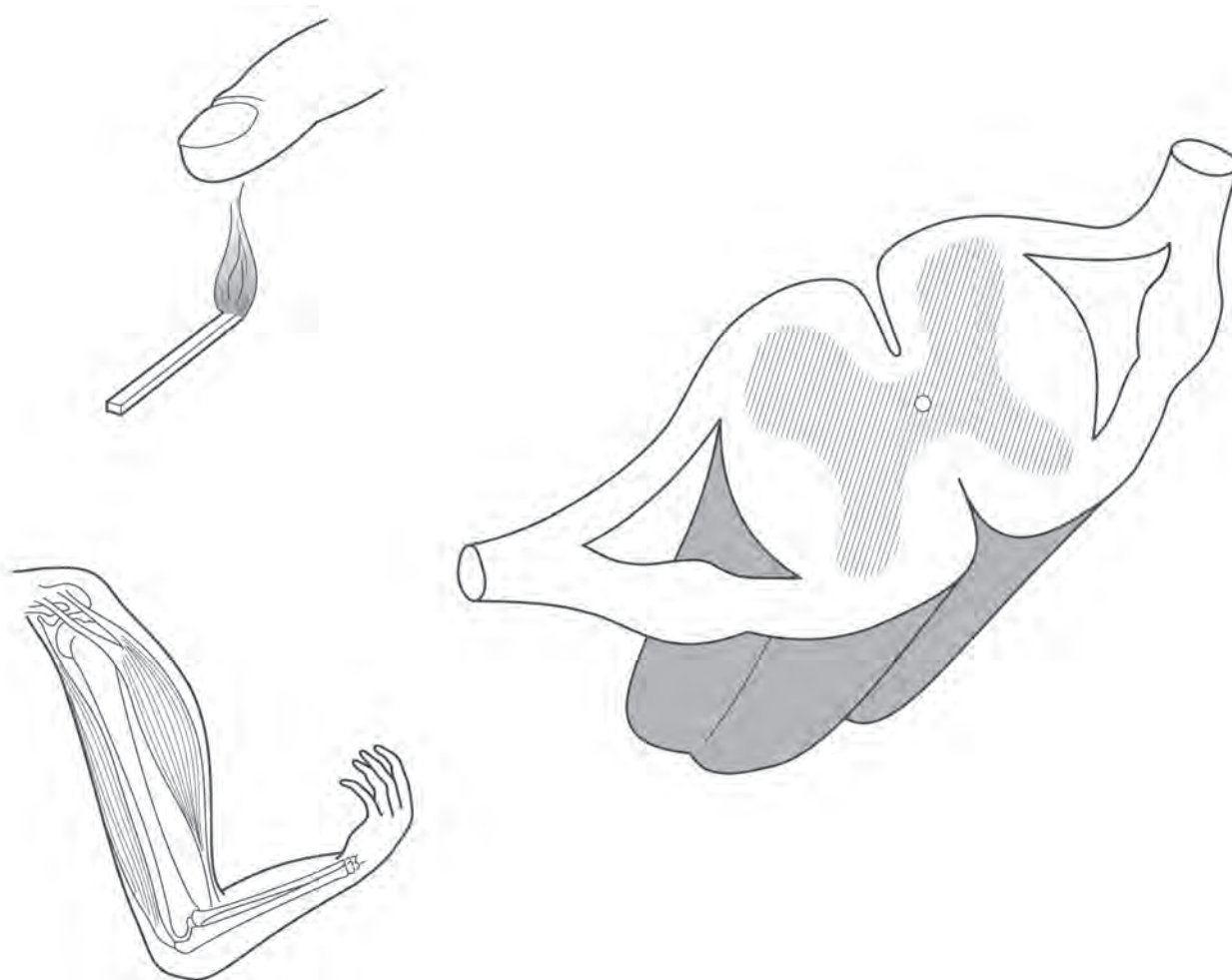
2. Calvin did experiments on a series of reactions which is now called the light independent stage of photosynthesis. He worked out that ribulose biphosphate is regenerated so that the reactions are in the form of a cycle, which is summarised below:



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

(Total 5 marks)

3. The diagram represents the spinal cord and structures involved in the hand withdrawal reflex. (Not drawn to scale).



- (a) Draw and **label** on the diagram a sensory, relay and motor neurone involved in the reflex action when a hand is withdrawn from a hot object. [3]
- (b) Explain giving **two** reasons, why nerve impulses can only travel in one direction. [2]

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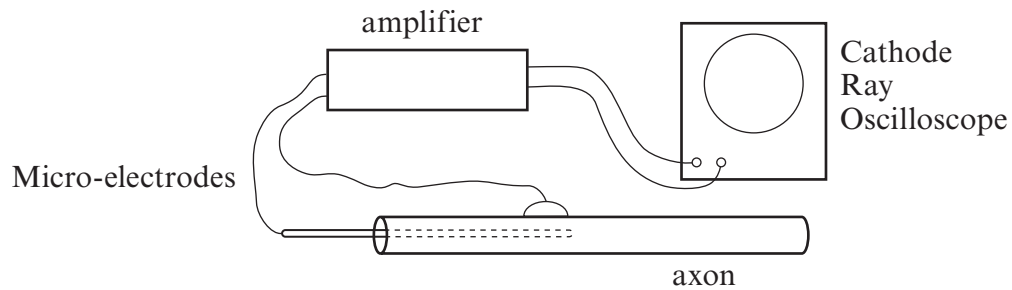
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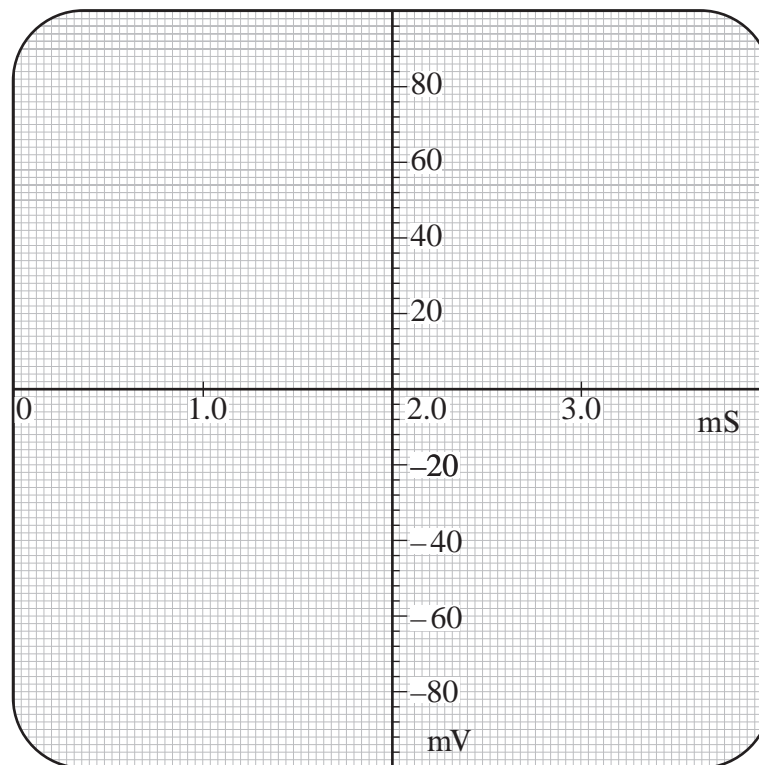
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- (c) The equipment shown in the diagram below is used to measure electrical potential across the membrane of squid giant axons.

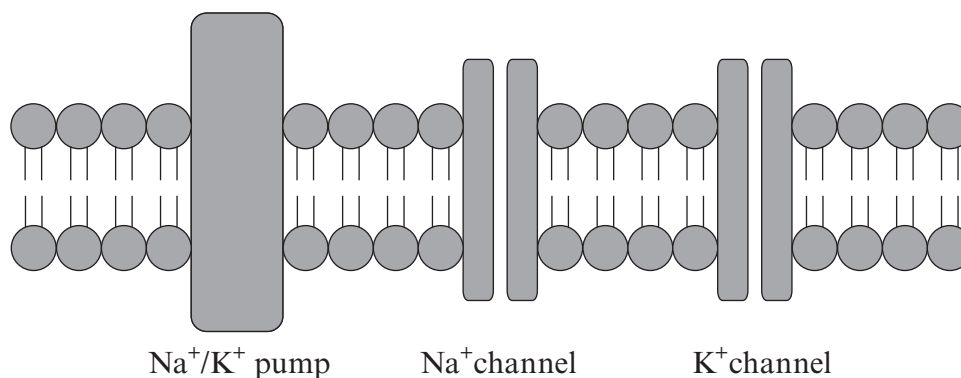


- (i) Use the grid below to draw a typical action as it would appear on the screen of the cathode ray oscilloscope. [2]



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

- (d) The diagram below shows the structural components of the axon membrane that are responsible for the potentials measured in part (c).



- (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

.....

.....

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

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.....

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.....

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(Total 17 marks)

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]

.....

.....

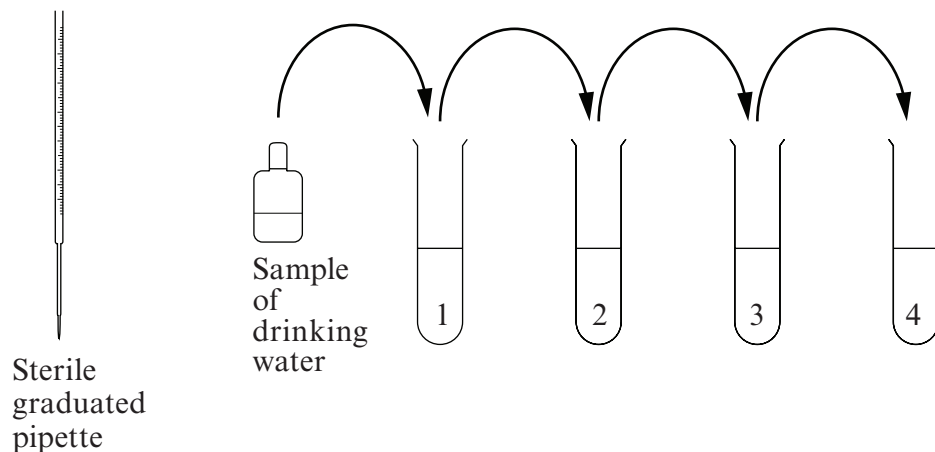
(b) Scientists might be able to determine the extent of contamination by counting the number of bacterial cells in water samples.

(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]



- (iii) If 1 cm³ of the drinking water sample contained 80 000 living bacterial cells, how many bacterial cells would there be in 0.5 cm³ 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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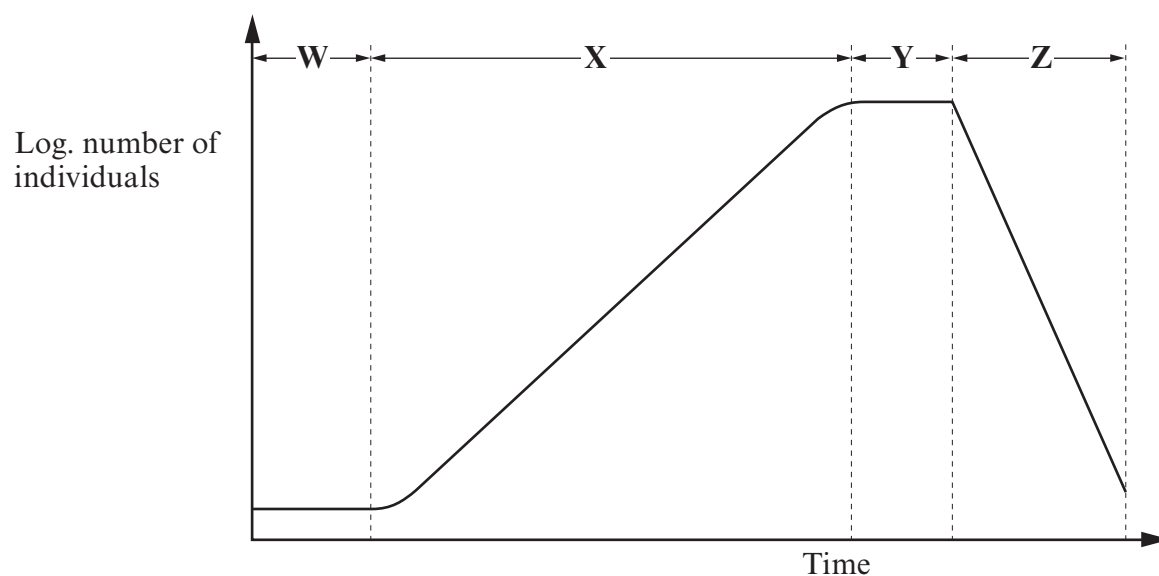
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(Total 14 marks)

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

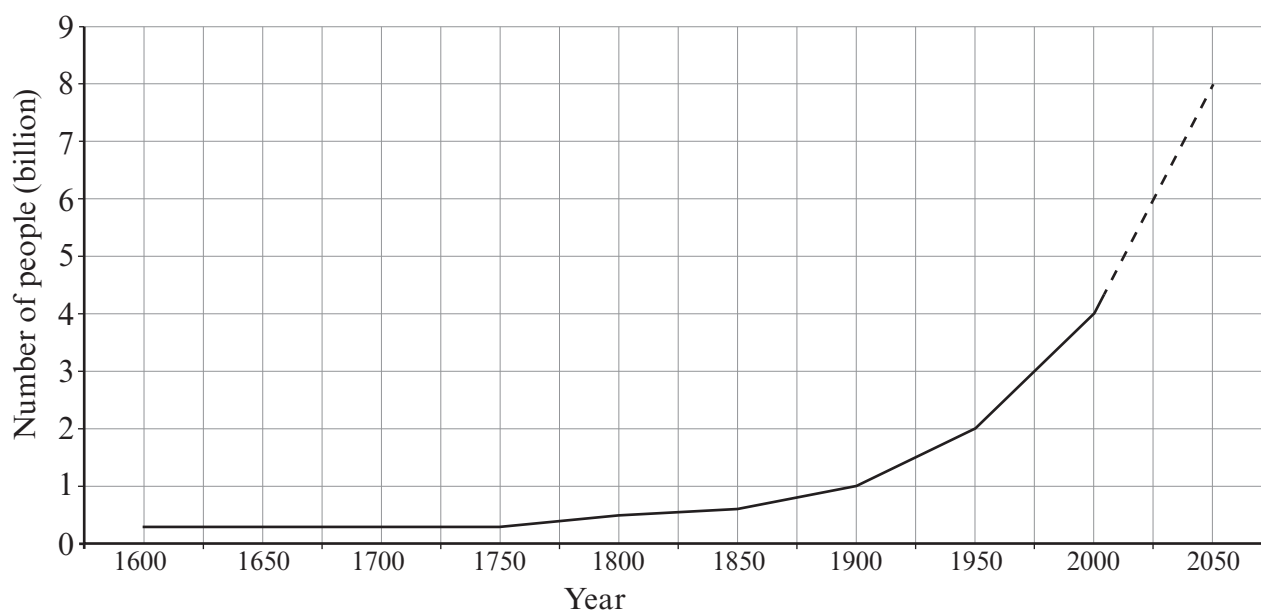
Y

Z

- (b) The growth for world human populations may be given by the formula;

$$\text{Population growth} = \text{Birth} - \text{Deaths}$$

A growth curve for world human population is shown with a solid line below.



(i) How did birth rate compare with death rate over the following periods?

(I) 1600 to 1750

[1]

.....

.....

(II) 1700 to 1900

[1]

.....

.....

(ii) Describe **one** difference between the population growth phases in humans and yeast cells. [1]

.....

.....

.....

(iii) Describe **two** human activities that have allowed human population to increase so rapidly after 1900. [2]

.....

.....

.....

.....

(iv) Give **two** reasons why the growth curve for human population might not continue as shown by the broken line. [2]

.....

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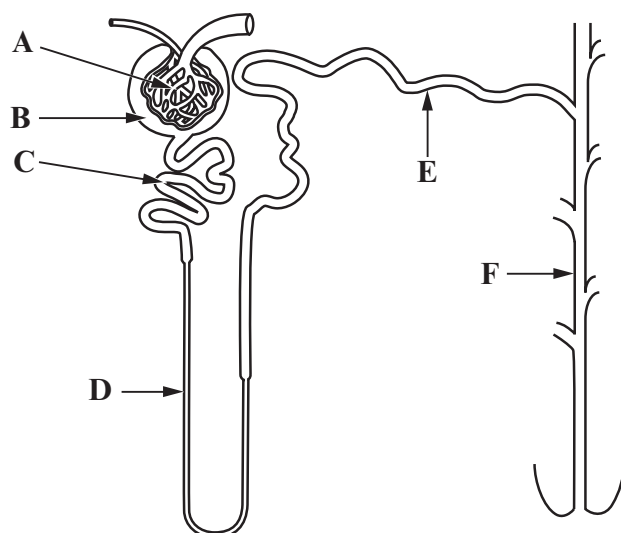
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(Total 9 marks)

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]

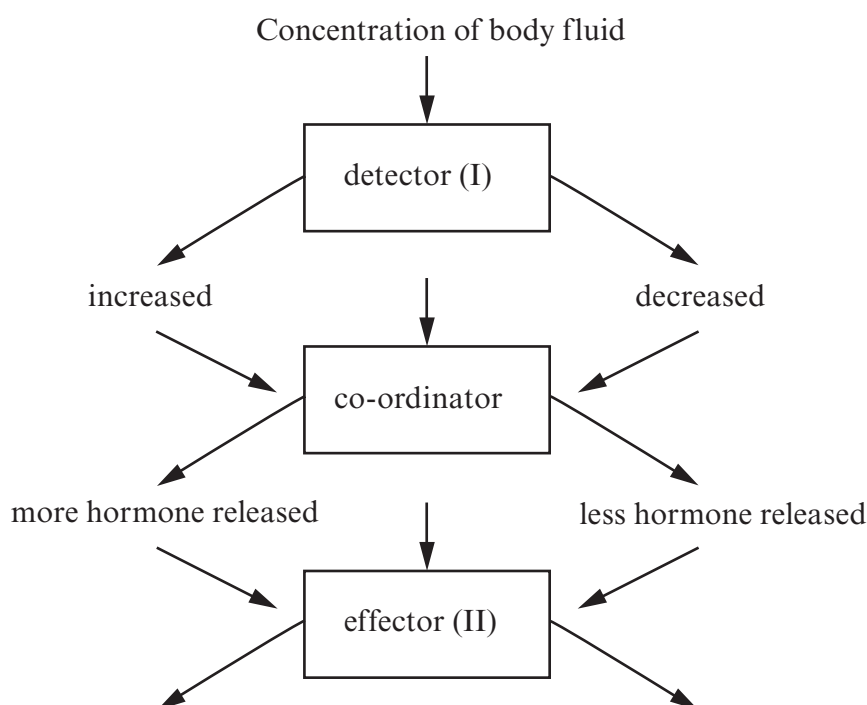
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(iii) Use your answer to parts (i) and (ii) to identify on the diagram of the Osmoregulatory Feedback Loop below [1]

(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]



..... How hormone changes the effector

..... How concentration of urine changes

..... How volume of urine changes


 Concentration of body fluid returns to normal

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

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]

