Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4471/02

ADDITIONAL SCIENCE/BIOLOGY

BIOLOGY 2
HIGHER TIER

A.M. TUESDAY, 13 May 2014

1 hour

Suitable for Modified Language Candidates

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**6**	
3.	**5**	
4.	**6**	
5.	**6**	
6.	**9**	
7.	**7**	
8.	**8**	
9.	**6**	
Total	**60**	

4471
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

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

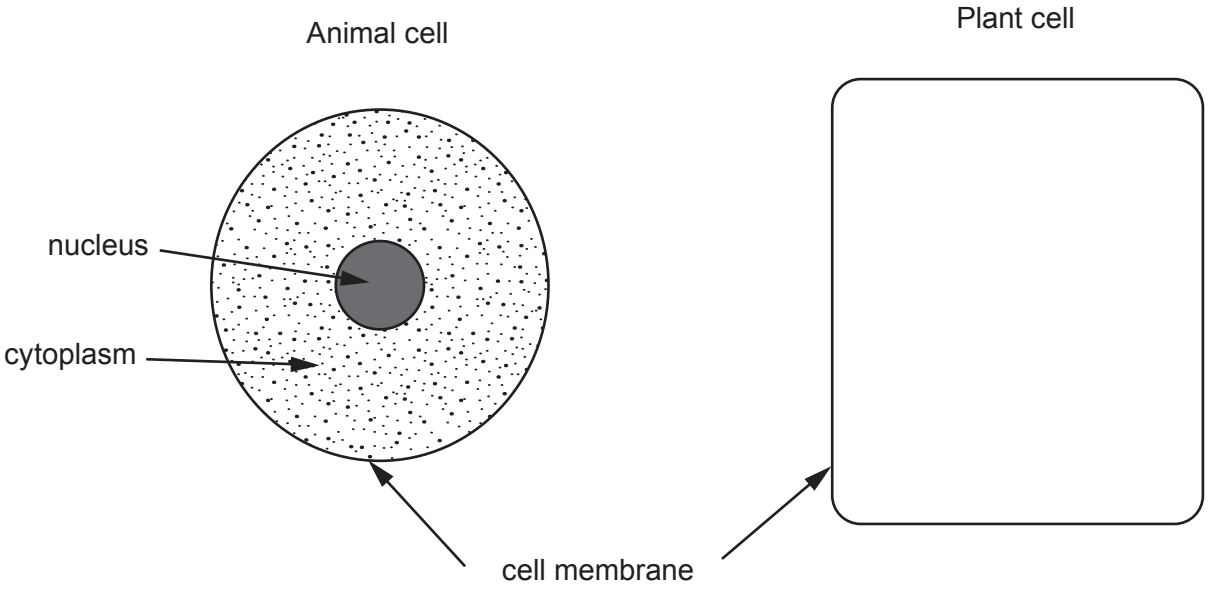
The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to question **4** and question **9**.

Examiner only

Answer **all** *questions.*

1. *(a)* (i) The diagrams below show an animal cell and the **cell membrane** of a plant cell. Complete the drawing of the plant cell. *No labels are required.* [2]



(ii) State the function of the cell membrane. [1]

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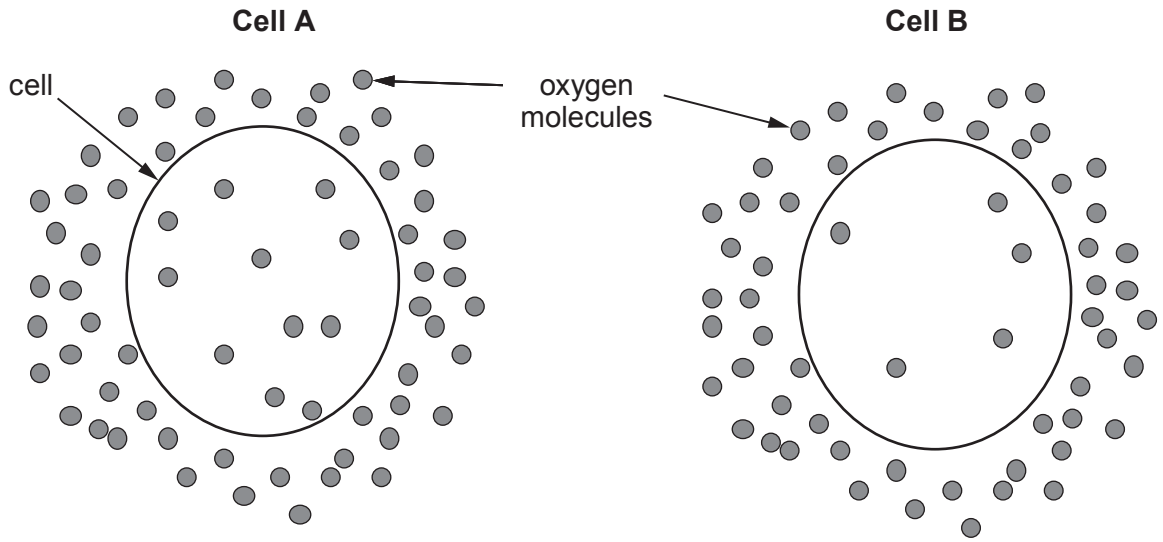
(b) The diagrams below show two cells which are carrying out respiration. Oxygen molecules are shown inside and outside both cells.



Examiner only

(i) Answer the following questions by placing a tick [✓] in the correct box. [3]

I. In cell **A** the oxygen molecules move:

into the cell ☐

out of the cell ☐

no net movement. ☐

II. In cell **B** the oxygen molecules move:

into the cell ☐

out of the cell ☐

no net movement. ☐

III. Into which cell could there be the greater net movement of oxygen:

cell **A** ☐

cell **B**? ☐

(ii) Name the process by which the oxygen molecules are moving. [1]

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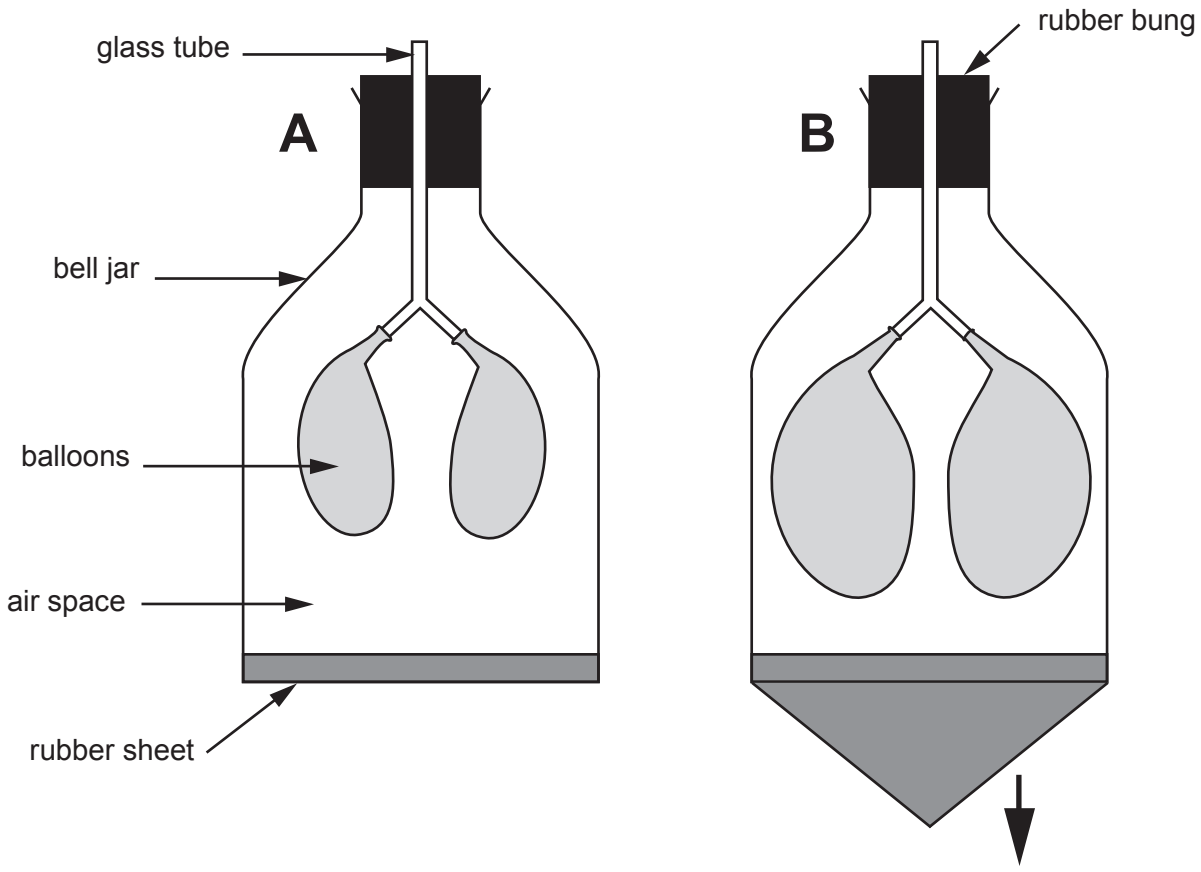
Turn over.

Examiner only

2. The model below represents the human thorax (chest) during expiration and inspiration.



(a) Complete the following sentences by using one of the following choices. [4]

the same **greater** **less**

(i) Compared to diagram **A**, the 'lung' volume in diagram **B** is ..... .

(ii) Compared to diagram **A**, the 'lung' pressure in diagram **B** is ..... .

(iii) Compared to diagram **A**, the 'thoracic' volume in diagram **B** is ..... .

(iv) Compared to diagram **A**, the 'thoracic' pressure in diagram **B** is ..... .

(b) Give reasons why the bell jar model above is not a true representation of the human thorax. [2]

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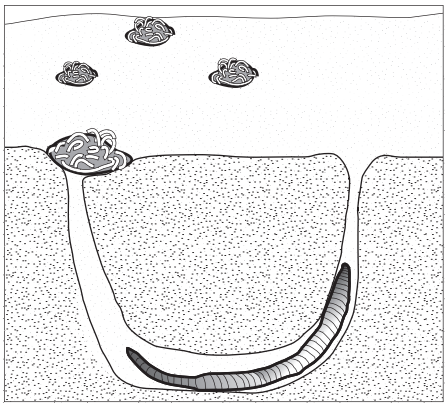
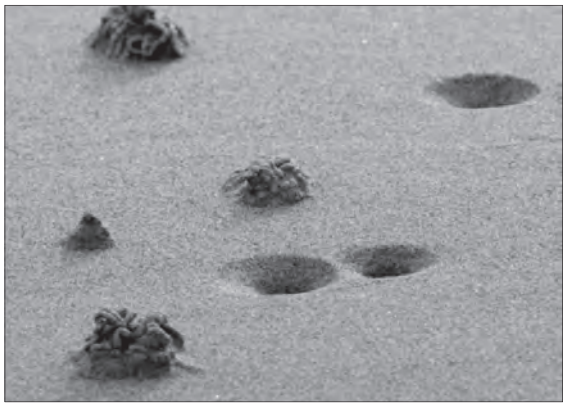
Examiner only

3. Lugworms *(Arenicola marina)* live in burrows in the sand on beaches. At one end of the burrow is a hole. At the other end is a mound of sand, called the cast, which the lugworm has removed from the burrow. Each burrow is occupied by one lugworm only.

Burrow in section



Surface view



© Alan Gravell

Owen was asked by his teacher to estimate the number of lugworms, on a section of Whiteford Beach on Gower. He had to count the number of casts.

Owen decided to use 1 m^2 quadrats to estimate the number of lugworms present in an area of the beach measuring 80 m × 40 m.

(a) Which of the following methods would be the correct way for Owen to use the quadrats to sample the number of lugworms? [1]

Tick (✓) the correct answer.

method	tick (✓)
Place the quadrats where there are lots of casts	
Place the quadrats randomly within the sample area	
Place the quadrats carefully so as not to damage the casts	

Examiner only

(b) Owen counted the number of casts in 10 quadrat samples.
The table below shows his results.

quadrat number	number of casts
1	5
2	7
3	1
4	11
5	4
6	6
7	9
8	4
9	13
10	2
Mean	.....

(i) Complete the table above. Calculate the mean number of casts per quadrat of Owen's samples. [1]

(ii) Estimate the number of lugworms in the section of the beach by using the following equation: [2]

Estimated number of lugworms **=** Mean number of casts per quadrat **×** Area of section of beach

Estimated number of lugworms .....

(c) Why is this method of sampling **not** suitable for estimating the population of earthworms in an area of grassland? [1]

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Examiner only

4. Describe the method involved in testing a leaf for the presence of starch.
Each of the stages involved in the method should be described in sequence. Include the reason for carrying out each stage.
Your description must include reference to the colour changes shown by the leaf and what these changes indicate. [6 QWC]

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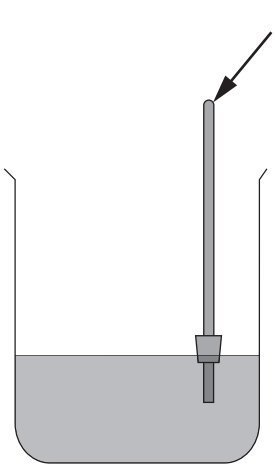
Examiner only

5. An experiment was set up to investigate the digestion of fat in milk by lipase. The following apparatus was used.



Beaker containing milk and lipase

Laptop with pH readout from WiFi pH sensor

The beaker containing milk and lipase was kept at a constant temperature in a water bath.
The pH readout on the laptop was recorded every 5 minutes for 40 minutes.
The results are shown below.

time (minutes)	pH
0	9.1
5	8.9
10	8.8
15	8.7
20	8.6
25	7.5
30	7.0
35	6.4
40	5.9

(a) Explain why the pH changed during the experiment. [2]

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Examiner only

(b) (i) The average rate of fall in pH in the first 20 minutes is 0.025 pH units per minute. After 20 minutes bile was added to the beaker.
Calculate the average rate of fall in pH units per minute in the 20 minutes after the bile was added. [1]

..... pH units per minute

(ii) Explain why the rate of fall in pH **increased** when bile was added. [3]

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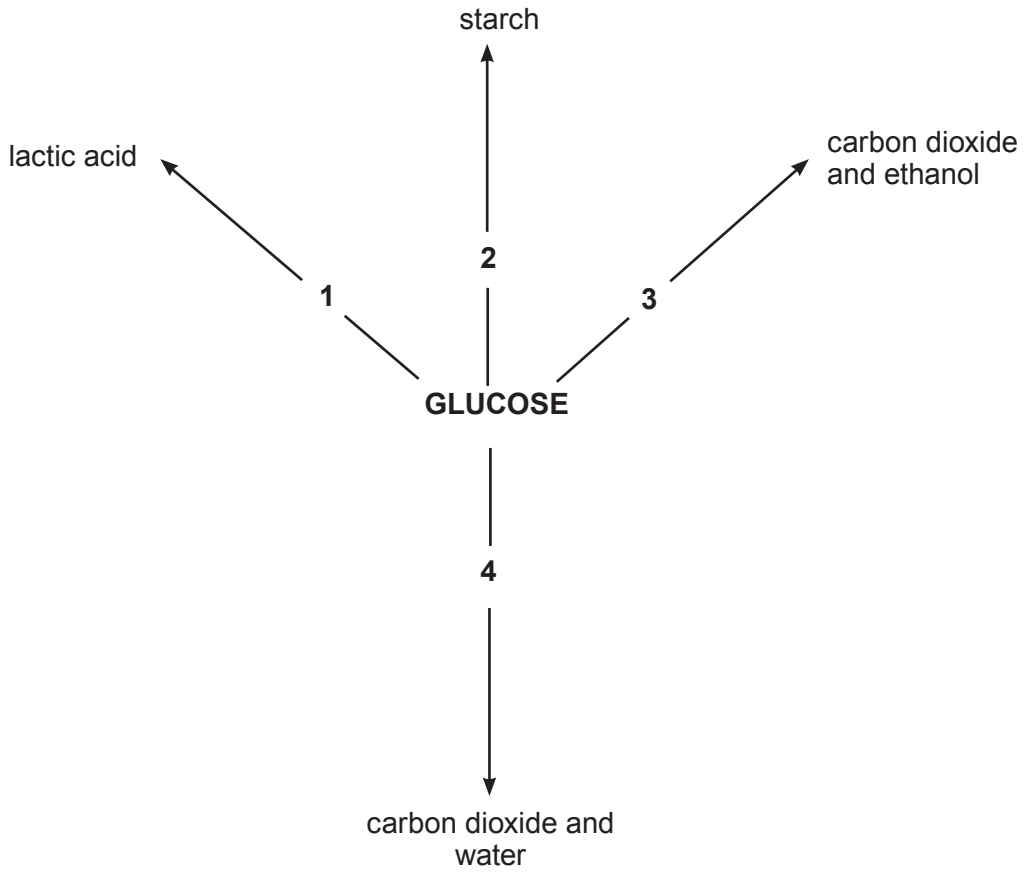
Turn over.

Examiner only

6. The diagram below shows a summary of how glucose is used by different organisms.



(a) Use the diagram above. Use a number to show the process which [3]

(i) does NOT release energy; .....

(ii) releases most energy per molecule of glucose; .....

(iii) takes place in yeast without using oxygen. .....

Examiner only

(b) An athlete ran a 100 m race. The table below shows events which happened in her body from the start of the race to the end of the recovery period after the race.
The events below are given letters but are NOT in the correct order in which they happened.

A She breathes oxygen rapidly and respires aerobically.

B Her oxygen debt is repaid.

C Her muscles ache.

D Lactic acid is produced.

E She begins anaerobic respiration in her muscles.

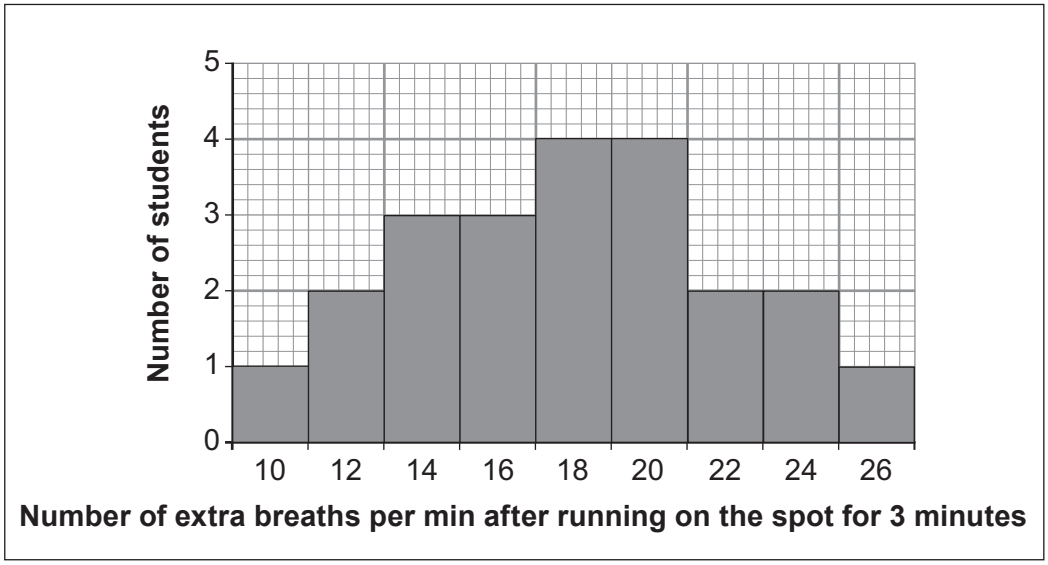
F She breathes slowly and respires aerobically.

Arrange the events above in the correct order in which they happened. Write the correct letter in the appropriate box in the table below.
One has been done for you. [4]

order of events	letter
1st	F
2nd	
3rd	
4th	
5th	
6th	

Examiner only

(c) Some year 11 students had their rates of breathing measured before and after running on the spot for three minutes.
The following bar chart shows the increase in breathing rates of the students after they had finished running.



(i) How many students had their breathing rates measured? [1]

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(ii) The average breathing rate for a physically fit year 11 student is 18 breaths per minute at rest. This rises to 36 breaths per minute after running on the spot for three minutes.
Scientists consider that physically fit year 11 students take a maximum of 18 extra breaths per minute after running on the spot for three minutes.
Use the bar chart to calculate how many of the students may be physically **unfit**.[1]

..... students

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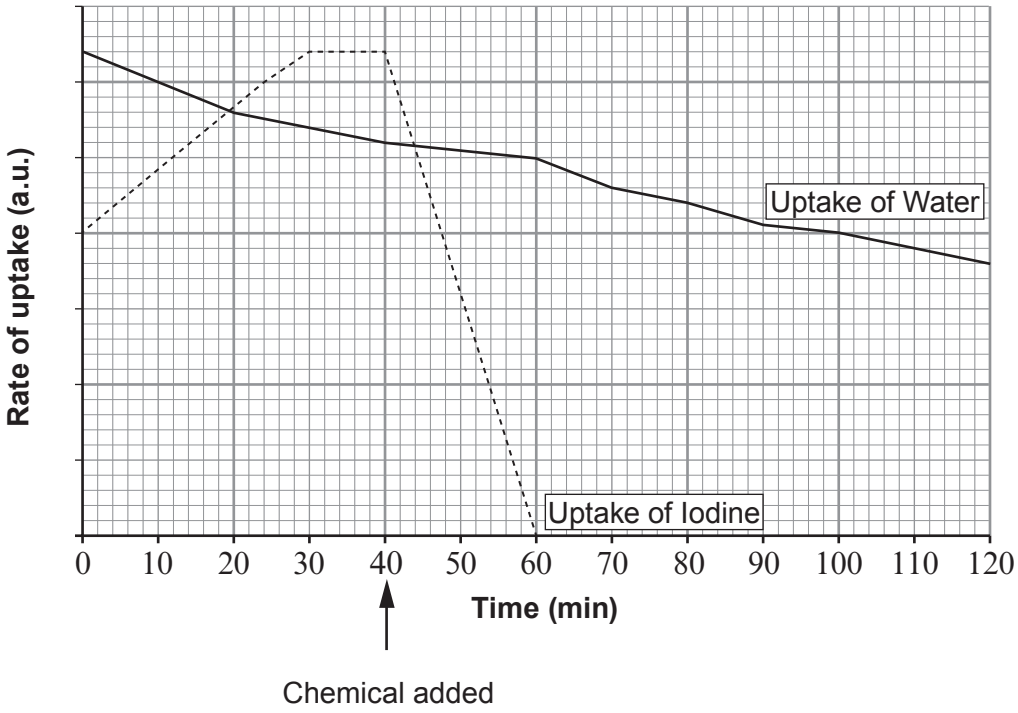
7. Kelp, *Laminaria digitata*, is an alga which lives in the sea.

The graph below shows the rate of uptake of water and iodine from sea water into kelp in a laboratory.



Examiner only

At forty minutes, a chemical was added to the sea water which stopped respiration taking place in the cells of the kelp.

(a) (i) Use the graph opposite. **Describe** the effect of adding the chemical on the uptake of iodine **and** water. [3]

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(ii) **Explain** the effect of adding the chemical on the uptake of iodine. [3]

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(b) What process is responsible for the uptake of the water? [1]

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Turn over.

Examiner only

8. *(a)* In DNA there is a genetic code which controls the order in which certain chemicals are linked together to form proteins.

(i) Name the **four** bases which make up the genetic code in DNA. [2]

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(ii) Name the types of chemicals which are linked together to form proteins. [1]

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(b) Name the type of cell division responsible for growth. Describe its importance in organisms. [2]

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In each cell some genes are active and some are not. The number of active genes in some types of cells are shown in the table below:

types of cells	number of active genes
liver	2091
kidney	712
heart	1195
pancreas	1094
small intestine	297

(c) Use the data above. Which type of cell produces the most enzymes? Explain your answer. [3]

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Examiner only

9. A student used red blood cells to carry out an investigation into cell membranes. Red blood cells were placed in salt solutions at three different concentrations. A sample of red blood cells was then removed from each concentration and placed on a microscope slide. The cells were viewed using a microscope for a period of time. The observations were recorded in a table:

concentration of salt solution (%)	observation of red blood cells
0.0	swell and burst
0.9	remain the same size
3.0	smaller and shrivelled

Explain the observations shown in the table. [6 QWC]

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END OF PAPER