ST EDWARD'S
OXFORD



16+ ENTRANCE EXAMINATION

For entry in September 2015

Biology

Time: 1 hour

Candidates Name: .....

Instructions to Candidates

Attempt **all** questions.
Write your answers in the spaces provided on the question paper

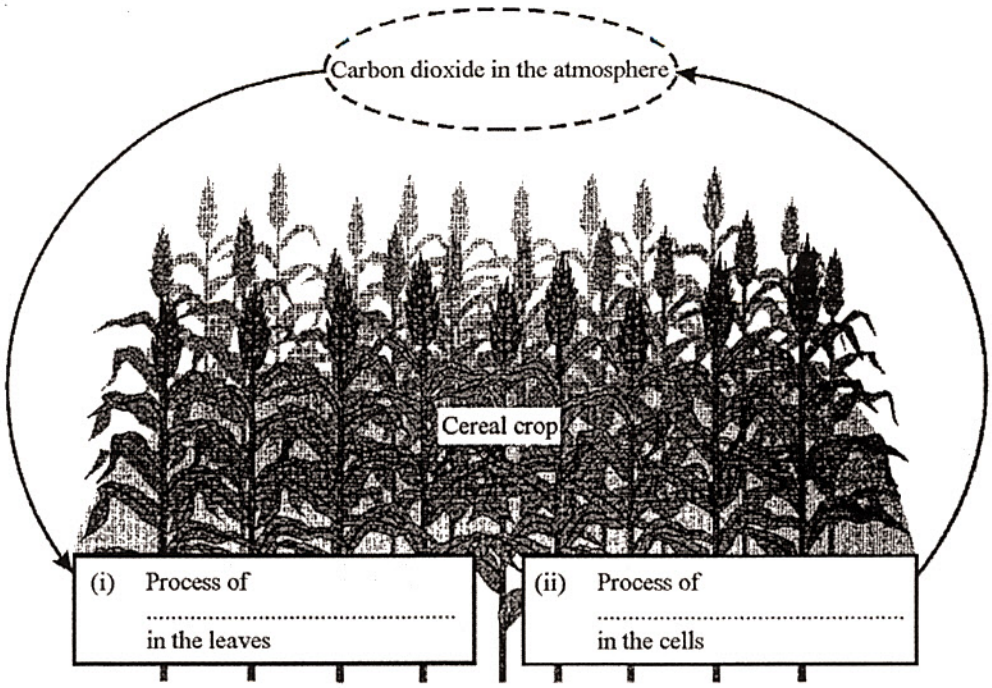
INFORMATION FOR CANDIDATES

The number of marks is given in brackets () at the end of each question or part question. The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.

For Examiners' Use		
Question	**Max**	**Mark**
1	6	
2	7	
3	8	
4	6	
5	5	
6	5	
7	4	
8	5	
9	9	
10	5	
Total: /60		

1. (a) The diagram shows a cereal crop.

Complete spaces (i) and (ii).



(2)

(iii) What sort of weather may cause the cereal crop to wilt?

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(1)

(b) Describe the process of transpiration in plants.

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(3)

(Total 6 marks)

2. (a) (i) Complete the genetic diagram to show the possible combinations of gametes for the four children and state the sex of the child for each combination.

Parents	**XX**	**XY**
Possible combinations	☐ ☐ ☐ ☐	
Sex of child	....	

(1)

(ii) What name is given to the process when a cell divides to produce gametes?

.....

(1)

(iii) How many pairs of chromosomes are there in each human body cell?

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(1)

(iv) How many chromosomes are present in a human ovum?

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(1)

(b) (i) Give **two** advantages to living things of reproducing sexually rather than asexually.

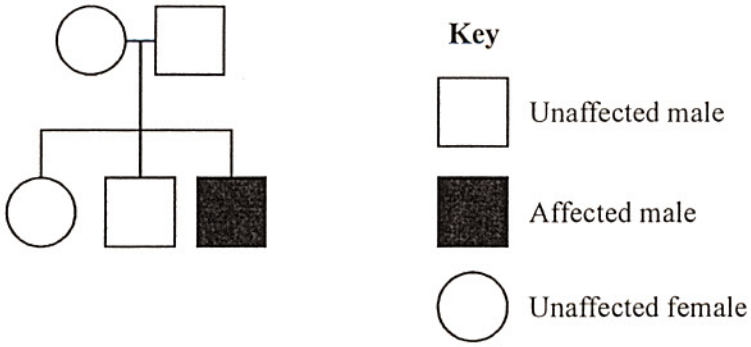
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(2)

(ii) The genetic diagram shows two parents and three children.



Only the son has cystic fibrosis, which is caused by a recessive allele. What conclusion may be made about the parents' genes?

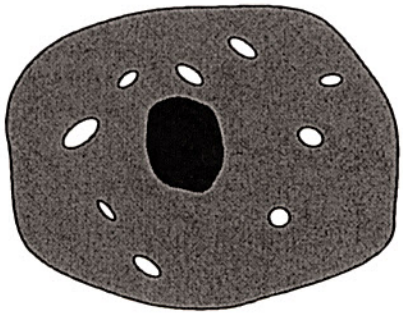
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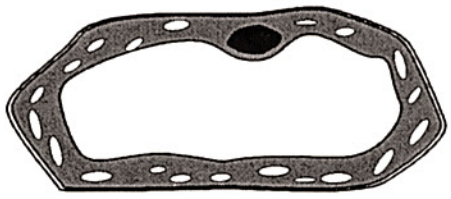
(1)

(Total 7 marks)

3. The diagrams show a cheek cell from a human and a leaf cell from a plant.



Cheek cell



Leaf cell

(a) The two cells have a number of parts in common.

(i) On the cheek cell, label **three** of these parts which both cells have.

(3)

(ii) In the table, write the names of the **three** parts you have labelled above and describe the main function of each part.

Part	Function
.....	
.....	
.....	

(3)

(b) Blood contains white cells and red cells. State the function of each type of cell in the blood.

White cells .....

.....

Red cells .....

.....

(2)

(Total 8 marks)

4. A person undertook a number of different activities. These activities required different amounts of energy. Being at rest required the least energy and rowing a boat required the most. During the activities the pulse rate and the volume of blood being pumped from the left ventricle per minute were measured. The results are shown in the table.

Activity	**Energy requirement**	**Pulse rate (in beats per minute)**	**Stroke volume (volume of blood pumped each beat from left ventricle in cm^3)**	**Cardiac output**
Rest	Lowest	70	80	5 600
Writing		85	96	8 160
Cleaning the floor		100	120	12 000
Wallpapering		120	136	
Walking fast		132	130	
Rowing a boat	Highest	153	124	18 972

(a) As the energy requirement increases, how does the change in the pulse rate differ from the change in the stroke volume?

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(1)

(b) Calculate the cardiac output of the left ventricle for wallpapering and walking fast. Enter the values in the table.

(1)

(c) (i) Describe, as carefully as you can, how the cardiac output changes with increasing activity.

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(2)

(ii) Explain the changes in cardiac output which occur as a person increases their activity.

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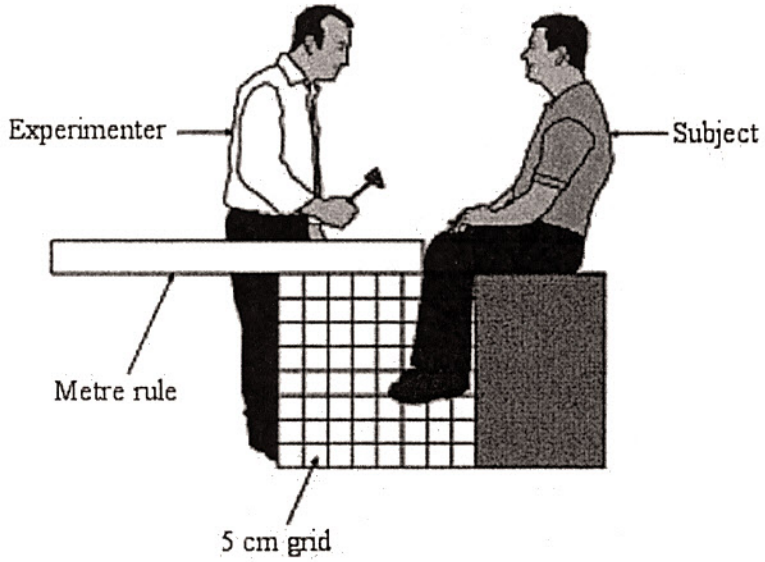
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(2)
(Total 6 marks)

5. When the tendon below the knee is tapped with a hammer, the lower leg jerks upwards in a reflex action. A group of students wanted to find out how the speed of the hammer affected the distance the lower leg moved.

The diagram shows how the experiment was set up.



Each trial was recorded on a video. A frame was taken every 33 milliseconds. The video was then played using single-frame advance. The number of frames for the hammer to move to the knee was found. The faster the speed, the smaller was the number of frames. The video was also used to find the distance moved by the toe.

In each trial, the experimenter held the hammer 20 cm from the subject's knee and then hit the subject's tendon. For each trial the experimenter used the hammer at a different speed.

The table shows some of the results.

Trial number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Distance hammer moved to knee (in cm)	20	20	20	20	20	20	20	20	20	20
Number of frames it took the hammer to move to the knee	15	16	12	10	9	8	7	6	2	2
Distance moved by toe in cm	0	0	5	5	10	10	10	10	15	15

(a) What was the control variable in this experiment?

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(1)

(b) Give **two** advantages of using a video to measure the time it took for the hammer to move to hit the tendon.

1 .....

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2 .....

.....

(2)

(c) Give **one** conclusion from the results of the experiment.

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(1)

(d) Give **one** way in which the precision of the experiment could have been improved.

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(1)

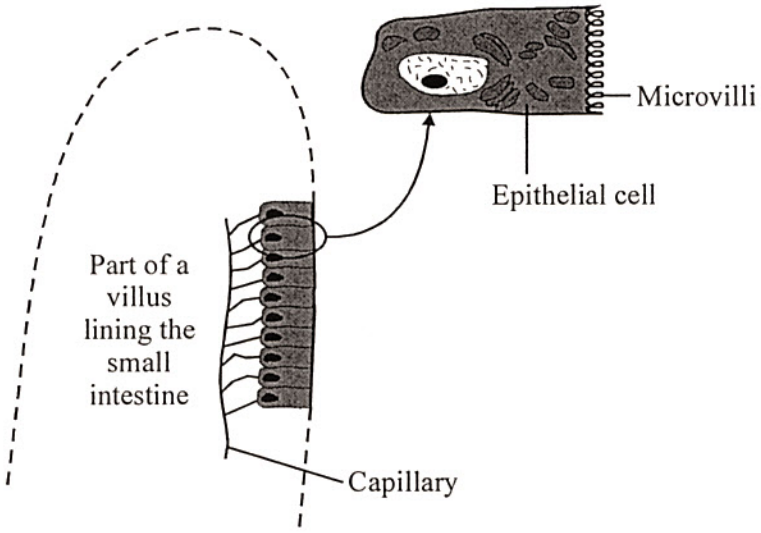
(Total 5 marks)

6. (a) Starch and protein are foods which have to be digested before they can be absorbed. For each, state the enzyme involved in the digestion process, where it occurs in the digestive system and what is formed and absorbed.

Food	Enzyme	Where digestion occurs	What is formed and absorbed
Starch	.....	.....	.....
Protein	.....	.....	.....

(4)

The diagram shows part of the lining of the small intestine. Digestion involves the breakdown of large molecules to smaller ones which are absorbed into the blood stream through the microvilli of the epithelial cells.



(b) Why are epithelial cells, which form the lining of the small intestine, adapted to be the shape shown?

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(1)

(Total 5 marks)

7. In compost heaps, dead plants are broken down by microbes.
This breakdown is much slower:

- when the weather is cold
- when the weather is dry
- when the heap is squashed down so that no air can circulate.

(a) What **three** conditions inside compost heaps are needed for microbes to work **quickly?**

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2 .....

3 .....

(3)

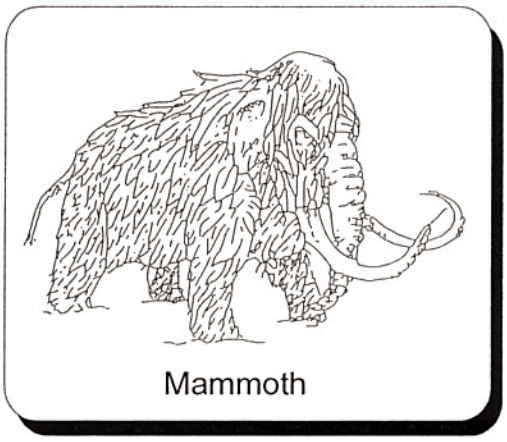
(b) Why is the breakdown of dead plants important for living plants?

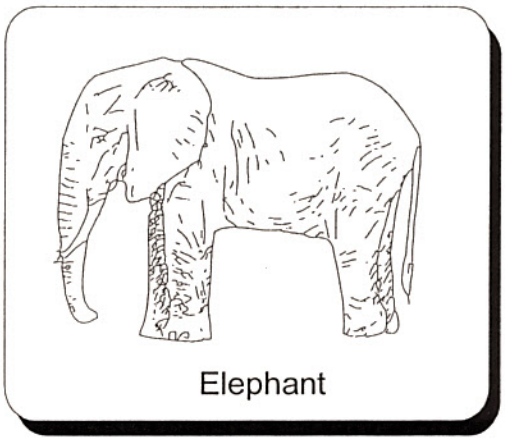
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(1)
(Total 4 marks)

8. The drawings below show a mammoth, an extinct relation of the elephant which lived in arctic regions, and a modern elephant which lives in tropical areas.





The mammoth, which was very hairy, and the elephant, are both thought to have evolved from a scantily haired ancestor. Explain, as fully as you can, how the **mammoth** evolved from the common ancestor.

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(Total 5 marks)

9. Human activities are changing the proportions of the gases in the Earth's atmosphere.

(a) Explain, as fully as you can, why the level of carbon dioxide in the atmosphere is changing.

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(3)

(b) Give **two** reasons why the methane level in the atmosphere is increasing.

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(2)

(c) Many scientists think that these changes in the level of carbon dioxide and methane are making the Earth warm up.

Explain this as fully as you can.

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(4)
(Total 9 marks)

10. External human fertilisation *(in vitro* fertilisation) may be done to help a woman with blocked oviducts to become pregnant.

(i) Suggest **one** reason why the blockage of the oviducts would cause infertility.

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(1)

(ii) Some of the main stages of *in vitro* fertilisation are:

- the woman is given an injection of follicle-stimulating hormone (FSH) shortly after menstruation;
- she is also given an injection of luteinizing hormone (LH);
- several eggs are then removed from her body;
- the eggs are placed in a solution very similar in composition to the fluid inside the female reproductive tract before the sperm are added to them.

Suggest the reasons for the inclusion of each of these stages in external fertilisation.

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(4)
(Total 5 marks)