Candidate Name:

St Swithun's
WINCHESTER

Biology

Sixth Form Academic Assessment

Sample paper

Time allowed: 1 hour

59 Marks in Total

Instructions to Candidates

Additional materials: Calculator (optional), pencil, eraser

- All questions to be answered on the paper
- All calculations to be shown (calculator not essential)
- Graph in pencil please
- Read the questions carefully & underline key words
- Include enough detailed points to match the allocated marks

1	/5
2	/9
3	/11
4	/8
5	/10
6	/10
7	/6
TOTAL	/59

Answer ALL questions. Write your answers in the spaces provided.

1 The diagram shows a pot containing yoghurt and fruit.

(a) Describe how a named bacterium produced this yoghurt from milk.

(3)

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(b) Suggest the health benefits to a human of adding fruit to the yoghurt.

(2)

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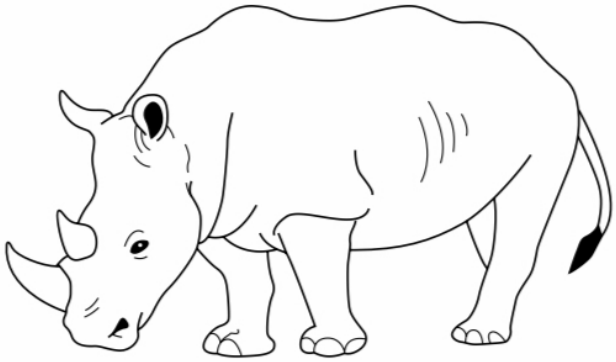
(Total for Question 1 = 5 marks)

2 A rhino is a large mammal that lives in hot parts of Africa.

The drawing shows a rhino.



(a) The rhino feeds on plants and rests in the shade during the day.

(i) Which of the following describes the trophic level of a rhino?

(1)

- ☒ **A** producer
- ☒ **B** primary consumer
- ☒ **C** secondary consumer
- ☒ **D** tertiary consumer

(ii) Which of the following explains why the rhino rests in the shade during the day?

(1)

- ☒ **A** it has a large surface area to volume ratio and needs to avoid overheating.
- ☒ **B** it has a large surface area to volume ratio and needs to gain heat.
- ☒ **C** it has a small surface area to volume ratio and needs to avoid overheating.
- ☒ **D** it has a small surface area to volume ratio and needs to gain heat.

(b) The horn of the rhino is valuable in some human cultures. This results in rhinos being killed just for their horn.

This species is at risk of extinction because the mean rate of killing is one rhino every six hours.

In 2016, there were an estimated 25 000 of one species of rhino in Africa.

Calculate the year in which this rhino species would become extinct, assuming the number of births equals the number of natural deaths.

(3)

year = ...

(c) In an effort to protect the rhino from extinction, scientists have produced a heart rate monitor.

The monitor is attached to the rhino. It sends an alarm signal to the nearest police station if the rhino is under stress.

This allows the police to respond quickly to save the rhino from being killed.

(i) Explain how stress affects the heart rate of a rhino.

(2)

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(ii) Describe the evidence the scientists need to find out if this method helps to protect the rhino from extinction.

(2)

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(Total for Question 2 = 9 marks)

3 A study investigates the effect of training on athletic performance.

In the study, the number of capillaries in the muscle tissue of a person is measured before and after a six-week period of training.

(a) The table shows the results.

Mean number of capillaries per mm²	
before training	after training
437	460

(i) Explain how training may affect the athletic performance of this person.
Use information from the table to support your answer.

(5)

(ii) Give **two** ways in which the design of the study could be improved.

(2)

1 .....

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2 .....

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(b) The diameter of a capillary is 8.0 μm and the diameter of the aorta is 25.0 mm.
1000 μm = 1 mm.

(i) Calculate the ratio of the diameter of the aorta to the diameter of the capillary.
Show your working.

(2)

ratio = ...

(ii) Explain why the aorta has a thicker wall than the capillary.

(2)

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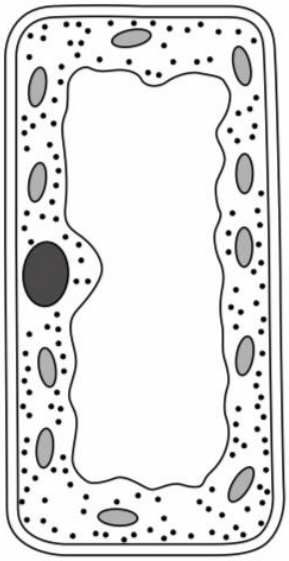
(Total for Question 3 = 11 marks)

4 The diagram shows a cell.



(a) (i) Which type of cell does the diagram show?

(1)

- ☒ **A** an animal
- ☒ **B** a bacterium
- ☒ **C** a fungus
- ☒ **D** a plant

(ii) The statements below describe conditions required for some molecules to move into this cell.

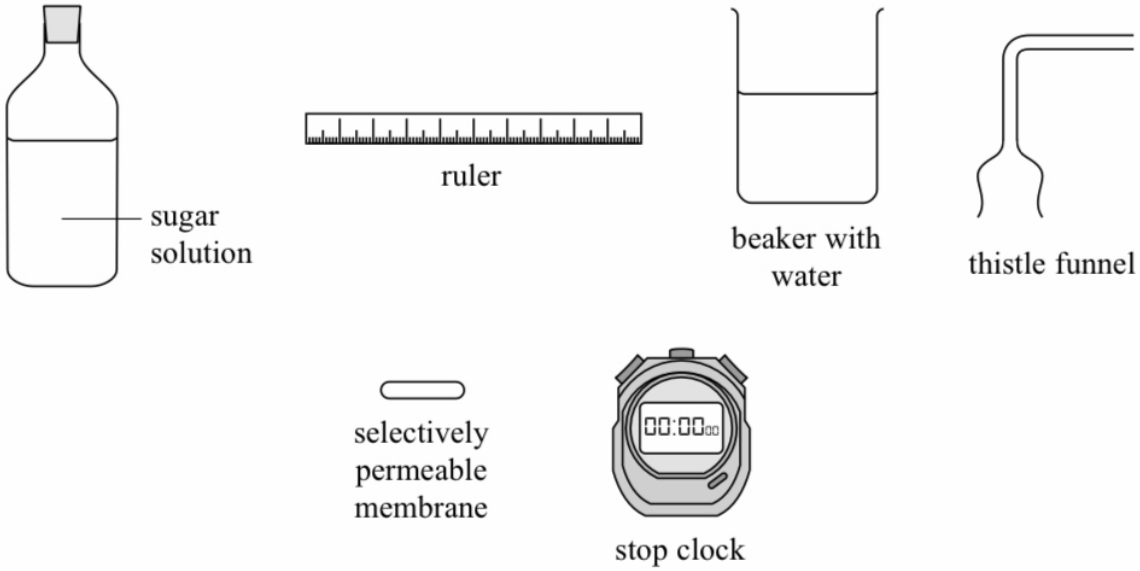
1. a concentration gradient
2. use of ATP

Which of these statements is correct for the process for osmosis?

(1)

- ☒ **A** 1 only
- ☒ **B** 2 only
- ☒ **C** 1 and 2
- ☒ **D** neither 1 nor 2

(b) The diagram shows some of the apparatus used to investigate the rate of osmosis.

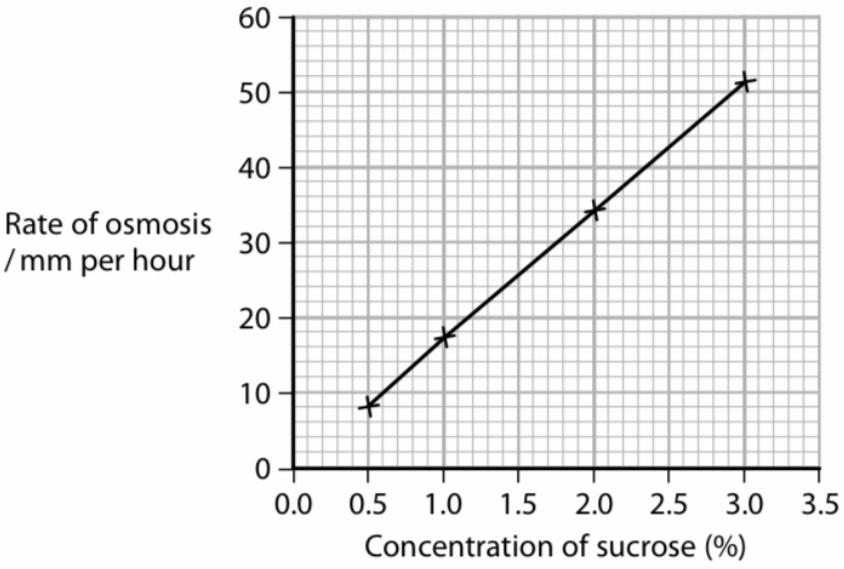


In the space below draw a labelled diagram to show how you would put this apparatus together to investigate the rate of osmosis.

(4)

(c) The apparatus is used to find out the effect of different sucrose concentrations on the rate of osmosis.

The graph below shows the results.



Calculate, using information from the graph, the rate of osmosis in mm per minute that would occur for a sucrose concentration of 2.5%.
Show your working.

(2)

rate of osmosis = ... mm per minute

(Total for Question 4 = 8 marks)

(c) A species of plant does not grow by the side of roads.

One hypothesis to explain this observation is that sulfur dioxide inhibits seed germination.

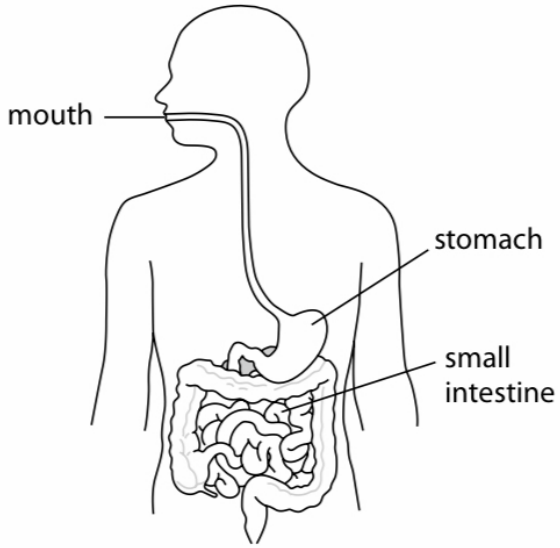
Design an investigation to test this hypothesis.

Your answer should include experimental details and be written in full sentences.

(6)

(Total for Question 6 = 9 marks)

5 The diagram shows parts of the human digestive system.



(a) Describe how food passes from the mouth to the stomach.

(2)

(b) Explain what happens to protein in the stomach.

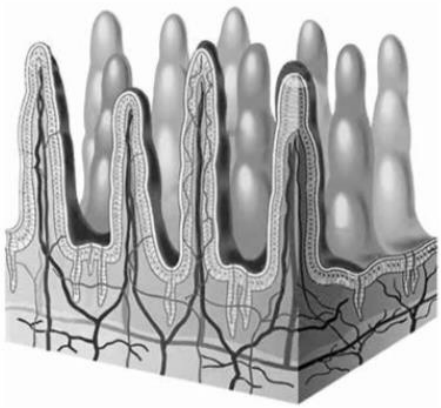
(4)

(c) Gluten is a protein found in wheat.

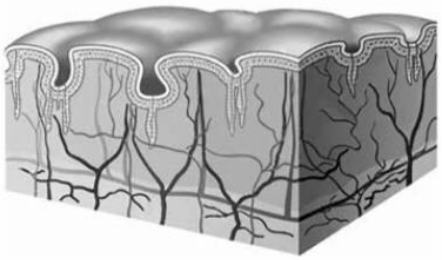
In some people, the lining of the small intestine can be damaged by gluten. This causes a condition called coeliac disease.

The diagram shows the lining of the small intestine of a child unaffected by gluten and a child with coeliac disease.

Unaffected



Coeliac disease



Suggest how coeliac disease could affect the growth of a child.

(4)

(Total for Question 7 = 10 marks)

6 Plants make sugars by the process of photosynthesis.

(a) (i) Which of the following factors is least likely to limit the rate of photosynthesis?

(1)

- ☒ **A** carbon dioxide concentration
- ☒ **B** light intensity
- ☒ **C** oxygen concentration
- ☒ **D** temperature

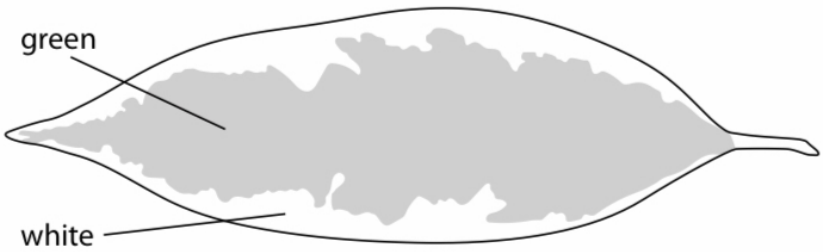
(ii) Which combination of factors is most likely to limit the rate of photosynthesis in the early morning?

(1)

- ☒ **A** carbon dioxide concentration and soil pH
- ☒ **B** temperature and light intensity
- ☒ **C** water content of soil and soil pH
- ☒ **D** water content of soil and light intensity

(b) A student carries out an experiment to investigate the need for chlorophyll in photosynthesis.

He uses a variegated leaf as shown.



The green part of the leaf has cells that contain chlorophyll. The white part of the leaf has cells that do not contain chlorophyll.

(i) Describe the procedure used to test this leaf for starch.

(4)

(ii) Draw a labelled diagram of the leaf to show its appearance after the student has completed the test for starch.

(2)

(c) Suggest a method the student could use to measure the area of the green part of the leaf.

(2)

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(Total for Question 10 = 10 marks)

6 Male infertility can be caused by reduced sperm production and reduced sperm movement.

Scientists investigated the effect of a drug called letrozole on male infertility.

A large group of infertile men was divided into two smaller groups.

Group 1 received 2.5 mg of letrozole per day for six months and Group 2 received no treatment.

The scientists measured the following at the start of the investigation and after six months:

- sperm concentration
- percentage of moving sperm
- blood testosterone level
- blood oestrogen level
- side effects such as hair loss and skin rash

The table below shows the results.

Factors measured	Group 1 (letrozole)		Group 2 (no treatment)	
	start	after 6 months	start	after 6 months
sperm concentration / number per cm^3	450	1.4×10^6	475	450
percentage of moving sperm	2	18	2	2
blood testosterone level / arbitrary units	249	1198	266	266
blood oestrogen level / arbitrary units	44	0	44	48
number of men with side effects	0	8	0	0

The scientists concluded that letrozole is a safe and effective treatment for male infertility.

Evaluate this conclusion.

(6)

(Total for Question 8 = 6 marks)