

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education  
January 2006



**APPLIED SCIENCE (DOUBLE AWARD)  
HIGHER TIER  
Unit 2 Science for the Needs of Society**

**3860/2H  
H**

Wednesday 18 January 2006 9.00 am to 10.30 am

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>a ruler</li> </ul> <p>You may use a calculator.</p>
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For Examiner's Use			
Number	Mark	Number	Mark
1		5	
2		6	
3		7	
4		8	
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

**Instructions**

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

- The maximum mark for this paper is 90.
- The marks for questions are shown in brackets.

Answer **all** questions in the spaces provided.

**1** Plants carry out photosynthesis in order to produce food.

(a) The diagram shows photosynthesis occurring in a leaf.

Choose words from the list to complete the labels on the diagram.

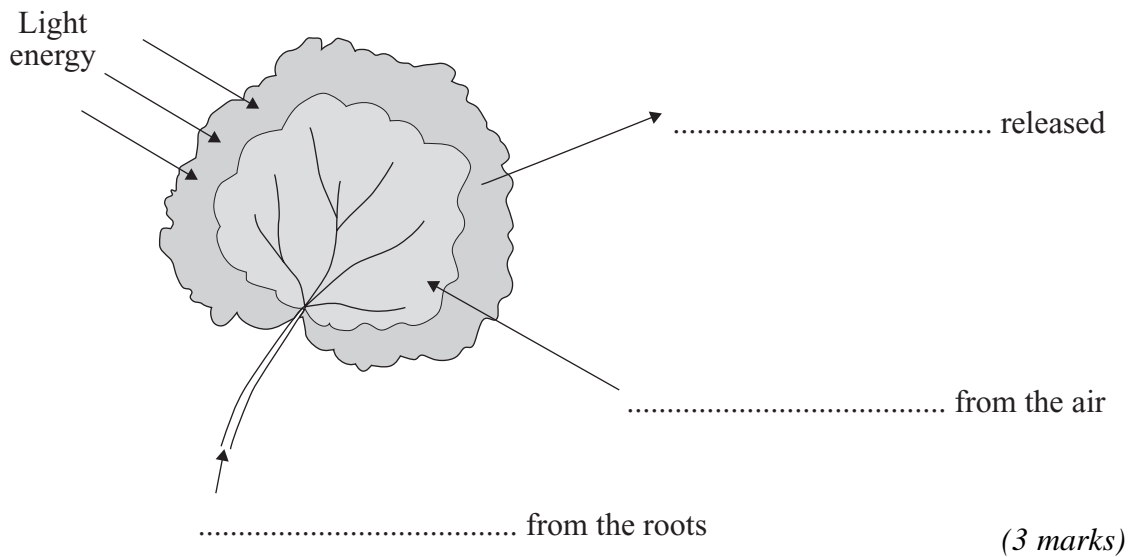
**carbon dioxide**

**glucose**

**nitrogen**

**oxygen**

**water**



(3 marks)

(b) Name the green substance that allows plants to carry out photosynthesis.

.....  
(1 mark)

(c) What chemical is made during photosynthesis and stored in the leaf?

.....  
(1 mark)

(d) Describe an experiment that you could use to investigate how the amount of light affects photosynthesis.

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(4 marks)

9

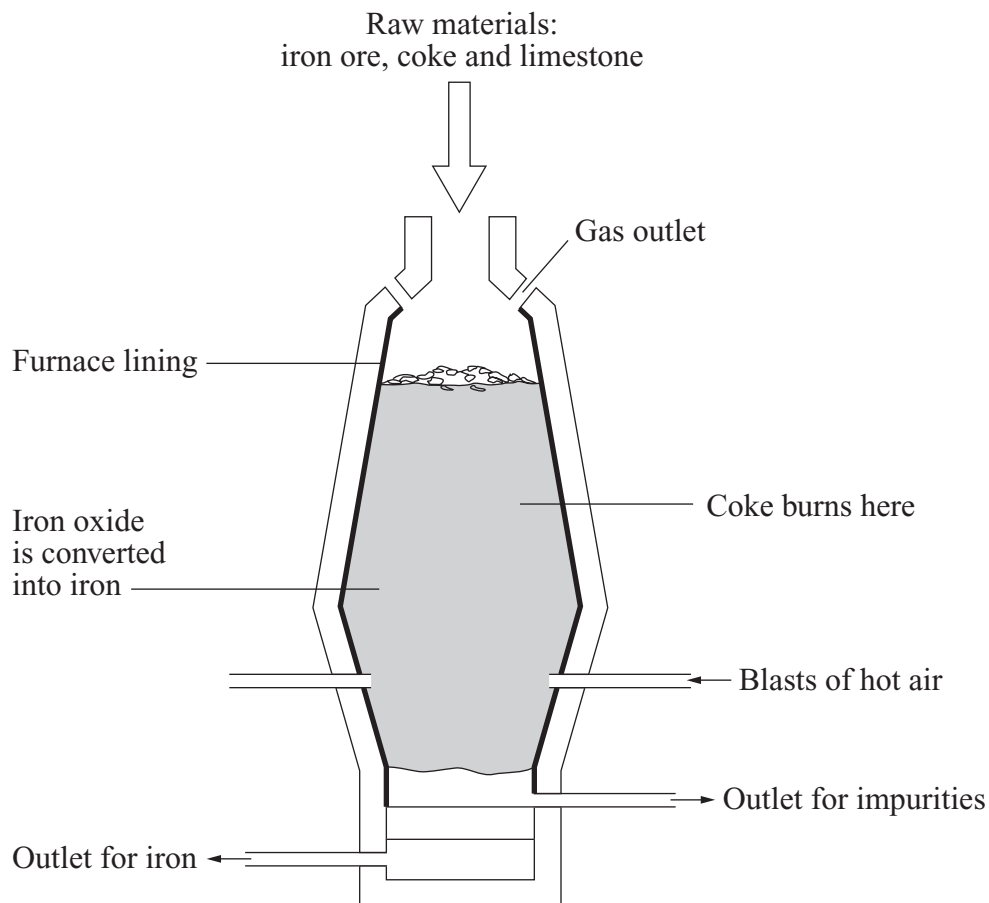
**Turn over for the next question**

**Turn over ►**

2 Iron is a very important element with many industrial uses.

It is obtained from iron ore (iron oxide) by heating with coke and limestone in a blast furnace.

A labelled diagram of a blast furnace is shown below.



(a) Three raw materials are fed into the top of the blast furnace.

Complete the table below with information about the raw materials.

Raw material	Chemical name	Chemical symbol or formula	Type of chemical
Iron ore	Iron oxide		Compound
Coke		C	Non-metal element
Limestone		CaCO <sub>3</sub>	

(4 marks)

(b) When coke burns in the furnace, this is an *exothermic* reaction.

(i) What is an *exothermic* reaction?

.....

.....

(1 mark)

(ii) Why is this reaction important in the making of iron?

.....

.....

(1 mark)

(c) Limestone is added to remove impurities.

Limestone breaks down in the hot furnace, forming calcium oxide and carbon dioxide.

limestone  $\rightarrow$  calcium oxide + carbon dioxide

(i) How is limestone obtained for use in the blast furnace?

.....

.....

(1 mark)

(ii) Write a symbol equation for the breakdown of limestone into calcium oxide and carbon dioxide.

.....  $\rightarrow$  ..... + .....

(3 marks)

(d) Describe the chemical changes that occur when iron oxide is changed into iron.

You may use a word equation or a symbol equation as part of your answer.

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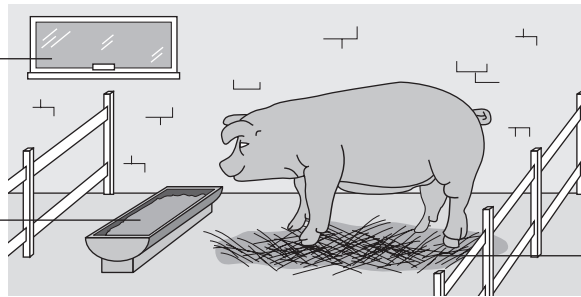
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(3 marks)

3 The following diagram shows some of the features you would find in a commercial pig house.

**Feature A**

Plenty of ventilation



**Feature B**

Access to food

**Feature C**

A means of keeping warm

(a) (i) For each feature, describe how it could increase the amount of meat obtained from the pigs.

**Feature A** .....

.....

**Feature B** .....

.....

**Feature C** .....

.....

(3 marks)

(ii) Is this method of meat production intensive or organic? Explain your answer.

.....

.....

(1 mark)

(b) (i) Give **two** advantages of using this type of farming.

1 .....

2 .....

(2 marks)

(ii) Give **two** disadvantages of rearing pigs using this type of farming.

1 .....

2 .....

(2 marks)

- (c) The following label is found on meat that is grown organically.

SOIL ASSOCIATION ORGANIC STANDARD
--------------------------------------

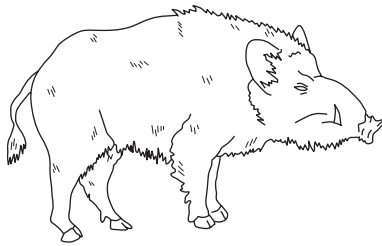
Suggest how the pigs might be reared for the meat to be given this label.

.....  
 .....

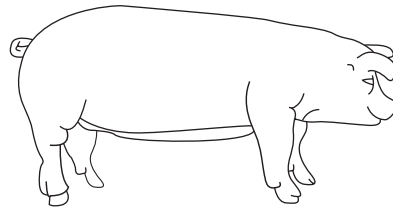
(1 mark)

- (d) Over hundreds of years, pigs have been bred from wild boars.

The diagrams show a wild boar and a modern day pig.



Wild boar



Modern day pig

- (i) Look at the diagrams.

Give **two** characteristics that have been selected when breeding modern pigs.

1 .....

2 .....

(2 marks)

**Question 3 continues on the next page**

**Turn over ►**

(ii) How did farmers use selective breeding to produce our modern day pig?

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*(4 marks)*

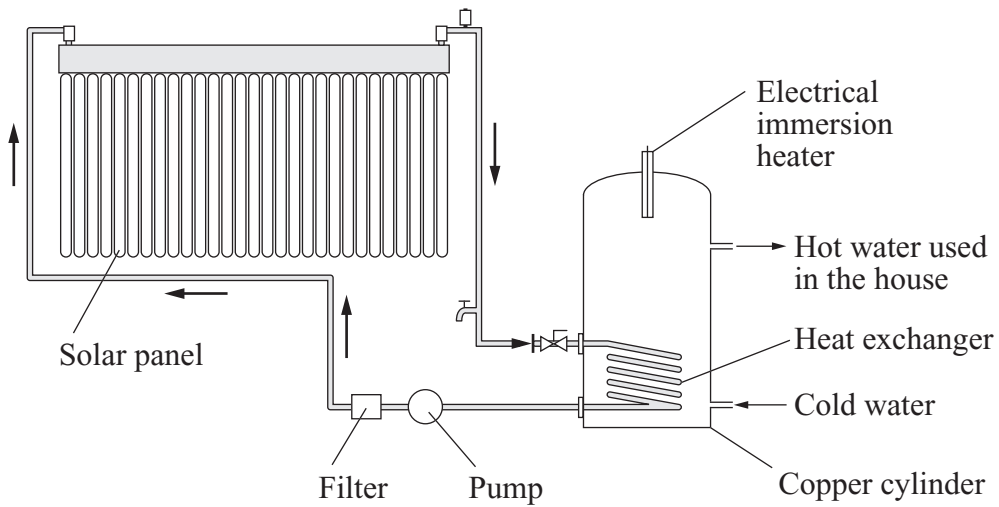
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**Turn over for the next question**

**Turn over ►**

4 A solar panel water heater was installed on the roof of a house to reduce electrical heating costs.



(a) The solar panel is mounted on the part of the roof that faces south.

Many small black plastic tubes carry water through the solar panel.

(i) Why are many small tubes used instead of one large tube?

.....  
 .....  
 (1 mark)

(ii) Explain why the tubes are coloured black.

.....  
 .....  
 .....  
 (2 marks)

(b) Use the words **conduction** and **convection** to explain how heat is transferred from the solar water heater to the hot water supply.

.....  
 .....  
 .....  
 .....  
 (4 marks)

- (c) Antifreeze is added to the system to prevent the water from freezing in winter.

Explain why this reduces the efficiency of the heat transfer.

.....  
 .....  
 .....

(2 marks)

- (d) Before the solar panel was installed, a 3 kW immersion heater was used to heat the water.

The immersion heater was switched on for 4 hours each day.

- (i) Use the equation to calculate the number of Units used by the 3 kW immersion heater in 4 hours.

$$\text{energy transferred (kWh)} = \text{power (kW)} \times \text{time (hours)}$$

.....  
 .....

Number of Units = ..... kWh  
 (2 marks)

- (ii) One unit of electricity costs 7p.

Calculate the cost of using the immersion heater for 4 hours.

.....  
 .....

Cost = ..... p  
 (2 marks)

- (iii) Calculate the cost of using the immersion heater for 4 hours every day for one year.

.....  
 .....

Annual cost = £ .....  
 (2 marks)

Turn over ►

(iv) The solar panel water heater costs £3000.

How many years will it take to pay for the system with the money saved by not using the immersion heater for 4 hours each day?

.....

.....

.....

Number of years = .....  
(2 marks)

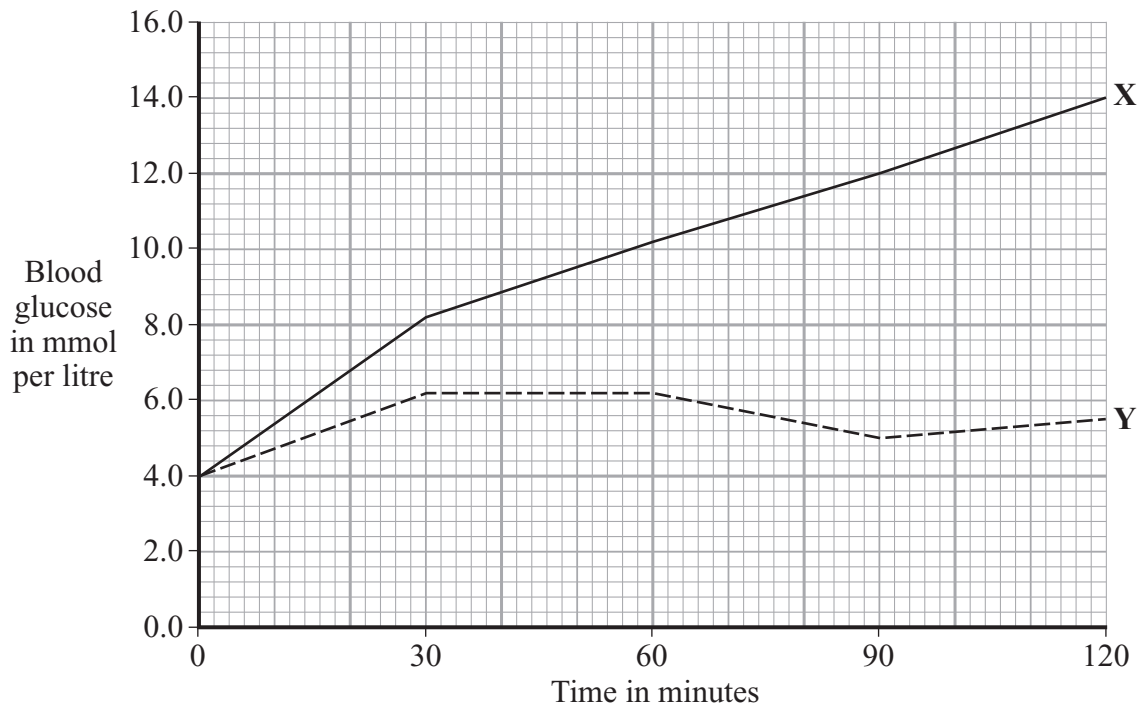
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5 The level of glucose in your blood has to be kept constant.

The graph shows the blood glucose concentration of two students X and Y.

Both students ate a meal at time 0.

Student X is diabetic.

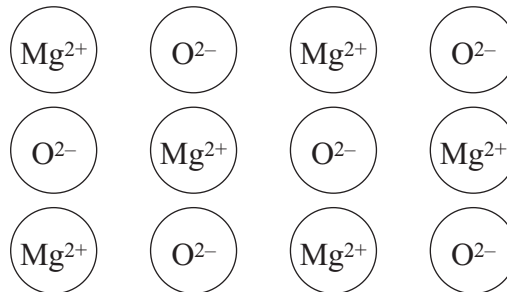




6 Chemical compounds are held together by either ionic or covalent bonds. The type of bonding and structure affects the physical and chemical properties of the compounds.

(a) Magnesium oxide is a material with strong bonds.

It has a very high melting point.



Describe the chemical bonding in magnesium oxide.

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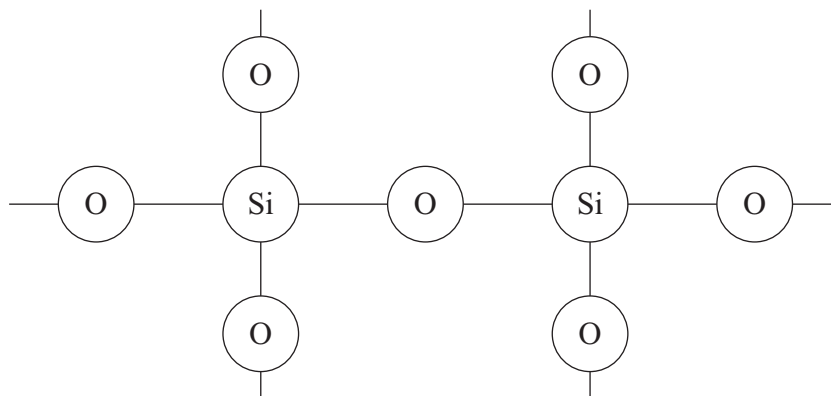
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(3 marks)

(b) Silicon oxide is a ceramic. It is a strong, brittle material with a very high melting point.



Describe the type of bonding and structure in silicon oxide.

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(3 marks)

(c) Give **one** use for a ceramic material such as silicon oxide.

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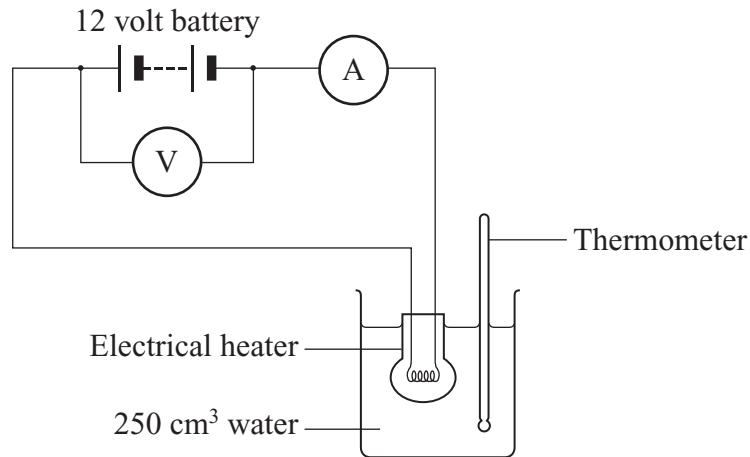
(1 mark)

7

**Turn over for the next question**

**Turn over ▶**

- 7 A manufacturer wanted to investigate the efficiency of a water heater made of a new material. A technician carried out an experiment using the apparatus shown in the diagram.



The results are recorded below.

Time electrical heater was switched on for	30 minutes
Temperature of water at start of experiment	21.0 °C
Temperature of water at end of experiment	35.7 °C
Voltage reading	12 volts
Current reading	1.5 amps

- (a) Calculate the power of the electrical circuit.

.....  
 .....  
 .....

Power = ..... watts  
 (3 marks)



- (b) Use the equation to calculate the energy input from the electrical circuit in kilowatt-hours.

$$\text{energy (kWh)} = \text{power (kW)} \times \text{time (hours)}$$

.....

.....

.....

Energy = .....kWh  
(3 marks)

- (c) The technician calculated the amount of energy gained by the water to be 0.0042 kWh. Calculate the efficiency of the total heat transfer from the electrical heater to the water.

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.....

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(3 marks)

- (d) Suggest **two** ways to improve the efficiency of the heat transfer.

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(2 marks)

11
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**Turn over for the next question**

**Turn over ►**

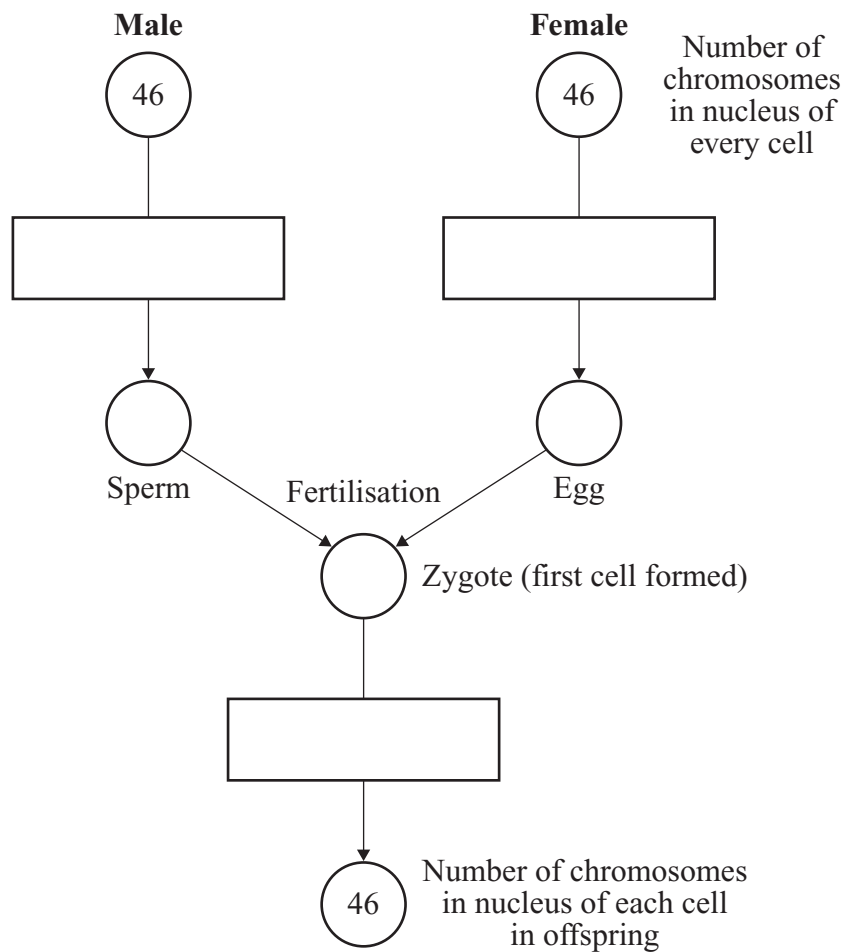
8 Doctors who study problems of infertility and genetic disorders must have an understanding of human reproduction.

The diagram shows stages in the reproductive cycle of a human.

(a) Complete the diagram by filling in:

(i) the circles with the correct number of chromosomes; (3 marks)

(ii) the rectangles with the names of the type of cell division. (3 marks)



(b) Describe what happens during the process when sperm and egg cells are produced.

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*(3 marks)*

<b>9</b>

**END OF QUESTIONS**

**There are no questions printed on this page**