

Surname							Other Names							
Centre Number							Candidate Number							
Candidate Signature														

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General Certificate of Secondary Education
June 2004



**SCIENCE SINGLE AWARD (MODULAR)
HIGHER TIER
Paper 1**

3469/H

H

Monday 7 June 2004 1.30 pm to 3.00 pm

In addition to this paper you will require:

- the Data Sheet (enclosed);
- a ruler.

You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	
		17	
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 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.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

ENVIRONMENT, INHERITANCE AND SELECTION

1 (a) This question is about the hormones that control the monthly cycle in women.

Complete the sentences.

Hormones control the monthly release of an egg from a woman's

They also control the thickness of the lining of her

Hormones that are given to women to stimulate the release of eggs are called
..... drugs.

Hormones that are given to women to prevent the release of eggs are called
oral

(4 marks)

(b) In humans, one of the pairs of chromosomes in each cell carries the genes which determine sex.

What is the difference between the sex chromosomes of a man and a woman?

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

(2 marks)



2 (a) Cornflowers are weeds that grow in crops such as wheat.

Suggest **two** factors that cornflowers and wheat will compete for.

1

2

(2 marks)

(b) *To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Sulphur dioxide is released when some fossil fuels are burned.

Describe, in as much detail as you can, how sulphur dioxide affects the environment.

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.....
.....

(3 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

PATTERNS AND REACTIONS

3 Use the Periodic Table of Elements on the Data Sheet to help you to answer this question.

(a) Describe, in as much detail as you can, the structure of a fluorine atom.

.....

.....

.....

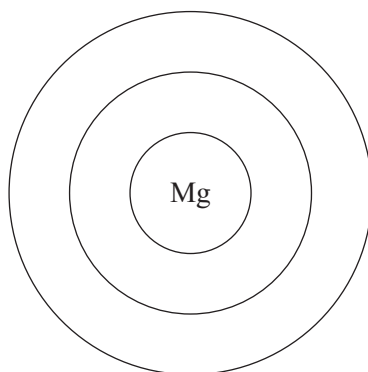
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(3 marks)

(b) Complete the diagram to show the electronic structure of a magnesium atom.



(1 mark)

4

4 Hydrogen peroxide slowly decomposes into water and oxygen.



The reaction can be speeded up by adding manganese dioxide.

- (a) (i) What do we call a substance that speeds up a chemical reaction without being changed itself?

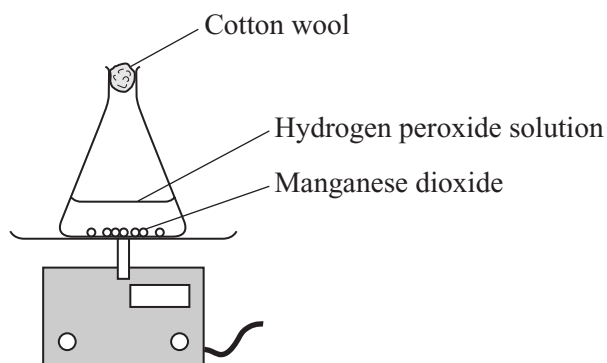
.....
(1 mark)

- (ii) Give **two** other ways of increasing the rate of this reaction.

1.....
2.....
(2 marks)

- (b) The diagram shows how the rate of this reaction can be measured.

As the hydrogen peroxide decomposes, the mass of the flask and its contents decreases.



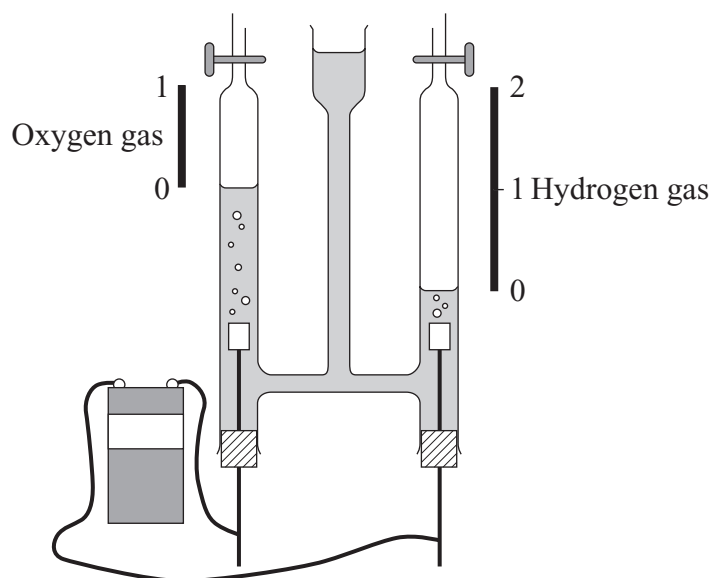
Why does this decrease in mass take place?

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

4

Turn over ►

- 5 In the nineteenth century, the scientist Gay-Lussac electrolysed water and got the results shown in the diagram.



He did experiments on other compounds. His results are shown in the table.

Volumes of reacting gases in cm ³				Ratio of reacting gases in compound	
hydrogen	100	oxygen	50	H:O	2:1
hydrogen	90	nitrogen	30	H:N	3:1
nitrogen	50	oxygen	100	N:O	

- (a) Complete the table. (1 mark)
- (b) What does this tell you about the way in which gases combine?

.....

.....

(1 mark)

- (c) Gay-Lussac suggested that the formula of water is H_2O .

Dalton thought it was HO .

Look at the results for the electrolysis of water. Which scientist was correct?

.....

Give the reason for your answer.

.....

.....

(1 mark)

- (d) Dalton believed that atoms of the same element would repel each other.

A scientist called Avogadro said that gases such as oxygen existed as pairs of atoms linked to form molecules.

What holds the two oxygen atoms together in an oxygen molecule?

.....

.....

(1 mark)

4

TURN OVER FOR THE NEXT QUESTION

Turn over ►

FORCES, WAVES AND RADIATION

- 6 (a) A government decides to launch a spy satellite to see if another country is increasing the size of its air force. They decide **not** to use a geostationary satellite.

What type of orbit should the satellite be placed in? Indicate the position of the orbit and its height.

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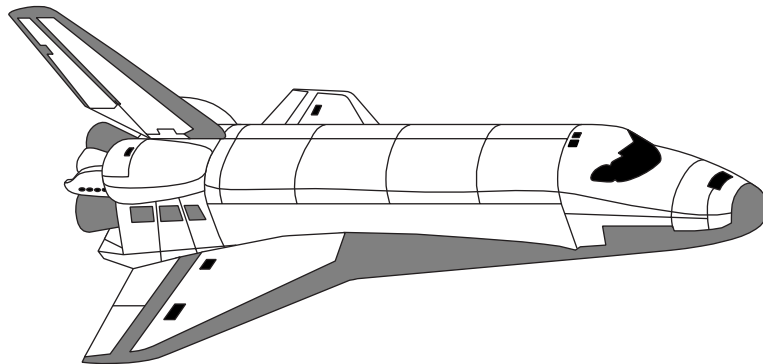
(2 marks)

Explain the reasons for your answer.

.....

(2 marks)

- (b) The drawing shows a space shuttle.

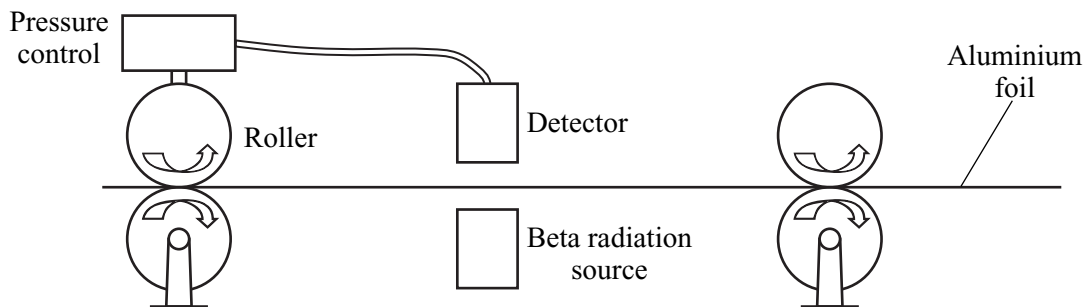


Explain how a space shuttle stays in an orbit around the Earth.

.....

(2 marks)

7 The diagram shows how the thickness of aluminium foil is controlled. The thicker the aluminium foil, the more radiation it absorbs.



(a) The designers used a beta radiation source for this control system.

(i) Why would an alpha radiation source be unsuitable in this control system?

.....

 (1 mark)

(ii) Why would a gamma radiation source be unsuitable in this control system?

.....

 (1 mark)

(b) The substance used in the beta radiation source is radioactive.

(i) Why are some atoms radioactive?

.....

 (1 mark)

(ii) Explain why radiation is dangerous to humans.

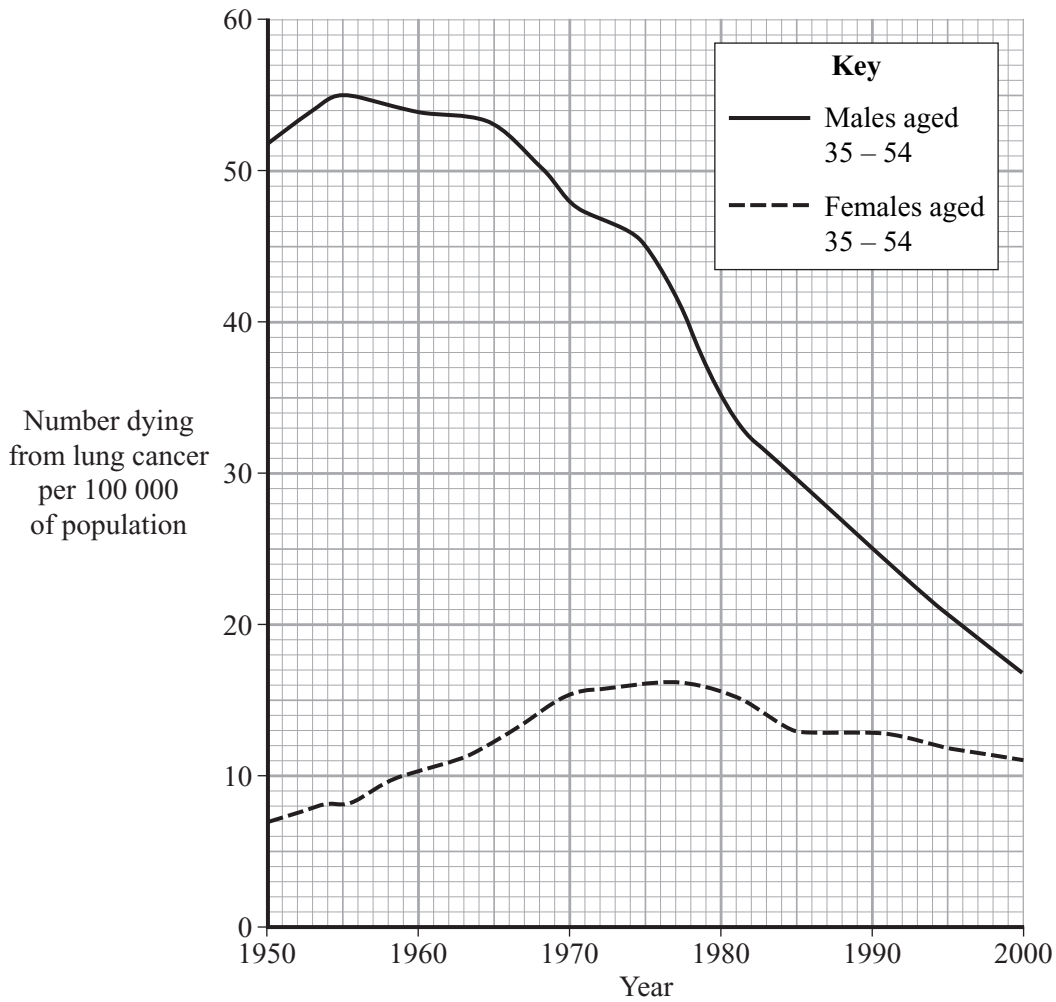
.....

 (2 marks)

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

8 Scientists study the effect of smoking on the number of people dying from lung cancer.

Graph 1 shows the number of people who died from lung cancer in this country between 1950 and 2000.



Graph 1

(a) Describe how the number of men who died from lung cancer changed between 1960 and 2000.

.....

.....

.....

.....

(2 marks)

(b) Describe **two** differences between the numbers of men and women who died from lung cancer between 1960 and 2000.

1

.....

2

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(2 marks)

(c) A town in this country had 500 000 inhabitants in 1955.

How many men aged 35–54 from that town are likely to have died from lung cancer in 1955?

.....

.....

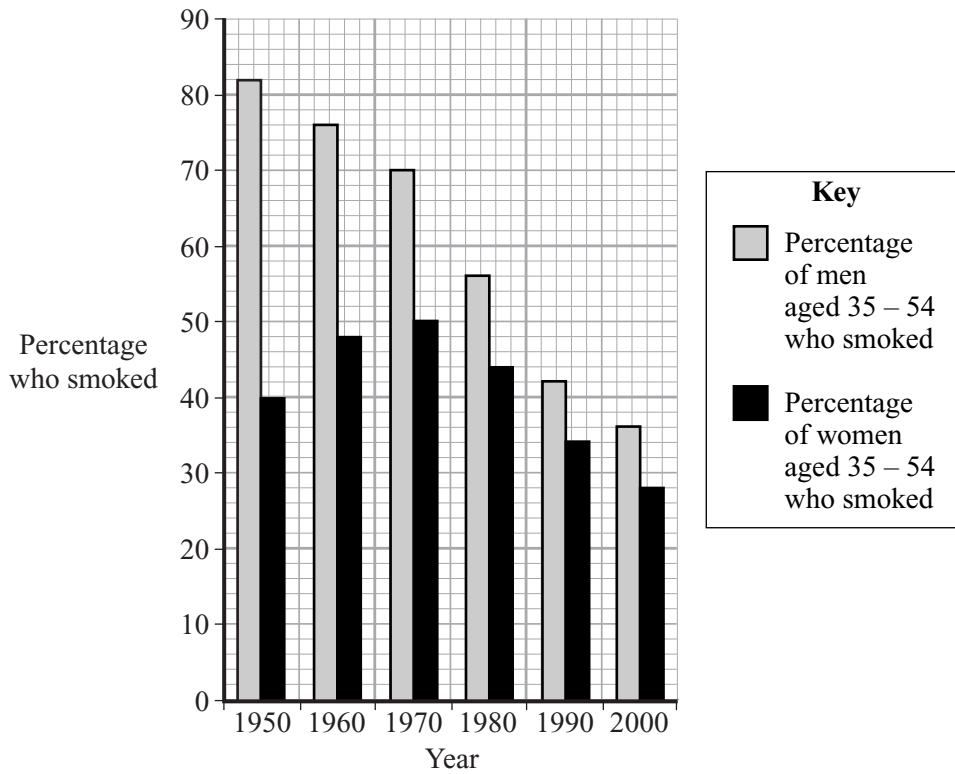
Number of men.....

(1 mark)

QUESTION 8 CONTINUES ON THE NEXT PAGE

Turn over ►

(d) **Graph 2** shows the percentage of the population who smoked between 1950 and 2000.



Graph 2

Explain how the data from **graphs 1** and **2** support the hypothesis that smoking increases the risk of getting lung cancer.

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(2 marks)

7

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

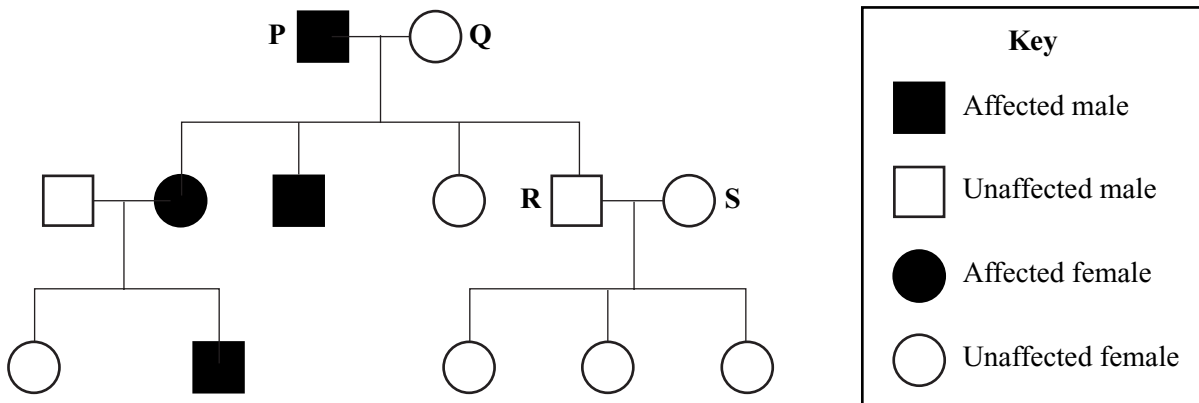
Turn over ►

ENVIRONMENT, INHERITANCE AND SELECTION

9 Huntington's disease is a rare inherited disorder of the nervous system.

It is caused by a dominant allele **H**. The recessive allele of this gene is represented by **h**.

The diagram shows the inheritance of Huntington's disease in a family.



- (a) Use a genetic diagram to show the inheritance of the Huntington's disease allele by the children of parents **P** and **Q**.

(3 marks)

(b) Explain why none of the children of **R** and **S** inherited Huntington's disease.

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(2 marks)

5

TURN OVER FOR THE NEXT QUESTION

Turn over ►

10 (a) Sex cells are produced by meiosis.

Describe what happens to the chromosomes when a cell divides by meiosis.

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(2 marks)

(b) Darwin's theory of natural selection depends on the fact that individual organisms within a species may show a wide range of variation.

Explain how meiosis and sexual reproduction give rise to variation.

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.....

(2 marks)

(c) Mutation may also give rise to variation.

(i) What is meant by mutation?

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.....

(1 mark)

(ii) Are all mutations harmful? Explain the reason for your answer.

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

(2 marks)



PATTERNS AND REACTIONS

11 Use the Periodic Table of Elements on the Data Sheet to help you to answer this question.

Francium (Fr) is a very rare element. It is estimated that there is only 25 g of francium in the Earth's crust. Francium is radioactive and has a half-life of only a few minutes.

Mendeleev predicted the existence of francium in the 1870s but the element was not discovered until 1939.

(a) Explain why Mendeleev was able to predict the existence of francium in the 1870s.

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.....

(2 marks)

(b) Suggest why there is not much experimental evidence for the properties of francium.

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.....

(1 mark)

(c) (i) If you could react francium with water, how would the reaction compare with that of sodium with water?

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.....

(1 mark)

(ii) Explain the reason for your answer.

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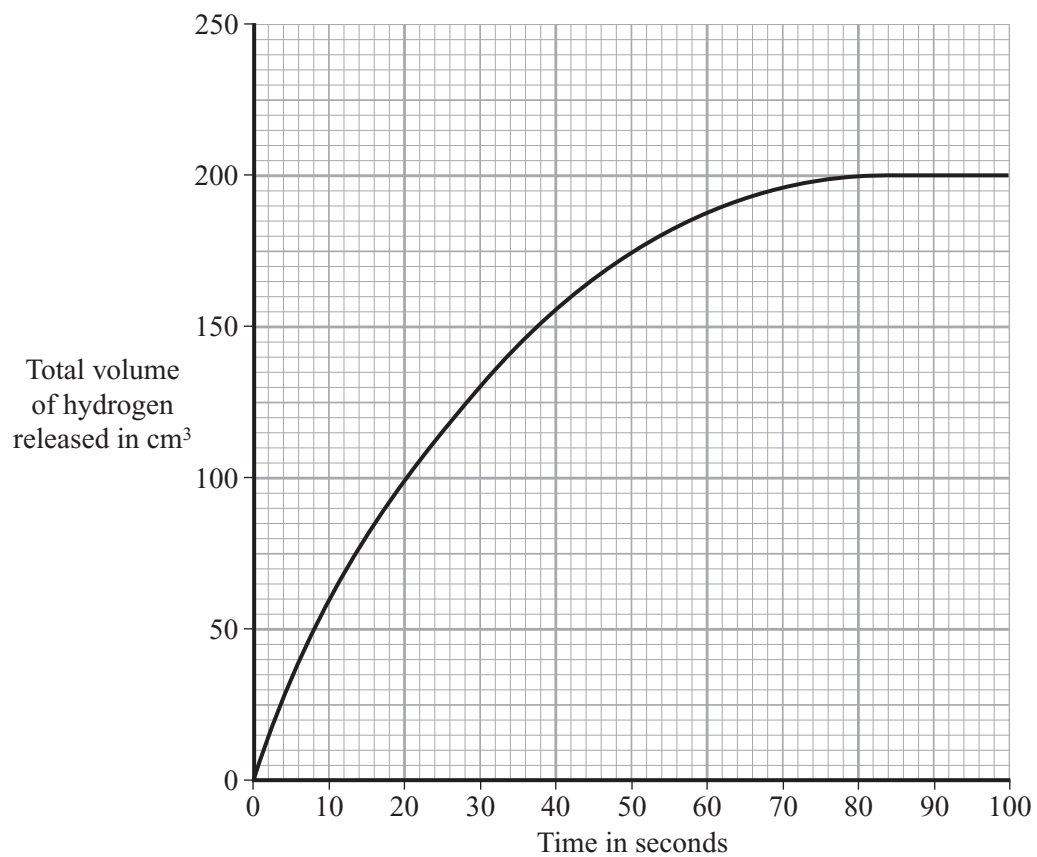
(2 marks)

6

Turn over ►

12 Magnesium reacts with dilute sulphuric acid.

A student measured the volume of hydrogen given off every 10 seconds. The results are shown on the graph.



(a) The average rate of hydrogen production in the first 10 seconds is $(60 \text{ cm}^3 \div 10 \text{ s}) = 6 \text{ cm}^3/\text{s}$.

(i) Calculate the average rate of production of hydrogen between 30 seconds and 50 seconds. Show clearly how you work out your answer.

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.....
.....

Rate cm^3/s
(3 marks)

(ii) Explain, as fully as you can, why the average rate between 30 and 50 seconds is different from the rate between 0 and 10 seconds.

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(2 marks)

(b) In industry, enzymes are used in both batch processes and continuous processes.

Give **one** reason why continuous processes are usually more profitable than batch processes.

.....
.....

(1 mark)

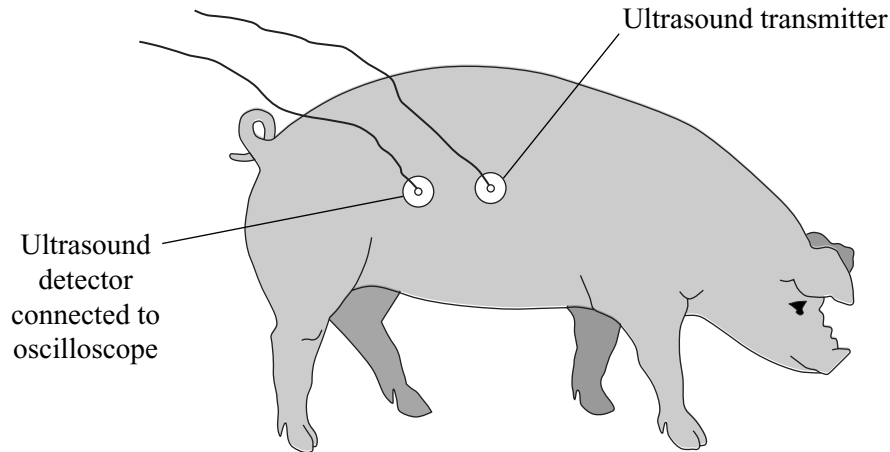


TURN OVER FOR THE NEXT QUESTION

Turn over ►

FORCES, WAVES AND RADIATION

- 13** Pigs have a layer of fat in their skin. Underneath the fat is a layer of muscle. Ultrasonic waves are used to measure the thickness of the layer of fat. An ultrasound transmitter and detector are attached to the skin of the pig.



- (a) Explain why ultrasound can be used to measure the thickness of the layer of fat.

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(2 marks)

- (b) The oscilloscope does not measure distance directly.

- (i) What does the oscilloscope measure in this case?

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(1 mark)

- (ii) What other information is needed to calculate the thickness of the layer of fat in a pig?

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(1 mark)

14 (a) (i) Describe the structure of alpha particles.

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.....
.....

(2 marks)

(ii) What are beta particles?

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.....
.....

(1 mark)

(b) Describe how beta radiation is produced by a radioactive isotope.

.....
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(1 mark)

4

TURN OVER FOR THE NEXT QUESTION

Turn over ►

15 'Red shift' is one of the pieces of evidence which led scientists to propose the 'big bang' theory.

(a) Describe the big bang theory.

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

(2 marks)

(b) *To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain how red shift provides evidence for the big bang theory.

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.....
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.....

(3 marks)



QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 16** The table shows the amounts of some of the substances filtered, reabsorbed and excreted by the kidneys in one day.

Substance	Amount filtered	Amount reabsorbed	Percentage reabsorbed	Amount excreted
water		178.5 litres	99.2%	1.5 litres
urea	56 g	28 g	50%	28 g
glucose	800 units	800 units	100%	0
sodium	25 200 units	25 050 units		150 units
chloride	18 000 units	17 850 units	99.2%	150 units

- (a) Calculate the amount of water filtered by the kidneys in one day.

.....
 Amount litres
 (1 mark)

- (b) Calculate the percentage of the filtered sodium that was reabsorbed. Show clearly how you work out your answer.

.....

 Percentage reabsorbed
 (1 mark)

- (c) What effect, if any, does increased secretion of ADH have on:

- (i) the volume of urine?

.....

- (ii) the concentration of urine?

.....

.....

(2 marks)



Turn over ►

17 Electricity is generated in different ways in different power stations.

- (a) The cost of nuclear fuel is less than the cost of fuel for gas-fired power stations.

Gas-fired power stations are now being built in this country, but nuclear power stations are not.

Explain **one** reason for this.

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

(2 marks)

- (b) There is no fuel cost for a tidal power station.

- (i) The capital cost of the generating equipment for tidal power stations is much higher than the capital cost of a gas-fired power station with the same output.

Give **one** reason why.

.....
.....

(1 mark)

- (ii) Suggest **one** other reason why more tidal power stations have not been built in this country.

.....
.....

(1 mark)

- (c) Some hydrocarbons are used as fuels in power stations.

The table gives the boiling points of four hydrocarbons.

Hydrocarbon	Boiling point in °C
W	165
X	-160
Y	-40
Z	180

- (i) Which of these hydrocarbons are gases at room temperature (20 °C)?

.....
(1 mark)

- (ii) Which of these hydrocarbons has the largest molecules?

.....
(1 mark)

- (iii) Which of these hydrocarbons ignites most easily?

.....
(1 mark)

- (d) Some hydrocarbons are used to produce polymers.

Which type of hydrocarbons can be converted into polymers?

.....
(1 mark)

END OF QUESTIONS

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