UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL COMBINED SCIENCE **5130/02**

Paper 2 **October/November 2008**

2 hours 15 minutes

Additional Materials: Answer Booklet/Paper.

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer **one** part of each of the three questions.
Write your answers on the separate answer paper provided.

A copy of the Periodic Table is printed on page 24.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
10	
11	
12	
Total	

This document consists of **21** printed pages and **3** blank pages.

Section A

For Examiner's Use

Answer **all** the questions.

Write your answers in the spaces provided on the question paper.

1 Fig. 1.1 shows apparatus to demonstrate the process of osmosis.

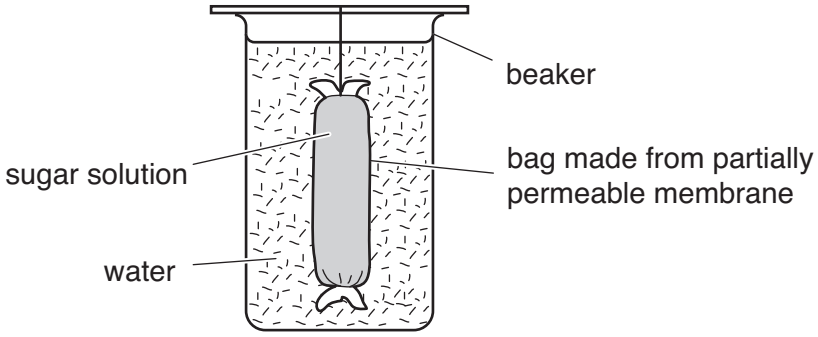

Fig. 1.1

(a) The apparatus is set up and left for an hour.

(i) How will the appearance of the bag change during this time?

.....

..... [1]

(ii) Explain the cause of this change.

.....

.....

..... [2]

(b) Use ideas about osmosis to explain the following observations.

(i) Red blood cells burst when placed in distilled water.

.....

.....

.....

..... [2]

(ii) A plant that has wilted when left in the sun without watering recovers when watered.

For Examiner's Use

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..... [4]

2 Iron is extracted from haematite in a blast furnace. This is shown in Fig. 2.1.

For Examiner's Use

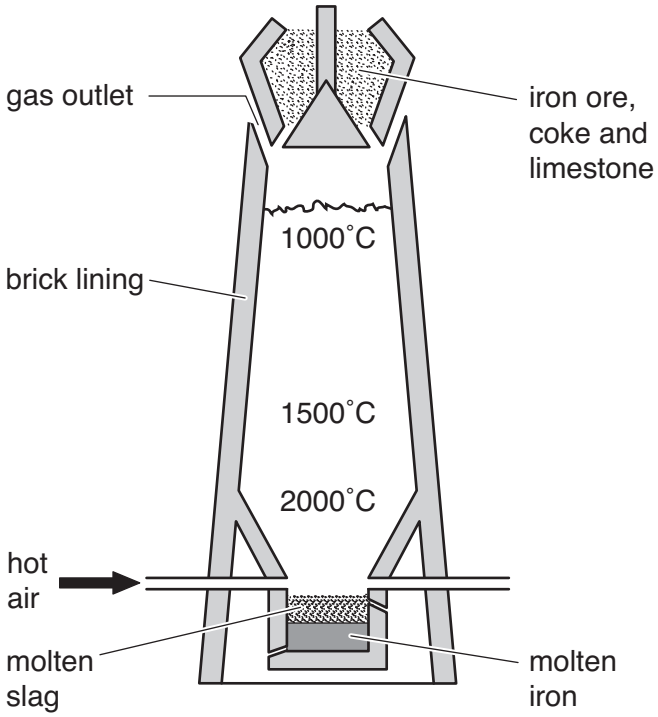

Fig. 2.1

(a) Coke is almost pure carbon. In the blast furnace this carbon burns to produce carbon dioxide.

$$C + O_2 \rightarrow CO_2$$

(i) This carbon dioxide reacts with more coke to produce carbon monoxide.

Write a balanced equation for this reaction.

..... [2]

(ii) The reaction between carbon dioxide and coke is endothermic. Heat energy is absorbed by this reaction.

Explain how the furnace stays at a high temperature.

.....

..... [2]

(b) Iron(III) oxide reacts with carbon monoxide to produce iron.

For Examiner's Use

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

(i) This is a redox reaction, involving both reduction and oxidation.

What substance is oxidised during the reaction?

..... [1]

(ii) Haematite used in a blast furnace contains 80% iron(III) oxide.

Calculate the maximum mass of iron that can be extracted from one tonne of this haematite.

Work out your answer in kg. (1 tonne = 1000 kg)

[A_r: C,12; Fe,56; O,16.]

mass of iron = ... kg [3]

3 Fig. 3.1 shows a house hot water tank.

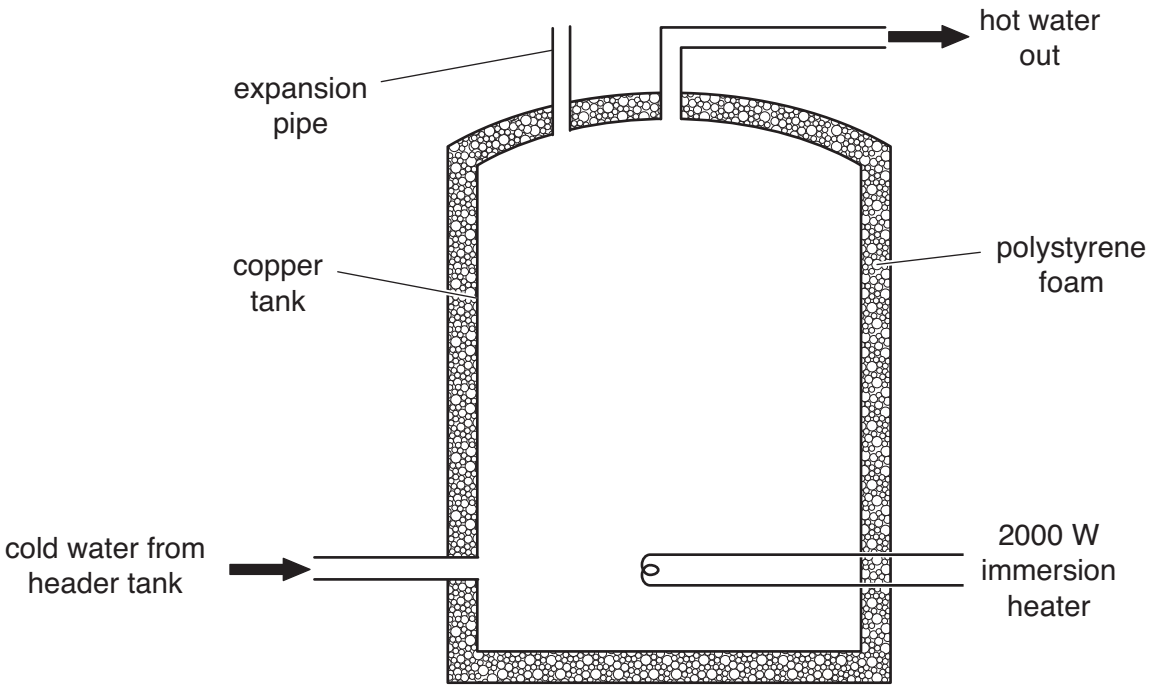

Fig. 3.1

A thermostat keeps the water at 70°C.

(a) The polystyrene foam is full of air bubbles.
Explain how this foam reduces heat loss from the tank.

.....

.....

..... [2]

(b) Explain why the immersion heater is fitted near the bottom of the tank rather than at the top.

.....

.....

..... [2]

(c) The tank is fitted with a thermostat and an expansion pipe.
Suggest why the expansion pipe is fitted to the tank.

.....

.....

..... [2]

(d) The heater takes 45 minutes to heat a tank of cold water.
The cost of electricity is 12 cents per kilowatt-hour.
The heater is rated at 2000 W.

Calculate the cost of heating the water in the tank.

For Examiner's Use

cost = …… cents [3]

4 Fig. 4.1 shows blood vessels in the placenta.

For Examiner's Use

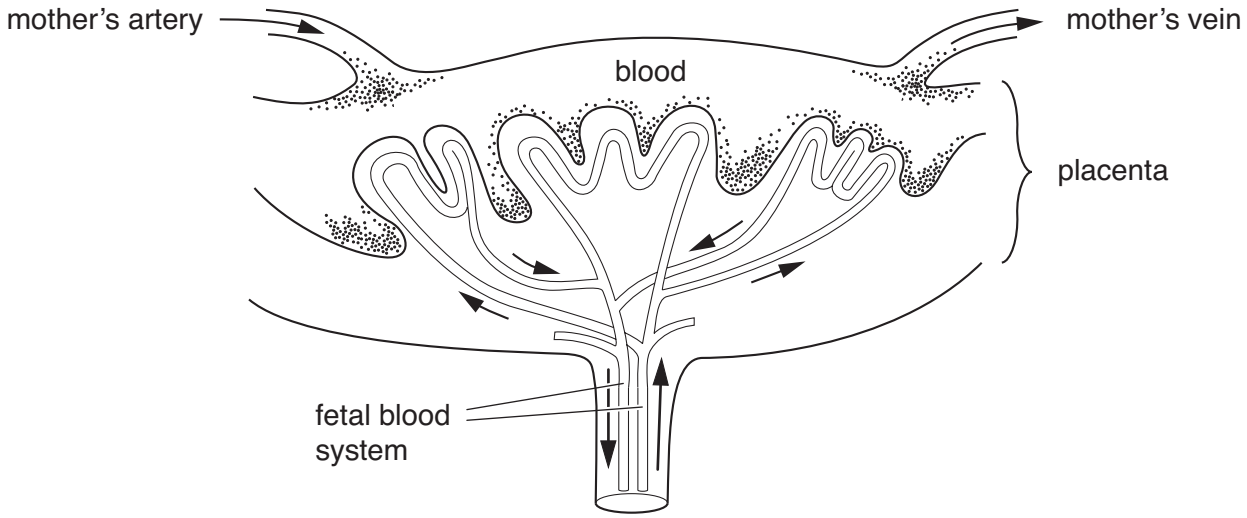

Fig. 4.1

(a) The blood of both the mother and the baby contains dissolved substances. These substances can be exchanged within the placenta.

In each case, name **two** substances that pass

(i) from the mother's artery into the fetal blood system,

.....

..... [2]

(ii) from the fetal blood system into the mother's vein.

.....

..... [2]

(b) Choose **one** dissolved substance that passes from the fetal blood system into the mother's vein.

Describe what happens to this substance after it has left the placenta.

.....

.....

..... [2]

(c) In the womb the baby is surrounded by amniotic fluid.

What is the function of this fluid?

.....

..... [1]

5 Fig. 5.1 shows the graphical formulae of five organic compounds.

For Examiner's Use

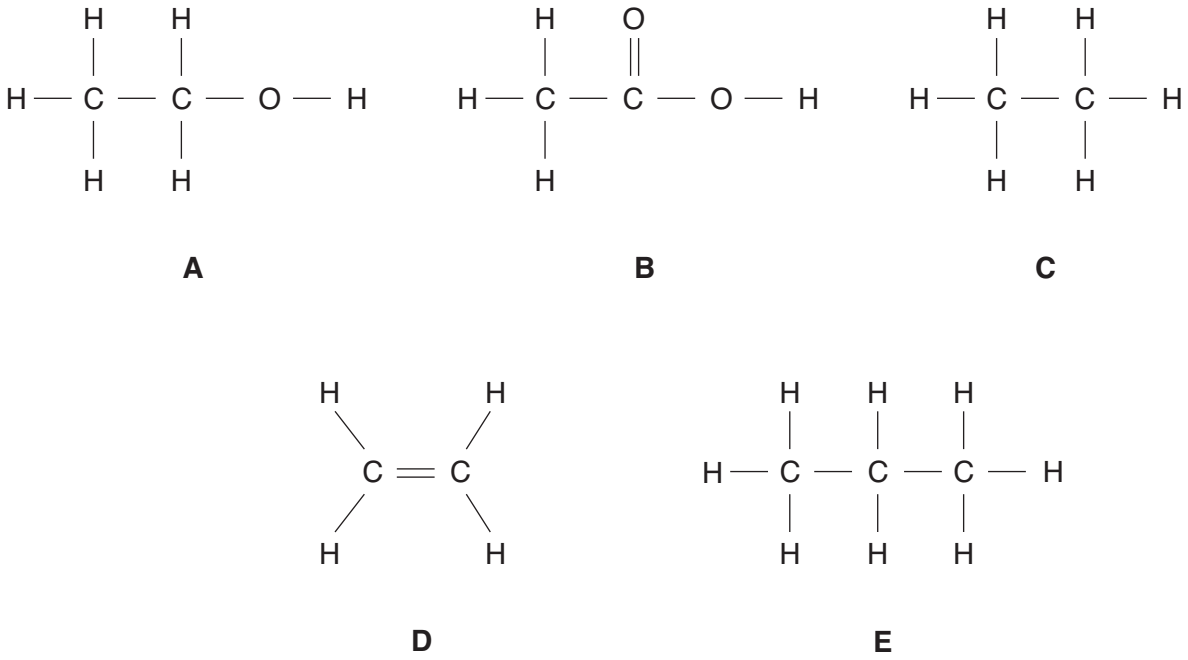

Fig. 5.1

(a) Choose compounds from Fig. 5.1 to answer the following questions.

(i) Which **two** of the compounds are alkanes?

..... and ..... [2]

(ii) Which compound will decolourise bromine water?

..... [1]

(iii) Which **two** compounds react to form an ester?

..... and ..... [2]

(b) Compound **D** can be used to make a polymer by addition polymerisation.

(i) Draw a diagram to show the structure of this polymer.

[2]

(ii) Explain why compound **C** will **not** undergo addition polymerisation.

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.....

.....

..... [2]

6 A student uses the apparatus in Fig. 6.1 to find the resistance of a component **R**.
He measures potential difference across **R** for different values of the current flowing through the circuit.

For Examiner's Use

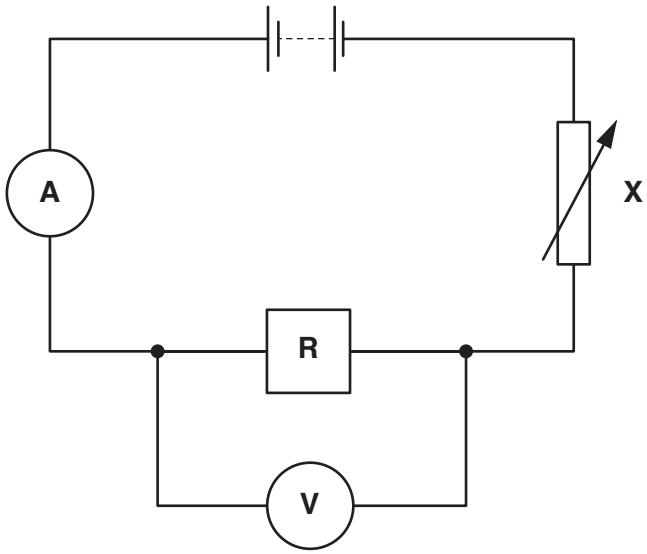

Fig. 6.1

(a) What is the name of component **X**?

..... [1]

This question is continued on p12.

(b) The student's results are shown in the table.

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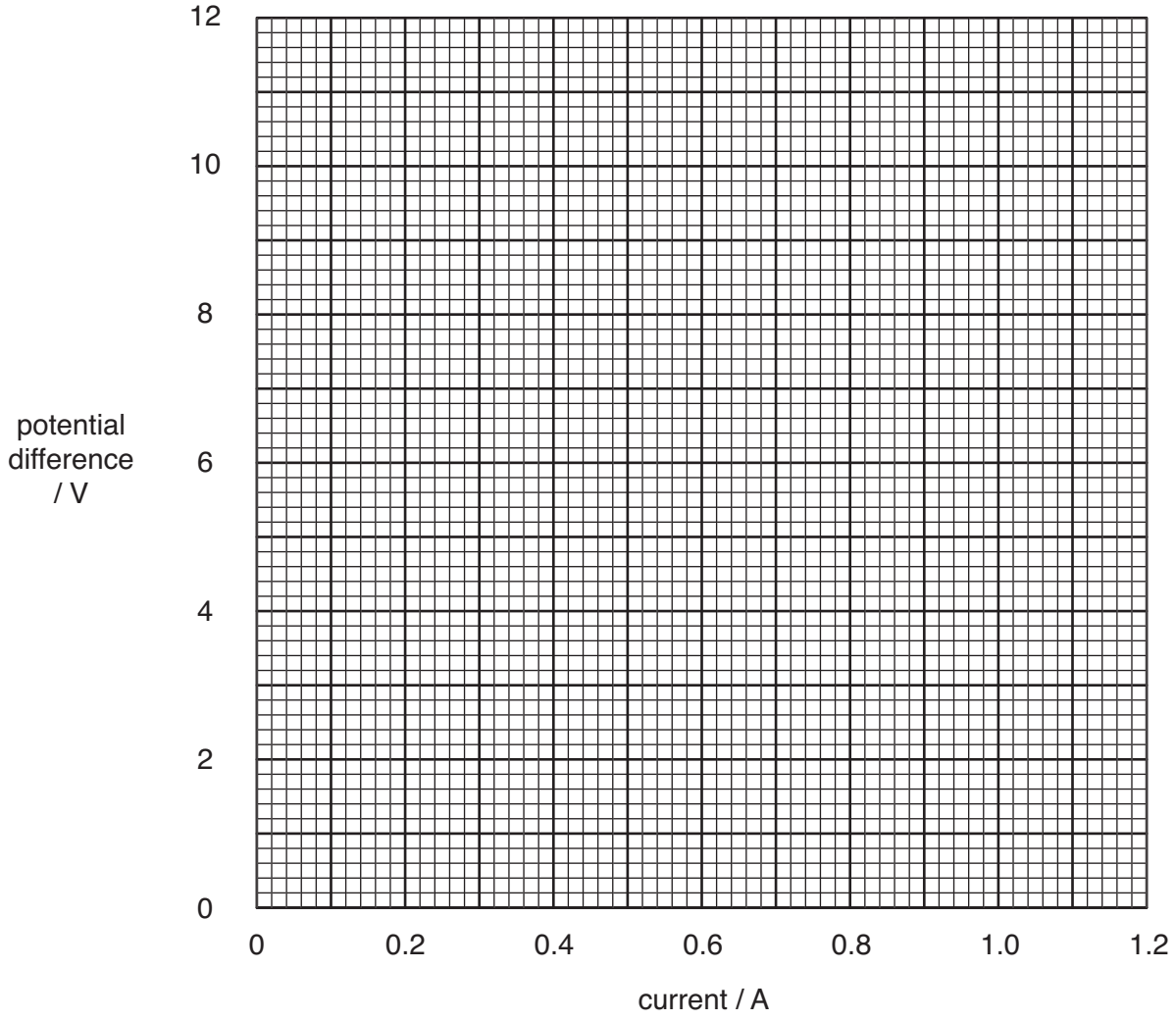
current / A	potential difference / V
0.2	1.7
0.4	3.4
0.6	5.1
0.8	6.9
1.0	8.6

(i) Plot these results on the grid. [2]

(ii) Draw a best fit line. [1]



(iii) What does this graph show about the relationship between potential difference and current for component **R**?

.....

..... [2]

(c) Calculate the resistance of component **R** using the set of results in the table for a current of 0.6 A.

For Examiner's Use

resistance = ... unit ..... [3]

7 Fig. 7.1 shows the inheritance of coat colour in mice.
The allele for a brown coat, **B**, is dominant to the allele for a white coat, **b**.

For Examiner's Use

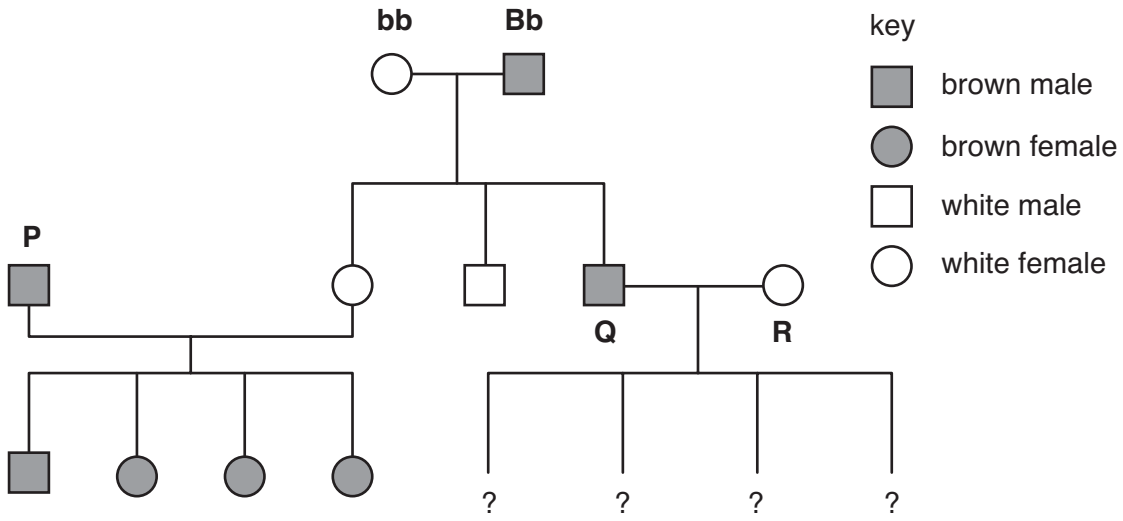


Fig. 7.1

(a) (i) What is the most likely genotype of mouse **P**?

..... [1]

(ii) Explain your answer to **(i)**.

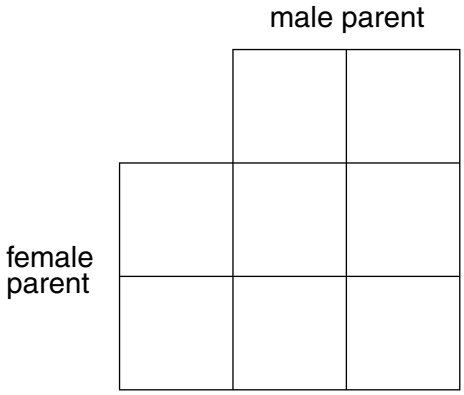
.....

.....

..... [2]

(b) Mouse **Q** has the phenotype **Bb** and mouse **R** has the phenotype **bb**.

Complete this diagram to work out the chance of their offspring having a white coat.



chance of offspring having a white coat = ... [4]

8 **(a)** Complete this table to show the arrangement of electrons in these elements.
Use the Periodic Table on page 24 to help you.
The first one has been done for you.

For Examiner's Use

element	electron arrangement			
Ar	2	8	8	–
C				
Ca				
C*l*				

[3]

(b) The element with the symbol Ar is found in Group 0 of the Periodic Table.

(i) What name is given to this Group?

..... [1]

(ii) What chemical property is shared by elements in this Group?

..... [1]

(iii) What physical property is shared by elements in this Group?

..... [1]

(c) The element with the symbol C*l* exists as two isotopes.

Explain the meaning of the term *isotopes*.

.....

..... [1]

9 Fig. 9.1 shows graphs of speed against time for journeys made by two cars.

For Examiner's Use

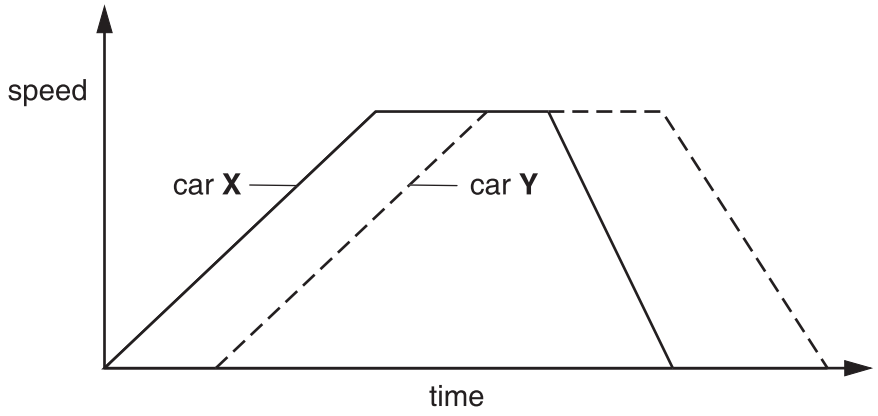


Fig. 9.1

(a) Look at the following statements about these graphs.

Put ticks in the boxes to show which statements are **true** and which are **false**.

	true	false
Car **X** achieved a higher speed than car **Y**.	☐	☐
The two cars had equal positive acceleration.	☐	☐
Car **X** had a lower negative acceleration than car **Y**.	☐	☐

[2]

(b) Car **Z** has a mass of 1200 kg.

It is travelling at a uniform velocity of 15 m/s.

Calculate the kinetic energy of car **Z**.

kinetic energy = ... unit ..... [3]

Section B

Answer **one** part, **(a)** or **(b)**, of each of the three questions.

Write your answers on the separate answer paper provided.

10 Either

(a) Look at this information about the organisms living in an area of wooded grassland.

- hares and ground squirrels eat plant leaves and roots
- monkeys eat tree fruits and seeds
- leopards eat monkeys and hares
- snakes eat monkeys
- crowned eagles eat snakes and ground squirrels

(i) Use this information to construct a food web for this area of wooded grassland.
Name a producer in this food web. [6]

(ii) Most of the leopards in this area are killed by poachers.
Suggest and explain **two** effects this may have on other organisms in the food web. [4]

Or

Part (b) of this question is on p18.

Or

(b) A large group of thirty-year-old male smokers of 20 cigarettes per day were studied during their lifetime. Fig. 10.1 shows the number of deaths caused by lung cancer in this group at various ages. Deaths caused by lung cancer for non-smokers at similar ages are also shown.

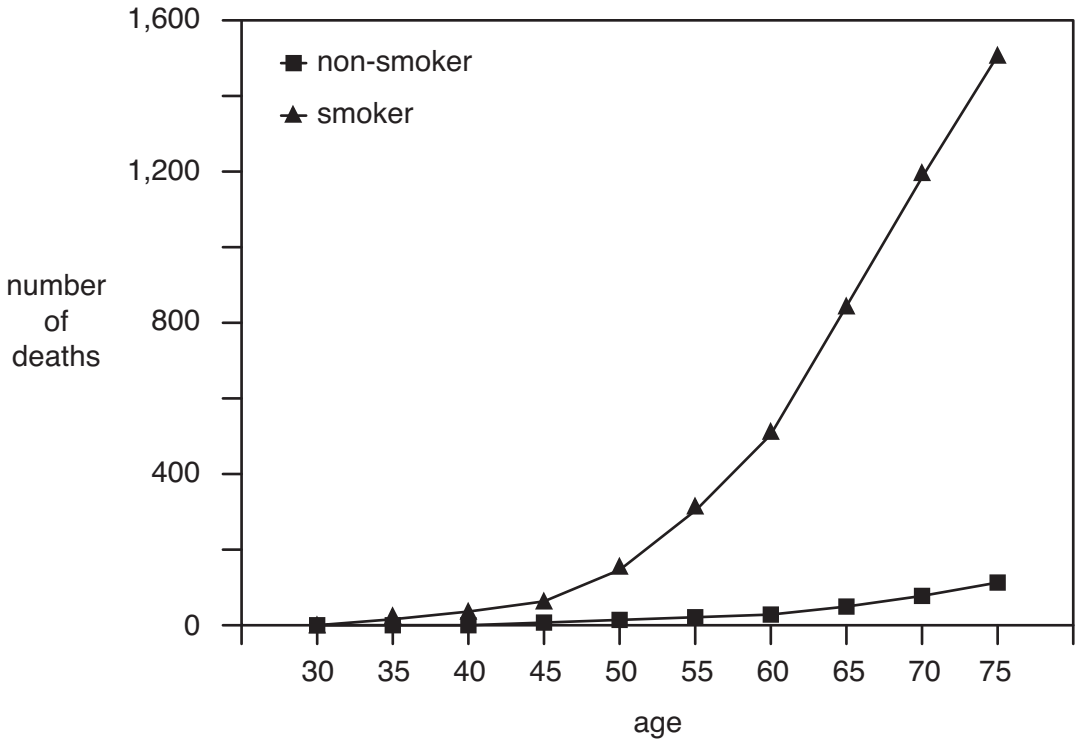


Fig. 10.1

(i) Use Fig. 10.1 to draw conclusions about the effect of smoking on the chances of a thirty-year-old male dying from lung cancer during his lifetime.
Give reasons why this data **cannot** be used to assess the risk of individual smokers in the population dying from lung cancer during their lifetime. [4]

(ii) Describe other harmful effects that smoking may have.
Suggest measures that can be taken to reduce the harmful effects of smoking. [6]

11 Either

(a) A student is given a blue solution.

(i) He identifies this as copper(II) nitrate solution. Describe the tests he could use to make this identification. [6]

(ii) The student places two carbon electrodes into the blue solution and connects them to a power supply. After a few minutes he notices that the solution and the negative electrode (cathode) are changing in appearance.

Describe and explain these changes in appearance. Include an equation for the reaction that takes place. [4]

Or

(b) (i) Name **two** common pollutants of the air. For each pollutant that you name, state **one** source of the pollution and describe **one** adverse effect on the environment. [6]

(ii) Nitrogen makes up 79% of the air. Nitrogen is used to make ammonia in the Haber process.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

A flow diagram of the Haber process is shown in Fig 11.1.

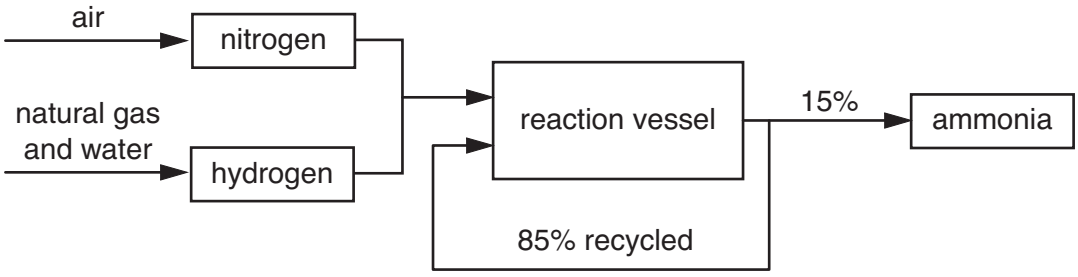


Fig. 11.1

Describe the essential conditions needed for the Haber process.
Explain why 85% of the gases leaving the reaction vessel are recycled. [4]

12 Either

(a) A manufacturing company produces aluminium foil of uniform thickness from thick aluminium sheet. They use the machine shown in Fig. 12.1.

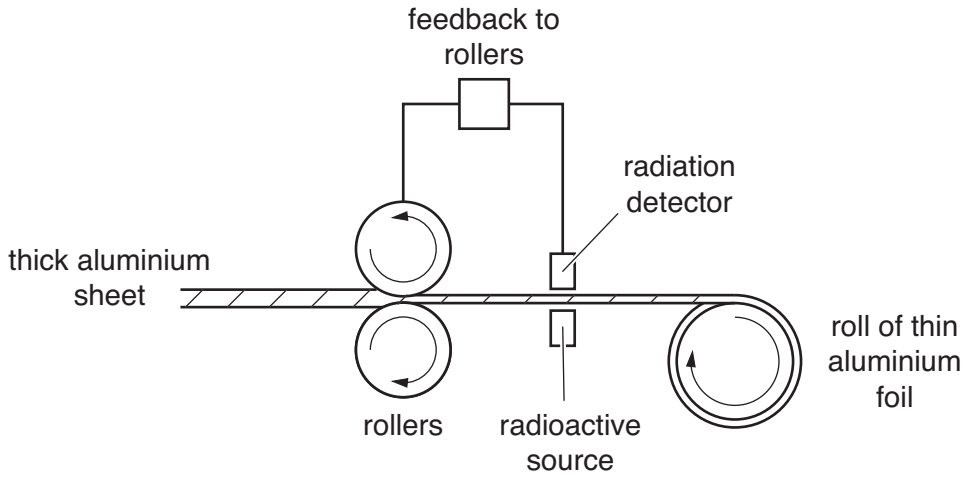


Fig. 12.1

(i) Explain how the machine always produces aluminium foil of the same thickness. [3]

(ii) The company can purchase radioactive sources that emit only alpha radiation, beta radiation or gamma radiation. Describe a laboratory investigation that can be used to decide which of the three radioactive sources the company should use in this machine. Include a diagram of the apparatus for this investigation and the results you would expect. [7]

Or

(b) (i) It is possible for us to see what has happened to stars in distant galaxies, but it is not possible for us to hear what has happened. Explain this difference. [4]

(ii) Describe an experiment to determine the speed of sound in air. Show how the results are used to calculate the speed of sound. [6]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radius 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).