Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

ADDITIONAL COMBINED SCIENCE   **5130/02**

Paper 2

October/November 2004

2 hours 15 minutes

Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

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.

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.

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.
A copy of the Periodic Table is printed on page 20.

For Examiner's Use	
Section A	
11	
12	
13	
Total	

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **19** printed pages and **1** blank page.

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International Examinations

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Section A

Answer **all** the questions.

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

1 A student investigates how the activity of an amylase enzyme varies with temperature. Her results are shown in the bar chart in Fig. 1.1.
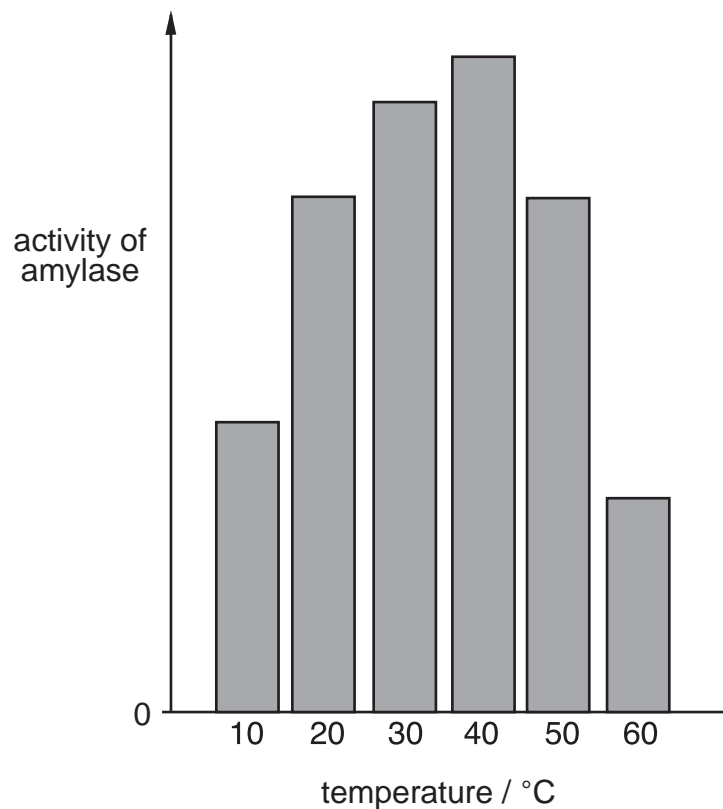

Fig. 1.1

(a) (i) What is an *enzyme*?

....

....[2]

(ii) Describe the reaction that is helped by amylase.

....

....[2]

(b) (i) Use Fig. 1.1 to describe the effect of increase in temperature on the activity of the amylase.

....

....

....[2]

(ii) Explain the change in activity of the amylase above 40 °C.

....[1]

(c) State two conditions which must be the same for each experiment in this investigation.

1 ....

....

2 ....

....[2]

2 Fig. 2.1 contains definitions of three scientific terms.
Choose the correct terms from the list to complete the table.

diffusion   **mass**

osmosis   **polyester**

protein   **weight**

scientific term	definition
	the movement of gas molecules, from a region of their higher concentration to a region of their lower concentration, down a concentration gradient
	a macromolecule made by joining together amino acids
	a measure of the amount of substance in a body

Fig. 2.1

[3]

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3 Crude oil is a mixture of many different hydrocarbons. Before use the crude oil is separated into several fractions.

(a) The list contains some of the apparatus that is used to separate crude oil into fractions in the laboratory.

condenser

five test-tubes

flask

thermometer

(i) Draw a diagram of the apparatus after it has been set up.
Label each piece of apparatus.

[4]

(ii) Mark with **C** on your diagram the place where you would put the crude oil and mark with **F** the place where you would obtain one of the fractions. [2]

(b) Name and give a use for two of the fractions obtained from crude oil.

1 ....

....

2 ....

....[4]

4 Fig. 4.1 shows a light ray being reflected from the surface of a mirror.

mirror

light ray

P **Q**

angle of ....

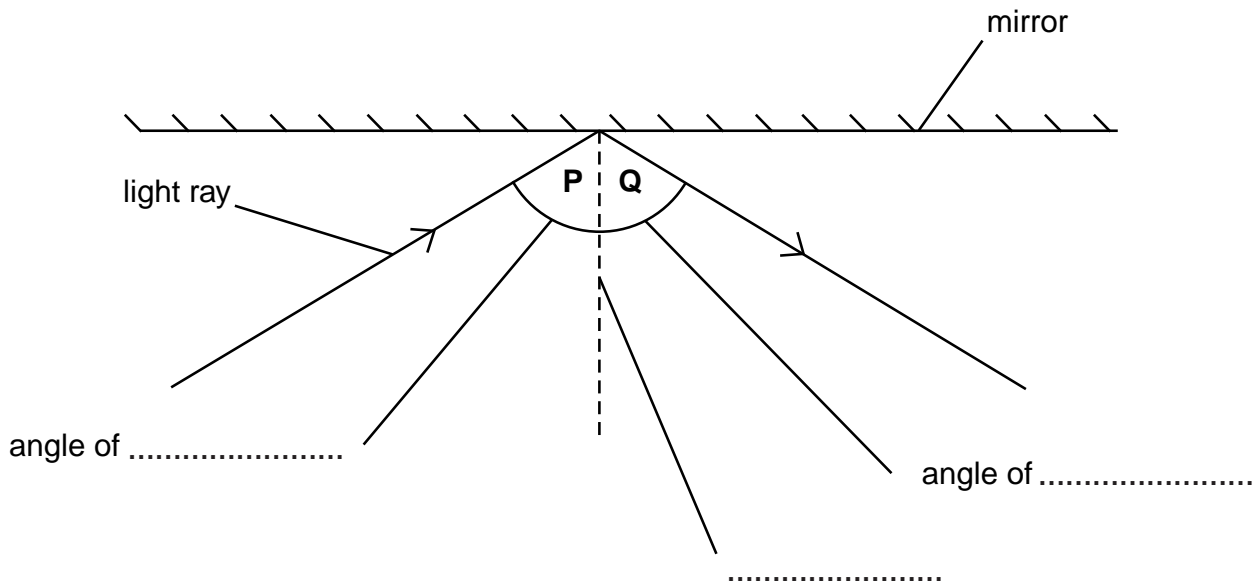angle of ....

....

Fig. 4.1

(a) **(i)** Complete the three labels in Fig. 4.1. [3]

(ii) What is the relationship between the angles **P** and **Q**?

....[1]

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(b) Light can also be reflected using a prism. Fig. 4.2 shows two prisms being used in a periscope.

prism

ray of light

periscope
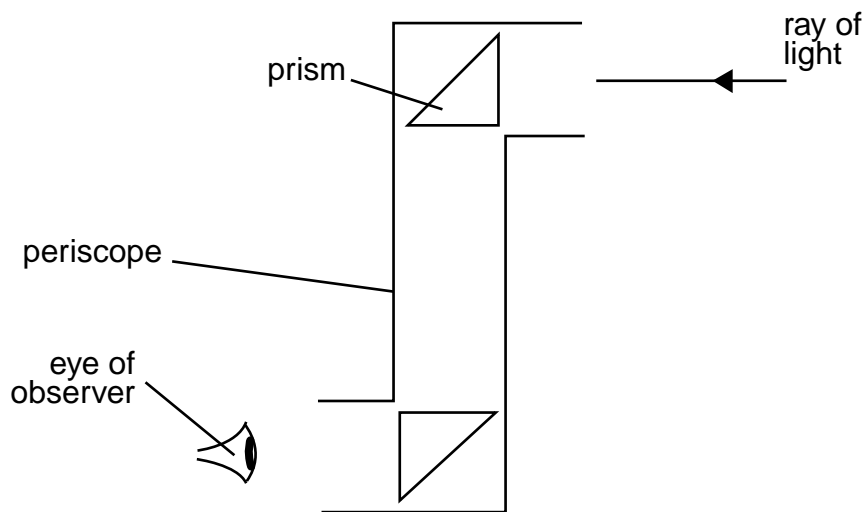
eye of observer

Fig. 4.2

(i) Complete the ray of light in Fig. 4.2 to show how it passes through the periscope to the eye of the observer. [1]

(ii) When a ray of white light hits a prism at an angle different from that shown in the periscope, dispersion occurs.
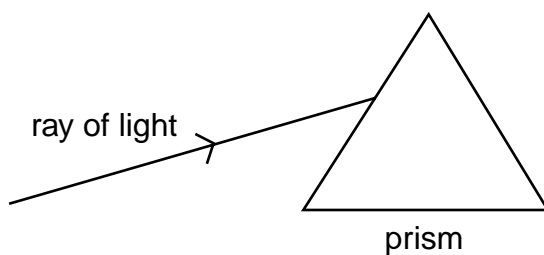Complete Fig. 4.3 to show this dispersion.

ray of light

prism

Fig. 4.3

[3]

5 Fig. 5.1 shows how the concentration of sugar in the leaves and stem of a green plant varies during one day.

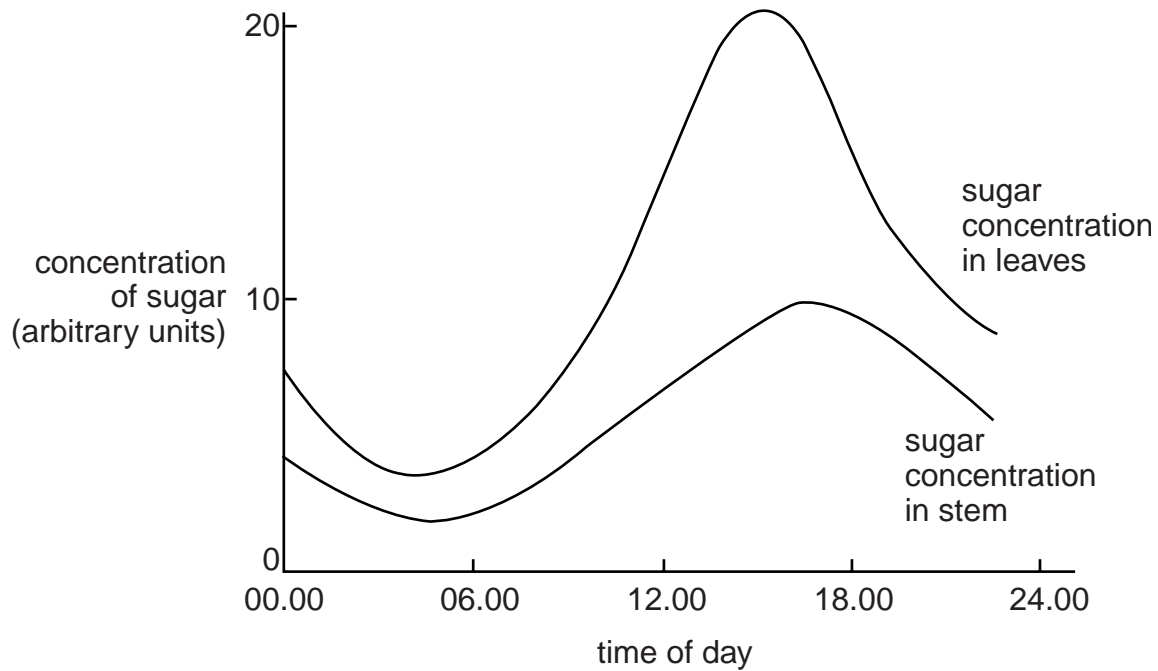**Fig. 5.1**

(a) Plants make their own food in the form of sugar.

(i) Name the process by which sugar is produced.

....[1]

(ii) Complete the word equation for this process.

_____ + _____ → glucose + oxygen   [2]

(b) (i) Using the graph, describe how the concentration of sugar in the leaves varies during a 24 hour period.

....

....[2]

(ii) Suggest an explanation for these changes in concentration.

....

....

....[2]
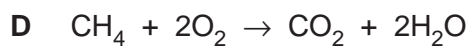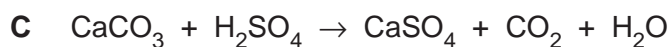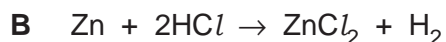
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(c) Fig. 5.1 shows that the highest sugar concentration in the leaves occurs at about 15.00 hours, but the highest concentration of sugar in the stem occurs at about 16.00 hours. Suggest an explanation for this.

....

....

....[2]

6 Study these symbol equations.

  A $KOH + HCl \rightarrow KCl + H_2O$

  B $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

  C $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + CO_2 + H_2O$

  D $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

  E $2Na + Cl_2 \rightarrow 2NaCl$

(a) Choose from the letters **A**, **B**, **C**, **D** and **E** to answer the following questions.
You may use each letter once, more than once, or not at all.

  (i) Which equation shows the production of a flammable gas?

  ....[1]

  (ii) Which equation shows a neutralisation reaction?

  ....[1]

  (iii) Which equation shows the combustion of a fuel?

  ....[1]

  (iv) Which equation shows the synthesis of a compound from elements?

  ....[1]

  (v) Which equation does **not** show the formation of a salt?

  ....[1]

(b) Write in the boxes the word equation for the symbol equation **C**.
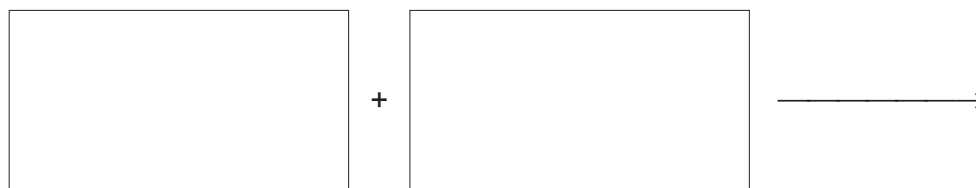
[2]

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Turn to page 12 for Question 7.

7 Fig. 7.1 shows a fairground ride with chairs carried round on a wheel.
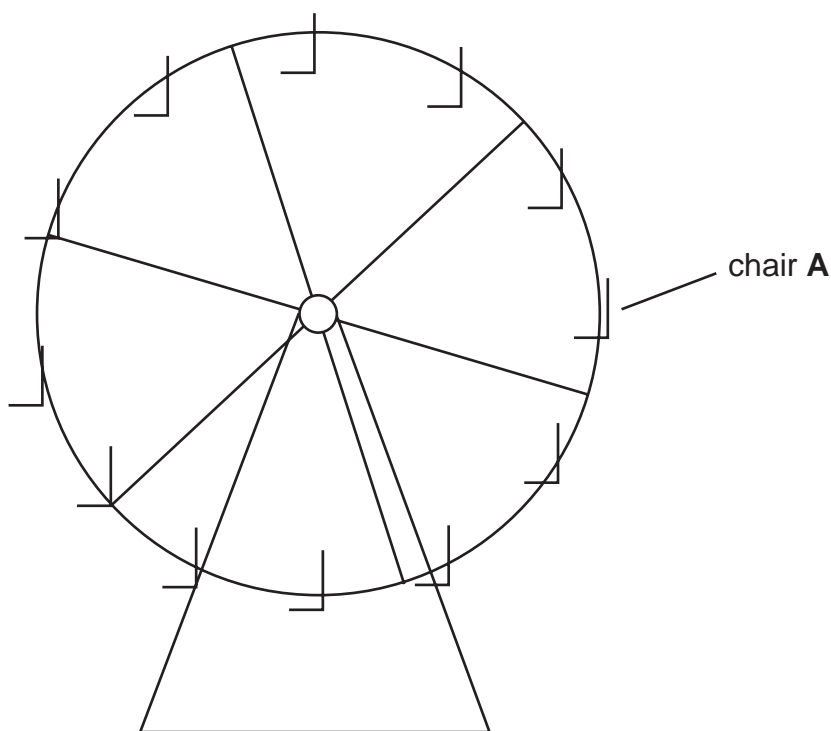

chair **A**

Fig. 7.1

(a) The average mass of one chair occupied by a person is 200 kg.
The radius of the wheel is 10.5 m.

(i) What is the average weight, in Newtons, of one chair occupied by a person?
(The weight of 1 kg mass is 10 N)

weight = _____ N [1]

(ii) Calculate the work done when an occupied chair is raised from the bottom of the
wheel to the top.
Show your working and give the unit for your answer.

work done = _____ unit _____ [4]

(b) The circumference of the wheel is 66 m.
The wheel makes one turn each minute.
Calculate the speed at which each chair travels.
Show your working and give your answer in m/s.

speed = _____ m/s [2]

(c) Calculate the moment about the centre of the wheel caused by the weight of chair **A** and its occupant.
Show your working and give the unit for your answer.

moment = _____ unit _____ [3]

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8   Fig. 8.1 gives information about six foods.

food	% water	% carbohydrate	% fat	% protein
cheese	39	0	35	25
eggs	78	0	10	12
fish	77	0	3	18
beans	12	60	1	20
maize	10	78	1	8
meat	63	0	18	18

Fig. 8.1

(a)   From Fig. 8.1, choose **one** food that would provide a lot of energy.
Give a reason for your choice.

....

....

....[2]

(b)   A man has a heart attack. He is told that avoiding certain foods will help to prevent him
having a second heart attack.

(i)   Suggest two foods in Fig. 8.1 that he should avoid.

....

....[2]

(ii)   Give a reason for your choice.

....

....[1]

9 Hydrogen peroxide decomposes into water and oxygen.
The reaction is catalysed by the black solid manganese(IV) oxide.
In an experiment, 1.0 g of manganese(IV) oxide was added to a solution of hydrogen peroxide and the volume of oxygen released was measured every minute.
The results of this experiment are shown in Fig. 9.1.

time / minutes	0	1	2	3	4	5
volume of oxygen / cm^3	0	15	23	26	27	27

Fig. 9.1

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

(ii) Draw a smooth curve through the points.

Label this curve **A**. [1]

volume of oxygen / cm^3

0   5   10

time / minutes
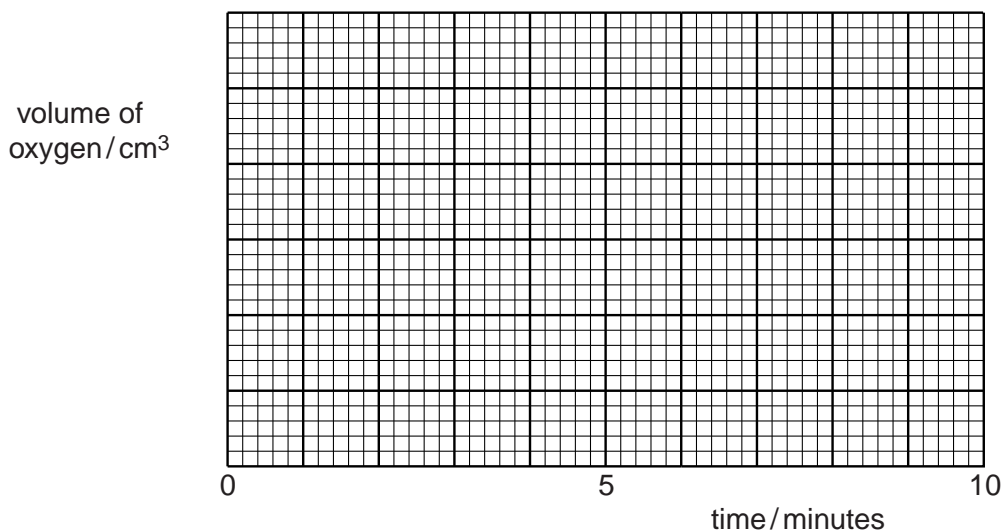
(b) The experiment is repeated with all conditions kept the same, except that the hydrogen peroxide is diluted with an equal volume of water.
Sketch on the grid the curve you would expect for this repeat experiment.
Label this curve **B**. [2]

10 Fig. 10.1 shows the decay curve for a radioactive isotope.
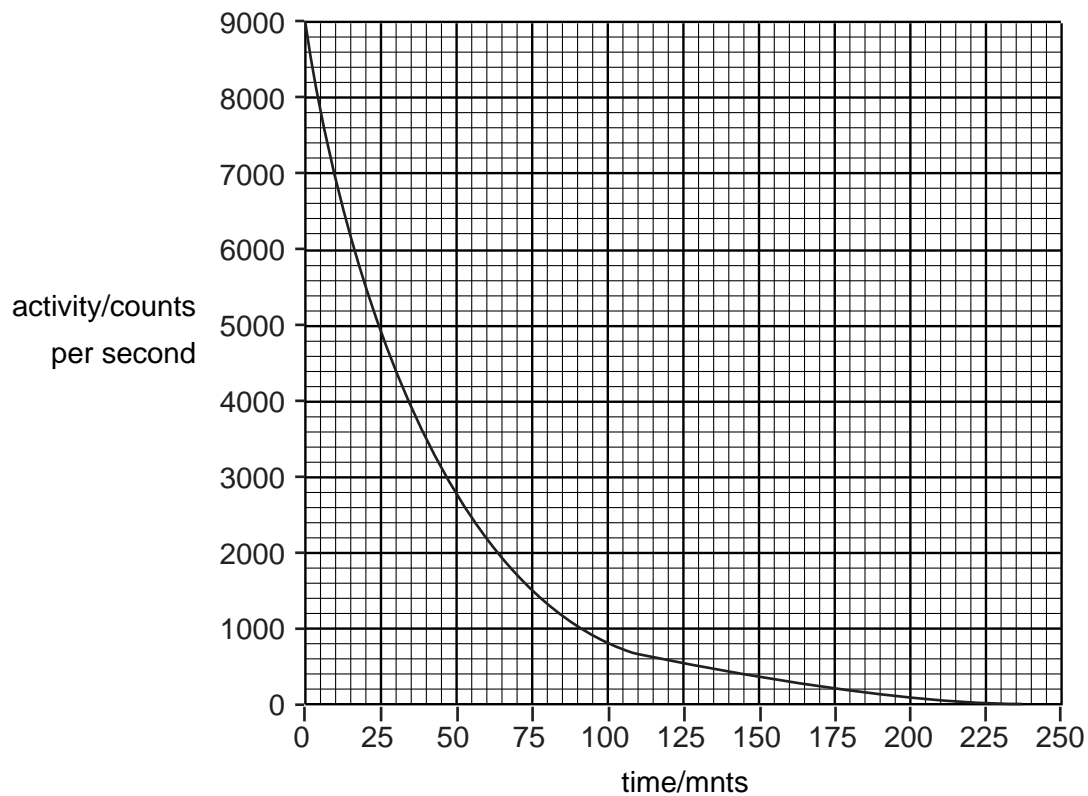
Fig. 10.1

(a) What is meant by the term *radioactivity*?

....

....[2]

(b) Use the graph to find the half-life of this radioactive isotope.
Show on the graph how you work out your answer.

half-life = _____ minutes [2]

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Section B

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

Write your answers on the separate answer paper provided.

11 Either

(a) (i) Explain how pollen from one plant can fertilise the ovules of another plant.
Include in your answer descriptions of transfer of pollen and fertilisation of ovules. [5]

(ii) The colour of fruit produced by a plant is controlled by a pair of alleles.
Red is the dominant colour and yellow is recessive.
A farmer uses pollen from a heterozygous red-fruited plant to fertilise the flowers of a homozygous yellow-fruited plant. He uses the seeds from the fruit of this plant to grow 100 new plants.
Predict and explain the number of yellow-fruited plants that he obtains.
You may use a genetic diagram to make your answer clear.
Use the symbol **R** for the dominant allele and **r** for the recessive allele. [5]

Or

(b) (i) The body temperature of a human varies little despite large changes in the temperature of the surroundings.
Describe how humans maintain a constant body temperature. [4]

(ii) Explain how urea is excreted from the human body. In your answer give details of the route followed by urea from the liver where it is formed, until it is removed from the body.
Why is it essential for urea to be removed from the body? [6]

12 Either

(a) In the Periodic Table, Group I contains the alkali metals and Group VII contains the halogens.

 (i) Describe trends in the properties of the elements in these two Groups of elements. [6]

 (ii) Sodium is an alkali metal with the electron arrangement 2,8,1 and chlorine is a halogen with the electron arrangement 2,8,7.
 Using this information, draw a diagram to show bonding in the compound sodium chloride.
 [4]

Or

(b) Copper metal is purified by electrolysis.
 A simplified diagram of the cell used is shown in Fig. 12.1.
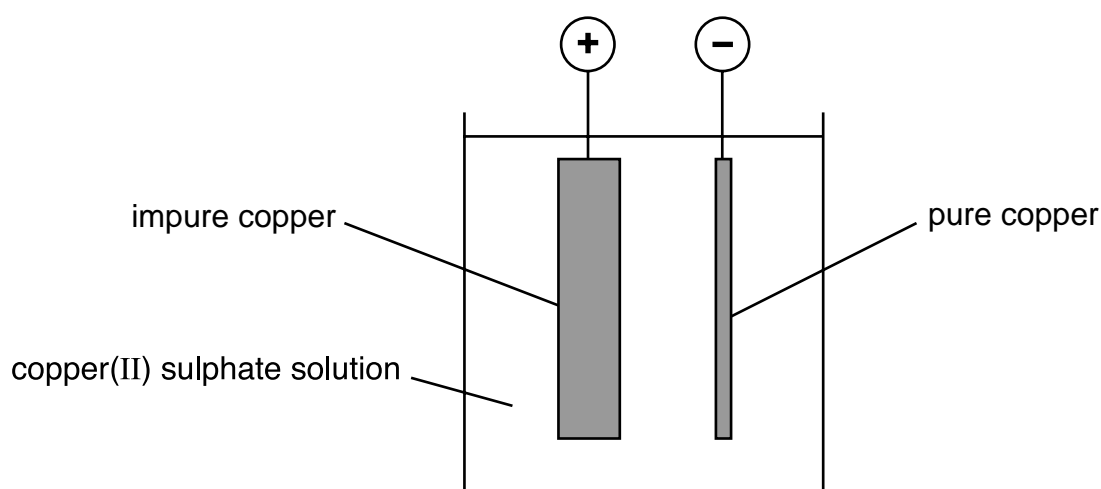
Fig. 12.1

 (i) Write ionic equations for the reactions taking place at the electrodes. [4]

 (ii) Describe and explain any changes in the mass of the electrodes and in the concentration of the solution. [6]

13 Either

(a) A student did an experiment to find the resistance of a piece of wire.
Her results are shown in Fig. 13.1.

potential difference across wire /volts	current in circuit /amps
0.3	0.5
0.6	1.0
0.9	1.5
1.2	2.0

Fig. 13.1

(i) Describe how the student could have carried out this experiment.
Include a circuit diagram in your answer. [6]

(ii) Explain how the student's results are consistent with Ohm's Law.
Why does an electric light bulb not obey Ohm's Law? [4]

Or

(b) Fig. 13.2 shows apparatus used to test the thermal conductivity of a copper rod and a plastic rod.
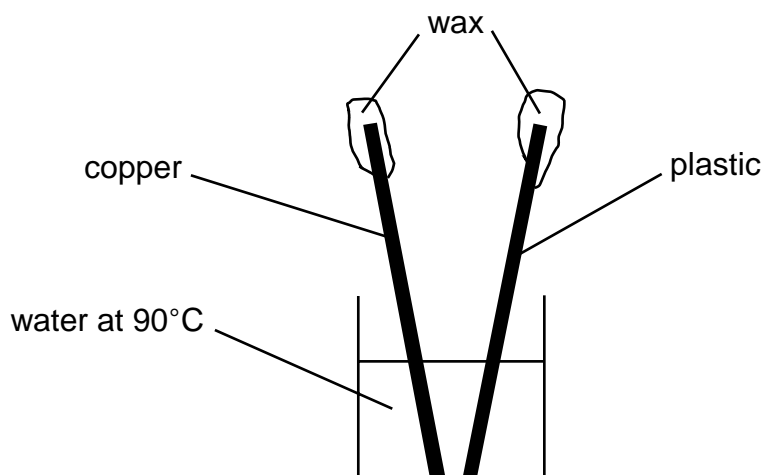

Fig. 13.2

(i) Describe the results you would expect from this experiment.
Explain your answer in terms of the behaviour of electrons, atoms and molecules.
Describe how the different thermal properties of copper and plastic are used in the kitchen. [7]

(ii) Metals expand when heated.
Describe and explain one everyday consequence of the thermal expansion of metals. [3]

DATA SHEET
The Periodic Table of the Elements

Group

I	II			III	IV	V	VI	VII	0
									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

1 **H** Hydrogen 1

I	II																	III	IV	V	VI	VII	0
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** Radium 88	227 **Ac** Actinium 89 †															

*58-71 Lanthanoid series

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

†90-103 Actinoid series

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

Key

a	
X	a = relative atomic mass
b	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.).

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