

Centre Number	Candidate Number	Name
---------------	------------------	------

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

**CO-ORDINATED SCIENCES**

**0654/02**

Paper 2 Core

May/June 2006

**2 hours**

Candidates answer on the Question Paper.  
No Additional Materials are required.

**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.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.  
You may use a pencil for any diagrams, graphs, tables or rough working.  
A copy of the Periodic Table is printed on page 20.  
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	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
<b>Total</b>	

This document consists of **20** printed pages.



1 Blood contains red cells, white cells and plasma.

(a) Match each of these components with its function by drawing lines to link the boxes.

component	function
red cells	transporting urea
white cells	preventing and fighting infection
plasma	transporting oxygen

[2]

(b) The heart pumps blood around the body. Describe how the heart pushes blood into the arteries.

.....

.....

..... [2]

(c) Plants do not have a heart to pump fluids around them.

(i) State the name of the vessels that carry water from a plant's roots to its leaves.

..... [1]

(ii) Explain what makes the water move up these vessels.

.....

.....

..... [2]

2 (a) Explain in terms of particles why

(i) an inflated balloon shrinks when placed in a refrigerator,

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

(ii) water evaporates more quickly on a warm day than on a cold day.

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

(b) Explain why snow skis have a large surface area.

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

- 3 (a) A student uses pH and temperature sensors connected to a computer to investigate three liquids, **A**, **B** and **C**. The apparatus is shown in Fig. 3.1.

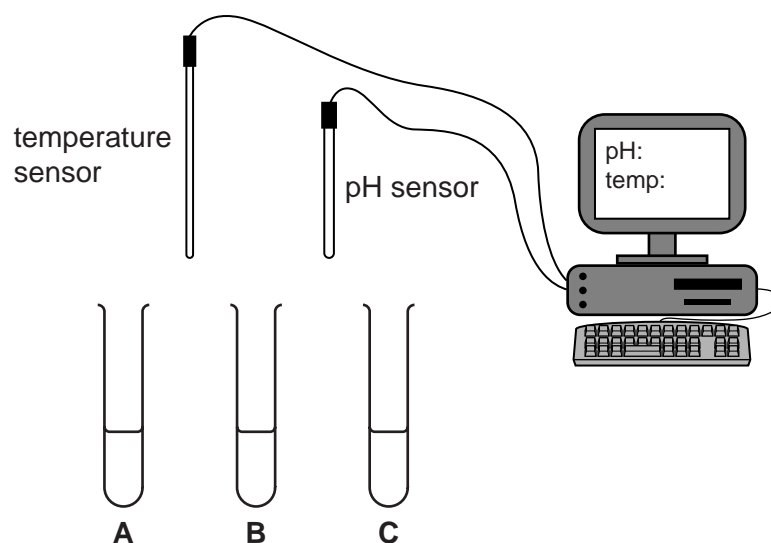


Fig. 3.1

The results obtained when the pH sensor was placed into the liquids in the test-tubes are shown in Table 3.2.

Table 3.2

tube	pH
<b>A</b>	14.0
<b>B</b>	7.0
<b>C</b>	1.0

- (i) Which liquid in Table 3.2 could be pure water?  
Explain your answer.

.....  
..... [1]

- (ii) Which liquid in Table 3.2 would react with magnesium to produce a salt and hydrogen gas?  
Explain your answer.

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

- (b) The student then placed the temperature sensor into liquid C.

Predict and explain what will happen to the temperature reading from the sensor when liquid A is poured into liquid C.

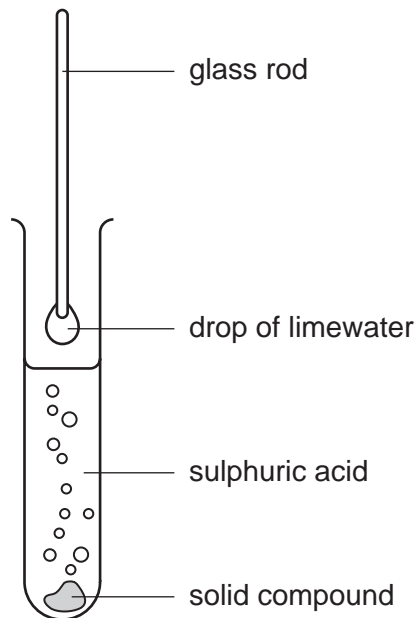
.....

.....

.....

..... [3]

- (c) When sulphuric acid is added to a solid compound, a gas is given off. A drop of limewater on the end of a glass rod is held in this gas. The drop of limewater turns cloudy.



What type of compound could the solid be?  
Explain your answer.

.....

.....

.....

..... [2]

4 In many parts of the world, cattle are farmed to provide meat and milk for humans. The cattle may be fed on maize. This information can be shown as a food chain.



(a) The arrows in the food chain represent the flow of energy along the chain. Where did this energy originally come from?

..... [1]

(b) Name the consumer or consumers in this food chain.

..... [1]

(c) This food chain does not show decomposers. Describe the role of decomposers in a food web.

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

(d) (i) The maize that the cattle eat is digested in their alimentary canal. Explain what digestion is and why it is important.

.....  
.....  
.....  
..... [3]

(ii) The maize that the cattle eat contains starch. Suggest how it is digested in their alimentary canal.

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

(e) State **one** dietary problem that is found in the country where you live, and explain how it may affect people's health.

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

5 (a) Electrical signals can be sent along nerve cells. A bright light shines into a person's eye. Impulses are produced in the nerve cells. These travel to the central nervous system, which may then send impulses to an effector.

(i) State where in the eye receptor cells are found.

..... [1]

(ii) Suggest a possible effector.

..... [1]

(b) Rays of light entering the eye are refracted by the lens. Complete Fig. 5.1 below to show what happens when parallel rays of light are refracted by a lens.

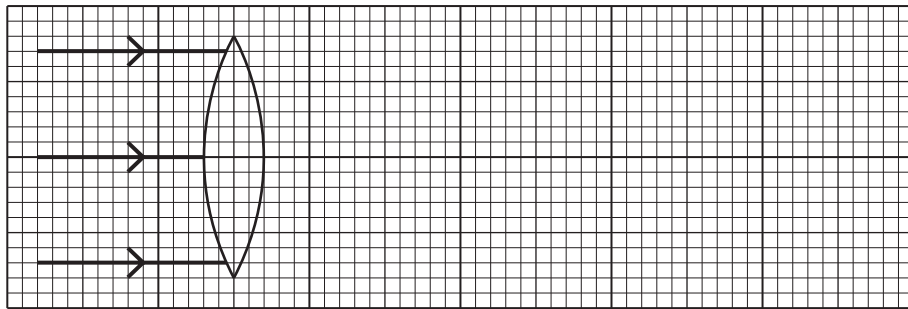


Fig. 5.1

[2]

(c) The eye is able to detect the three primary colours of light.

(i) Name these colours.

1. ....

2. ....

3. ....

[2]

(ii) These three colours of light are electromagnetic waves. Apart from their colour, state **one** other way in which they differ from each other.

.....  
..... [1]

6 Explain briefly the difference between these terms.

(a) *electrolysis* and *electrolyte*

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

(b) *sol* and *emulsion*

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

(c) *longitudinal waves* and *transverse waves*

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



7 Fig. 7.1 shows the structure of the female reproductive system.

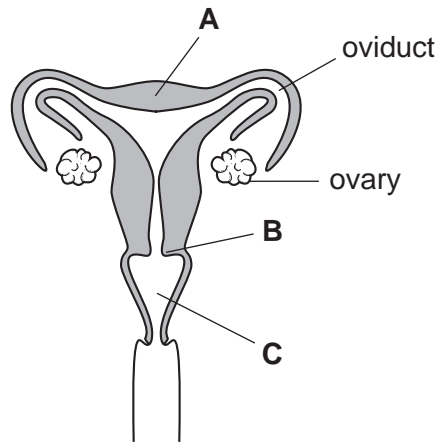


Fig. 7.1

(a) Name the parts labelled **A**, **B** and **C**.

- A .....
- B .....
- C .....

[3]

(b) Eggs are produced in the ovaries. One egg is released from an ovary each month.

Describe what happens if this egg is **not** fertilised.

- .....
- .....
- ..... [2]

(c) If the egg is fertilised, it may implant in the uterus and develop into an embryo.

Outline how the embryo is provided with nutrients.

- .....
- .....
- ..... [2]

8 Fig. 8.1 shows three aeroplanes at an airport.

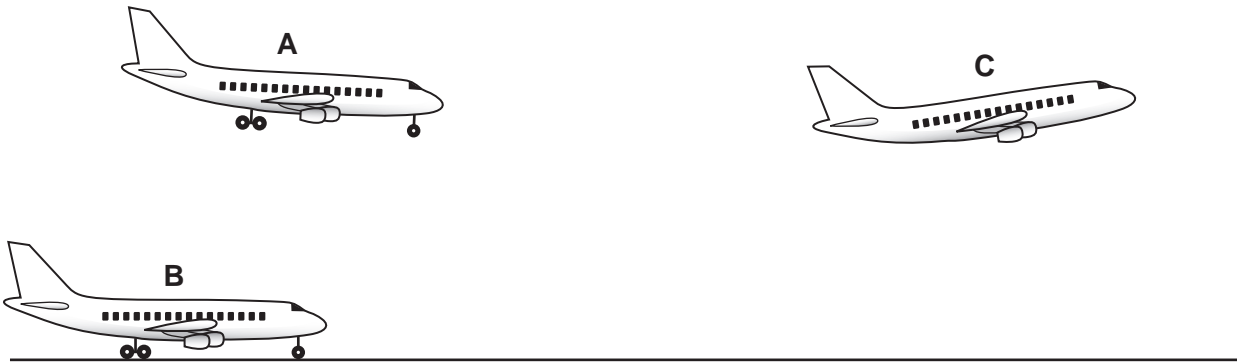


Fig. 8.1

- (a) Aeroplane **A** is moving at a constant velocity towards the main runway.  
Aeroplane **B** is stationary, waiting for take off.  
Aeroplane **C** has just taken off and is accelerating.

(i) Which, if any, of the aeroplanes has zero momentum?

Explain your answer.

.....  
 ..... [1]

(ii) The momentum of one of the aeroplanes is changing.

State which aeroplane and explain your answer.

.....  
 ..... [1]

(iii) Which aeroplanes have no unbalanced forces acting on them?

Explain your answer.

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

(iv) Aeroplane **A** travels at 70 m/s for 30 seconds. Calculate the distance travelled.

Show your working and state the formula that you use.

formula used

working

.....m [2]

(b) People who fly frequently have greater exposure to ionising radiation than those who do not fly.

Explain why this can be harmful.

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

- 9 Growing crops take up several elements they need from the soil. The chemical symbols of three of these elements are N, P and K.

- (a) (i) One of these elements, when uncombined, is a metal. Name this element.

..... [1]

- (ii) State which **two** of these elements have the same number of electrons in the outer shells of their atoms. Explain your answer briefly.

elements ..... and .....

explanation .....

..... [2]

Table 9.1 shows how much of these three elements is taken up from the soil by different crops.

**Table 9.1**

crop	mass removed in kg/hectare		
	N	P	K
barley	72	14	13
oats	72	13	18
potatoes	109	14	133
sugar beet	86	14	302
wheat	115	22	26

- (b) Which crop in Table 9.1 takes up the greatest mass of the two non-metallic elements per hectare?

Show how you obtained your answer.

..... [2]

(c) The elements taken up by growing crops are present in the soil as compounds. In industry, nitrogen from air is used to make ammonia. Ammonia is used to make ammonium nitrate, ammonium phosphate and urea, which are added to soil used for growing crops.

(i) Explain briefly why uncombined nitrogen molecules cannot be used by most growing crops.

.....  
..... [1]

(ii) Name the other element which reacts with nitrogen to form ammonia.  
..... [1]

(iii) The chemical formula of urea is  $N_2H_4CO$ .  
State the total number of atoms which are combined in one molecule of urea.  
.....  
..... [1]

(d) Explain why lime might be added to certain types of soil in order to make it suitable for growing crops.  
.....  
.....  
..... [2]

(e) Soils contain compounds which have been formed by the weathering of rocks.  
Describe **one** way by which the weathering of rocks occurs.  
.....  
.....  
..... [2]

- 10 Big-horn sheep live on rocky mountain sides in Canada. The males have very large horns. The size of their horns is caused by their genes.



- (a) State **one** feature shown in the photograph that is found only in mammals.

..... [1]

- (b) (i) Name the part of a cell that contains the genes.

..... [1]

- (ii) In which cells in the big-horn sheep's body will the gene for horn size be present?

..... [1]

- (c) In summer, it may be very hot in the mountains, but in winter it is very cold. Big-horn sheep keep their body temperature constant.

- (i) Explain why the cells of the sheep can function better if the temperature around them does not go up too high.

.....  
.....  
..... [1]

- (ii) Respiration inside the cells of the sheep produces heat energy that helps to keep them warm in cold weather.

Write the word equation for respiration.

..... [2]

- (iii) Explain why the sheep have to eat more food when it is cold.

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

11 Electricity is generated in a power station using a turbine and generator.

(a) Complete the sentence below to describe the energy changes which take place in a generator.

.....energy is changed into .....energy [1]

(b) The voltage of the electricity generated is increased using transformers for transmission through power lines to the users.

Explain why this is done.

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

(c) The electrical supply to a house is at a voltage of 220 V.  
An electric kettle is plugged into the supply.  
The current flowing through the heating element of the kettle is 10 A.

(i) Calculate the power taken by the kettle.

Show your working and state the formula that you use.

formula used

working

.....W [2]

(ii) Calculate the resistance of the heating element.

Show your working and state the formula that you use.

formula used

working

.....ohms [2]



(d) Some power stations use fossil fuels as a source of energy.

(i) What is meant by the term *fossil fuel*?

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

(ii) Name **one** fossil fuel.

..... [1]

- 12 (a) The diagrams below show some common raw materials which are changed by chemical reactions into useful products.

Choose words from the list to complete each box.

aluminium

ammonia

ceramics

chlorine

glass

paper

plastics

raw materials

useful products



silicon(IV) oxide  
mixed with metal oxides





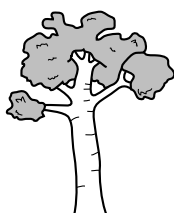
clay





petroleum  
(crude oil)





wood




[4]

(b) Petroleum (crude oil) is a black liquid mixture of hydrocarbons which is refined by the process of fractional distillation.

Fig. 12.1 shows a diagram of industrial apparatus used for fractional distillation.

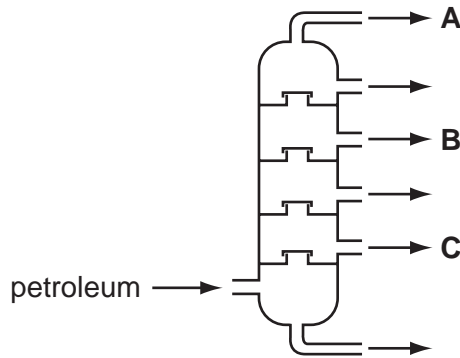


Fig. 12.1

(i) Name the **two** main elements which are bonded together in the majority of molecules found in petroleum.

..... [1]

(ii) State **one** difference in the properties of the materials coming out of the apparatus at points **A** and **C**.

.....  
..... [1]

(c) Some of the material coming out of the apparatus at point **B** in Fig. 12.1 undergoes cracking on the surface of a catalyst. This produces a mixture of saturated and unsaturated hydrocarbons. The catalyst is in the form of very small particles.

(i) Describe briefly how an unsaturated hydrocarbon differs from a saturated hydrocarbon.

.....  
..... [1]

(ii) Explain the meaning of the term *catalyst*.

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

(iii) Suggest why the catalyst is used in the form of very small particles.

.....  
..... [1]

**DATA SHEET**  
**The Periodic Table of the Elements**

		Group																																																																																														
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII																																																																																					
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10	23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulphur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18	39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36	85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54	133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	186 <b>Re</b> Rhenium 75	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	210 <b>Rn</b> Radon 86	226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89	71 <b>Lu</b> Lutetium 71	70 <b>Yb</b> Ytterbium 70	69 <b>Tm</b> Thulium 69	68 <b>Er</b> Erbium 68	67 <b>Ho</b> Holmium 67	66 <b>Dy</b> Dysprosium 66	65 <b>Tb</b> Terbium 65	64 <b>Gd</b> Gadolinium 64	63 <b>Eu</b> Europium 63	62 <b>Sm</b> Samarium 62	61 <b>Pm</b> Promethium 61	60 <b>Nd</b> Neodymium 60	59 <b>Pr</b> Praseodymium 59	58 <b>Ce</b> Cerium 58	92 <b>U</b> Uranium 92	91 <b>Pa</b> Protactinium 91	90 <b>Th</b> Thorium 90	94 <b>Pu</b> Plutonium 94	95 <b>Am</b> Americium 95	96 <b>Cm</b> Curium 96	97 <b>Bk</b> Berkelium 97	98 <b>Cf</b> Californium 98	99 <b>Es</b> Einsteinium 99	100 <b>Fm</b> Fermium 100	101 <b>Md</b> Mendelevium 101	102 <b>No</b> Nobelium 102	103 <b>Lr</b> Lawrencium 103

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

a	<b>X</b>	b
---	----------	---

Key

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

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