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	
Total	

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.

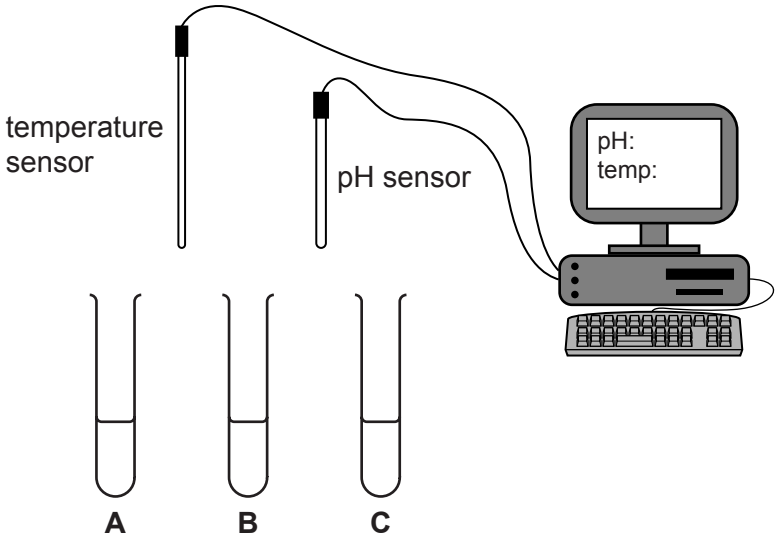


Fig. 3.1

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
A	14.0
B	7.0
C	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**.

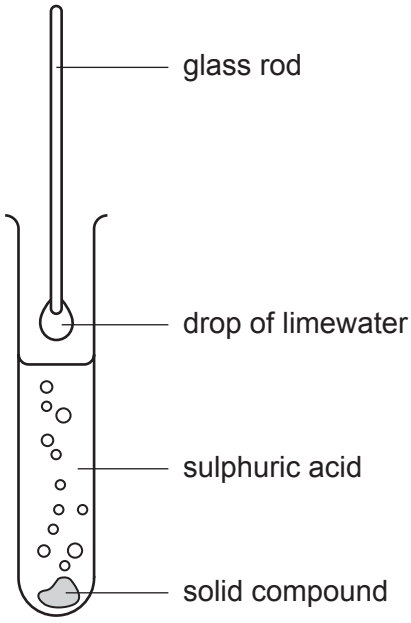
.....

.....

.....

..... [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.

maize → cattle → humans

(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.

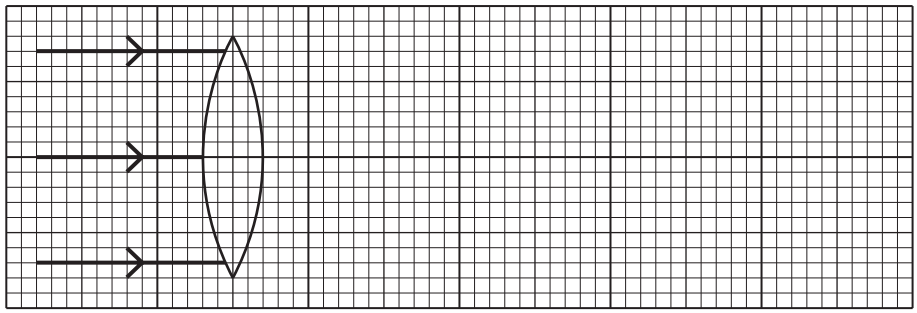
(i) State where in the eye receptor cells are found.

..... [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.



[2]

Fig. 5.1

(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.

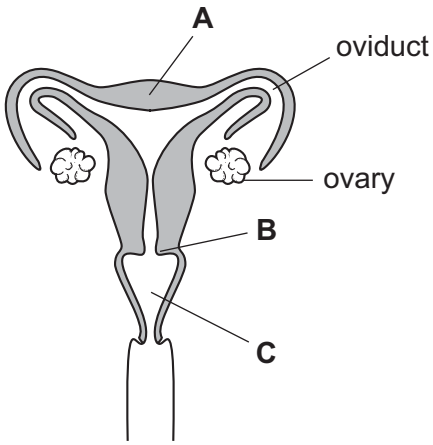


Fig. 7.1

(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]

[Turn over

8 Fig. 8.1 shows three aeroplanes at an airport.

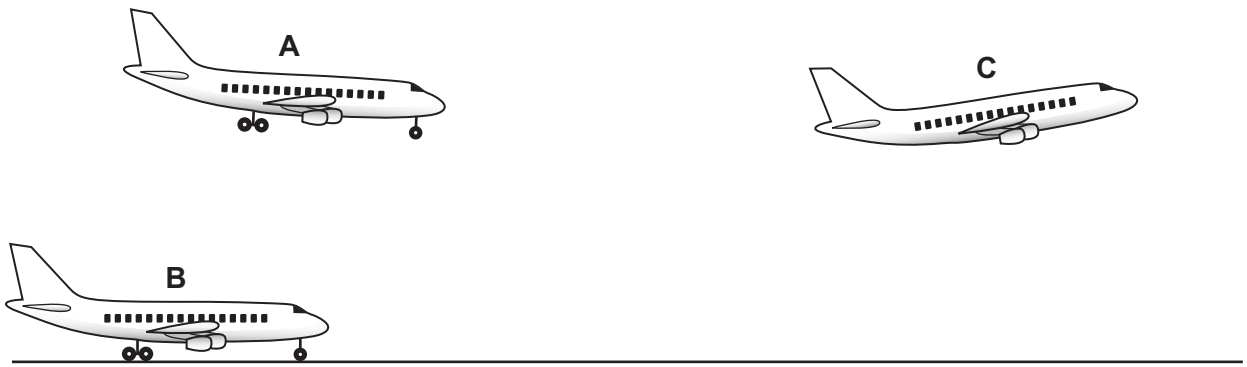


Fig. 8.1

(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]

For Examiner's Use

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.

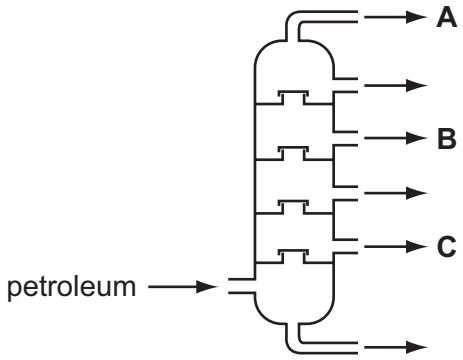


Fig. 12.1

(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	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															

*58-71 Lanthanoid series
90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92

Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63
Np Neptunium 93	Pu Plutonium 94	Am Americium 95

157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66
Cm Curium 96	Bk Berkelium 97	Cf Californium 98

165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69
Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101

173 Yb Ytterbium 70	175 Lu Lutetium 71
No Nobelium 102	Lr Lawrencium 103

Key

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

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