Centre Number	Candidate Number

Candidate Name _____

International General Certificate of Secondary Education
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

CO-ORDINATED SCIENCES 0654/2

PAPER 2

SPECIMEN PAPER FOR 1997

2 hours

Candidates answer on the question paper.
No additional materials are required.

Mark Scheme

Biol ✓ (JFM)
Chem ✓ (CDT)
Phys ✓

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

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 16.
You may use a calculator.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
TOTAL	

This specimen paper consists of 16 printed pages.

[Turn over

1 Solids, liquids and gases are made up of moving particles which are arranged in different ways.

(a) Complete the table using **four** of the statements from the lists below.

Use **one** statement in each space.

arrangement of particles
• well spread out;
• packed together in an orderly way;
• packed together in disordered way.

movement of particles
• vibrate about a fixed position;
• move freely in all the available space;
• move around each other with limited freedom.

	arrangement of particles	*movement of particles*
liquids	Packed together in disordered way.	Move around each other with limited freedom.
gases	Well spread out	Move freely in all available space.

[4]

(b) A solution of copper sulphate was left in a crystallising dish on a bench. A few days later the level of solution had dropped and crystals had formed at the edge of the solution.

Explain in terms of the kinetic theory what had happened to the water in the solution.

- The water particles are moving.
- Some of the particles break out through the surface
- They have enough energy to break their bonds [3]

(c) Copper sulphate has the formula $CuSO_4$.

Name and state the number of atoms of each element represented in this formula.

Copper (1) Sulphur (1) Oxygen (4) [2]

For Examiner's Use

2 A group of doctors carried out a study in the United States of America in 1992 to compare the rate of healing of broken bones in people who did and did not smoke cigarettes. The table shows the results.

	non-smokers	*ex-smokers*	*smokers*
number of people in the study	9	9	11
time taken for 1 cm of bone to regrow/months	2.32	2.72	2.98

(a) (i) Outline the conclusions which the doctors could draw from these results.

Slower bone regrowth in smokers than in non-smokers;
Slower bone growth in ex-smokers than in smokers;
Bone growth faster in ex-smokers than in smokers; [2]

(ii) Suggest **two** factors which the doctors should have taken into account when choosing people to take part in the study, in order to make a fair comparison.

1 Age;

2 Mass; Gender; [2]

(iii) Suggest what should be done to confirm the results of this study.

Repeat/increase number of people in the study

[1]

(b) The doctors who carried out the study thought that the rate of oxygen supply to the bone may affect its speed of healing. Suggest how breathing in cigarette smoke could reduce the oxygen supply to the bone.

Cigarette smoke contains Carbon Monoxide;
Carbon Monoxide joins with Haemoglobin; more
readily than oxygen does; (WTTE)
So less O_2 carried by Haemoglobin to the bone;

[4]

For Examiner's Use

3 (a) In 1986, a nuclear accident at the nuclear fission reactor in Chernobyl released radioactive materials into the atmosphere. Due to the heat generated, radioactive dust rose in the air and was eventually deposited in rain over Britain about a week later. Sheep ate the grass growing on this land. The radioactive materials had half-lives ranging from 5 days to 28 years.

(i) Explain how heat from the accident caused radioactive dust to rise in the air.

Any 3

- Air expands when heated
- It is less dense than cold air
- Hot air rises, taking dust with it
- Convection

[3]

(ii) What is meant by the term *nuclear fission*?

- large nuclei (atoms) split apart
- into 2 smaller nuclei

[2]

(iii) What piece of apparatus could be used to measure the radiation emitted by the grass?

GM tube (Geiger counter)

[1]

(iv) What is meant by the term *half-life*?

- Time taken
- for half a sample to decay.

[2]

(b) Describe **two** differences between alpha radiation and gamma radiation.

Any 2

1 Alpha is heavier

Alpha is charged

2 Alpha causes more ionisation

Alpha is less penetrating

[2]

Alpha can be deflected by fields

For Examiner's Use

(c) Radioactivity can be useful to humans. Apart from the generation of electricity describe **two** uses of radioactivity.

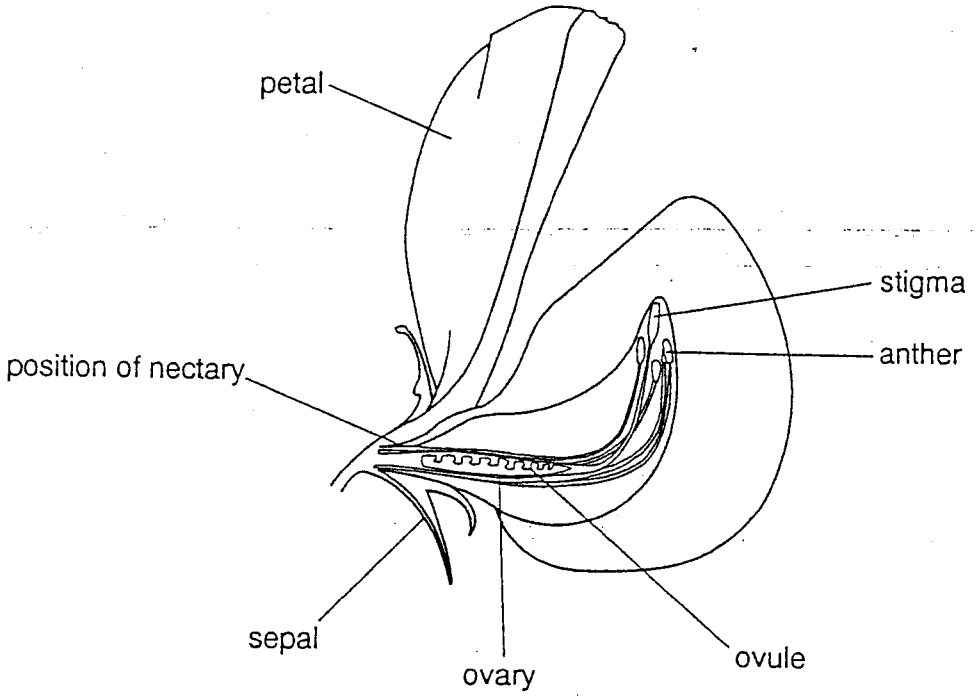
1 • Radiotherapy – to treat cancer.
• Diagnosis – tracer method.

2 • Monitoring thickness of materials
• finding leaks in pipes
• nuclear weapons (?)
• nuclear batteries [4]

etc

For Examiner's Use

4 The diagram shows a half flower from a bean plant.



(a) Complete the passage by using some of these words:

anthers **fertilisation** **nectary** **petals**

pollination **sepals** **stigma**

Pollen is made in the ....anthers.... of the flower. Insects, attracted by the colourful ....petals.... , rub pollen onto their backs as they push down to drink the sugary fluid in the ....nectary.... . When the insects fly to another flower, some of this pollen may be brushed onto the ....Stigma.... . This process is called ....pollination.... . [4]

(b) Name the structures, labelled on the diagram of the bean flower, which, after fertilisation, will develop into the following:

(i) a seed,

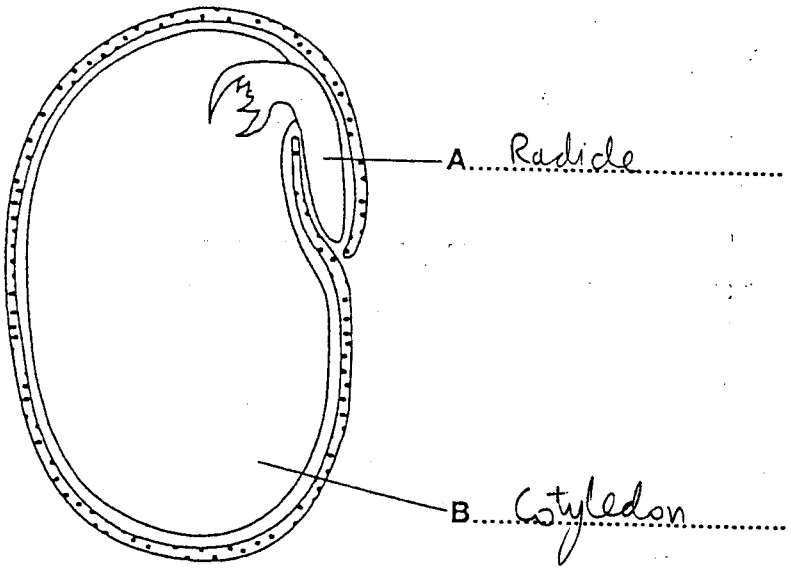
....Ovule.... [1]

(ii) a fruit.

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

For Examiner's Use

(c). The diagram below shows a seed from the same plant. The seed has been split in half.



On the diagram, name structures A and B. [2]

For Examiner's Use

5 (a) The table shows the cost of producing electricity from four sources in a European country.

source	*relative cost of electricity produced*
coal	2
oil	1
solar energy	6
tidal energy	5

(i) Which of these four sources are renewable?

Solar, tidal. (both needed) [1]

(ii) Suggest why solar and tidal energy are sometimes used to produce electricity despite their high relative cost.

- The sources are renewable (!)
- Fossil fuels are running out
- They produce no (chemical) pollution

[3]

(b) The electricity produced in a power station needs to be distributed efficiently.

(i) Name the device which produces electricity in power stations.

Generator / dynamo [1]

(ii) Name the device which increases the voltage of the electricity produced in power stations before it is distributed.

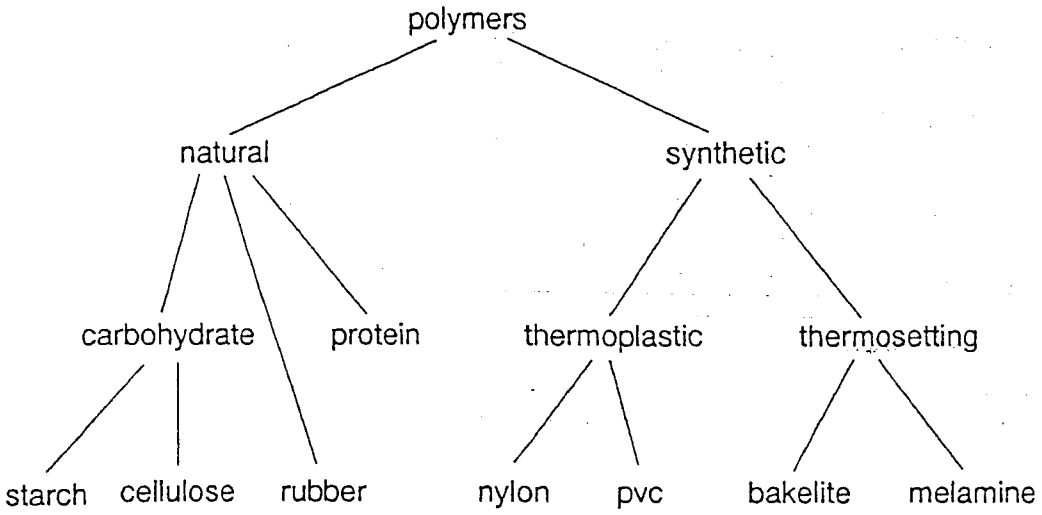
Transformer [1]

(iii) Explain why the voltage is increased before it is distributed.

- To reduce the current
- To reduce the energy wasted as heat in the cables. [2]
- To increase efficiency.

For Examiner's Use

6 Some polymers can be classified as follows:



(a) State **one** source of:

(i) natural polymers; trees / plants

.....[1]

(ii) the monomers used to form synthetic polymers.

crude oil

.....[1]

(b) State **one** element present in proteins but not in carbohydrates.

nitrogen [1]

(c) State **one** everyday use of cellulose.

paper [1]

(d) Using information from the diagram, describe how each of the following polymers would behave when heated.

(i) nylon soften (and melt if heated strongly)

(ii) melamine remain hard (decompose if heated strongly)

[2]

For Examiner's Use

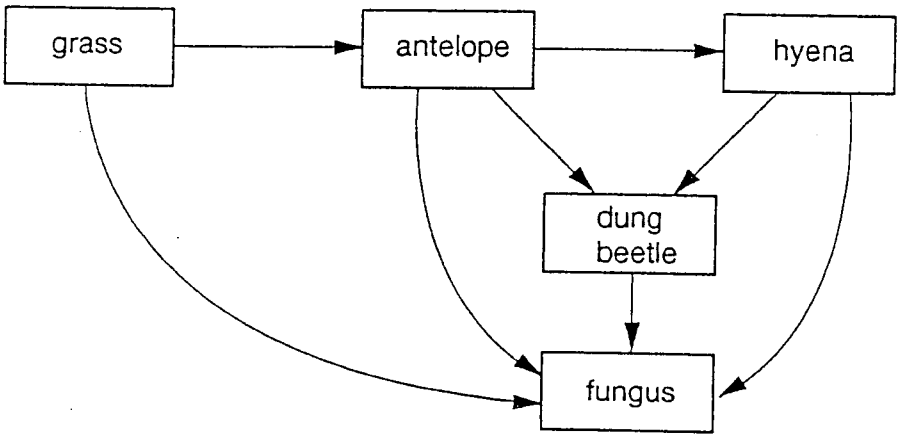
7 (a) Complete the table by choosing the correct word from the list below to match each of the descriptions.

community **ecosystem** **habitat** **population**

description	*word*
a group of organisms of the same species, living and breeding together	Population
the place where an organism lives	habitat
all the organisms, of many different species, which live together in the same area	Community
a group of living organisms, and their environment, which interact with each other	Ecosystem

[3]

(b) The diagram shows some organisms which could be found in an ecosystem. The arrows show the direction of energy flow between them.



(i) Explain how the energy would originally have entered the ecosystem.

Sunlight Absorbed; by grass; converted into chemical energy during photosynthesis [2]

(ii) From the diagram, name

a producer; Grass

a consumer; Antelope/hyena

a decomposer. Dung Beetle/ fungus [3]

For Examiner's Use

8 Read the passage and then answer the questions which follow.

> Although the telephone is a great advance in communication, early telephone systems suffered from one problem – wires. All messages had to be sent through wires. This meant that long pieces of wire had to spread out all over the world. If a wire broke, then parts of the telephone system could not be used.
>
> In 1897, Marconi used radio waves to send simple messages over short distances. This was the first radio. Even radio is not perfect. Radio waves travel easily through air and outer space but cannot travel through metal. Radio signals are also affected by electrical storms.

(a) Discuss the advantages and disadvantages of radio communication compared with telephone communication.

- Radio needs no wires
- Wires can break. • laying wires causes disruption
- Radio signals can be affected by outside interference
- Radio signals can be blocked

.....[4]

(b) (i) Radio waves and visible light are forms of electromagnetic radiation. Name **one** other form of electromagnetic radiation.

IR / UV / Microwaves / X-rays / Gamma .....[1]

(ii) Give **one** use for the form of electromagnetic radiation you have named in **(b) (i)**.

(Any suitable use.) .....[1]

9 A water filter used in the home removes dissolved impurities from tap water. The table shows the percentage of five impurities removed by this filter.

impurity	*percentage removed*
copper	80
iron	50
lead	70
nitrate	90
chlorine	95

(a) Which dissolved metal impurity is removed most effectively by this filter?

Copper [1]

(b) (i) Chlorine is added to water before it is supplied to the home.

State a reason for this.

kill bacteria

[1]

(ii) Suggest and explain why the filtered water should not be stored but used within hours of being filtered.

no chlorine, so water could make up bacteria [2]

(c) Suggest how nitrates get into water supplied to the home.

rain water dissolves nitrate fertilizer on land and runs into rivers [2]

(d) If water from this water filter is boiled in a pan, it deposits less scale than unfiltered water.

(i) Suggest **one** other impurity **not** listed in the table which the filter must remove.

Calcium/magnesium [1]

For Examiner's Use

(ii) Describe a test, using soap, to show that the filtered water has been softened.

1) Measured volumes of filtered and unfiltered water 2) add drops of soap one at a time, shake between each addition until a permanent lather appears. Compare number of drops. Filtered water should require less soap to produce lather. [5]

(Alternative answer involving height of lather with fixed amount of soap, also acceptable)

10 The table shows some details of a meal eaten by a student at school.

food eaten	*carbohydrate / g*	*protein / g*	*fat / g*	*vitamin C / mg*	*iron / mg*
Sausage	5	9	24	0	1
Fried potato	70	8	20	20	2
Beans	20	10	1	4	3
Fruit pie	60	2	25	1	1
Ice cream	20	0	12	0	0

(a) (i) Which food in this meal gave the student the most protein?

Beans (1)

(ii) What is the function of protein in the diet?

Need for Growth;
Repair;
Enzymes;
Antibodies [3]

(b) (i) The total energy value of this meal is 6300 kJ. In one day this student needs a total of 12 600 kJ. What proportion of the daily energy need will this meal provide?

$\frac{6300}{12600} = 0.5$ (1)

Answer .....

For Examiner's Use

(ii) What would happen if this student regularly ate more than 12 600 kJ per day?

Put weight on (1)

(iii) Most of the body's energy comes from fat and carbohydrate. Which **two** foods, shown in the table, would provide most energy for the student?

1 Fried Potato (1)

2 Fruit Pie (1) [4]

11 Choose from this list of electromagnetic waves to complete the sentences:

infra-red **light** **microwaves** **radiowaves** **ultraviolet** **X-rays**

(i) Broken bones can be diagnosed using X-rays [1]

(ii) Skin cancer can be caused by U-V [1]

(iii) The waves with the longest wavelength are radio [1]

(iv) Warm objects can be detected because they emit I-R waves. [1]

Electromagnetic waves are transverse waves. Sound waves are longitudinal waves.

Give **two** differences between transverse waves and longitudinal waves.

- Transverse: vibration perpendicular to travel
  longitudinal: vibration parallel to travel
- transverse can only travel through solids (?)

[2]

For Examiner's Use

12 (a) A group of students decided to investigate the conditions necessary for rusting. They put some iron nails in test tubes under different conditions and left them for a few days.

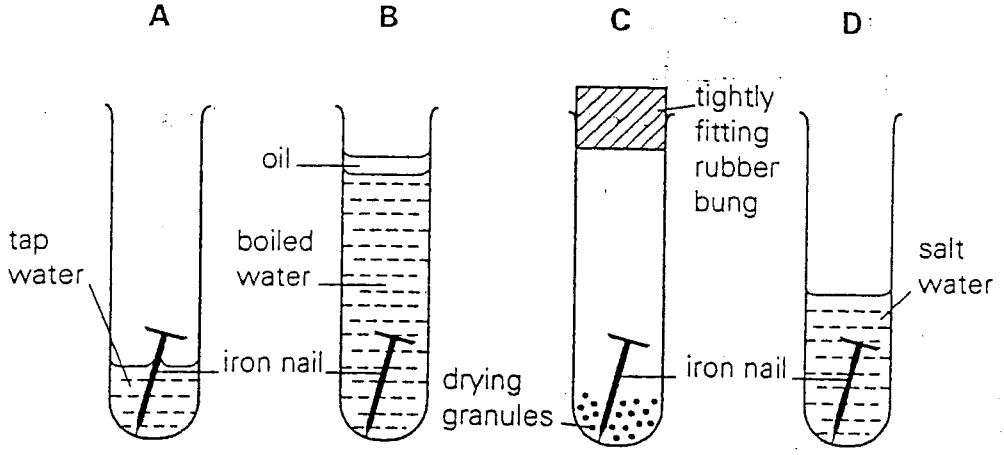


Table of students' results:

		tube A	*tube* B	*tube* C	*tube* D
conditions present in each tube	oxygen	✔	✘	✔	✔
	water	✔	✔	✘	✔
	salt	✘	✘	✘	✔
results	rust	✔	✘	✘	✔

(i) What can you deduce from the results in the table about the conditions necessary for the rusting of iron?

oxygen and water required (not salt) [2]

(ii) Suggest a further experiment which could be done to investigate whether the presence of salt affects the rate of rusting.

add salt (spatula) to test tube containing iron nail | water and air. (compare time taken to rust with another nail which only contains water | air (oxygen)) [3]

(b) Suggest **one** method of preventing rust on:

(i) an iron gate; paint | galvanising [1]

(ii) an iron hinge. oil | grease

DATA SHEET
The Periodic Table of the Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group 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 Radium 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.)