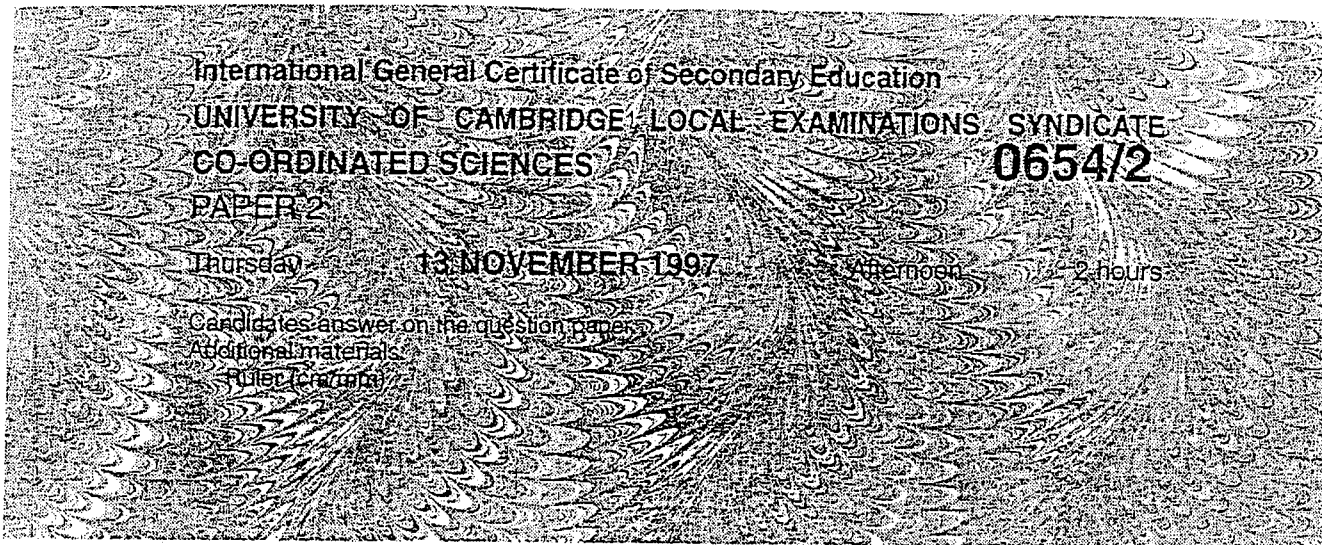


Candidate Name Mark Scheme

Centre Number	Candidate Number



TIME 2 hours

Bid ✓
Chem ✓
phys ✓

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.

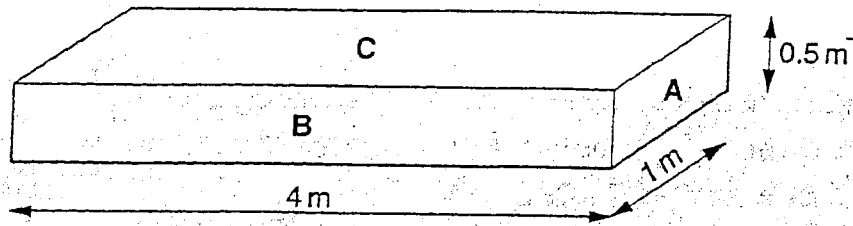
A copy of the Periodic Table is printed on page 20.

You may use a calculator.

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

This question paper consists of 18 printed pages and 2 blank pages.

- 1 The aluminium block in the diagram has a mass of 5400 kg. It is standing on the floor.



- (a) Calculate the density of the aluminium block.

Show your working and state any formula which you use.

$$\rho = \frac{m}{V} = \frac{5400}{4 \times 1 \times 0.5} = 2700$$

.....
.....
..... 2700 kg/m³ [3]

- (b) Calculate the weight of the block in newtons.

$$W = mg = 5400 \times 10 = 54000$$

..... N [1]

- (c) (i) On which face A, B or C will the block rest when exerting its greatest pressure on the floor?

A [1]

- (ii) Calculate the area of this face.

$$0.5 \times 1 = 0.5$$

..... m² [1]

- (iii) Calculate the greatest pressure the block can exert on the floor.

Show your working and state any formula which you use.

$$p = \frac{F}{A} = \frac{54000}{0.5}$$

..... 108000 N/m² [2]

2 The chemical formulae for each of three compounds found in rocks are shown below.

$\text{CaAl}_2\text{Si}_2\text{O}_8$	anorthite
KAlSi_3O_8	orthoclase
$\text{NaAlSi}_3\text{O}_8$	albite

(a) (i) State the number of atoms shown in the formula of anorthite.

..... 13 [1]

(ii) When a flame test is carried out on one of the compounds in the list, a bright yellow colour is produced.

Suggest with a reason which one of the compounds is being tested.

compound albite

reason sodium present produces yellow flame

..... [2]

(iii) State which one of the compounds contains an element from Group II of the Periodic Table.

..... anorthite [1]

(b) Rocks on the Earth's surface are constantly being broken down into small pieces which may end up as part of the soil.

(i) Describe briefly one physical weathering process which breaks down rocks.

..... action of wind (small loose fragments removed)

..... freeze/thaw effect (freezing rain water expanding & causing cracks)

..... extreme temperature changes (expansion & contraction) of rocks [2]

(ii) In addition to water and material from rocks, what other type of substance is needed for a fertile soil?

..... organic matter [1]

(c) A student collects a soil sample from an area where the main type of rock under the soil is limestone (calcium carbonate). The average pH of the soil in the area is 7.0

He heats the sample strongly over a Bunsen flame for about twenty minutes; and finds that the mass decreases.

(i) Suggest two reasons why the mass decreases.

reason 1 calcium carbonate decomposes giving off

..... carbon dioxide | water evaporates from soil | humus

reason 2 decomposes (any 2)

..... [2]

- (ii) The student adds a little of the heated soil to clean water, shakes the mixture and then, after cooling, filters it. The solution he obtains is slightly alkaline. Suggest a reason for this.

Calcium carbonate decomposes into
quick lime (calcium oxide) when dissolved⁽¹⁾
in water to make an alkaline⁽¹⁾ solution.

or equations
Calcium carbonate \rightarrow calcium oxide + carbon dioxide
Calcium oxide + water \rightarrow Calcium hydroxide. [3]

- 3 (a) (i) Name the enzyme which breaks down starch in the human digestive system.

Amylase [1]

- (ii) State the part of the digestive system where glucose is absorbed into the blood.

Small intestine [1]

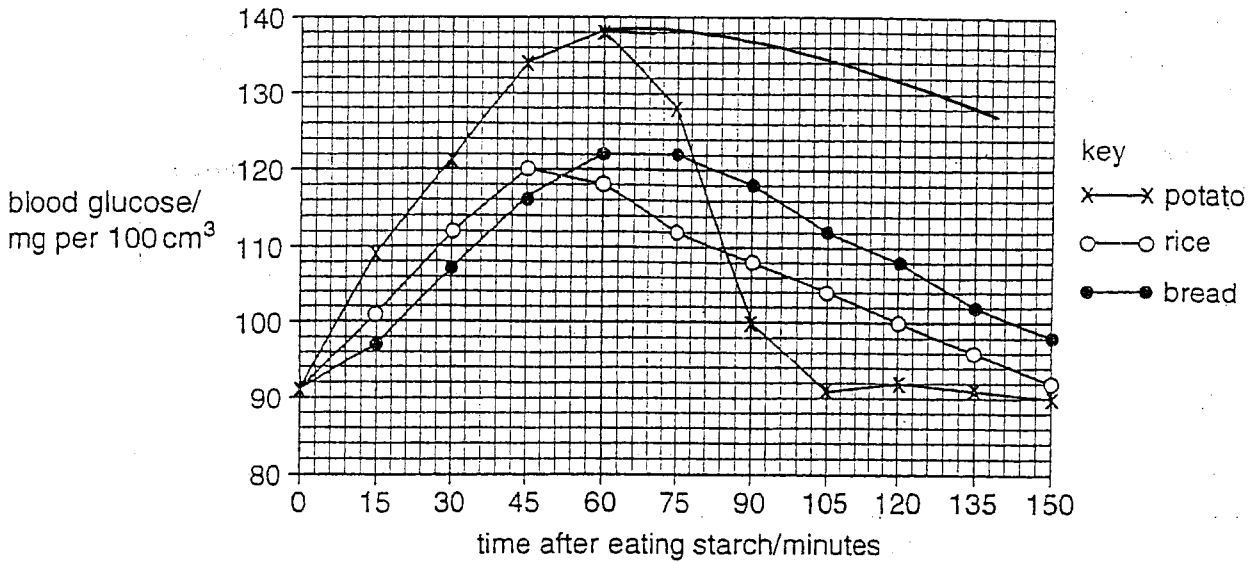
- (iii) State the part of the blood in which glucose is carried.

Plasma [1]

Several healthy people took part in an experiment to find out how quickly their digestive systems could break down starch from different kinds of food. The starch is digested to glucose.

A blood sample was taken from each person, and the concentration of glucose in their blood measured. They were then fed either rice, potato or bread containing 50 g of starch. During the next two and a half hours, fresh samples of blood were taken every 15 minutes, and the concentration of glucose in the blood measured.

The results of the experiment are shown in the graph.



(b) Which of the three foods would be the best to eat if you wanted:

(i) glucose to get into your blood as quickly as possible;

..... Potato [1]

(ii) an increased concentration of glucose in your blood for as long as possible?

..... Bread [1]

(c) Suggest and explain **two** reasons why the concentration of glucose in the blood began to fall about 60 minutes after the starchy foods were eaten.

..... Glucose is being used for respiration;
 No more is taken in, so concentration falls;
 Glucose cause insulin production;
 Insulin causes cells to take up glucose;
 Excess Glucose is converted into glycogen;
 [3]

(d) On the graph, draw a line to show the result you would expect if a person with diabetes was fed potato containing 50 g of starch. [2]

Falls (1)
 But slowly (1)

- 4 Small insects such as mosquitoes have very small wings which beat quickly. Larger insects such as dragonflies have larger wings which beat more slowly. The beating of the wings makes a buzzing noise.

The table shows the number of wing beats per second for five insects and their average flying speed.

insect	wing beats/beats per s	flying speed/metres per s
dragonfly	40	30
hawk moth	70	19
honeybee	225	5
housefly	200	4
mosquito	600	1

- (a) (i) Which insect in the table has the highest number of wing beats per second?

Mosquito.....[1]

- (ii) Which insect in the table has the greatest speed?

Dragonfly.....[1]

- (b) How long would it take a dragonfly to travel 100 metres?

Show your working and state any formula which you use.

$$t = \frac{d}{s} = \frac{100}{30} = 3.3 \text{ s}$$

[2]

- (c) Which insect's wing beats will produce a buzzing noise with the highest pitch?

Mosquito.
Explain your answer.

Highest beat frequency produces
highest pitch.....[1]

- (d) Describe how the buzzing sound of insects is transmitted through the air.

- By vibrations of air particles
- passed from particle to particle
- as a sound wave

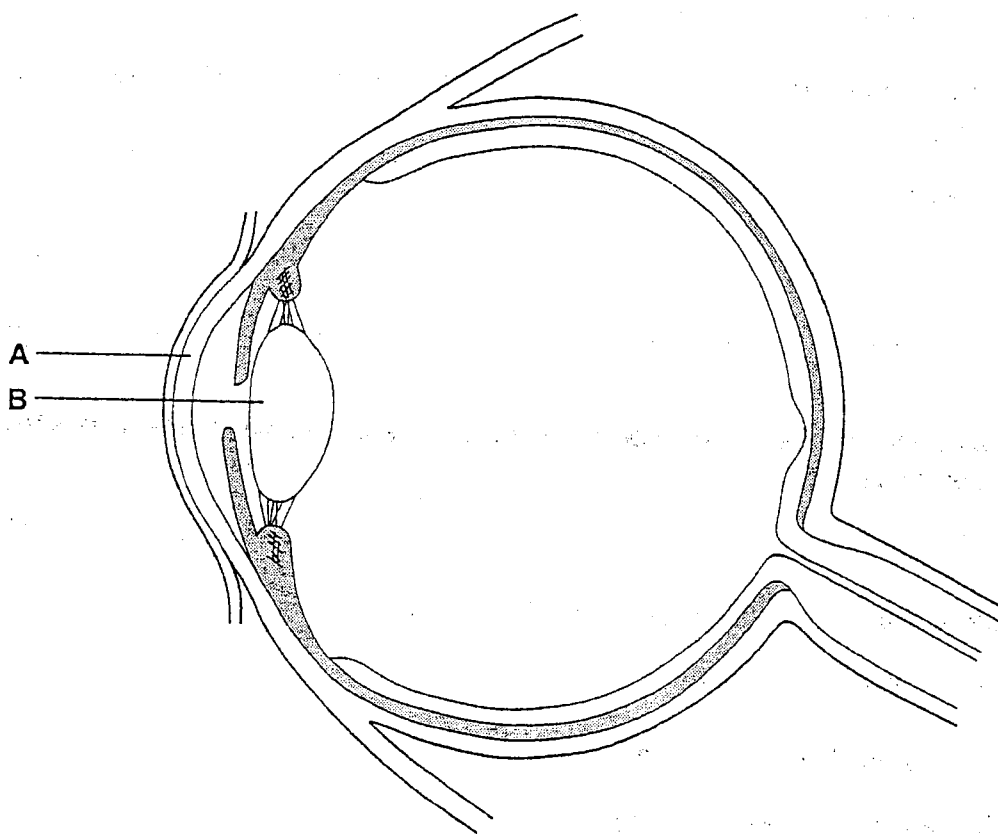
[2]

- 5 A person sees an insect flying rapidly towards her eye. As the image of the insect falls on a light-sensitive cell in the eye, an electrical impulse is produced. The impulse is carried along a nerve fibre to the brain. The brain sends an impulse along a different nerve fibre to the muscles in the person's eyelids. The muscles contract, and close the eyelid.

(a) Name the part of the body, mentioned in the passage above, which is

- (i) a receptor, light sensitive cells [1]
 (ii) part of the central nervous system, Brain [1]
 (iii) an effector. Muscles in eyelids [1]

(b) The diagram shows a section through a human eye.



(i) Name parts A and B.

- A Cornea B Lens [1]

(ii) Describe how parts A and B focus light from an object, such as the insect, onto a light-sensitive cell. You may draw on the diagram if it helps your answer.

- A refracts the light inwards;
 Has a fixed focal length;
 B refracts light inwards;
 If light from distant objects - lens is flat;
 Less refraction;

continue on page 8 if necessary

If light from close-up objects less rounded;
 move refraction;
 Accomodation;

[4]

6 The following list shows some properties of the element copper.

dense	malleable
ductile	sonorous
lustrous	unreactive

(a) (i) Select **one** property from this list which is important if copper is to be used to make a cooking pot.

Give a reason for your answer.

property unreactive / malleable

reason doesn't react with food / easily shaped

[2]

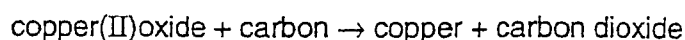
(ii) Give **one** other property of copper, **not** shown in the list, which is important when the pot is in use.

conducts heat

[1]

(b) Copper can be made by heating copper(II) oxide with carbon.

The equation for this reaction is



(i) Name this **type** of chemical reaction.

redox / reduction

[1]

(ii) In this reaction, copper ions are changed into copper atoms.

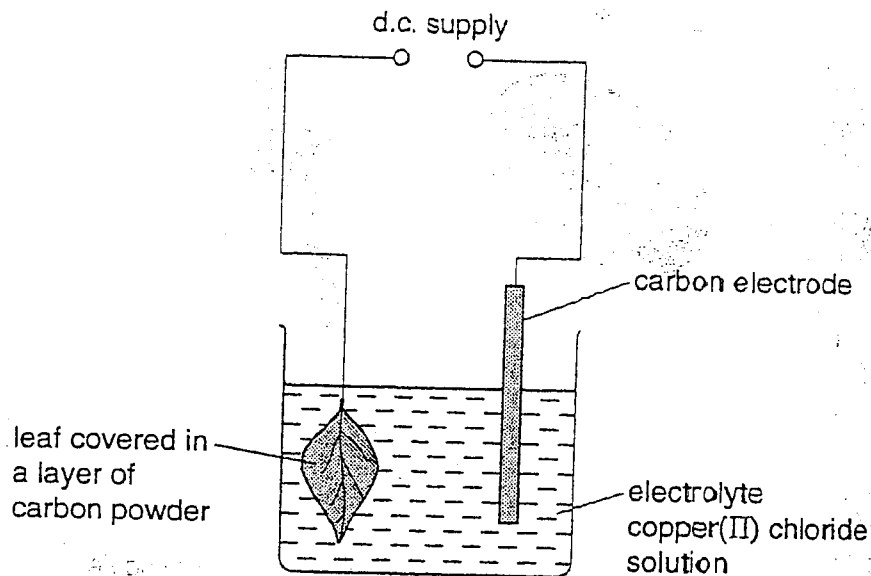
State **one** difference between a copper ion and a copper atom.

copper ion are charged (positive)
copper ions have fewer electrons
 (2 less)

[1]

- (c) Attractive jewellery can be made by copper plating leaves.

The apparatus below can be used to coat a leaf with a layer of copper.



- (i) State whether the leaf should be used as the cathode or the anode in this apparatus, and give a reason for your answer.

Cathode because copper ions are
positive and will attract to the negative
electrode [1]

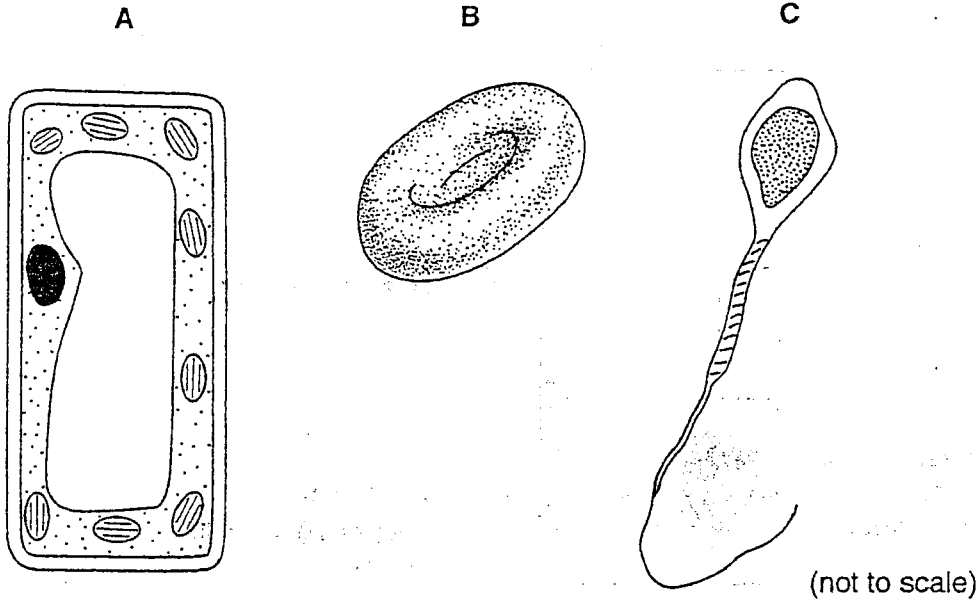
- (ii) Suggest why the apparatus above should be used in a fume cupboard.

Chlorine produced (1)
which is toxic (1) [2]

- (iii) Suggest why the leaf must be covered in a layer of carbon powder before it can be used in this process.

electrode needs to be a conductor (1)
the leaf does not conduct (1)
carbon does (1) (any 2) [2]

7 The diagrams show three cells.



(a) State whether each of the following is a plant cell or an animal cell.

Cell A Plant cell B Animal [1]

(b) Name **three** structures present in cell A which are **not** present in cell B. Outline the function of each structure you name.

structure 1 Chloroplast

function Photosynthesis

structure 2 Cell Wall

function Supports Cell

structure 3 Vacuole

function Stores waste / Supports cell

Nucleus

Contains genetic material / Controls cell.

(c) Cell C comes from a human.

(i) Name the organ which produces cell C.

Testis.....[1]

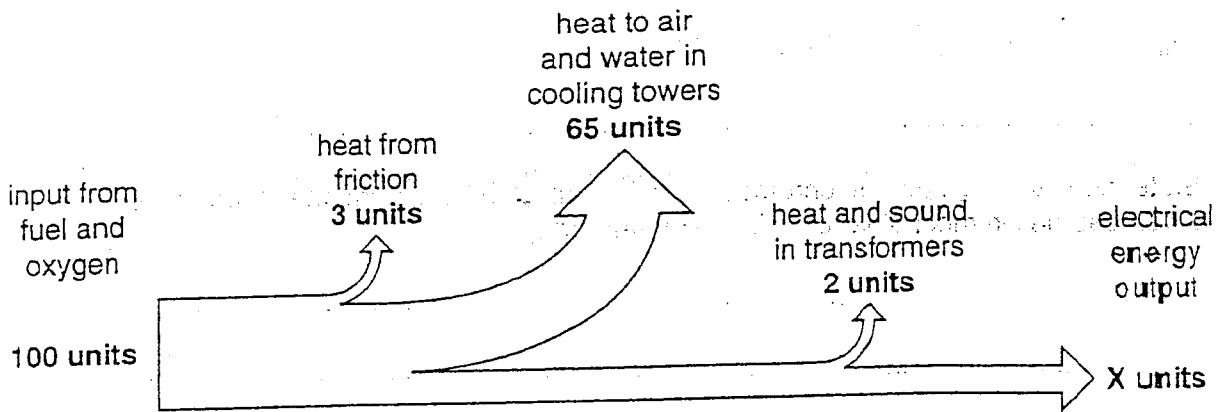
(ii) State how the number of chromosomes in cell C differs from the number of chromosomes in most other cells in the human body.

$\frac{1}{2}$[1]

(iii) Explain the significance of the difference you have stated in (ii).

So that when it fertilizes egg;
Normal $2n$ is restored; WTK.....[2]

8 This diagram shows the energy transfers which occur in a power station.



(a) (i) Calculate the value of X.

$$100 - (3 + 65 + 2) = 30 \text{ units [1]}$$

(ii) State the efficiency of the power station.

$$30\% \text{ [1]}$$

(b) Name two fuels which could be used in the power station.

1. Coal, oil

2. gas (not nuclear) [2]

(c) Describe how the power station transfers energy from the fuel into electricity.

Chemical \rightarrow heat \rightarrow KE \rightarrow electrical

(d) Name the device used to increase the voltage of the electricity before it is transmitted from the power station.

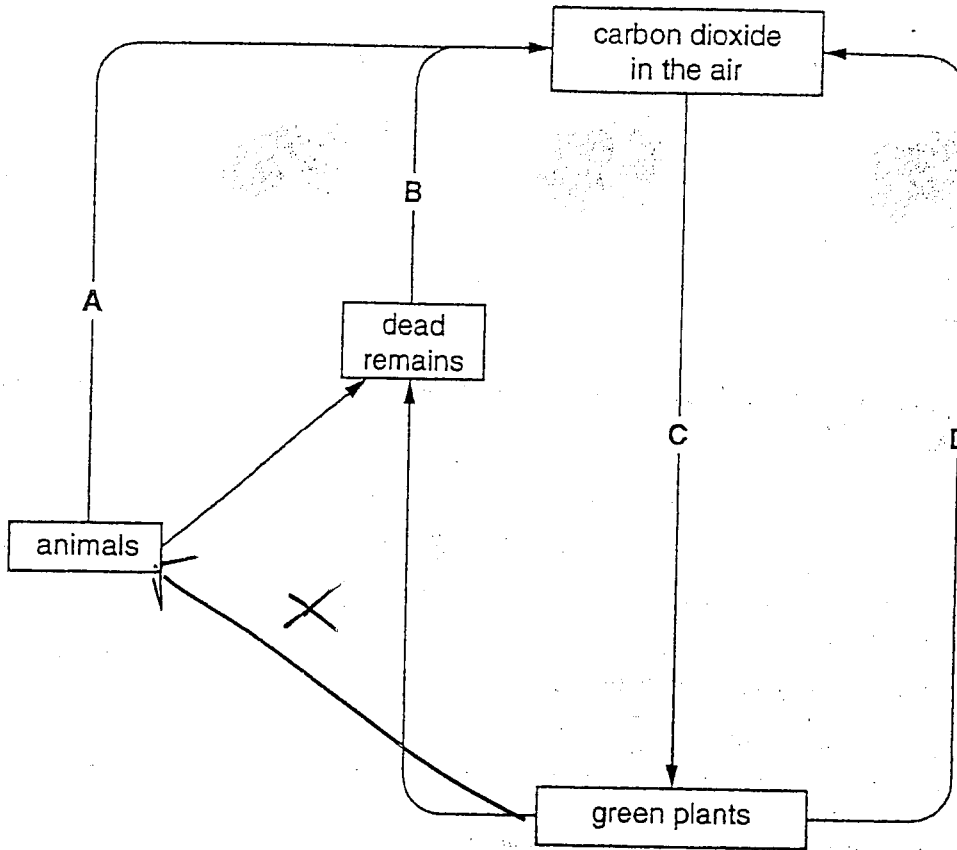
Transformer [1]

(e) Sulphur dioxide is a product of the burning of fossil fuels. Describe and explain one effect of this product on the environment.

• Acid rain

• Damages stonework / kills trees / marine life

9 The diagram shows part of the carbon cycle.



(a) Name process A.

Respiration [1]

(b) What type of organism is responsible for process B?

Decomposer [1]

(c) Write the word equation for process C.

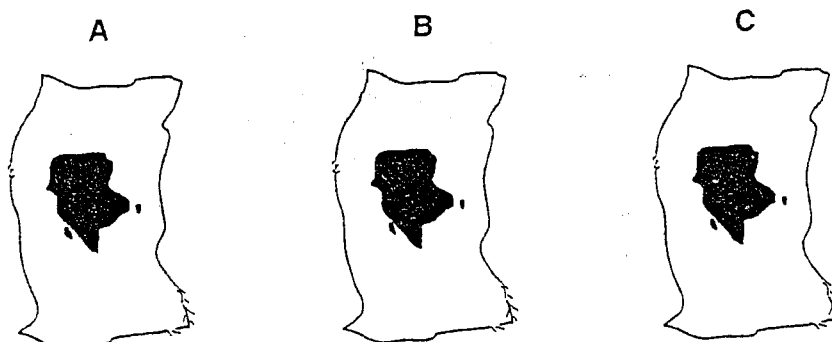


[3]

(d) On the diagram, draw an arrow labelled X to show how animals obtain carbon.

[1]

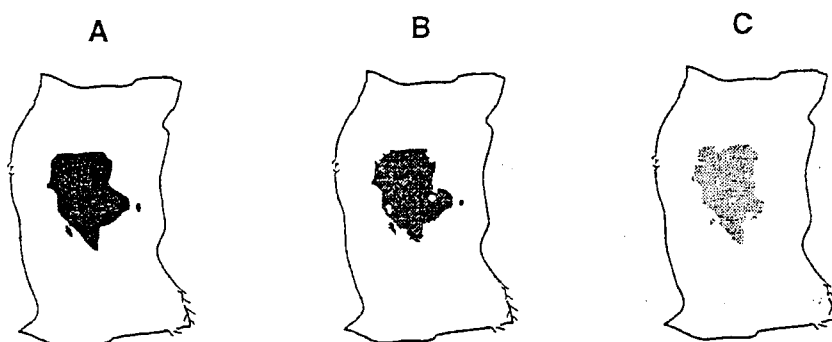
- 10 Three identical pieces of cloth A, B and C are stained with oil.



They are then placed into beakers and washed by stirring for 10 minutes under different conditions as shown below.

sample of cloth	washing conditions
A	water at 20 °C
B	a 5% solution of detergent at 20 °C
C	a 5% solution of detergent at 50 °C

The samples of cloth, after washing, are shown below.



- (a) (i) Why do the washing conditions for sample A have no effect on the oil stain?

no detergent / not hot enough
.....[1]

- (ii) Suggest why the washing conditions for C are the most effective in removing the oil.

highest temperature so fastest reaction
.....[2]

(iii) Suggest three ways in which the washing conditions could be changed so that more of the oil is removed.

1. greater detergent concentration
2. higher temperature
3. longer time for washing

[3]

(b) (i) At the end of the experiment, the beakers in which samples B and C were washed contain emulsions.

Explain the meaning of the word *emulsion*.

..... a suspension of small oil droplets

..... in an aqueous solution (eg vinegar)

(In general: small droplets of one liquid dispersed in another) [2]

(ii) Describe how the appearance of an emulsion is different from a pure liquid such as water.

You may use a diagram if it helps your answer.

can do

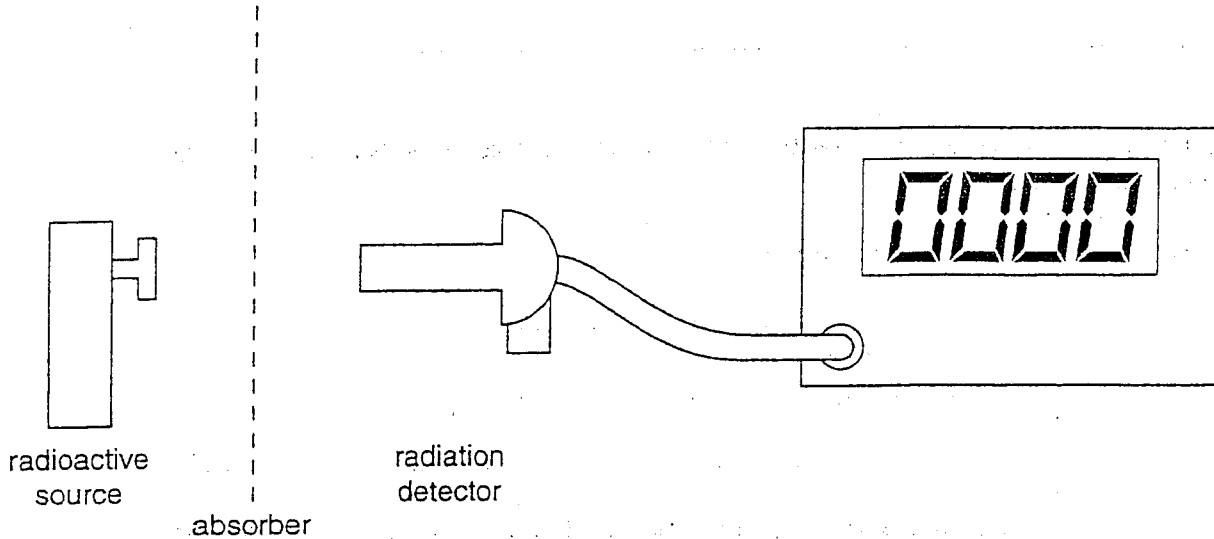
..... an emulsion is opaque

..... whereas a pure liquid will transmit light

[2]

11 A student investigated three different radioactive sources.

She placed each source 20 mm from a radiation detector. She used different absorbers, one at a time, between the source and the detector. She took one reading with each source and each absorber. The table shows her 12 readings.



absorber	count rate / counts per minute		
	source A	source B	source C
air only	3100	900	4300
paper	3120	50	3700
2 mm of aluminium	3000	30	50
15 mm of lead	1500	30	30

(a) Which source was the most radioactive?

C[1]

(b) (i) Identify which source is most likely to be an emitter of alpha radiation.

Explain your answer.

Q B
Because it is almost completely stopped
by paper[2]

- (ii) Identify which source is most likely to be an emitter of gamma radiation.

Explain your answer.

A
Because it is only partly stopped
by lead [2]

- (c) Suggest why radiation from source A appears to be able to penetrate paper more easily than air.

- Radiation fluctuates randomly
 - The difference is insignificant
- [2]

- (d) State two possible dangerous effects of radiation from radioactive sources on living things.

1. • Causes cell mutation which can lead to tumours (cancer)
 2. • Can lead to birth defects
 - High doses can cause burns
- [2]

DATA SHEET
The Periodic Table of the Elements

Group																		
I	II	III	IV	V	VI	VII	0											
1 H Hydrogen 1																	2 He Helium 4	
3 Li Lithium 7	4 Be Beryllium 9																	10 Ne Neon 20
11 Na Sodium 23	12 Mg Magnesium 24																	18 Ar Argon 40
19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 64	30 Zn Zinc 65	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84	
37 Rb Rubidium 85	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium 98	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131	
55 Cs Caesium 133	56 Ba Barium 137	57 La Lanthanum 139	58 Ce Cerium 140	59 Pr Praseodymium 141	60 Nd Neodymium 144	61 Pm Promethium 147	62 Sm Samarium 150	63 Eu Europium 152	64 Gd Gadolinium 157	65 Tb Terbium 159	66 Dy Dysprosium 162	67 Ho Holmium 165	68 Er Erbium 167	69 Tm Thulium 169	70 Yb Ytterbium 173	71 Lu Lutetium 175	86 Rn Radon 222	
87 Fr Francium 223	88 Ra Radium 226	89 Ac Actinium 227	90 Th Thorium 232	91 Pa Protactinium 231	92 U Uranium 238	93 Np Neptunium 237	94 Pu Plutonium 244	95 Am Americium 243	96 Cm Curium 247	97 Bk Berkelium 247	98 Cf Californium 251	99 Es Einsteinium 252	100 Fm Fermium 257	101 Md Mendelevium 258	102 No Nobelium 259	103 Lr Lawrencium 261		

*58-71 Lanthanoid series
f90-103 Actinoid series

Key

a	X
b	

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.)