

Candidate Name

Mark Scheme Biol ✓
Chem ✓
Phys ✓

Centre Number

Candidate Number

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International General Certificate of Secondary Education
 UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
 CO-ORDINATED SCIENCES
 PAPER 3
0654/3

SPECIMEN PAPER FOR 1997

2 hours

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

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	
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9	
10	
TOTAL	

This specimen paper consists of 16 printed pages.

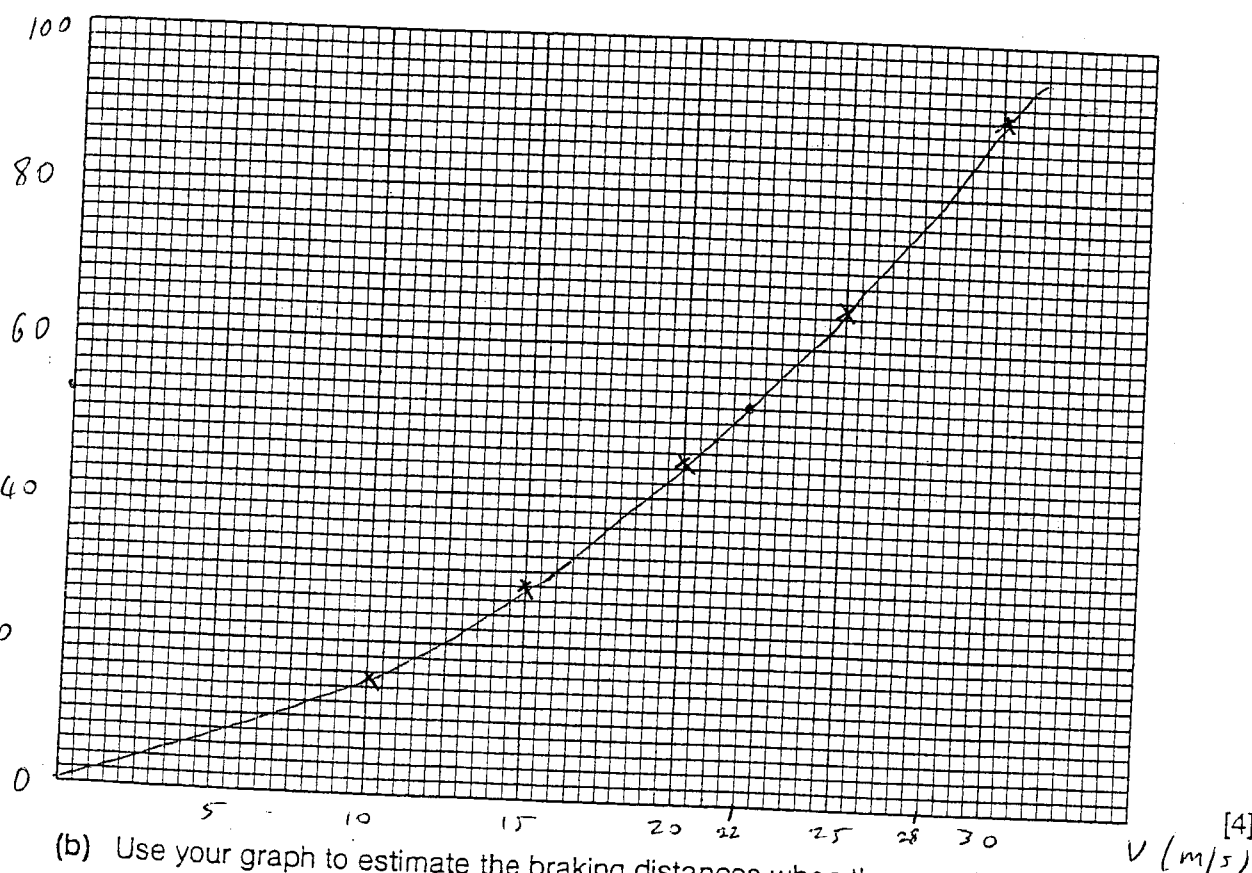
- 1 A test was carried out in which a car driver applied the brakes to stop the car as quickly as possible without skidding.

The distance the car took to stop (the braking distance) was measured for different speeds.

The results are shown in the table.

speed/ m per s	braking distance/ m
10	15
15	28
20	45
25	65
30	90

- (a) Plot a graph of these results on the grid.



- (b) Use your graph to estimate the braking distances when the speed of the car was:

(i) 22 m per s; Answer 52 m

(ii) 28 m per s. Answer 80 m

[2]

(c) How does the braking distance change with speed?

- Braking distance increases with speed
- Not proportional

[2]

(d) The same experiment was carried out with two people in the car. Explain why the braking distances were longer.

- Mass was higher
- Acceleration (deceleration) lower
- for a given force.

[3]

(e) Why does the wearing of safety belts usually lessen the injuries produced in a head-on car crash?

- Increases the stopping time
- reduces the acceleration (deceleration)
- reduces the force

[2]

Any
2

2 The activity series for some metals is:

calcium (most reactive)
magnesium
aluminium
zinc
iron
lead
copper (least reactive)

(a) Use the activity series to explain:

(i) how the voltage produced in a cell depends on the metals used in it;

The larger the difference in reactivity between the metals the larger the voltage. More reactive metals have a greater tendency to lose electrons & form ions in solution, making the electrodes more negative, compared to the less reactive metals.

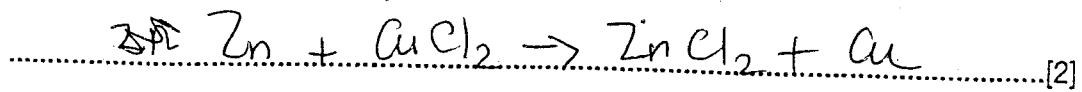
(ii) why zinc bars are attached to steel oil rigs in the sea.

Zinc is a sacrificial metal. Zinc will oxidize in preference to the iron, because zinc is more reactive, hence protecting iron from oxidation.

[4]

- (b) When 0.65 g of zinc powder was placed in a solution of copper(II) chloride and stirred thoroughly, copper powder was formed. This was removed by filtration, dried and weighed. The remaining solution contained zinc chloride.

(i) Give the balanced symbol equation for this reaction.



(ii) Calculate the mass of copper powder produced in this reaction. Show your working.

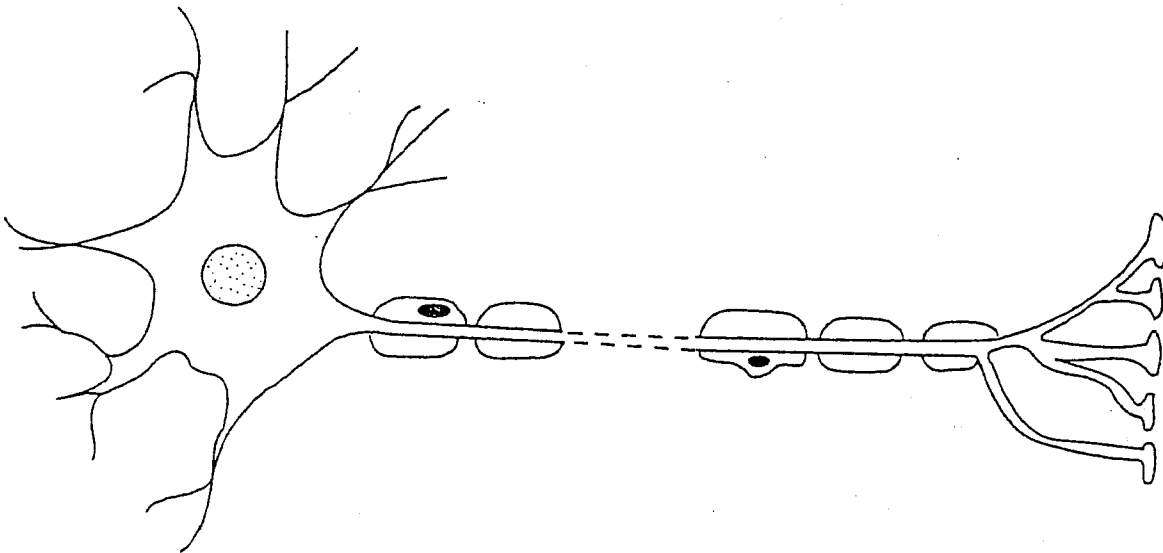
from equation, mols of Cu formed = mols of Zinc

$$\text{mols of zinc} = \frac{\text{mass}}{M_r} = \frac{0.65}{65} = 0.01 \quad (\Rightarrow \text{mols of Cu})$$

$$\text{mass of Cu} = 0.01 \times 64 \quad (\text{mols} \times M_r)$$

Answer 0.64g [3]

3 The diagram shows a motor neurone.



(a) (i) Describe the function of a motor neurone.

Transmission of Nerve impulses;
From Receptors CNS;
To ~~ES~~ Effector;
[3]

(ii) Describe two ways in which the structure of a motor neurone is related to its function.

1. Fatty Sheath - Speeds up transmission;
2. Axon very long;
Many connections to other Neurons;

[2]

(b) A reflex action is an automatic, rapid response to a stimulus.

(i) State one example of a reflex action in a named organism, describing both the stimulus and the response.

Any named reflex/response: ^{Stimulus} eg Pupil reflex in humans light Pupil gets smaller [1]

(ii) Describe briefly the sequence of events from the stimulus being received to the response you have described.

Light falls on Retina;
Impulse sent to CNS along sensory neurone;
Impulse passes along relay/intermediate neurone;
Impulse passes along motor neurone;
To iris muscles; [4]

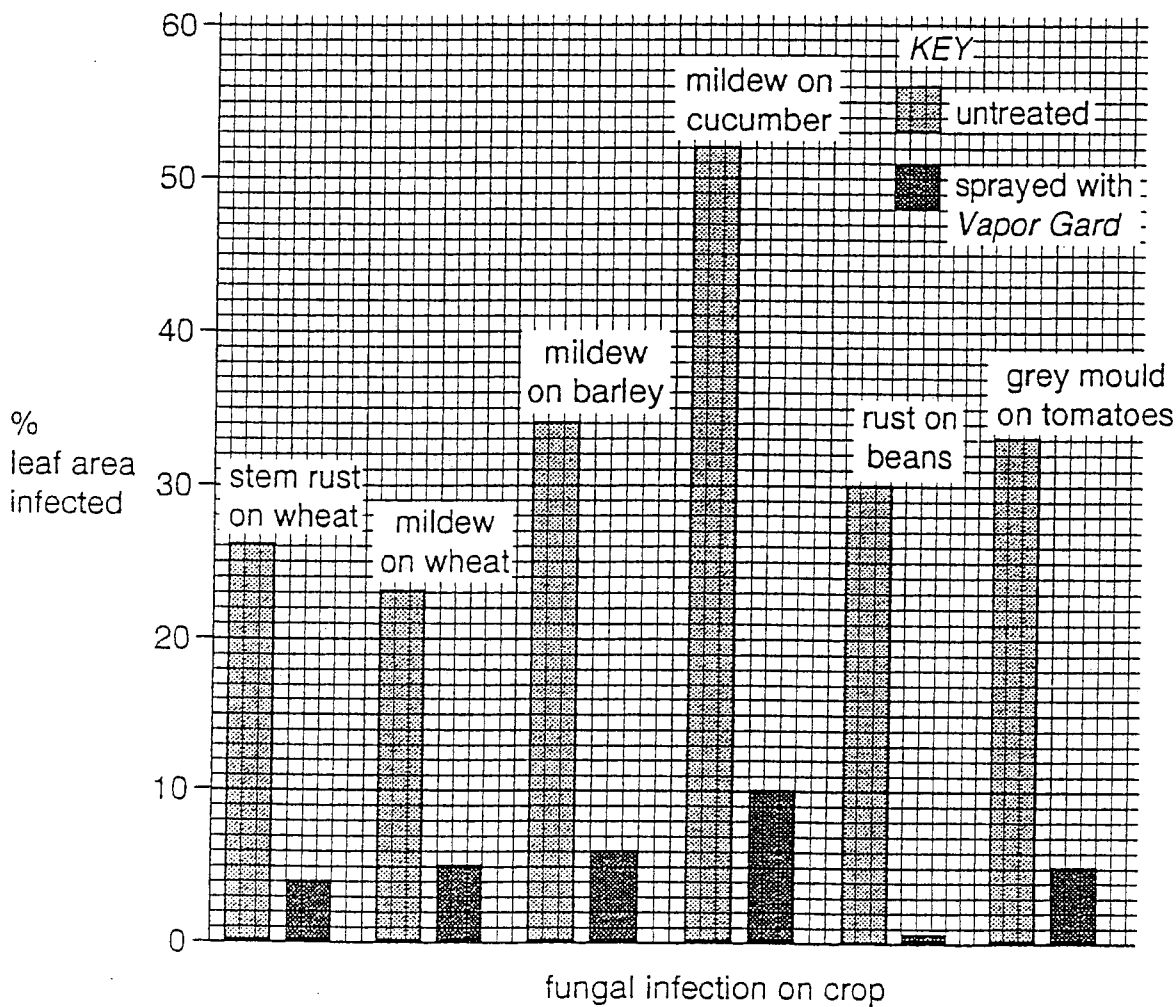
(iii) What is the value of this reflex action to the organism?

Presents Too Much light hitting retina/
Damage to retina. [1]

4 Read the passage, and then answer the questions which follow.

Each year, over 920 million tonnes of food crops are lost throughout the world because of fungal diseases. These losses occur despite the use of varieties of crops which are resistant to disease, and the use of fungicides. This is because the fungi which cause the diseases evolve rapidly to overcome the resistance of the plants, and to become resistant to the fungicides.

People who grow crop plants sometimes spray their leaves with polymers such as oils and waxes, which form a waterproof layer on the leaf surface and so cut down the rate of transpiration. Scientists have recently investigated whether these polymers can also help to protect against infection of leaves by fungi. The graph shows the results of an experiment which tested the effects of an anti-transpirant polymer called *Vapor Gard*. The scientists measured the percentage of leaf area infected by fungi in six crops grown in glasshouses.



(a) Explain how fungi may evolve to become resistant to fungicides.

Some fungi are resistant to fungicides;
When fungicide is applied resistant fungi survive;
Resistant fungi can reproduce
Resistance/Genes passed on the offspring (inherited);
Resistance spreads / ~~to~~ ~~to~~ ~~that~~ all fungi
will eventually become resistant; [5]

(b) State the conditions under which growers might want to reduce the rate of transpiration of crop plants.

Explain why this would be useful.

Dry conditions;
Blocks stomata;
Less water loss;
Plants do not wilt; [3]

(c) (i) Using the information in the chart, describe the effect of Vapor Gard on fungal infections.

Reduces % leaf area affected;
In all plants tested; [2]

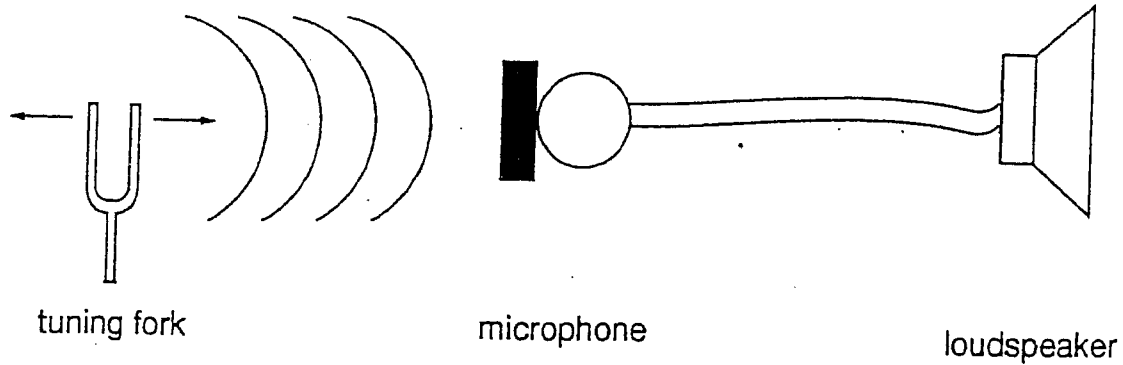
(ii) Suggest why Vapor Gard has this effect.

Blocks Stomata [1]

(d) Suggest further investigations and tests which should be carried out before Vapor Gard is used on a large scale to reduce fungal infections.

See if it affects other organisms that
feed on the plants;
See if it is persistent, how long it lasts;
See if there are long term effects on the
crops; [3]

- 5 (a) The diagram shows a tuning fork in front of a microphone.

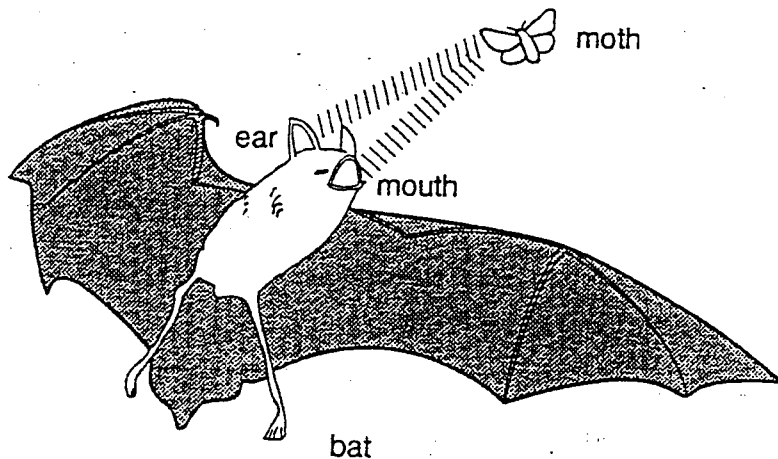


The prongs of the fork vibrate and produce a sound.

Explain how the sound travels from the tuning fork to the microphone.

- Any
2
- Air molecules made to vibrate by the fork
 - Vibration passed from molecule to molecule
 - As a sound wave
- [2]

(b)



Ultrasound is sound with a frequency so high that humans cannot hear it. Bats locate their prey by emitting pulses of ultrasound waves and detecting the pulses reflected off the prey.

A bat locates a moth. A pulse of ultrasound took 0.1 seconds between leaving and returning to the bat. The speed of ultrasound waves in air is 340 m/s.

Calculate the distance between the moth and the bat. Show your working and state any formula you use.

$$\text{Total distance} = v \times t = 340 \times 0.1 = 34 \text{ m}$$

$$\text{distance to bat} = \frac{34}{2} =$$

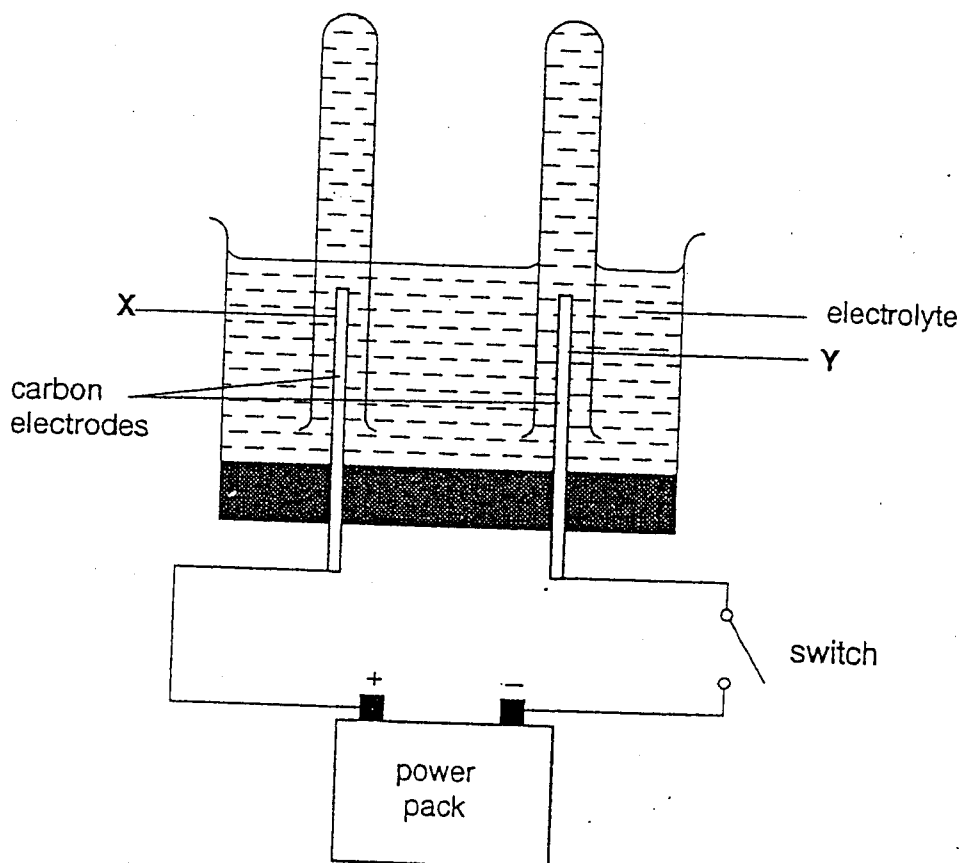
Answer 17m [2]

- (c) Earthquakes can cause severe damage to buildings. A village is 100 km from the centre of an earthquake. Explain why damage occurs to buildings in this village.

- Energy travels outwards from the centre
- As earthquake waves
- This causes the ground below buildings to vibrate

[3]

- 6 The diagram shows apparatus which can be used in the electrolysis of a solution.



- (a) Name the electrodes X and Y.

X Anode Y Cathode

[1]

- (b) Explain why the contents of the solution allow a current to flow, when the switch is closed.

When the switch is closed, the left hand electrode becomes positively charged and the right hand electrode negative. Ions (which are free in solution) are attracted to their oppositely charged electrodes. Positive ions therefore are attracted towards the negative (cathode), where they pick up electrons to become neutral atoms. Negative ions are attracted towards the anode which remains electron. The circuit is then complete and a current flows.

- (c) When sodium chloride solution is electrolysed, hydrogen is obtained at Y. Explain why this happens.

Sodium ion Na^+ and H^+ ion (from the water) are attracted towards the cathode. Hydrogen is discharged instead of sodium because hydrogen is less reactive.

$$\text{H}^+ + \text{e}^- \rightarrow \text{H} \quad (2\text{H} \rightarrow \text{H}_2)$$

[4]

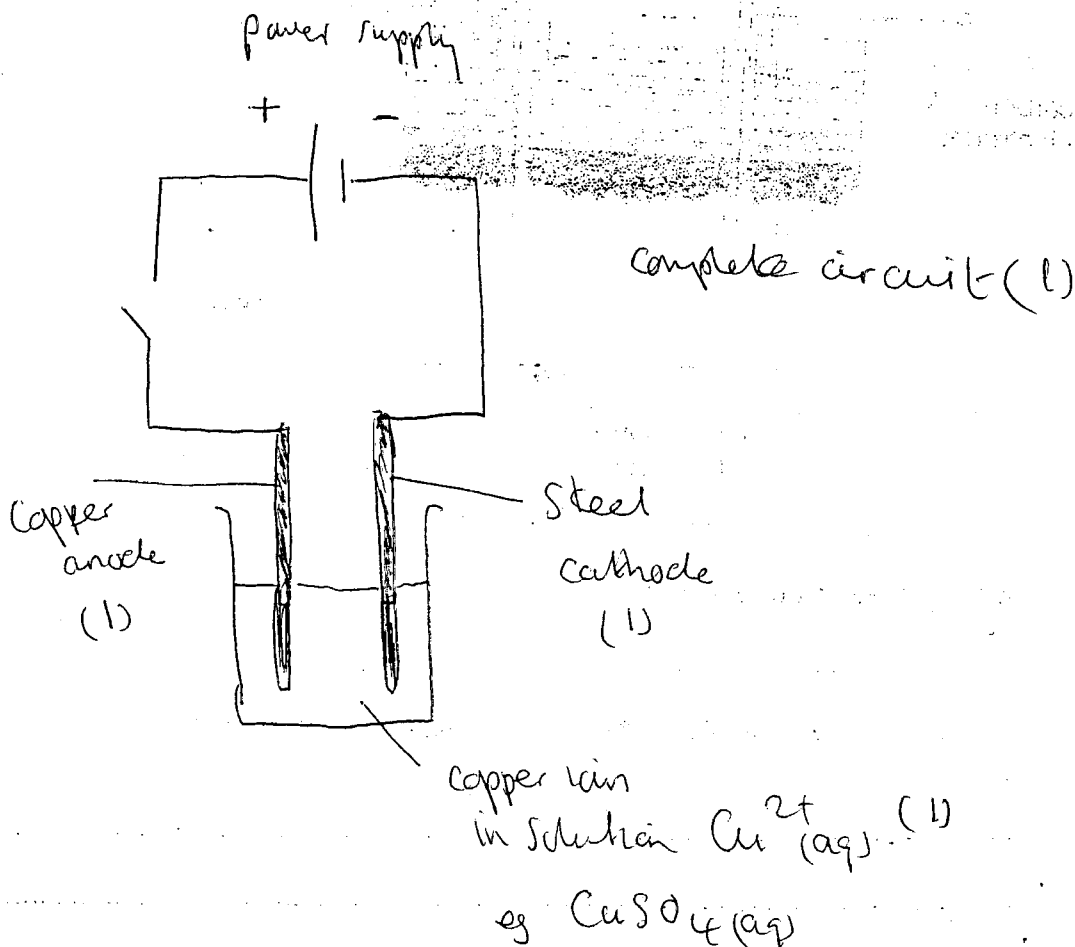
- (d) Suggest the substances which would be obtained at X and Y if the electrolyte was molten sodium chloride.

At X chlorine

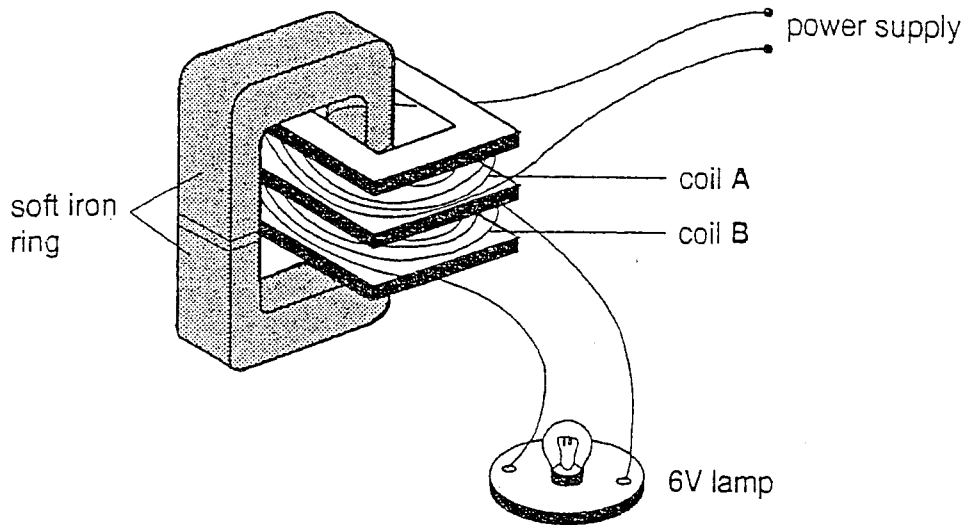
At Y sodium

[1]

- (e) Draw and label a diagram to show how electrolysis could be used to plate a piece of steel with copper. [4]



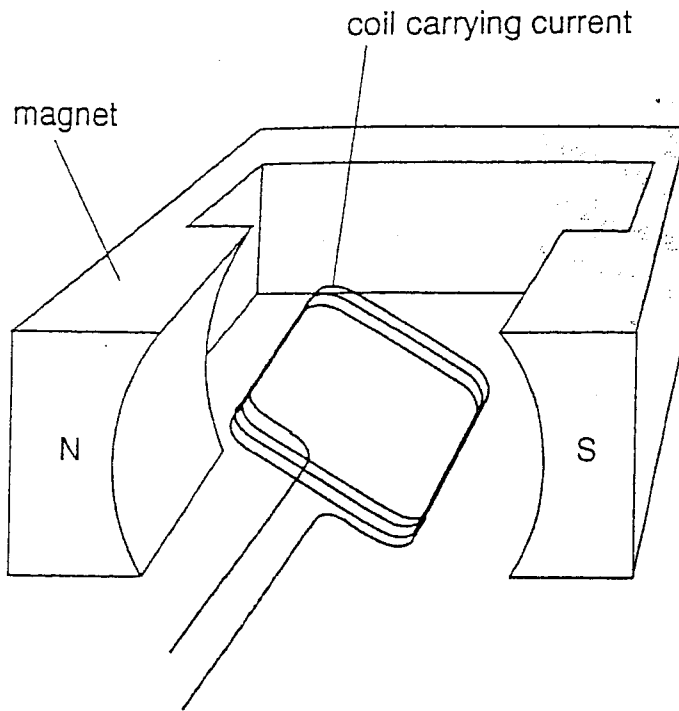
- 7 (a) The diagram shows a soft iron ring. Two coils each of 100 turns are wound around the ring. Coil A is connected to a power supply and coil B to a 6 V lamp.



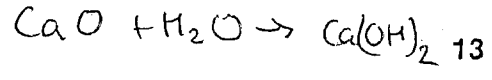
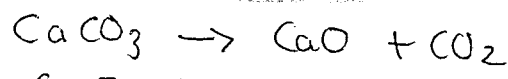
Explain what will happen if

- (i) The power supply is 6 V a.c. *Lamp fully lit*
(output is 6V ac) [1]
- (ii) The power supply is 6 V d.c. *Lamp not lit*
(output zero) [1]
- (iii) The power supply is 3 V a.c. *Lamp dimly lit*
Output is 3V ac [2]
- (iv) The power supply is 3 V a.c. and coil B has 200 turns. *Lamp fully lit. Output is 6V ac.* [2]

- (b) The diagram shows a wire coil carrying a current placed in a magnetic field. Explain fully what happens to the coil in this situation.



- Ans
4
- Each side of the coil experiences a force
 - Due to the motor effect
 - One up, one down
 - This causes a turning effect/moment/torque [4]
 - Which causes the coil to rotate.



8 (a) Describe how calcium hydroxide (lime) is obtained from calcium carbonate (limestone).

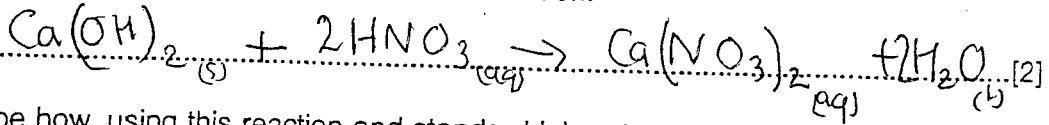
Calcium carbonate is heated until decomposition (1)

water (1) is added to quick lime formed (2)
(equation not required for answer)

(b) Calcium hydroxide (lime) can be used to neutralise industrial waste nitric acid. The reaction produces calcium nitrate and water.

Give the balanced symbol equation for this reaction.

(1) correct formulae
(1) balanced



(c) Describe how, using this reaction and standard laboratory apparatus, you could obtain a dry sample of calcium nitrate.

Measure out (using a measuring cylinder) about 25 cm³ of 1.0M nitric acid into a beaker. Using a spatula add lime powder, stirring between each addition. When mixture is neutral (check with pH paper) or no more lime will dissolve filter and collect filtrate in evaporating basin. Heat solution until crystals begin to appear. Allow to cool, filter crystals formed, pat dry on filter paper.

any 5

9 (a) Describe how you would test a food to find out if it contained protein. or allow water to evaporate.

Liquid food;
Add Sodium/Potassium hydroxide and few drops of dilute copper Sulphate; } Biuret reagent [3]
purple solution if protein is present;

* alternative answers OK
* heating ^{nitric acid} solution first can be alternative.
note it is not acceptable to heat calcium nitrate solution until all the water has evaporated because the calcium nitrate formed will start to decompose.

- (b) Discuss the roles of proteins in the human body, giving named examples where appropriate.

Protein is needed for muscles;

Skin;

Cell membranes;

Growth;

Repair of tissues;

Enzymes are proteins; (eg.)

~~Eggs~~ Energy source,

Antibodies are proteins.

[9]

- 10 (a) When you rub a piece of polythene with a cloth, both materials become electrically charged. The polythene gains a negative charge.

Explain how this happens.

- electrons which are negative
- are transferred from cloth → polythene
- leaving the polythene negative and the cloth positive

[3]

(b) A metal sphere carries a positive charge of 100 coulombs. The sphere is connected to earth and loses its charge in 20 seconds.

(i) Explain how the sphere loses its charge.

By an electric current
which is a flow of charge (to earth)

[2]

(ii) Calculate the average current flowing during the discharge.

Show your working and state any formula you use.

$$I = \frac{Q}{t} = \frac{100}{20}$$

Answer 5 A [2]

DATA SHEET
The Periodic Table of the Elements

		Group														
I	II	III	IV	V	VI	VII						0				
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1										4 He Helium 2				
23 Na Sodium 11	24 Mg Magnesium 12	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	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	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	101 Ru Ruthenium 44	106 Pd Palladium 46	103 Rh Rhodium 45	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	127 I Iodine 53	128 Te Tellurium 52	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	190 Os Osmium 76	195 Pt Platinum 78	192 Ir Iridium 77	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	212 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
87 Fr Francium	88 Ra Radium	89 Ac Actinium														

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

Key

a	X
b	

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

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	238 Pa Protactinium 91	238 U Uranium 92	244 Pu Plutonium 94	244 Am Americium 95	244 Cm Curium 96	244 Bk Berkelium 97	244 Cf Californium 98	244 Es Einsteinium 99	244 Fm Fermium 100

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