

Candidate
Number

Centre Number

Candidate Name _____

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**International General Certificate of Secondary Education
CAMBRIDGE INTERNATIONAL EXAMINATIONS**

CO-ORDINATED SCIENCE

PAPER 2

0654/2

MAY/JUNE SESSION 2002

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 24.

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

This question paper consists of 24 printed pages.

1 Fig. 1.1 shows the results of an experiment to investigate rusting of iron nails.

(a) Draw lines connecting each nail to the tube from which it has been removed. One line has already been drawn.

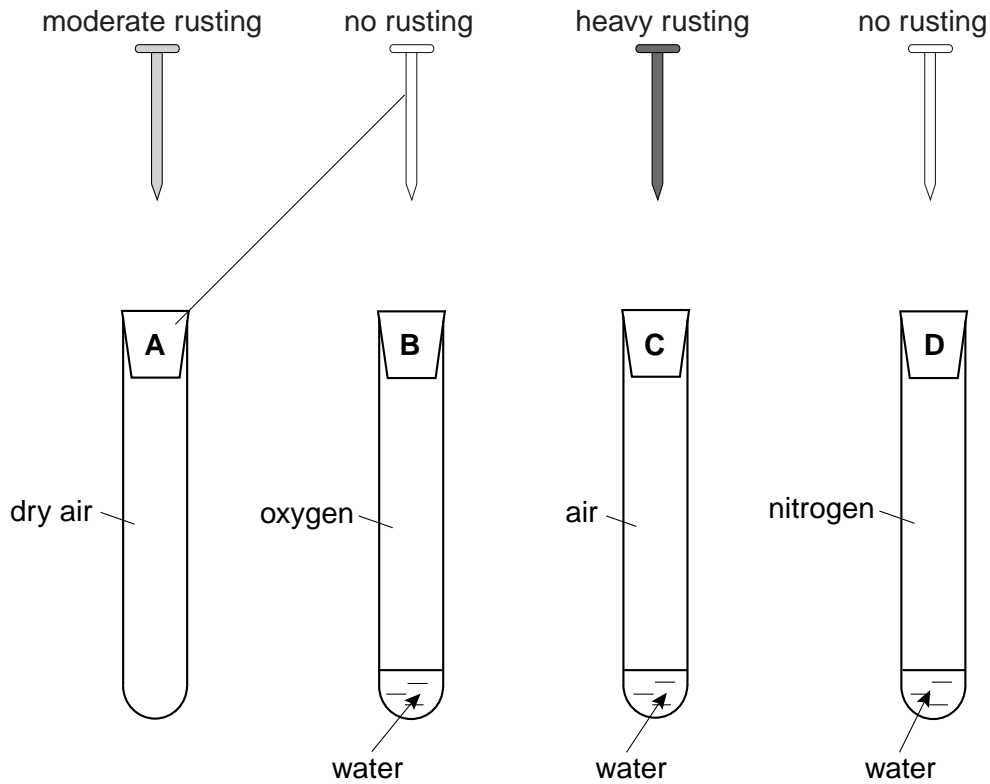


Fig. 1.1

[2]

(b) State the type of chemical reaction which occurs when iron rusts.

Explain your answer briefly.

.....

.....

..... [2]

(c) The Earth's core is thousands of kilometres from the atmosphere and is composed mainly of iron and nickel.

Suggest two reasons why the Earth's core is not rusting.

1

.....

2

..... [2]

(d) Iron reacts with dilute sulphuric acid to form a gaseous element and a solution of a salt.

Complete the **word** equation for the reaction.

iron + sulphuric acid → [2]

2 Fig. 2.1 shows a d.c. electric motor.

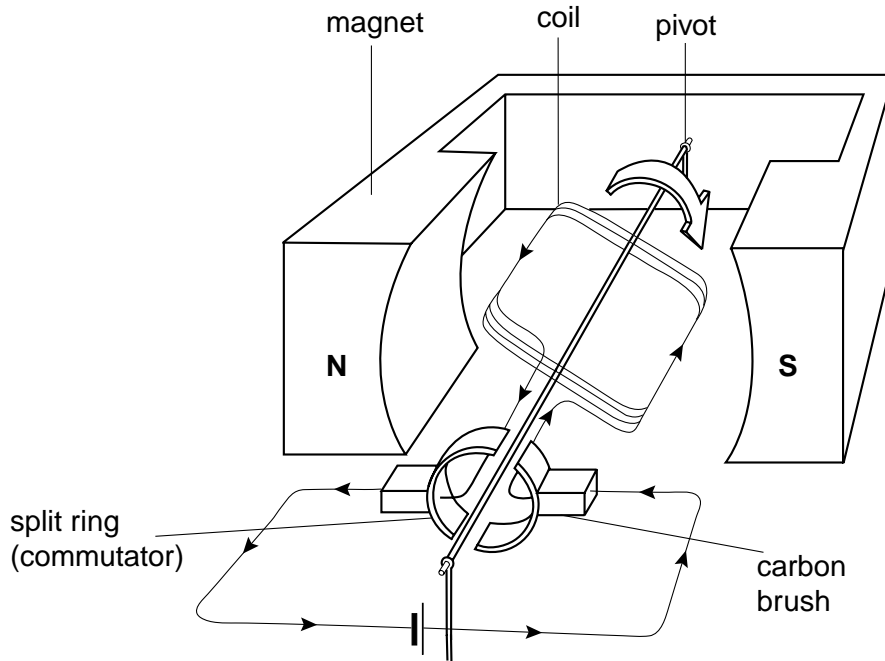


Fig. 2.1

(a) Suggest two ways of making the coil turn faster.

- 1
-
- 2
- [2]

(b) Apart from reversing the magnetic field, how could you reverse the motion of the coil?

..... [1]

(c) Write down the useful energy conversion which takes place in an electric motor.

..... [1]

(d) The voltage across the motor was 3 V.

The current flowing through the motor was 0.5 A.

(i) Calculate the resistance of the motor.

Show your working and state any formula that you use.

State the units of your answer.

..... [3]

(ii) Calculate the power input to the motor.

Show your working and state any formula that you use.

..... W [2]

(e) The motor was able to lift a load of 50 N by 0.1 m in 10 seconds.

Calculate the power output of the motor. Show your working and state any formula that you use.

..... W [3]

(f) Explain why there is a difference between your answers to parts **(d)(ii)** and **(e)**.

.....

..... [2]

- 3 The eye is a sense organ. In the eye, stimuli in the form of light are converted into electrical impulses. Fig. 3.1 shows a section through an eye.

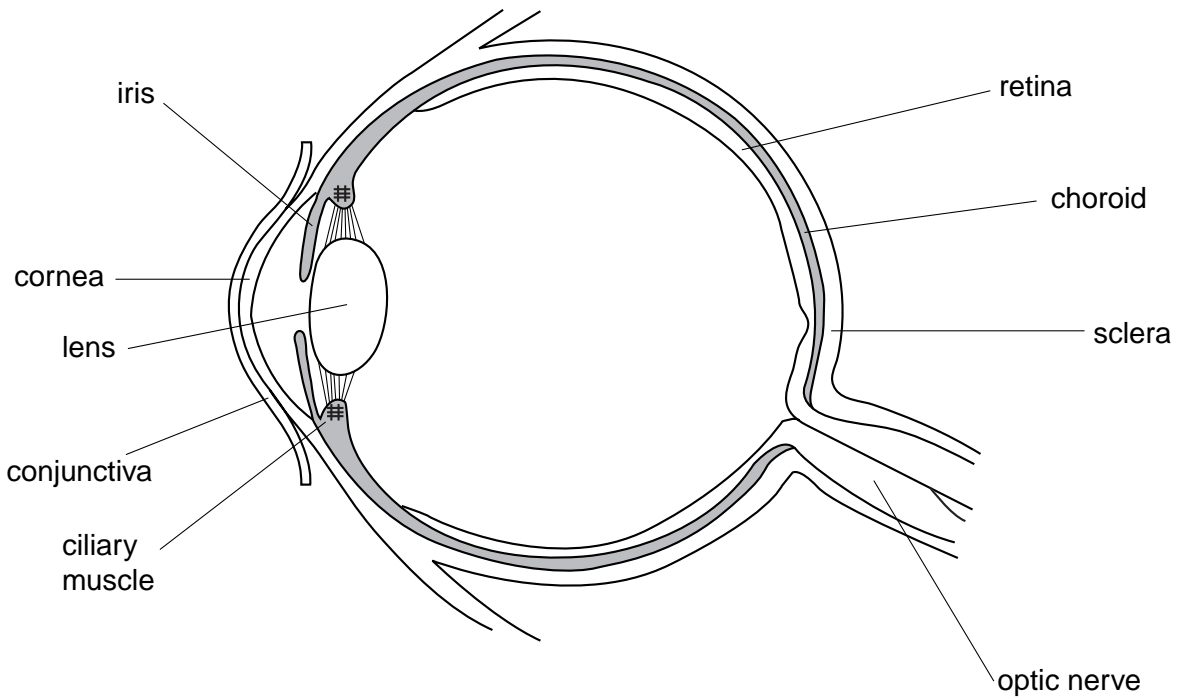


Fig. 3.1

(a) Name the parts of the eye where each of the following takes place.

(i) Light energy is converted into an electrical impulse.

..... [1]

(ii) Light rays are refracted to focus them onto the retina.

..... and [2]

(b) The image is formed on the retina of the eye. It is a real image.

Explain what is meant by the term *real image*.

.....
 [1]

(c) The iris controls the amount of light that enters the eye. It contains pigments (coloured substances) that absorb some of the light. The type of pigment in a person's iris is controlled by their genes. The dominant allele **B** gives brown pigment, while the allele **b** gives blue pigment.

(i) Complete the genetic diagram to show the possible eye colours of children born to a brown-eyed parent and a blue-eyed parent.

phenotypes of parents
genotypes of parents	Bb	bb
genotypes of gametes and
genotypes of offspring [5]

(ii) Approximately what ratio of brown-eyed to blue-eyed children would you expect this couple to have?

..... [1]

4 Fig. 4.1 shows a large rocky outcrop in a sandy desert region of the Earth. Fig. 4.2 shows the rock later in time.

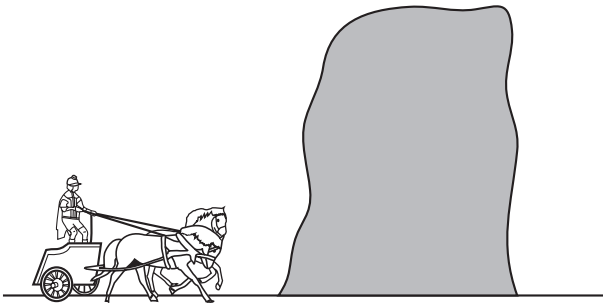


Fig. 4.1

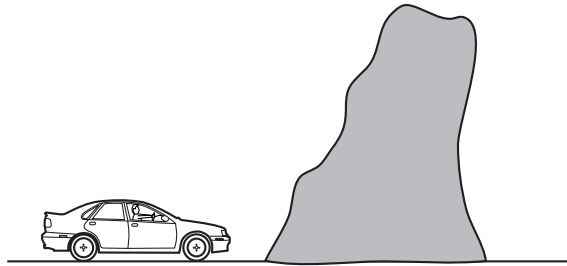


Fig. 4.2

(a) (i) What word is used to describe the natural processes which can change the shape and size of rocks over time?

..... [1]

(ii) What has caused the change of shape in the rock in Fig. 4.1?

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

(iii) Explain why the same person could not have observed the rock as it is shown in both Fig. 4.1 and Fig. 4.2.

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

(b) Rocks may also be worn away by the action of rain which is slightly acidic.

(i) Name a gaseous compound which dissolves in rainwater to form an acidic solution.

..... [1]

(ii) Suggest two changes in the conditions which could speed up the reaction which takes place when acidic rain falls onto rocks.

1

.....

2

..... [2]

(c) Soil contains many substances including tiny pieces of rock. Name **two** other components which improve the fertility of soil.

.....

..... [2]

5 A raindrop is falling to the Earth.

(a) (i) Name the two forces acting on the raindrop as it falls.

1

2 [2]

(ii) Explain why the raindrop eventually reaches a terminal velocity.

.....

..... [1]

(b) The mass of the raindrop is 0.1 g. At one stage during its fall it is travelling at 2 m/s.

Calculate the kinetic energy of the raindrop at this time. Show your working and state any formula that you use.

..... J [3]

(c) Raindrops are able to refract sunlight to produce a rainbow.

(i) What is *refraction*?

.....
 [1]

Fig. 5.1 shows a ray of white light being refracted as it passes through a prism.

(ii) Complete Fig. 5.1 to show where **red** light and **violet** light will be seen on the screen.

Label with an **R** where the red light is seen.

Label with a **V** where the violet light is seen.

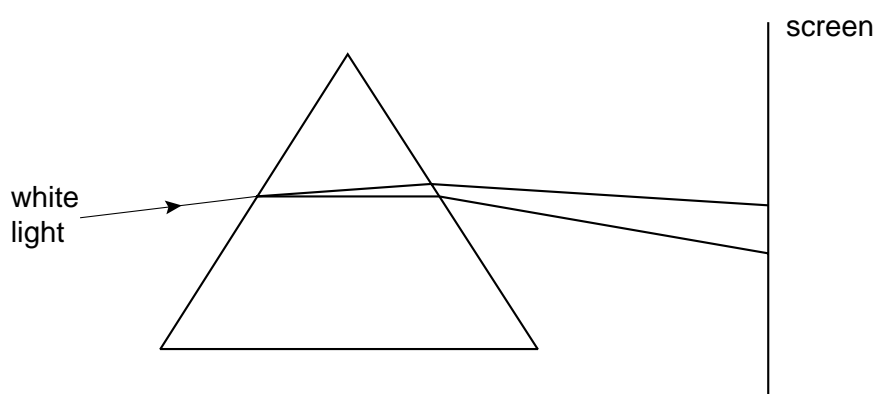


Fig. 5.1

[1]

6 Fig. 6.1 shows a root hair cell.

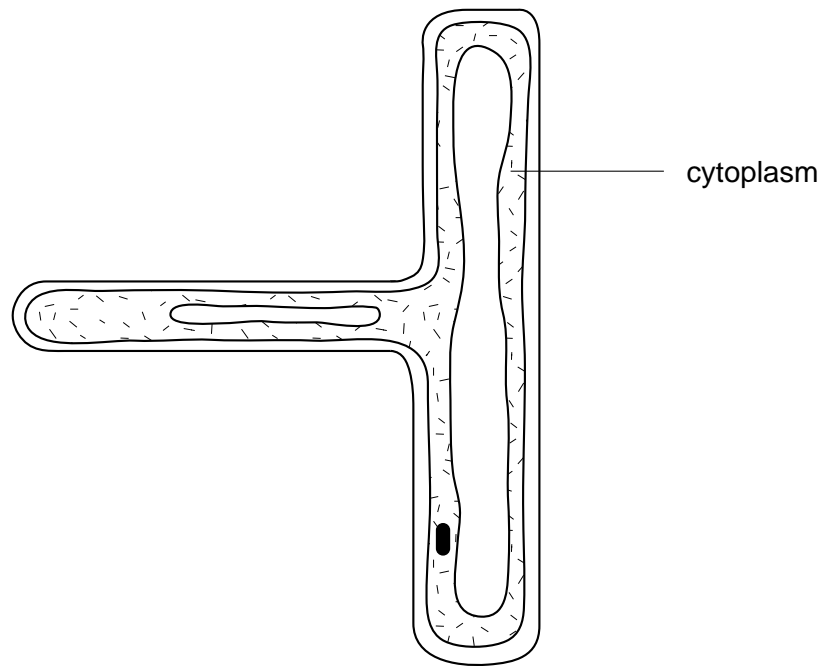


Fig. 6.1

(a) State two features of the cell that indicate that it is from a plant, and **not** from an animal.

1

2 [2]

(b) On Fig. 6.1, draw a label line to the part of the cell that is a partially permeable membrane, and label it **P**. [1]

(c) Root hair cells take up water from the soil. Use words from the list to complete the sentences which explain how this happens.

- atoms**
 - greater**
 - ions**
 - less**
- molecules**
 - osmosis**
 - respiration**
 - transpiration**

Water diffuse from the water between the soil particles, through the partially permeable membrane, and into the cell. They do this because the concentration of the solution inside the cell is than the concentration in the soil outside the cell. This process is called

[3]

(d) After the water has entered the root, it travels up through the xylem vessels to the leaves.

Explain why the water moves up through the xylem vessels.

.....

.....

..... [2]

- 7 In the experiment shown in Fig. 7.1, pieces of the insoluble compound calcium carbonate were added to solution Q. The temperature of the laboratory was 20 °C. Fig. 7.2 shows the experiment a short time later.

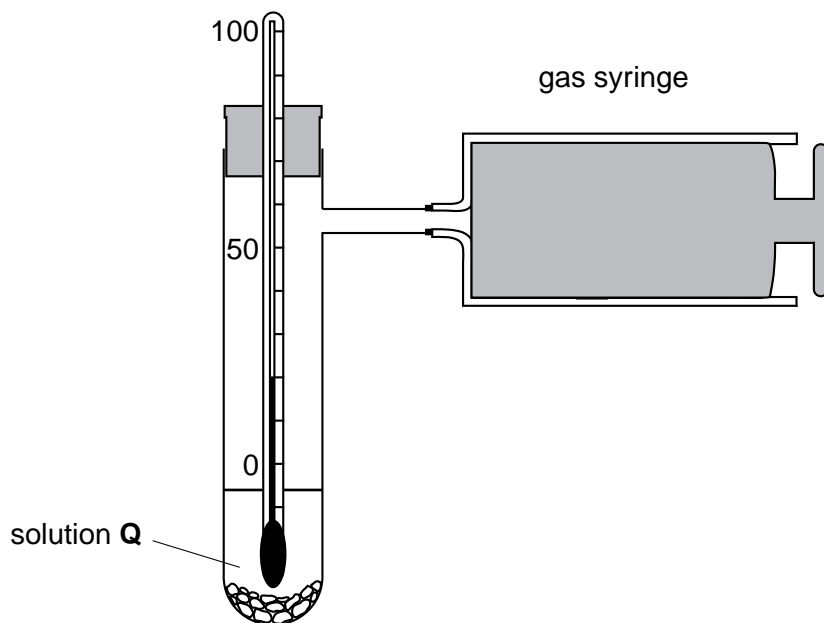


Fig. 7.1

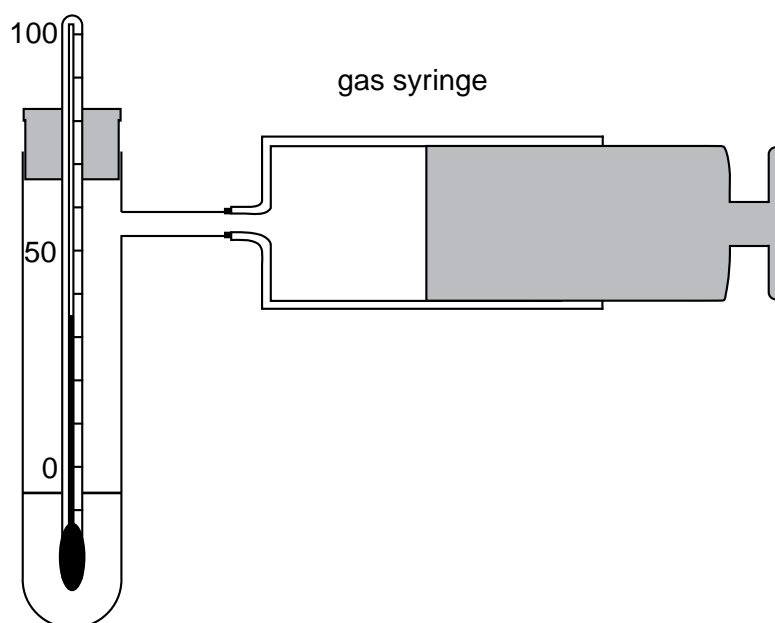


Fig. 7.2

- (a) (i) State three pieces of evidence in these diagrams which show that a chemical change has occurred.

1

.....

2

.....

3

..... [3]

- (ii) Suggest the type of substance in solution Q.

..... [1]

- (b) (i) State **two** physical properties which are common to the Group II elements magnesium, calcium and strontium.

.....

..... [2]

- (ii) Strontium reacts in cold water in a similar manner to calcium.

Suggest the name of **one** of the products when strontium reacts with water.

..... [1]

- 8 (a) A student wanted to find out if a food sample contained fat.

She chopped the food up into very small pieces, and then mixed some of it with liquid X.

She then poured some of the solution formed into water.

The mixture became cloudy white, so she knew that the food did contain fat.

- (i) Name liquid X.

..... [1]

- (ii) Name the type of mixture that formed between liquid X, the water and the fat, and that was cloudy white.

..... [1]

- (b) The student investigated the action of lipase on the fat in the food.

She mixed some of the food into water, and divided the mixture equally into three test tubes. She placed each test tube in a water bath at a different temperature and left them for five minutes.

Then she added equal amounts of lipase to each tube and mixed them thoroughly. She measured the pH in each tube, and then again after 5 minutes. Her results are shown in Fig. 8.1.

tube	temperature / °C	pH at start	pH after 5 minutes
1	5	7.0	6.8
2	35	7.0	6.2
3	80	7.0	7.0

Fig. 8.1

- (i) Describe the action of lipase on fats.

.....

.....

..... [2]

(ii) Explain why the pH changed from 7.0 to 6.2 in tube 2.

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

(iii) Suggest why the pH changed to 6.8 in tube 1.

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

(iv) Explain why the pH did not change in tube 3.

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

- 9 A sample of river water is sent to a chemical laboratory for testing. The tests that were carried out and the results are shown in Fig. 9.1.

test	result
A flame test	brick red colour
B reaction with acidified barium chloride	white precipitate
C reaction with acidified silver nitrate	white precipitate
D reaction with sodium hydroxide and aluminium powder	ammonia produced

Fig. 9.1

- (a) State what each one of these tests shows is present in the river water.

test **A**

test **B**

test **C**

test **D** [4]

- (b) The river water is also known to be hard.

- (i) Describe two observations that would be made when some of this river water is shaken with soap solution.

1

.....

2

..... [2]

- (ii) Which of the tests **A**, **B**, **C** or **D**, in Fig. 9.1 shows the presence of a substance which causes hardness in water?

..... [1]

- (c) River water may contain harmful micro-organisms which make it unsuitable for drinking.

Describe briefly how these micro-organisms can be removed.

.....

..... [1]

- 10 Fig. 10.1 shows some of the bones and muscles in a human leg. They work in a similar way to the bones and muscles in the arm.

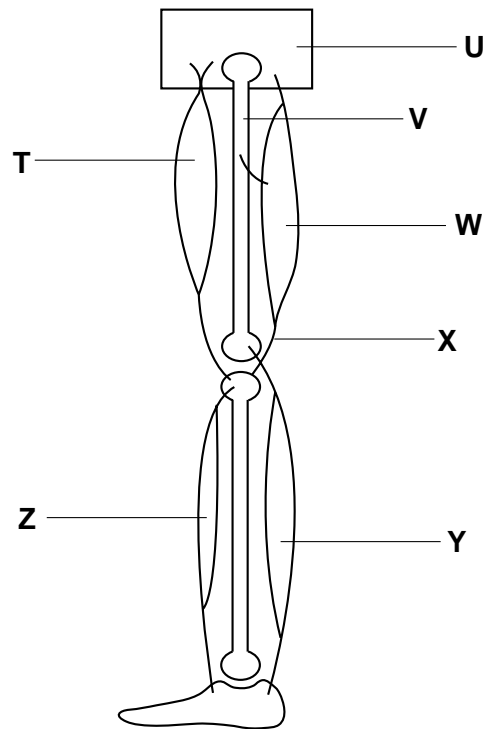


Fig. 10.1

- (a) Give the letter of each of the following.

(i) A tendon.

.....

[1]

(ii) A bone.

.....

[1]

(iii) A muscle that will bend (flex) the leg at the knee joint when it contracts.

.....

[1]

(b) (i) Describe what will happen when muscle **Y** contracts.

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

(ii) Which muscle will relax when muscle **Y** contracts?

..... [1]

(c) The knee joint is a synovial joint. Describe how friction is reduced at a synovial joint.

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

(d) Muscles need energy in order to be able to contract. Explain how they obtain this energy.

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

11 A girl is watching and listening to a concert.

(a) Complete the sentences by using the words below.

electrical light loudspeaker microphone
rays sound vibrations

A singer sings into a microphone. This converts waves into
..... signals, which travel along wires to an amplifier.

The signals then travel along more wires to a which
changes them into sound waves again. These travel through the air as a series
of to reach the girl's ear. [4]

(b) The loudness of a sound depends on the amplitude of the sound wave.

Draw and label a diagram to show what is meant by the amplitude of a wave.

[2]

- (c) The concert is being televised.

To produce pictures, a television uses a CR (cathode ray) tube.

Fig. 11.1 shows a heated wire in a CR tube.

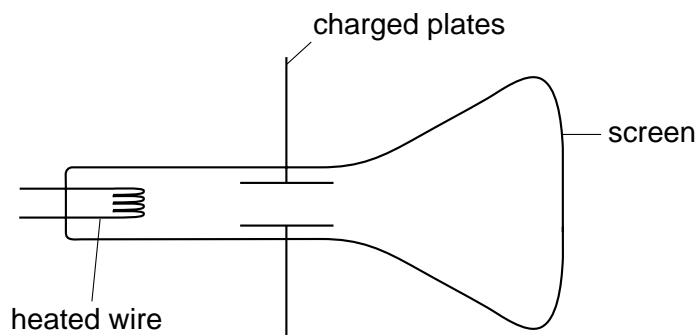


Fig. 11.1

- (i) Name the particles given off by the heated wire.
 [1]
- (ii) State the charge on these particles.
 [1]
- (d) A television produces colour pictures by emitting light waves corresponding to the three primary colours.
- (i) State the **three** primary colours of light.
 [2]
- (ii) State the property of a light wave that determines its colour.
 [1]

DATA SHEET
The Periodic Table of the Elements

		Group																					
I	II	III	IV	V	VI	VII	O																
7 Li Lithium 3	9 Be Beryllium 4	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">1 H Hydrogen 1</td> <td colspan="10"></td> </tr> </table>										1 H Hydrogen 1											4 He Helium 2
1 H Hydrogen 1																							
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	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	96 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86						
87 Fr Francium	88 Ra Radium	226 Ac Actinium											87										
		<p>*58-71 Lanthanoid series †90-103 Actinoid series</p>																					
		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">a</td> <td style="width: 5%; text-align: center;">X</td> <td colspan="8"></td> <td style="width: 5%; text-align: center;">b</td> </tr> </table>										a	X									b	
a	X									b													
		<p>a = relative atomic mass X = atomic symbol b = proton (atomic) number</p>																					
		<p>The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).</p>																					