UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5727661480

COMBINED SCIENCE **0653/33**

Paper 3 (Extended) **October/November 2011**

1 hour 15 minutes

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.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 24.

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	
Total	

This document consists of **20** printed pages.

For Examiner's Use

1 There are three states of matter – solid, liquid and gas.

Fig. 1.1 shows the arrangement of particles in a solid. 0653/33/O/N/11

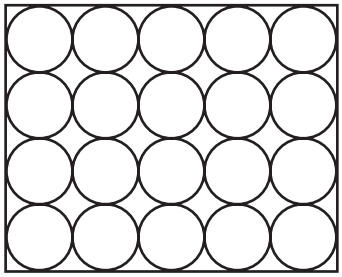
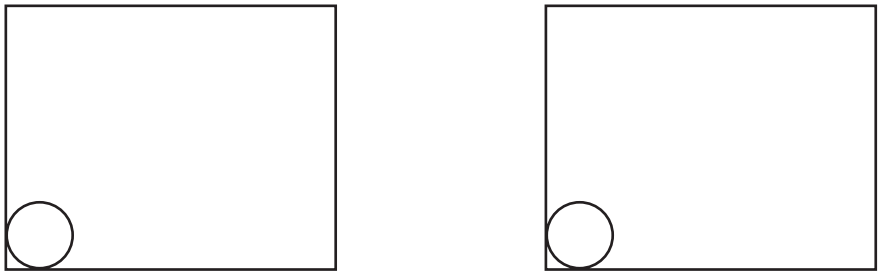


Fig. 1.1

1 (a) (i) Draw similar diagrams for a liquid and a gas. 0653/33/O/N/11



liquid gas

[2]

1 a (ii) Explain the arrangements you have drawn in terms of the forces between the particles. 0653/33/O/N/11

.....

.....

..... [2]

For Examiner's Use

1 (b) Explain the following using the ideas of conduction, convection and radiation.

1 b (i) Houses in hot climates are often painted white. 0653/33/O/N/11

.....

..... [1]

1 b (ii) A saucepan has a metal base but a plastic or wooden handle. 0653/33/O/N/11

.....

..... [1]

1 b (iii) In a kettle, the water is heated at the bottom but all of the water in the kettle becomes hot. 0653/33/O/N/11

.....

.....

..... [2]

2 **(a)** Fig. 2.1 shows a flowering plant, and two cells from the plant.

For Examiner's Use

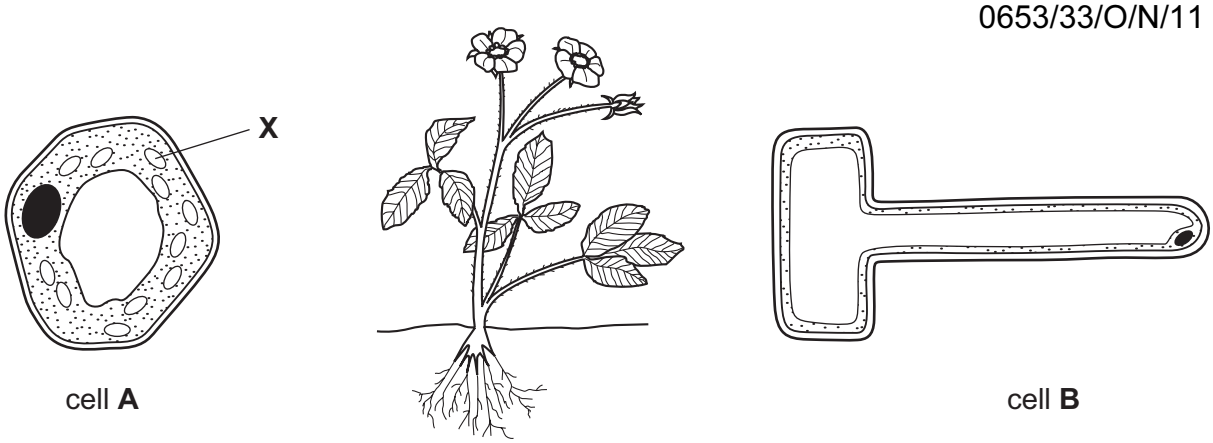


Fig. 2.1

2 a **(i)** On Fig. 2.1, draw a line from each cell to a part of the plant in which it could be found. [2]

2 a **(ii)** Explain why cell **A** contains the structures labelled **X**, but cell **B** does not.

.....

.....

.....

.....

..... [3]

2 a **(iii)** Suggest how the shape of cell **B** adapts it for its function.

.....

.....

..... [2]

For Examiner's Use

2 **(b)** The colour of the flower petals is determined by a gene with two alleles, **R** and **r**. Allele **R** is dominant and produces red flowers, and allele **r** produces white flowers.

2 b (i) Complete Table 2.1 to show the phenotype produced by each of the three possible genotypes.

0653/33/O/N/11

Table 2.1

OUT OF SYLLABUS

genotype	phenotype
RR	
Rr	
rr	

[1]

2 b (ii) On Table 2.1, draw a circle around **one heterozygous** genotype. [1]

0653/33/O/N/11

OUT OF SYLLABUS

2 b (iii) Predict the ratio of red to white flowers that would be produced if two plants with the genotypes **Rr** were crossed.

0653/33/O/N/11

OUT OF SYLLABUS

..... [1]

2 **(c)** A grower has a rare variety of orchid with unusual flowers. She decides to produce new plants from this orchid using an asexual method of propagation.

Suggest the advantages to the grower of using asexual propagation to produce new plants, rather than sowing seeds she has collected from the orchid plant.

0653/33/O/N/11

.....

.....

..... [2]

For Examiner's Use

3 **(a)** Fig. 3.1 shows apparatus a student used to investigate the electrolysis of a solution of potassium sulfate.

0653/33/O/N/11

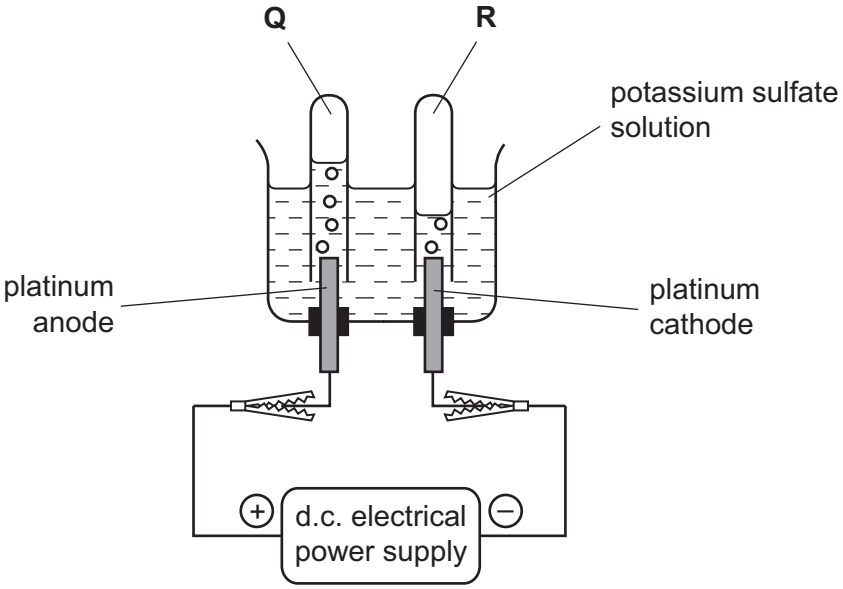


Fig. 3.1

During the experiment shown in Fig. 3.1, two different colourless gases, **Q** and **R**, collected in the small test-tubes. Neither of these gases contained any sulfur.

3 a (i) Name gases **Q** and **R**.

0653/33/O/N/11

Q .....

R ..... [2]

3 a (ii) Choose **one** of the gases, **Q** or **R**, and describe how the student should test it for the gas you have named.

0653/33/O/N/11

chosen gas .....

test .....

..... [1]

For Examiner's Use

3 (b) Potassium sulfate solution is made in a neutralisation reaction between an acid and an alkali. 0653/33/O/N/11

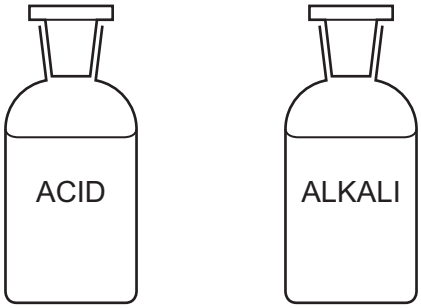


Fig. 3.2

3 b (i) Suggest a **word** chemical equation for a reaction between a suitable acid and alkali that would produce potassium sulfate. 0653/33/O/N/11

[2]

3 b (ii) Describe how a **neutral** solution of potassium sulfate could be obtained using suitable solutions of an acid and an alkali. 0653/33/O/N/11

.....

.....

.....

.....

..... [3]

3 b (iii) State the **ionic** equation which describes the neutralisation reaction between any aqueous acid and any aqueous alkali. 0653/33/O/N/11

..... [2]

For Examiner's Use

4 (a) Five types of radiation are listed below. 0653/33/O/N/11

alpha radiation **beta radiation** **gamma radiation**

infra–red radiation **ultraviolet radiation**

4 a (i) State which of these types of radiation is a stream of electrons. 0653/33/O/N/11

..... [1]

4 a (ii) State which of these types of radiation are forms of electromagnetic radiation. 0653/33/O/N/11

.....

..... [2]

4 a (iii) State **one** use for gamma radiation. 0653/33/O/N/11

..... [1]

4 a (iv) Complete Table 4.1 to compare alpha, beta and gamma radiations. 0653/33/O/N/11

Tick **one** box in each row of the table.

Table 4.1

	alpha	**beta**	**gamma**
most penetrating			
most ionising			
not deflected by an electric field			

[2]

For Examiner's Use

4 (b) Some students measured the level of radiation from a radioactive source for 42 days. Table 4.2 shows the results corrected for background radiation. 0653/33/O/N/11

Table 4.2

time / days	**0**	**7**	**14**	**21**	**28**	**35**	**42**
level of radiation / average counts per minute	64	45	33	23	16	12	8

Describe and explain the pattern in these results.

.....

.....

..... [2]

5 PTFE is an important plastic which has many uses in the home and industry. PTFE is made of polymer molecules.

For Examiner's Use

Fig. 5.1 shows the displayed formula of the monomer that reacts to produce PTFE.

0653/33/O/N/11

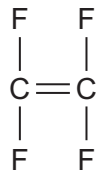


Fig. 5.1

5 **(a) (i)** Explain why the molecule shown in Fig. 5.1 is **not** a hydrocarbon.

0653/33/O/N/11

.....

..... [1]

5 a **(ii)** Fig. 5.2 shows the outer shell electrons in a carbon atom and a fluorine atom.

0653/33/O/N/11

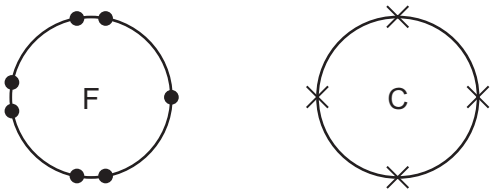
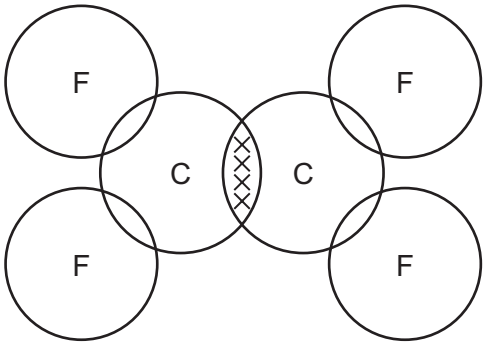


Fig. 5.2

Complete the bonding diagram below to show how the outer electrons are arranged in the molecule whose displayed formula is shown in Fig. 5.1.



[2]

For Examiner's Use

5 a (iii) Complete the diagram below to show the displayed formula of a small section of a PTFE molecule.

Your completed formula must contain eight fluorine atoms. 0653/33/O/N/11

[3]

5 (b) The element, fluorine, is a halogen in Group 7 of the Periodic Table.

(i) Use your knowledge of the physical states of the other halogens to predict and explain whether fluorine is a solid, a liquid or a gas at room temperature.

0653/33/O/N/11

prediction .....

explanation .....

.....

..... [2]

5 b (ii) Use your knowledge of the reactivities of the other halogens to predict and explain whether or not the following halogen displacement reaction will occur.

bromine + sodium fluoride → sodium bromide + fluorine

0653/33/O/N/11

.....

.....

..... [2]

6 Fig. 6.1 shows the human digestive system. 0653/33/O/N/11

For Examiner's Use

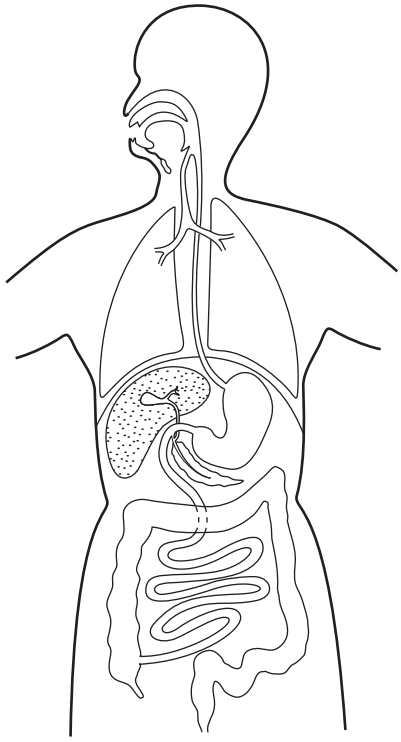


Fig. 6.1

6 (a) On Fig. 6.1, use label lines to label 0653/33/O/N/11

the stomach,

the colon. [2]

6 (b) On Fig. 6.1, label and name **one** part of the digestive system that food does **not** pass through on its way from mouth to anus. [1]

0653/33/O/N/11

6 (c) Describe how digestion takes place inside the stomach. 0653/33/O/N/11

.....

.....

..... [2]

6(d) Fig. 6.2 shows a food web involving humans. 0653/33/O/N/11

For Examiner's Use

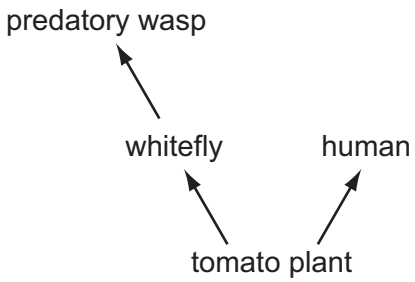


Fig. 6.2

If there are a lot of whitefly feeding on the tomato plants, there will be fewer tomatoes for humans to eat.

6 d (i) Use the information in Fig. 6.2 to suggest how biological control could be used to control the whitefly population. 0653/33/O/N/11

.....

..... [1]

6 d (ii) State **two** reasons, other than cost, why this could be a better way of controlling the whitefly than using pesticides. 0653/33/O/N/11

1 .....

.....

2 .....

..... [2]

For Examiner's Use

7 Some coffee drinks are sold in self-heating cans.

Fig. 7.1 shows a cross-sectional diagram of one design of self-heating can.

0653/33/O/N/11

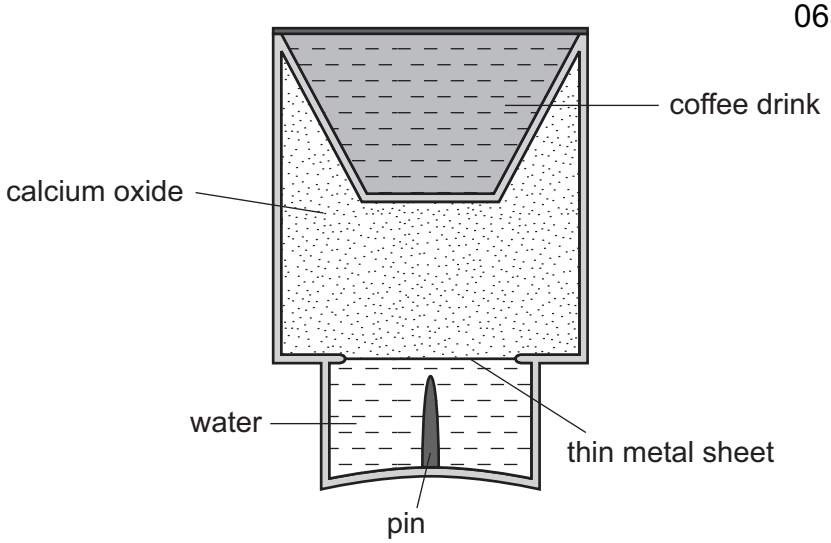


Fig. 7.1

Fig. 7.2 shows the can after it has been turned upside down and the pin pushed through the thin metal sheet. This allows the water to fall into the calcium oxide.

0653/33/O/N/11

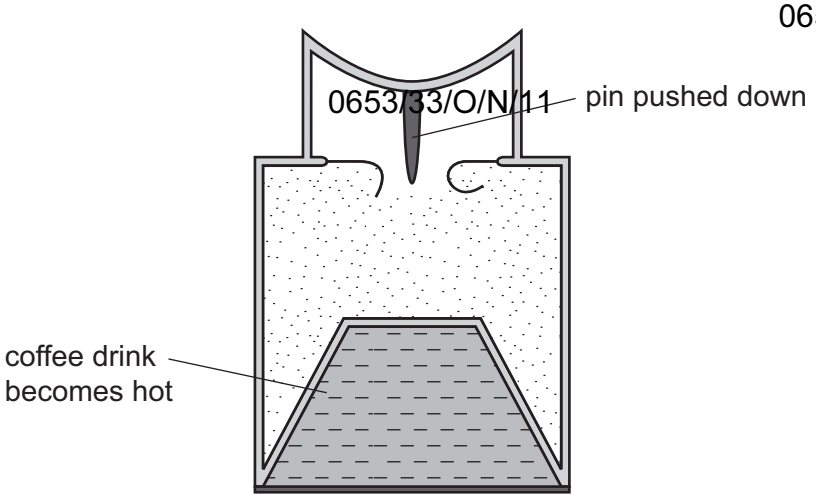


Fig. 7.2

7 **(a)** Explain briefly why the coffee drink in the self-heating can becomes hot when the water and calcium oxide mix.

0653/33/O/N/11

.....

.....

.....

..... [2]

For Examiner's Use

7 **(b) (i)** Use the position of calcium in the Periodic Table to explain why the electrical charge of a calcium ion is +2.

0653/33/O/N/11

.....

.....

.....

.....

..... [3]

7 **b (ii)** The reaction between calcium oxide and water produces the ionic compound calcium hydroxide, $Ca(OH)_2$.

0653/33/O/N/11

Deduce the electrical charge of the hydroxide ion.

Show how you obtained your answer.

.....

..... [2]

For Examiner's Use

8 **(a)** A student set up the circuit shown in Fig. 8.1 to investigate the relationship between the voltage across resistor **R** and the current through resistor **R**. 0653/33/O/N/11

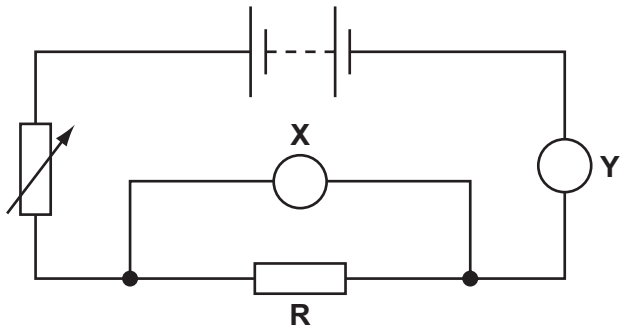


Fig. 8.1

8 a (i) Name the meters labelled **X** and **Y**. 0653/33/O/N/11

X .....

Y ..... [1]

8 a (ii) Explain the purpose of the variable resistor in the circuit. 0653/33/O/N/11

.....

..... [1]

8 a (iii) Fig. 8.2 shows a graph of the results. 0653/33/O/N/11

For Examiner's Use

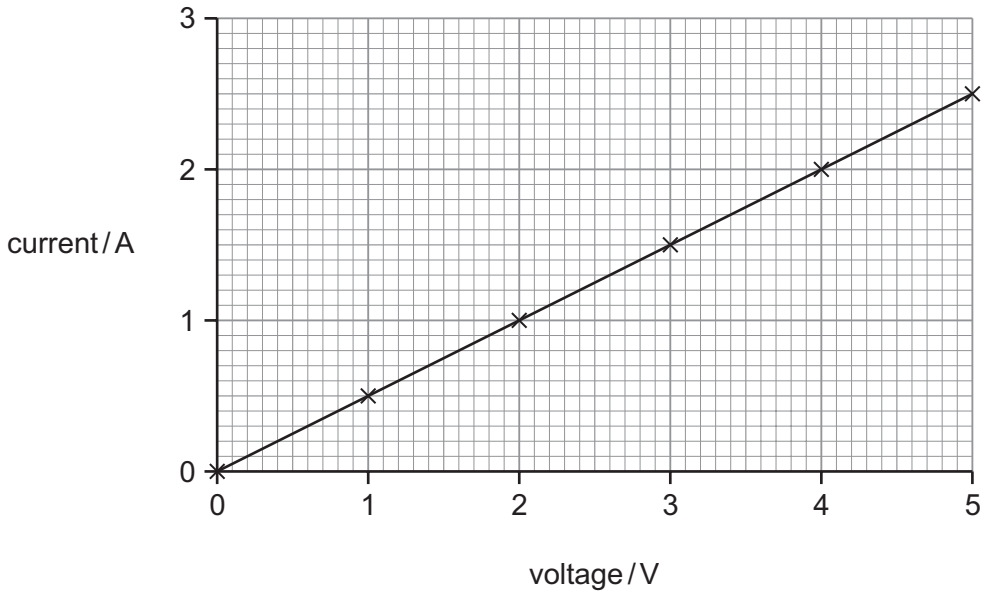


Fig. 8.2

Use the data on the graph to calculate the resistance of resistor **R**.

State the formula that you use and show your working.

formula used

working

..... [2]

8 (b) Two 10 ohm resistors are placed in parallel in a circuit. 0653/33/O/N/11

Calculate their total resistance.

State the formula that you use and show your working.

formula used

working

..... [3]

For Examiner's Use

8 **(c)** Fig. 8.3 shows a battery-operated d.c. electric motor driving a fan. When an electric current passes through the coil it rotates.

0653/33/O/N/11

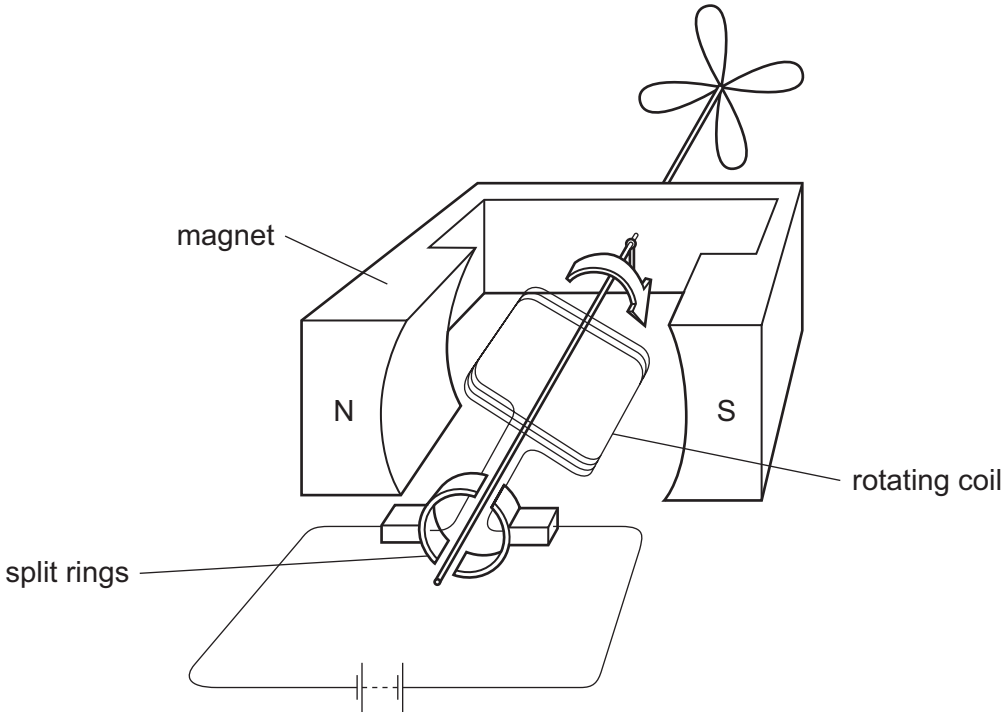


Fig. 8.3

8 c (i) Describe what happens to the coil if the poles of the magnets are reversed and the rest of the circuit remains the same.

0653/33/O/N/11

.....[1]

8 c (ii) Describe what happens if a greater electric current is passed through the coil.

0653/33/O/N/11

.....[1]

8 c (iii) Explain the purpose of the split rings.

0653/33/O/N/11

.....

.....

.....[2]

For Examiner's Use

9 A man walking along a road decided to cross to the other side. As he was walking across the road, a car sounded its horn, which made him jump. He then crossed the rest of the road more quickly.

9 (a) For each of the actions that the man took, state whether it was a **reflex** action or a **voluntary** action. 0653/33/O/N/11

walking along the road .....

walking across the road .....

jumping in response to the car horn .....

crossing the road more quickly ..... [2]

9 (b) Explain **one** advantage and **one** disadvantage of reflex actions over voluntary actions. 0653/33/O/N/11

advantage .....

.....

disadvantage .....

..... [2]

9 (c) State the roles of each of the following parts of the nervous system in a reflex action. 0653/33/O/N/11

receptor .....

.....

motor neurone .....

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II									III	IV	V	VI	VII	0		
															4 He Helium 2		
					1 H Hydrogen 1												
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 Sulfur 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.).