



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

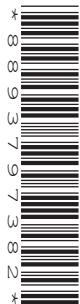
CANDIDATE  
NAME

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--



**COMBINED SCIENCE**

**0653/42**

Paper 4 (Extended)

**October/November 2018**

**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 an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.

This document consists of **23** printed pages and **1** blank page.

1 Fig. 1.1 shows a farm tractor pulling a trailer.

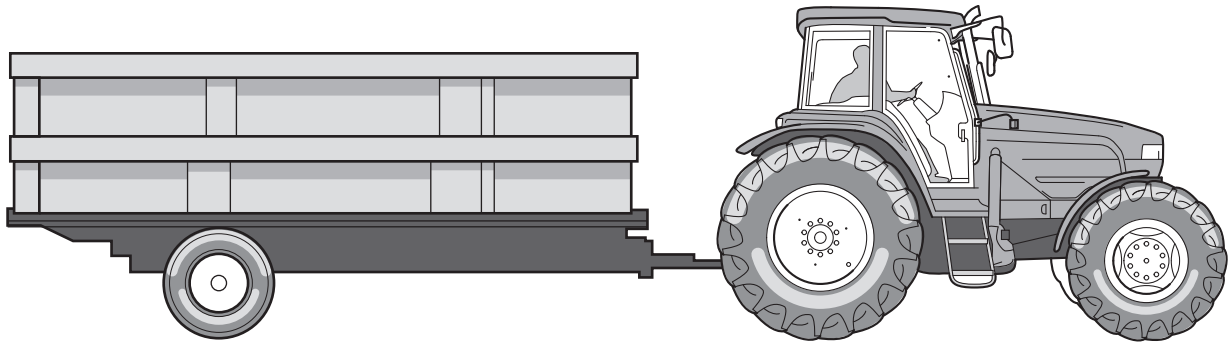


Fig. 1.1

(a) The tractor and trailer are moving across a level field. Fig. 1.2 shows the four forces **W**, **X**, **Y** and **Z** acting on the trailer.

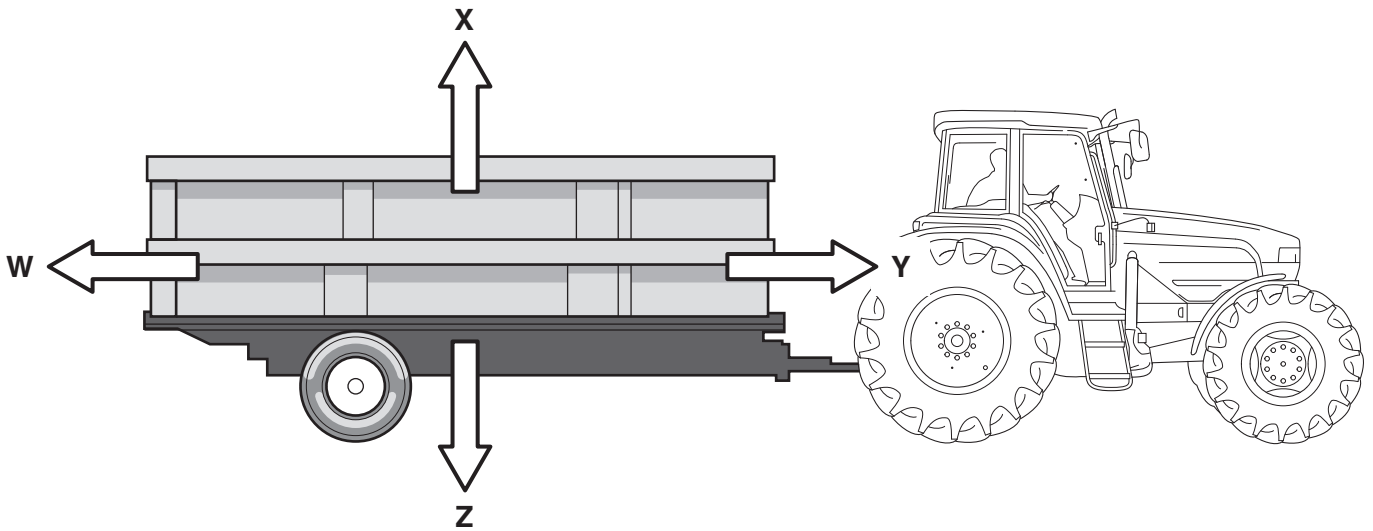


Fig. 1.2

(i) State the letter corresponding to the gravitational force acting on the trailer.

.....

[1]

(ii) The tractor and trailer are moving at a constant speed.

Force **W** has a value of 2000 N.

State the value of force **Y**. Explain your answer.

force **Y** = ..... N

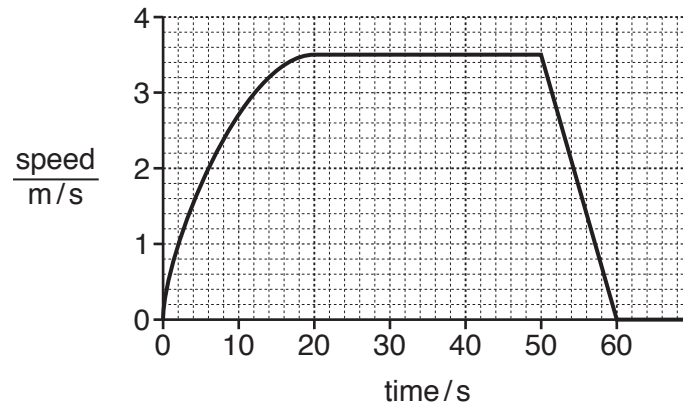
explanation .....

.....

[2]

- (b) The tractor leaves the trailer on the field and drives to the farmyard.

Fig. 1.3 shows a speed–time graph of the tractor as it travels from the field to the farmyard.



**Fig. 1.3**

- (i) On Fig. 1.3, label with a letter **C** a point in the journey when the tractor is travelling with constant acceleration. [1]
- (ii) The tractor travels 46 m in the first 20 s of this journey.

Use this information, and information from the graph in Fig. 1.3, to calculate the distance from the field to the farmyard.

Show your working.

distance = ..... m [3]

(c) The tractor, without the trailer, requires a force of 1500 N to move a distance of 50 m at constant speed.

(i) Calculate the useful work done on the tractor when it moves 50 m at this constant speed.

State the formula you use and show your working.

formula

working

work done = ..... J [2]

(ii) The power input to the tractor is 25 kW for 15 s as the tractor moves the distance of 50 m.

Calculate the energy used by the tractor in this time.

State the formula you use and show your working.

formula

working

energy = ..... J [2]

- (iii) Use your answers to (c)(i) and (c)(ii) to calculate the efficiency of the tractor as it moves a distance of 50 m.

State the formula you use and show your working.

formula

working

efficiency = .....[2]

- 2 Magnesium chloride is a soluble salt. It is made when dilute hydrochloric acid reacts with magnesium carbonate.

Magnesium carbonate is insoluble in water.

- (a) (i) Excess magnesium carbonate powder is mixed with dilute hydrochloric acid.

Suggest methods for

1. removing unreacted magnesium carbonate from the reaction mixture,

.....

2. obtaining solid magnesium chloride from the solution.

.....

[2]

- (ii) The reaction is repeated using the same mass of larger pieces of magnesium carbonate instead of powder.

Describe the effect of this change on the rate of the reaction.

.....

.....[1]

- (iii) Describe the effect of using the same volume of more concentrated hydrochloric acid on the rate of this reaction.

Explain your answer.

effect .....

explanation .....

.....

[2]

- (b) When the magnesium carbonate reacts with dilute hydrochloric acid, the temperature rises.

State the name given to chemical reactions that cause the temperature to rise, and explain this observation.

Use ideas about energy changes in your answer.

reaction .....

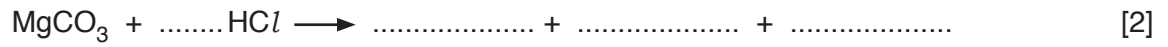
explanation .....

.....

[2]

(c) When magnesium carbonate reacts with dilute hydrochloric acid, a colourless gas and a colourless salt solution are formed.

(i) Complete the balanced equation for this reaction.



(ii) Describe a test for aqueous chloride ions.

State the result that shows chloride ions are present.

test .....

result .....

.....

[2]

**BLANK PAGE**



3 Pollen is used by flowering plants to reproduce by sexual reproduction.

(a) Pollen has a haploid nucleus.

State what is meant by the terms

1. *haploid*, .....

.....

2. *nucleus*. .....

.....

[2]

(b) Table 3.1 shows some statements about flowers.

Put a tick (✓) next to **all** statements that are characteristics of wind-pollinated flowers.

**Table 3.1**

statement	tick (✓) if correct
small green or brown flowers	
produce nectar	
anthers inside the flower	
stigma outside the flower	
light, smooth pollen grains	
produce scent	

[3]

- (c) The apparatus shown in Fig. 3.1 is used to compare the transpiration rates of twigs (small branches) from two different species of trees, **A** and **B**. The twigs are of a similar size and they have the same number of leaves.

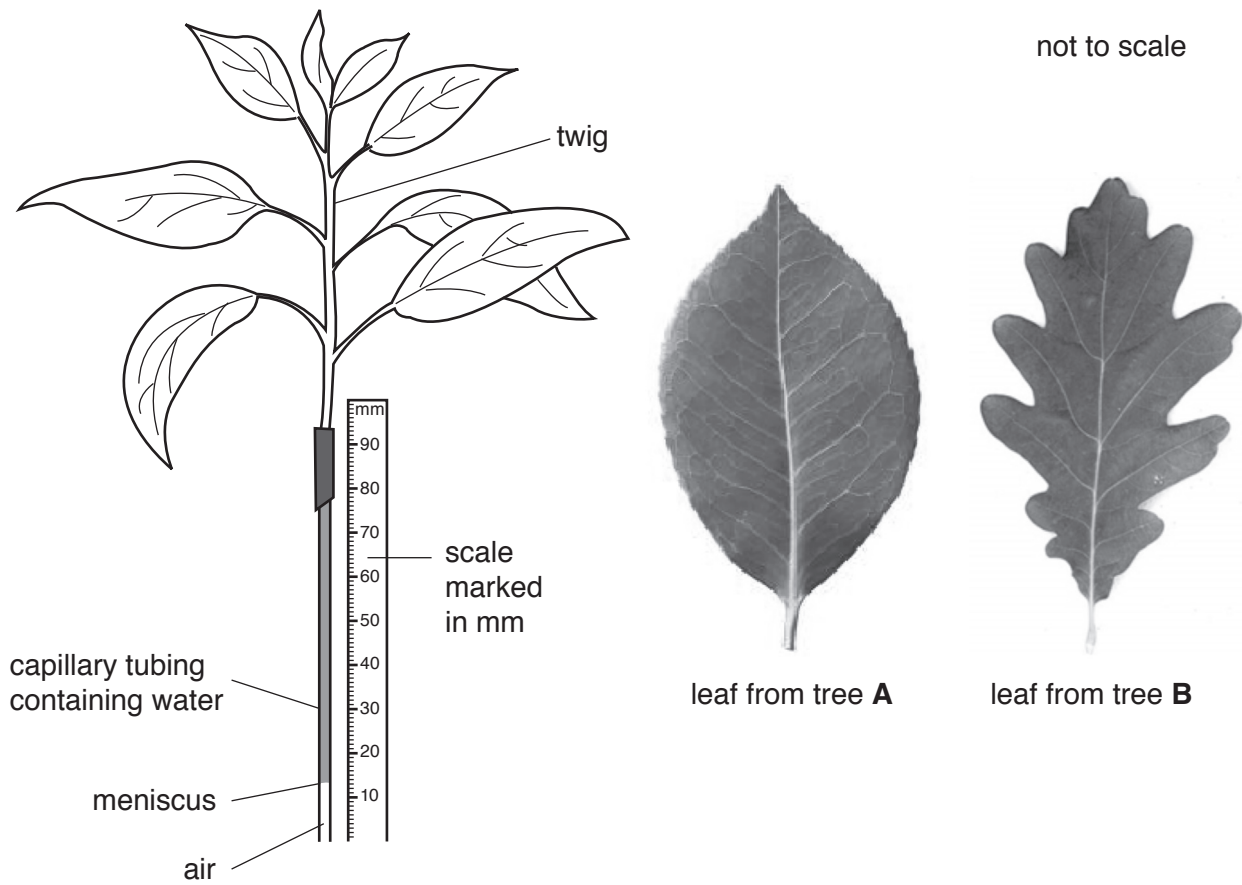


Fig. 3.1

As water vapour is lost from the leaves by transpiration, water is drawn up the tube and the meniscus (the bottom of the column of water) moves upwards.

Readings are taken of the position of the meniscus every minute for five minutes.

Fig. 3.2 shows a graph of the results for tree **A** and for tree **B**.

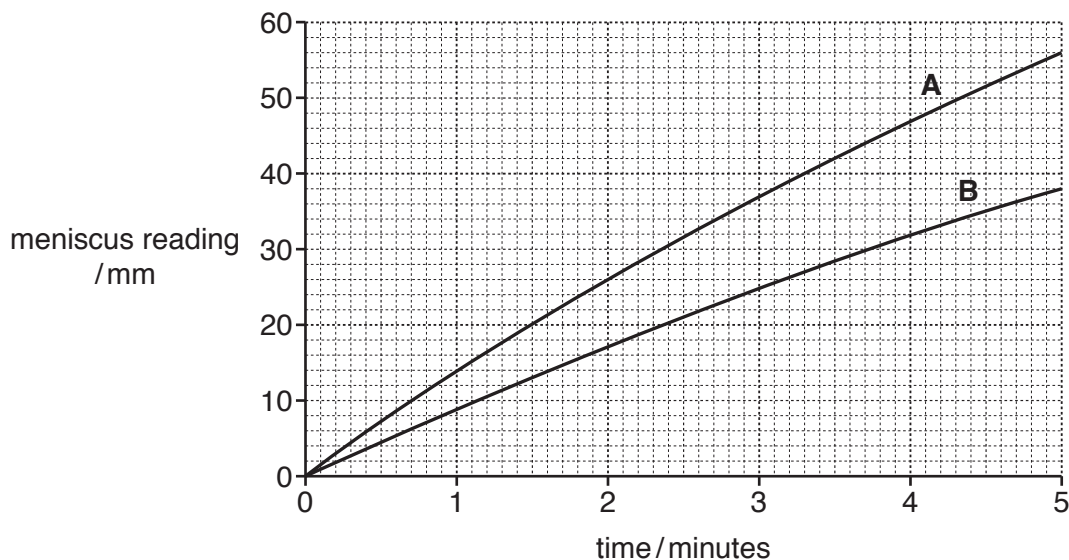


Fig. 3.2

Suggest **two** differences between the leaves of trees **A** and **B** that could explain the difference in the rate of transpiration.

1. ....
  - .....
  2. ....
  - .....
- [2]

(d) The experiment is repeated with the twig from tree **B** later on in the day when the humidity of the air has increased.

(i) On Fig. 3.2 draw a line to show a possible graph of the results. Label this line **C**. [1]

(ii) Explain your response to (d)(i).

.....

.....[1]

- 4 Fig. 4.1 is a diagram of the internal structure of the heart.

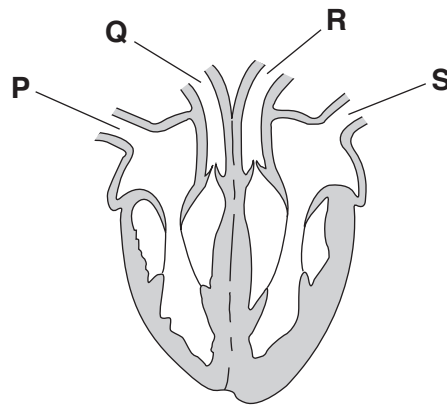


Fig. 4.1

- (a) The letters **P**, **Q**, **R** and **S** on Fig. 4.1 show the blood vessels entering and leaving the heart.

State the letters which identify the veins.

.....[1]

- (b) Use words or phrases from the list to complete the following sentences.

Each word or phrase may be used once, more than once or not at all.

**greater**      **lower**      **atrium**      **left**      **right**  
**shorter**      **ventricle**      **valve**

Blood flows to the lungs from the ..... side of the heart. Blood flowing to the lungs has a ..... pressure than blood leaving the ..... side of the heart. This is because the blood travels a ..... distance to the lungs. [3]

(c) Fig. 4.2 shows a fetus (growing baby) in a mother's uterus during pregnancy.

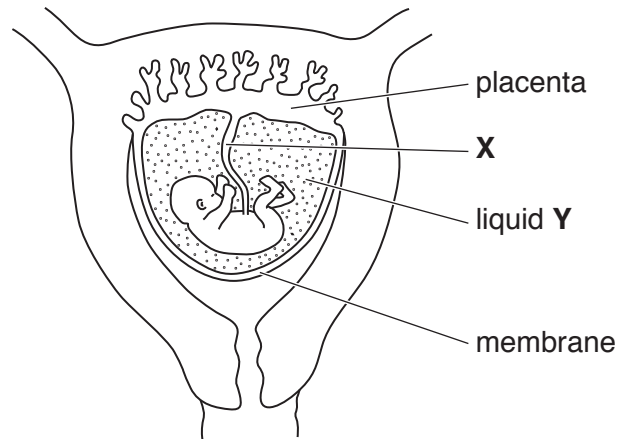


Fig. 4.2

(i) Name X and Y shown on Fig. 4.2.

X .....

Y .....

[2]

(ii) When the membrane breaks, liquid Y is lost. Occasionally this happens too early in the pregnancy.

Suggest **and** explain how this affects the fetus.

.....

.....

.....[2]

(iii) The fetus obtains the materials it needs from the placenta.

State **one** substance which diffuses

1. from the mother's blood into the placenta,

.....

2. from the placenta into the mother's blood.

.....

[2]

5 (a) Ethane,  $C_2H_6$ , is an alkane.

(i) State the type of bonding between atoms in a molecule of ethane.

.....[1]

(ii) Complete the structure of a molecule of ethane.



[2]

(b) Petroleum is separated into useful products by the process shown in Fig. 5.1.

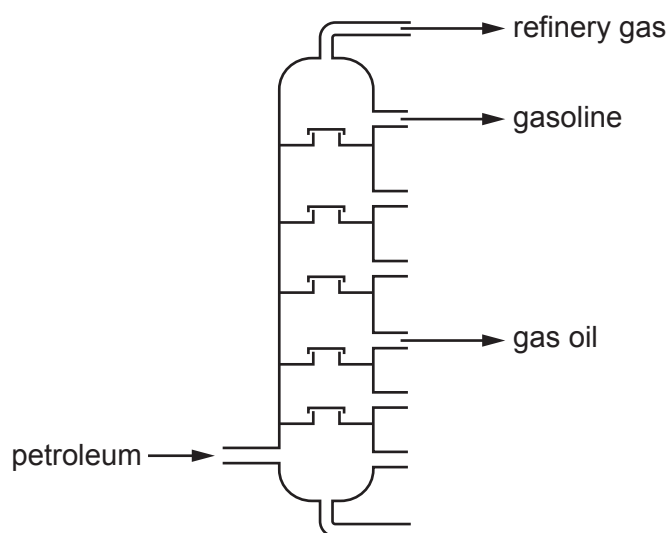


Fig. 5.1

(i) Name this process.

.....[1]

(ii) Compare the molecules in gasoline to the molecules in gas oil.

Use ideas about boiling point ranges, molecular sizes and intermolecular attractive forces in your answer.

.....  
.....  
.....  
.....  
.....[3]

(c) Ethene, C<sub>2</sub>H<sub>4</sub>, is an alkene.

Name the process used to make ethene from fractions obtained from petroleum.

.....[1]

(d) The atomic number of carbon is 6.

State the electronic structure of a carbon atom.

..... [1]



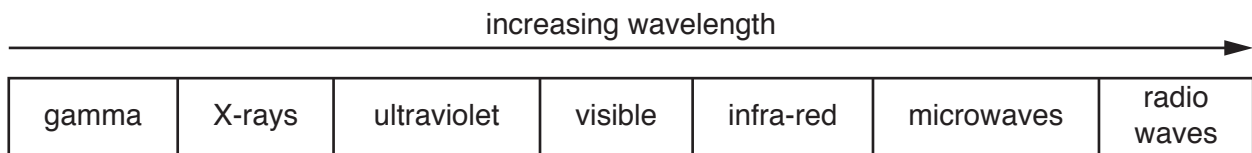


(d) Astronomers use telescopes to study stars. Stars are extremely hot bodies that lose energy by emitting electromagnetic radiation into space.

(i) Explain why stars can only lose energy by radiation, and not by conduction or convection.

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

(ii) Fig. 6.2 shows the electromagnetic spectrum.



**Fig. 6.2**

Stars emit all types of radiation.

The energy carried by electromagnetic waves increases as the frequency increases.

Explain why gamma radiation enables stars to lose energy most rapidly.

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

- 7 Fig. 7.1 shows a simplified version of the carbon cycle. The element carbon is present in different molecules as it moves through the cycle.

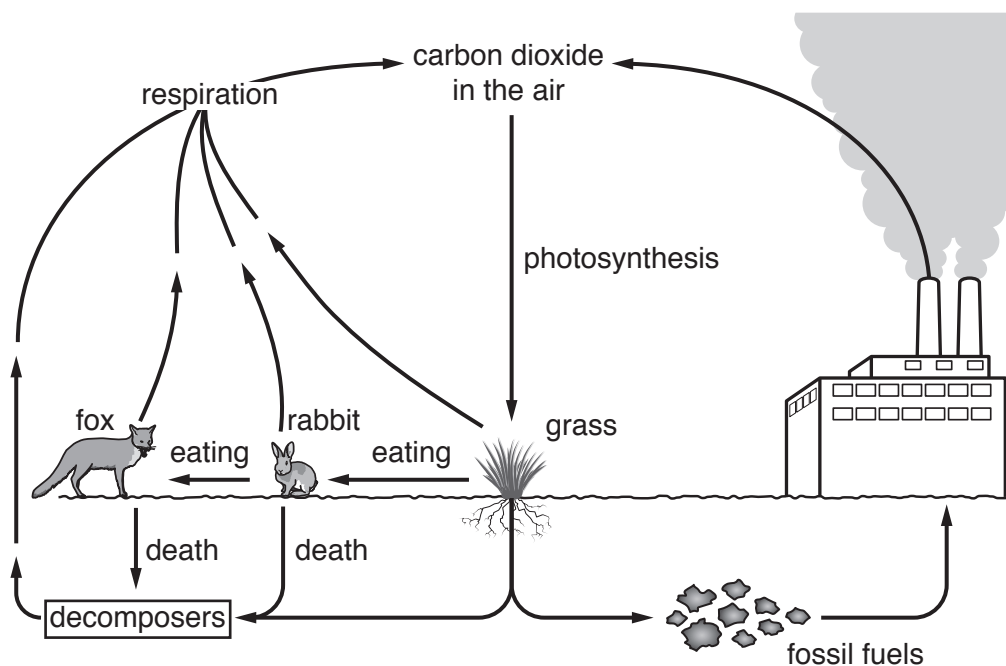


Fig. 7.1

- (a) The element carbon is transferred from carbon dioxide in the atmosphere to the grass.

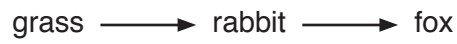
Suggest a compound in the grass which contains carbon.

.....[1]

- (b) State the balanced symbol equation for respiration.

.....[2]

(c) A food chain from Fig. 7.1 is shown.



(i) The arrows represent the transfer of chemical energy.

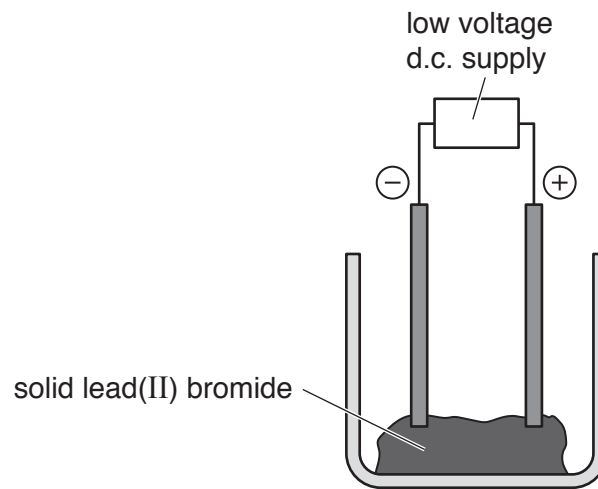
Describe **two** ways in which energy is lost during the transfer between the rabbit and the fox.

- 1. ....
  - 2. ....
- [2]

(ii) Describe how the element carbon is released as carbon dioxide from the body of the fox after it dies.

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

- 8 (a) A teacher tries to use the apparatus shown in Fig. 8.1 to demonstrate the electrolysis of lead(II) bromide.



**Fig. 8.1**

Explain why this electrolysis does not work.

Use ideas about physical states and ions in your answer.

.....

.....

.....

.....

[2]

(b) A student electrolyses aqueous copper bromide using the apparatus shown in Fig. 8.2.

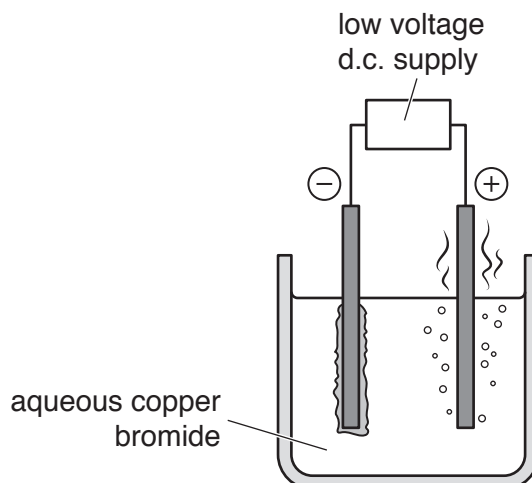


Fig. 8.2

(i) In this process metallic copper is formed.

Copper is a transition metal. It forms coloured compounds.

Describe **one other** property of a **transition** metal.

.....[1]

(ii) Identify the ions that move to each electrode to form the product.

anode .....

cathode .....

[2]

(c) Iron is extracted from iron(III) oxide,  $\text{Fe}_2\text{O}_3$ , in the blast furnace.

(i) State the fuel used in the blast furnace.

.....[1]

(ii) State **one** substance that reduces iron(III) oxide in the blast furnace.

.....[1]

- 9 Fig. 9.1 shows a circuit diagram for an investigation into how the resistance of a lamp changes with the current in the lamp.

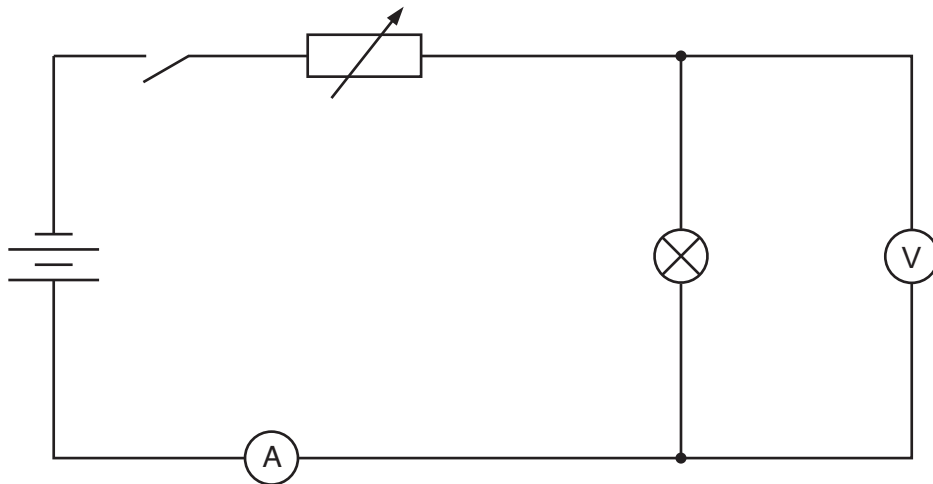


Fig. 9.1

- (a) Explain why the variable resistor has been included in the circuit.

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

- (b) Table 9.1 shows some results from the investigation.

Table 9.1

experiment	voltmeter reading /V	ammeter reading /A	resistance of lamp / $\Omega$
1	6.0	0.54	11
2	4.0	0.46	8.7
3	3.0	0.40	7.5
4	2.0	0.32	6.3

The lamp becomes less bright as the voltage reading decreases from 6.0V to 2.0V.

Explain why this happens.

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

- (c) (i) On Fig. 9.1 add a second identical lamp in parallel with the first. [1]
- (ii) Experiment 5 is now carried out with the second identical lamp in the circuit in parallel with the first lamp.

The total current in the circuit is now 0.76A.

State the current in the first lamp. Give a reason for your answer.

current = ..... A

reason .....

.....

.....

[2]

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cie.org.uk](http://www.cie.org.uk) after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

## The Periodic Table of Elements

Group									
I	II	III	IV	V	VI	VII	VIII		
3 Li lithium 7	4 Be beryllium 9	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20		
11 Na sodium 23	12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	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
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 —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —
							111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —
							114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —
							117 Ts tennessine —	118 Og oganeson —	119 Uue unbinilium —
							120 Ubn unbinilium —	121 Ubu unbinilium —	122 Ubn unbinilium —
							123 Ubn unbinilium —	124 Ubn unbinilium —	125 Ubn unbinilium —
							126 Ubn unbinilium —	127 Ubn unbinilium —	128 Ubn unbinilium —
							129 Ubn unbinilium —	130 Ubn unbinilium —	131 Ubn unbinilium —
							132 Ubn unbinilium —	133 Ubn unbinilium —	134 Ubn unbinilium —
							135 Ubn unbinilium —	136 Ubn unbinilium —	137 Ubn unbinilium —
							138 Ubn unbinilium —	139 Ubn unbinilium —	140 Ubn unbinilium —
							141 Ubn unbinilium —	142 Ubn unbinilium —	143 Ubn unbinilium —
							144 Ubn unbinilium —	145 Ubn unbinilium —	146 Ubn unbinilium —
							147 Ubn unbinilium —	148 Ubn unbinilium —	149 Ubn unbinilium —
							150 Ubn unbinilium —	151 Ubn unbinilium —	152 Ubn unbinilium —
							153 Ubn unbinilium —	154 Ubn unbinilium —	155 Ubn unbinilium —
							156 Ubn unbinilium —	157 Ubn unbinilium —	158 Ubn unbinilium —
							159 Ubn unbinilium —	160 Ubn unbinilium —	161 Ubn unbinilium —
							162 Ubn unbinilium —	163 Ubn unbinilium —	164 Ubn unbinilium —
							165 Ubn unbinilium —	166 Ubn unbinilium —	167 Ubn unbinilium —
							168 Ubn unbinilium —	169 Ubn unbinilium —	170 Ubn unbinilium —
							171 Ubn unbinilium —	172 Ubn unbinilium —	173 Ubn unbinilium —
							174 Ubn unbinilium —	175 Ubn unbinilium —	176 Ubn unbinilium —
							177 Ubn unbinilium —	178 Ubn unbinilium —	179 Ubn unbinilium —
							180 Ubn unbinilium —	181 Ubn unbinilium —	182 Ubn unbinilium —
							183 Ubn unbinilium —	184 Ubn unbinilium —	185 Ubn unbinilium —
							186 Ubn unbinilium —	187 Ubn unbinilium —	188 Ubn unbinilium —
							189 Ubn unbinilium —	190 Ubn unbinilium —	191 Ubn unbinilium —
							192 Ubn unbinilium —	193 Ubn unbinilium —	194 Ubn unbinilium —
							195 Ubn unbinilium —	196 Ubn unbinilium —	197 Ubn unbinilium —
							198 Ubn unbinilium —	199 Ubn unbinilium —	200 Ubn unbinilium —
							201 Ubn unbinilium —	202 Ubn unbinilium —	203 Ubn unbinilium —
							204 Ubn unbinilium —	205 Ubn unbinilium —	206 Ubn unbinilium —
							207 Ubn unbinilium —	208 Ubn unbinilium —	209 Ubn unbinilium —
							210 Ubn unbinilium —	211 Ubn unbinilium —	212 Ubn unbinilium —
							213 Ubn unbinilium —	214 Ubn unbinilium —	215 Ubn unbinilium —
							216 Ubn unbinilium —	217 Ubn unbinilium —	218 Ubn unbinilium —
							219 Ubn unbinilium —	220 Ubn unbinilium —	221 Ubn unbinilium —
							222 Ubn unbinilium —	223 Ubn unbinilium —	224 Ubn unbinilium —
							225 Ubn unbinilium —	226 Ubn unbinilium —	227 Ubn unbinilium —
							228 Ubn unbinilium —	229 Ubn unbinilium —	230 Ubn unbinilium —
							231 Ubn unbinilium —	232 Ubn unbinilium —	233 Ubn unbinilium —
							234 Ubn unbinilium —	235 Ubn unbinilium —	236 Ubn unbinilium —
							237 Ubn unbinilium —	238 Ubn unbinilium —	239 Ubn unbinilium —
							240 Ubn unbinilium —	241 Ubn unbinilium —	242 Ubn unbinilium —
							243 Ubn unbinilium —	244 Ubn unbinilium —	245 Ubn unbinilium —
							246 Ubn unbinilium —	247 Ubn unbinilium —	248 Ubn unbinilium —
							249 Ubn unbinilium —	250 Ubn unbinilium —	251 Ubn unbinilium —
							252 Ubn unbinilium —	253 Ubn unbinilium —	254 Ubn unbinilium —
							255 Ubn unbinilium —	256 Ubn unbinilium —	257 Ubn unbinilium —
							258 Ubn unbinilium —	259 Ubn unbinilium —	260 Ubn unbinilium —
							261 Ubn unbinilium —	262 Ubn unbinilium —	263 Ubn unbinilium —
							264 Ubn unbinilium —	265 Ubn unbinilium —	266 Ubn unbinilium —
							267 Ubn unbinilium —	268 Ubn unbinilium —	269 Ubn unbinilium —
							270 Ubn unbinilium —	271 Ubn unbinilium —	272 Ubn unbinilium —
							273 Ubn unbinilium —	274 Ubn unbinilium —	275 Ubn unbinilium —
							276 Ubn unbinilium —	277 Ubn unbinilium —	278 Ubn unbinilium —
							279 Ubn unbinilium —	280 Ubn unbinilium —	281 Ubn unbinilium —
							282 Ubn unbinilium —	283 Ubn unbinilium —	284 Ubn unbinilium —
							285 Ubn unbinilium —	286 Ubn unbinilium —	287 Ubn unbinilium —
							288 Ubn unbinilium —	289 Ubn unbinilium —	290 Ubn unbinilium —
							291 Ubn unbinilium —	292 Ubn unbinilium —	293 Ubn unbinilium —
							294 Ubn unbinilium —	295 Ubn unbinilium —	296 Ubn unbinilium —
							297 Ubn unbinilium —	298 Ubn unbinilium —	299 Ubn unbinilium —
							300 Ubn unbinilium —	301 Ubn unbinilium —	302 Ubn unbinilium —
							303 Ubn unbinilium —	304 Ubn unbinilium —	305 Ubn unbinilium —
							306 Ubn unbinilium —	307 Ubn unbinilium —	308 Ubn unbinilium —
							309 Ubn unbinilium —	310 Ubn unbinilium —	311 Ubn unbinilium —
							312 Ubn unbinilium —	313 Ubn unbinilium —	314 Ubn unbinilium —
							315 Ubn unbinilium —	316 Ubn unbinilium —	317 Ubn unbinilium —
							318 Ubn unbinilium —	319 Ubn unbinilium —	320 Ubn unbinilium —
							321 Ubn unbinilium —	322 Ubn unbinilium —	323 Ubn unbinilium —
							324 Ubn unbinilium —	325 Ubn unbinilium —	326 Ubn unbinilium —
							327 Ubn unbinilium —	328 Ubn unbinilium —	329 Ubn unbinilium —
							330 Ubn unbinilium —	331 Ubn unbinilium —	332 Ubn unbinilium —
							333 Ubn unbinilium —	334 Ubn unbinilium —	335 Ubn unbinilium —
							336 Ubn unbinilium —	337 Ubn unbinilium —	338 Ubn unbinilium —
							339 Ubn unbinilium —	340 Ubn unbinilium —	341 Ubn unbinilium —
							342 Ubn unbinilium —	343 Ubn unbinilium —	344 Ubn unbinilium —
							345 Ubn unbinilium —	346 Ubn unbinilium —	347 Ubn unbinilium —
							348 Ubn unbinilium —	349 Ubn unbinilium —	350 Ubn unbinilium —
							349 Ubn unbinilium —	350 Ubn unbinilium —	351 Ubn unbinilium —
							352 Ubn unbinilium —	353 Ubn unbinilium —	354 Ubn unbinilium —
							355 Ubn unbinilium —	356 Ubn unbinilium —	357 Ubn unbinilium —
							358 Ubn unbinilium —	359 Ubn unbinilium —	360 Ubn unbinilium —
							361 Ubn unbinilium —	362 Ubn unbinilium —	363 Ubn unbinilium —
							364 Ubn unbinilium —	365 Ubn unbinilium —	366 Ubn unbinilium —
							367 Ubn unbinilium —	368 Ubn unbinilium —	369 Ubn unbinilium —
							370 Ubn unbinilium —	371 Ubn unbinilium —	372 Ubn unbinilium —
							371 Ubn unbinilium —	372 Ubn unbinilium —	373 Ubn unbinilium —
							372 Ubn unbinilium —	373 Ubn unbinilium —	374 Ubn unbinilium —
							373 Ubn unbinilium —	374 Ubn unbinilium —	375 Ubn unbinilium —
							374 Ubn unbinilium —	375 Ubn unbinilium —	376 Ubn unbinilium —
							375 Ubn unbinilium —	376 Ubn unbinilium —	377 Ubn unbinilium —
							376 Ubn unbinilium —	377 Ubn unbinilium —	378 Ubn unbinilium —
							377 Ubn unbinilium —	378 Ubn unbinilium —	379 Ubn unbinilium —
							378 Ubn unbinilium —	379 Ubn unbinilium —	380 Ubn unbinilium —
							379 Ubn unbinilium —	380 Ubn unbinilium —	381 Ubn unbinilium —
							380 Ubn unbinilium —	381 Ubn unbinilium —	382 Ubn unbinilium —
							381 Ubn unbinilium —	382 Ubn unbinilium —	383 Ubn unbinilium —
							382 Ubn unbinilium —	383 Ubn unbinilium —	384 Ubn unbinilium —
							383 Ubn unbinilium —	384 Ubn unbinilium —	385 Ubn unbinilium —
							384 Ubn unbinilium —	385 Ubn unbinilium —	386 Ubn