UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

7776176824

CO-ORDINATED SCIENCES **0654/23**

Paper 2 (Core) **October/November 2010**

2 hours

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	
10	
Total	

This document consists of **22** printed pages and **2** blank pages.

1 Fig. 1.1 shows a section through the human thorax.

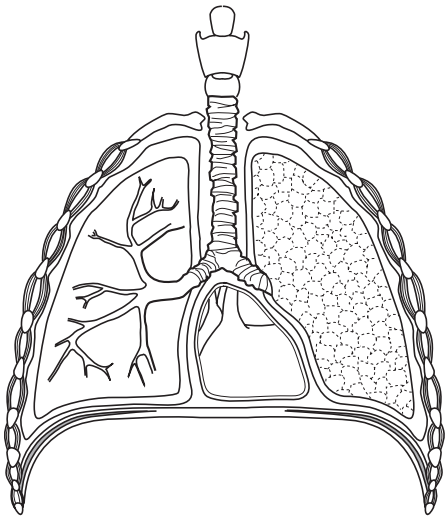


Fig. 1.1

(a) On the diagram, use label lines to label each of the following structures:

the trachea

the heart

a bronchiole [3]

(b) List the structures through which blood passes as it flows from the heart to the lungs and back to the heart again.

Choose from these words:

aorta	**artery**	**capillaries**	**left atrium**	**left ventricle**
pulmonary artery	**pulmonary vein**	**right atrium**	**right ventricle**	**vena cava**

The first structure has been done for you.

1 right ventricle

2 .....

3 .....

4 .....

5 ..... [4]

(c) Describe how the blood transports oxygen.

.....

.....

..... [2]

(d) Describe how oxygen is supplied to a developing fetus in its mother's uterus.

.....

.....

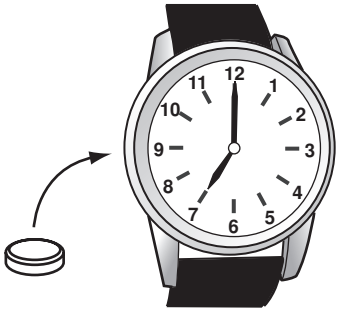
.....

..... [3]

2 In electrochemical cells (batteries), electrical energy is obtained from chemical reacti

(a) Fig. 2.1 shows some uses of electrochemical cells.

watch



torch (flashlight)

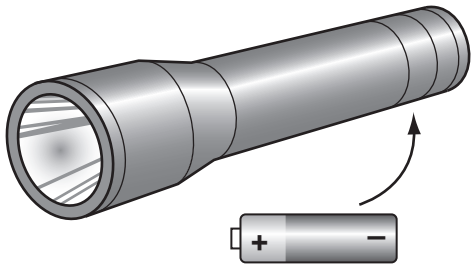


Fig. 2.1

(i) Electrochemical cells like those in Fig. 2.1 have to be replaced when they have stopped working.

Explain briefly what has happened inside the cells to cause them to stop working.

.....

..... [1]

(ii) State **one** reason why different cells are used in the watch and the torch (flashlight).

.....

..... [1]

(b) Some types of digital clocks use electrical energy which is obtained fr… electrochemical cell. These cells can be made by placing metal electrodes in… potato.

Fig. 2.2 shows a simplified diagram of such a clock.

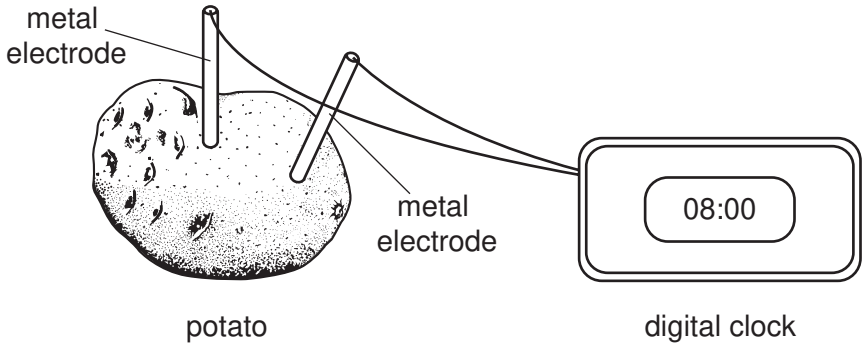


Fig. 2.2

(i) Suggest why a potato can be used as part of an electrochemical cell.

.....

..... [1]

(ii) State how the voltage supplied by the cell can be changed.

.....

..... [1]

(c) Some modern cars, known as hybrids, have two engines.

In one of these engines, hydrocarbon fuel is burnt to provide the energy required to move the car. In the other, electrical energy is provided by a powerful electrochemical cell.

At lower speeds, the electric engine drives the car and the other engine is switched off.

(i) Name a liquid hydrocarbon which is used as car fuel.

..... [1]

(ii) Name the process which is used to separate car fuel from petroleum.

..... [1]

(iii) Name **two** compounds which are produced when hydrocarbon fuel is burnt in a car engine.

1 .....

2 ..... [2]

(iv) Suggest why air pollution in towns and cities might be reduced if hybrid cars replaced ordinary cars.

.....

.....

.....

.....

..... [3]

3 **(a)** A student wrote down some properties of alpha, beta and gamma radiations.

Draw a line from each property to the correct radiation.

property	radiation
has no charge	
has no mass	alpha
passes through paper but stopped by a few millimetres of aluminium	
	beta
passes through several centimetres of lead	
contains positively charged particles	gamma
stopped by paper	

[3]

(b) Alpha, beta and gamma radiations are known as ionising radiations.

(i) Explain the meaning of the term *ionising radiation*.

.....

..... [1]

(ii) Explain why alpha radiation is more effective at ionising than beta radiation.

..... [1]

(iii) State **two** effects of ionising radiation on the human body.

1 .....

2 ..... [2]

4 Nitrogen compounds in soil are taken up by growing crops.

Fig.4.1 shows two ways in which nitrogen compounds may be added to soil used for growing crops.

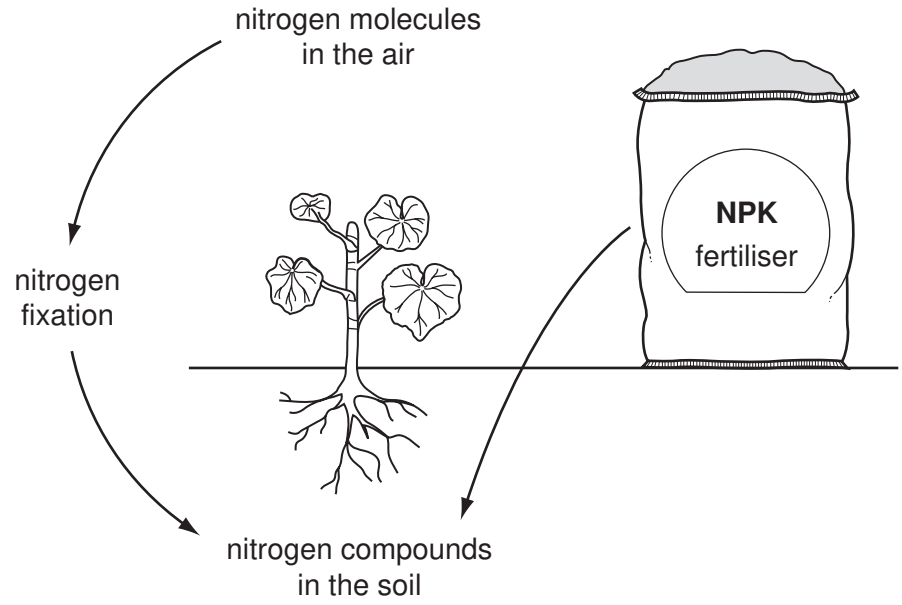


Fig. 4.1

(a) (i) State the meaning of the term *nitrogen fixation*.

.....

..... [1]

(ii) Outline **one** way in which nitrogen fixation occurs.

.....

.....

..... [2]

(iii) Explain why nitrogen molecules taken directly from the air **cannot** be used by most growing crops.

.....

..... [1]

(b) Table 4.1 shows how much of three elements, nitrogen, phosphorus and pota was removed from the soil by different crops. In this table, the elements are show their chemical symbols.

Table 4.1

crop	mass removed in kg / hectare		
	N	**P**	**K**
oats	72	13	18
sugar beet	86	14	302
wheat	115	22	26

(i) State the crop in Table 4.1 which took up the **highest** mass of potassium per hectare.

..... [1]

(ii) The sugar beet was planted in a field of 2.5 hectares.

Calculate the combined mass of nitrogen and phosphorus taken up by the crop of sugar beet.

Show your working.

.....kg [1]

(c) The nitrogen in NPK fertiliser exists in the form of compounds such as the ammonium nitrate, NH_4NO_3, and diammonium phosphate, $(NH_4)_2HPO_4$.

Ammonium nitrate is made by reacting ammonia with nitric acid.

(i) Name the type of chemical reaction which occurs between ammonia and nitric acid.

..... [1]

(ii) State the total number of atoms which are shown combined in the formula of diammonium phosphate.

..... [1]

(iii) Describe a chemical test to show whether a solution contains ammonium ions.

.....

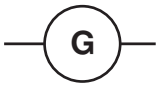
.....

.....

..... [3]

(d) Starch molecules are polymers of glucose.

(i) Draw a small section of a molecule of starch, using the symbol



to represent a glucose molecule.

[1]

(ii) **Name** the elements that are combined in glucose.

..... [1]

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Please turn over for Question 5.

5 **(a)** A student investigated the relationship between the potential difference across a lamp and the current in the lamp.

(i) List the apparatus she would need to carry out this investigation.

.....

.....

..... [2]

Fig. 5.1 shows a graph of the results of this investigation.

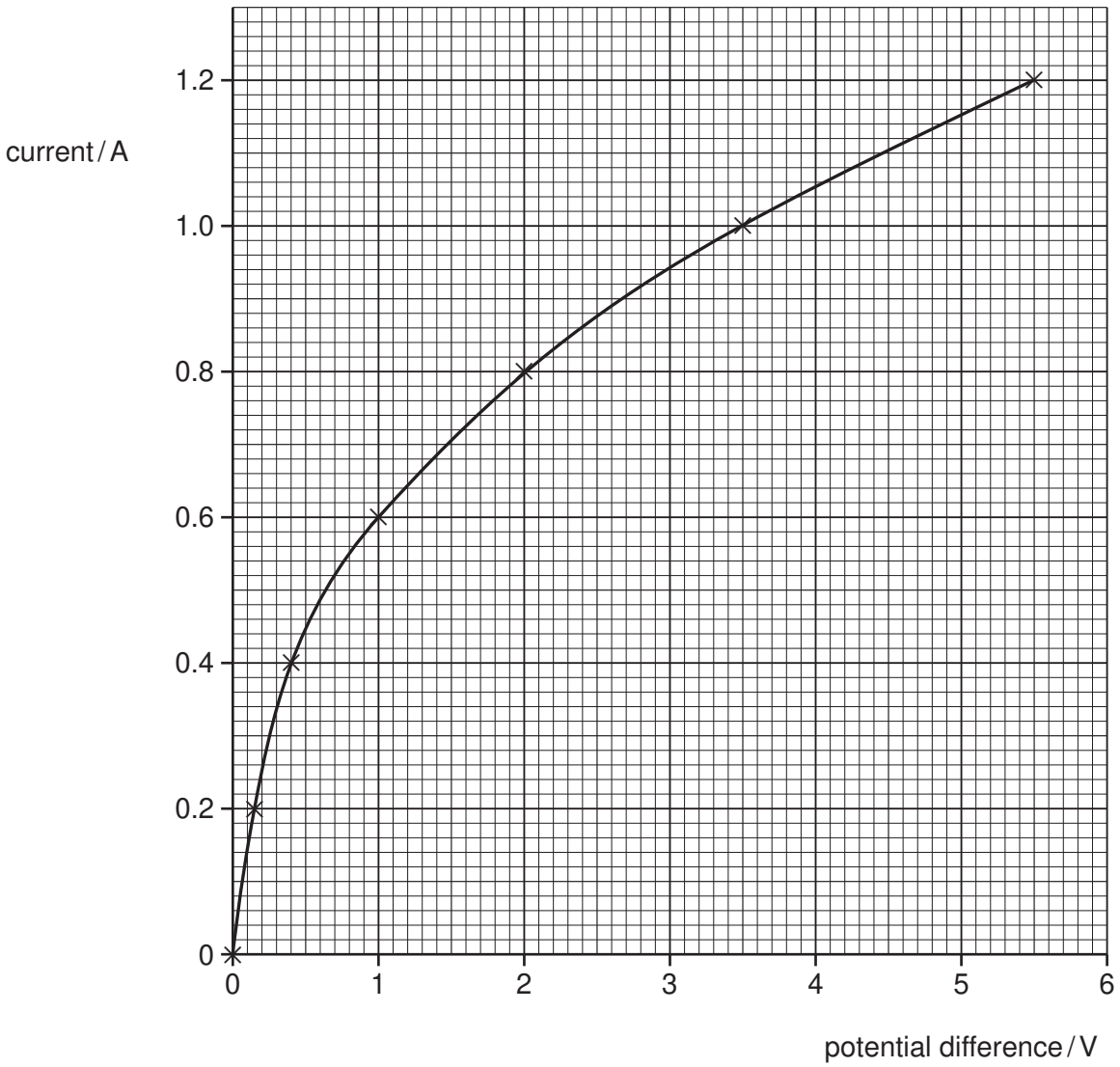

Fig. 5.1

(ii) Calculate the resistance of the lamp when the current was 0.6 A.

State the formula that you use and show your working.

formula used

working

..... ohms [2]

(b) (i) The generator at a power station supplies a current of 50 A at a voltage of 25 000 V.

Use the formula

power = voltage × current

to calculate the power output of the generator.

Show your working.

..... W [1]

(ii) Electrical energy is transmitted along cables at a very high voltage of 400 000 V.

Explain how this reduces the cost of supplying the electricity. Use the ideas of energy loss and current in your answer.

.....

.....

.....

..... [3]

(iii) State **two** properties of aluminium which make it suitable for overhead power cables.

1 .....

2 ..... [2]

6 Fig. 6.1 shows two plant cells. One has been placed in a blue dye and the other in a red dye.

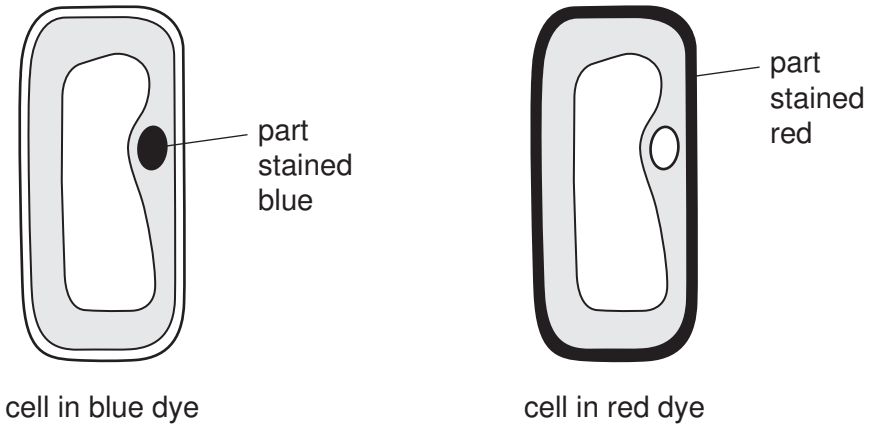

Fig. 6.1

(a) (i) Name the part of the cell that has been stained by each dye.

the blue dye .....

the red dye ..... [2]

(ii) Which dye(s) has passed through a cell membrane? Tick the correct box.

☐ neither blue or red

☐ both blue and red

☐ blue only

☐ red only [1]

(iii) Which dye(s) would stain part of an animal cell? Tick the correct box.

☐ neither blue or red

☐ both blue and red

☐ blue only

☐ red only [1]

(b) (i) Cells from the palisade layer of a leaf contain structures **not** shown in Fig. 6.

These structures contain a green pigment that absorbs energy from sunlight. Th
energy is used to help the plant to make its own food.

On the cell in blue dye in Fig. 6.1, **draw** and **name** one of these structures. [2]

(ii) Describe how a plant makes its own food.

.....

.....

.....

..... [3]

(iii) Explain how the process you have described in **(ii)** benefits animals.

.....

.....

.....

..... [3]

7 An athlete is running in a sprint race.

(a) Fig. 7.1 shows the athlete's speed during the race.

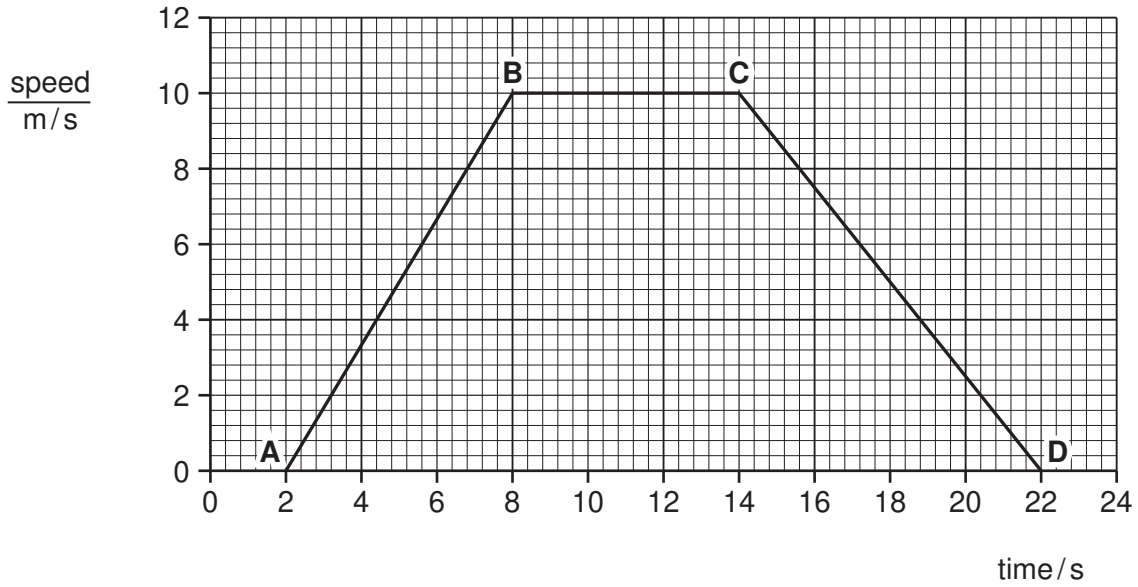

Fig. 7.1

(i) Describe the athlete's motion between **B** and **C**.

.....

..... [1]

(ii) Describe the athlete's motion between **C** and **D**.

.....

..... [1]

(b) Complete the sentence by choosing suitable words.

As the athlete runs, the ..... energy in the food he has eaten changes to ..... energy and heat energy. [2]

(c) At the end of the race, evaporation helps to cool the athlete.

(i) Use the idea of particles to explain how evaporation helps the athlete to cool down.

.....

.....

..... [2]

(ii) At the end of a long race, an athlete may be wrapped in a shiny foil bla
prevent him cooling down too quickly.

Explain how the shiny foil blanket helps reduce energy losses. Use ideas about conduction, convection and radiation in your answer.

.....

.....

.....

..... [3]

8 **(a)** The disease cystic fibrosis is caused by a recessive allele, **f**, of a gene. The sym
the normal, dominant allele is **F**.

(i) State the genotype of a person with cystic fibrosis.

..... [1]

(ii) State the phenotype of a person who is heterozygous for cystic fibrosis.

..... [1]

(iii) Explain why a person who has the alleles **FF** cannot have a child with cystic fibrosis.

You can use a genetic diagram as part of your answer if it helps your explanation.

.....

.....

.....

..... [3]

(b) A person with cystic fibrosis often has a blockage of the duct that leads from the pancreas into the alimentary canal.

This duct usually carries pancreatic juice, which contains the enzymes amylase, protease and lipase.

(i) Describe the function of amylase.

.....

..... [2]

(ii) Explain why a person with a blocked pancreatic duct will not be able to absorb as many nutrients from their food as a person with a normal pancreatic duct.

.....

.....

..... [2]

9 Fig. 9.1 shows the driving force and frictional force acting on a car of mass 1
travelling at a constant speed of 18 m / s.

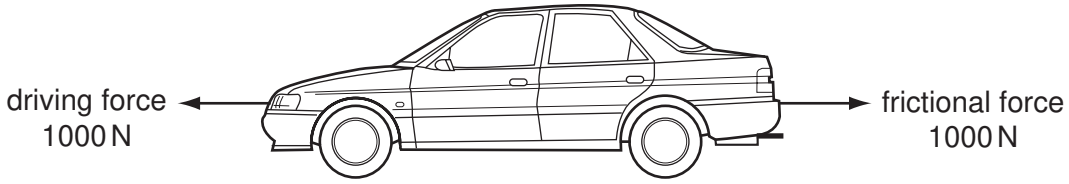

Fig. 9.1

(a) (i) Calculate the distance travelled in one minute.

.....m [1]

(ii) Calculate the work done by the driving force in one minute.

State the formula that you use and show your working.

formula used

working

..... J [2]

(b) Explain, in terms of forces, why the car is travelling at a constant speed.

.....

..... [1]

(c) Fig. 9.2 shows a car on a hydraulic lift in a garage. The total weight being lifted is 18 000 N. The lift uses four large pistons. Each large piston has an area of 0.03 m^2. The smaller piston **X** has an area of 0.01 m^2.

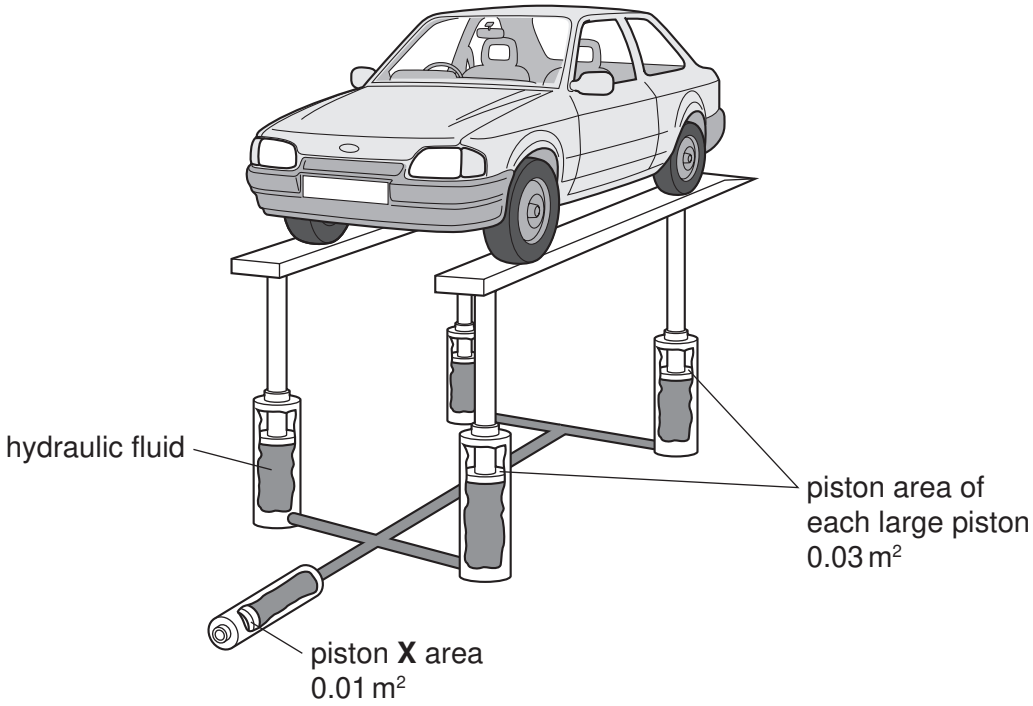

Fig. 9.2

(i) Calculate the total area of the four large pistons.

..... m^2 [1]

(ii) Use the formula

pressure = force / area

to calculate the pressure in the hydraulic fluid used in the lift.

Show your working.

..... N/m^2 [1]

(iii) This pressure is caused by piston **X**.

Calculate the minimum force which piston **X** must exert to lift the car.

Show your working.

..... N [2]

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Please turn over for Question 10.

10 Table 10.1 shows some properties of five elements, **P** to **T**. The code letters are **n**... chemical symbols of the elements.

Table 10.1

element code letter	melting point / °C	boiling point / °C	conduction of electricity	number of outer electrons in an atom
P	-89	-186	insulator	8
Q	650	1090	conductor	2
R	-7	58	insulator	7
S	181	1342	conductor	1
T	-220	-188	insulator	7

Answer the following questions, using **only** the elements shown in the table.

(a) (i) State and explain which elements are from the same **group** of the Periodic Table.

elements .....

explanation .....

..... [1]

(ii) State and explain which elements are metals.

elements .....

explanation .....

..... [1]

(iii) State and explain which elements are gases at a room temperature of 20 °C.

elements .....

explanation .....

..... [1]

(b) Fig. 10.1 shows atoms of the two elements **R** and **S**. Only the outer electron she
shown.

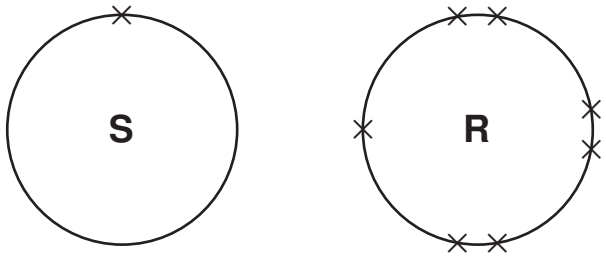

Fig. 10.1

When element **R** reacts with element **S** the atoms of both elements change and become **ions**.

(i) Describe, in terms of electrons, how an atom of element **S** would change into an ion.

.....

..... [1]

(ii) Predict and explain whether the compound formed between elements **S** and **R** is likely to be a solid, liquid or gas at room temperature.

Explain your answer.

state .....

explanation .....

.....

..... [3]

(c) The element bromine is produced when compounds dissolved in seawater react with chlorine.

The word equation for a typical reaction producing bromine is shown below.

chlorine + sodium bromide ⟶ sodium chloride + bromine

(i) State the colour change which would show that bromine is produced in this reaction.

..... [1]

(ii) Explain briefly, in terms of reactivity, why these reactants produce bromine.

.....

..... [1]

DATA SHEET
The Periodic Table of the Elements

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