Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4472/01

W16-4472-01

ADDITIONAL SCIENCE/CHEMISTRY

CHEMISTRY 2
FOUNDATION TIER

P.M. TUESDAY, 12 January 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**5**	
3.	**7**	
4.	**7**	
5.	**4**	
6.	**5**	
7.	**7**	
8.	**6**	
9.	**5**	
10.	**6**	
Total	**60**	

4472
010001

ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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 in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

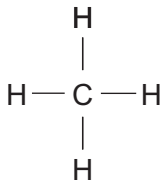
Assessment will take into account the quality of written communication (QWC) in your answer to question **10**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

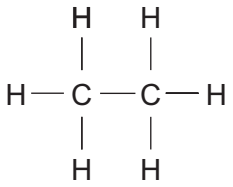
Examiner only

Answer **all** *questions.*

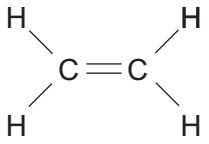
1. *(a)* The structural formulae of some hydrocarbons are shown below.



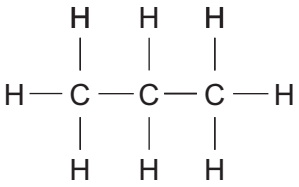
A



B



C



D

(i) Give the **letter** of the hydrocarbon called methane. [1]

.....

(ii) Give the **letter** of the hydrocarbon used to make polythene. [1]

.....

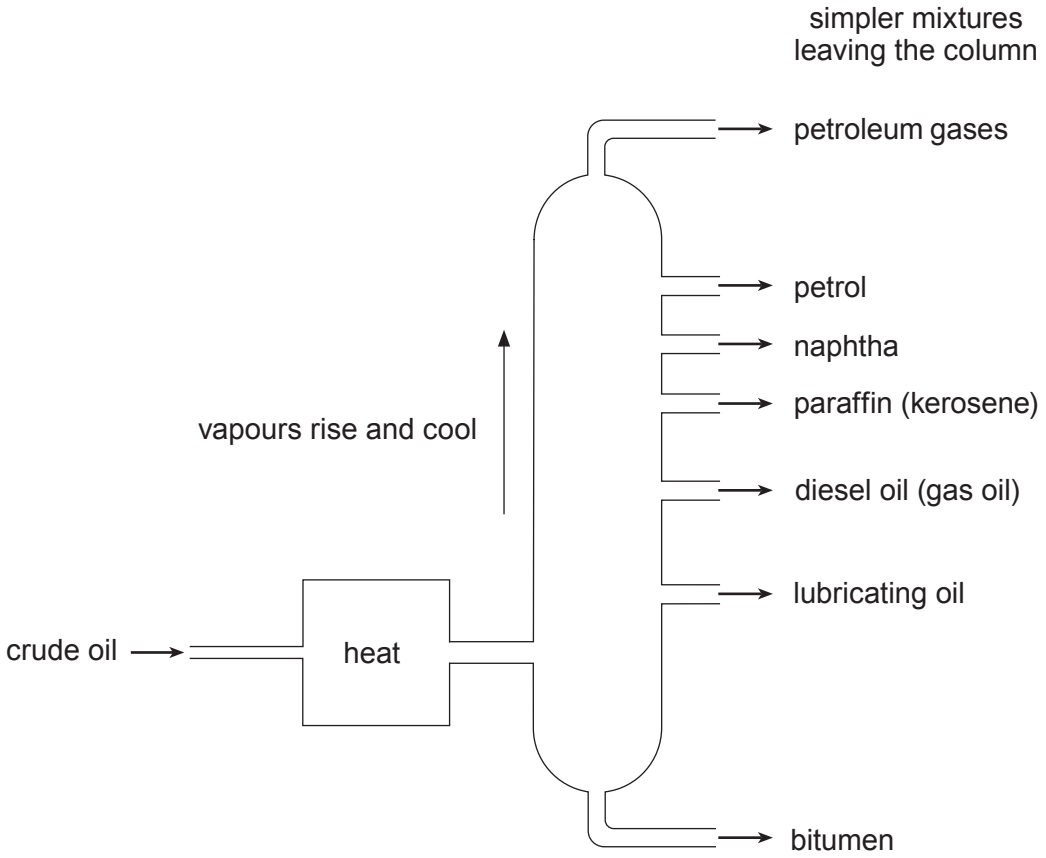
(iii) Give the **letter** of the hydrocarbon represented by the molecular formula C_2H_6. [1]

.....

(b) An alkane contains four carbon atoms and ten hydrogen atoms. Draw its **structural formula**. [1]

Examiner only

(c) The diagram below shows how crude oil is separated in a fractionating column.



boiling point	**condensation**	**colour**	**freezing**	**fractions**
fractional distillation	**polymers**	**polymerisation**	**melting point**	**boiling**

Use **only** terms from the box above to answer parts (i)-(iv).

(i) Name the change of state that takes place when crude oil is heated. [1]

.....

(ii) Name the change of state that takes place when vapours cool. [1]

.....

(iii) State the general name given to the simpler mixtures leaving the column. [1]

.....

(iv) Hydrocarbons of similar size are collected at the same level. State the property on which this depends. [1]

.....

Examiner only

2. *(a)* The table below shows the properties of the particles found in atoms.

Particle	Mass	Charge
proton	1	+1
neutron	1	0
electron	very small	-1

(i) All atoms are neutral. Name the **two** particles **always** found in equal numbers in atoms. [1]

..... and .....

(ii) Name the particle **not** found in the nucleus of an atom. [1]

.....

(iii) The mass number of a beryllium atom is 9. It contains 4 protons. Give the number of neutrons found in this atom. [1]

.....

(b) Calculate the relative formula mass (M_r) of sodium hydrogencarbonate, $NaHCO_3$. [2]

$A_r(H) = 1$ $A_r(C) = 12$ $A_r(O) = 16$ $A_r(Na) = 23$

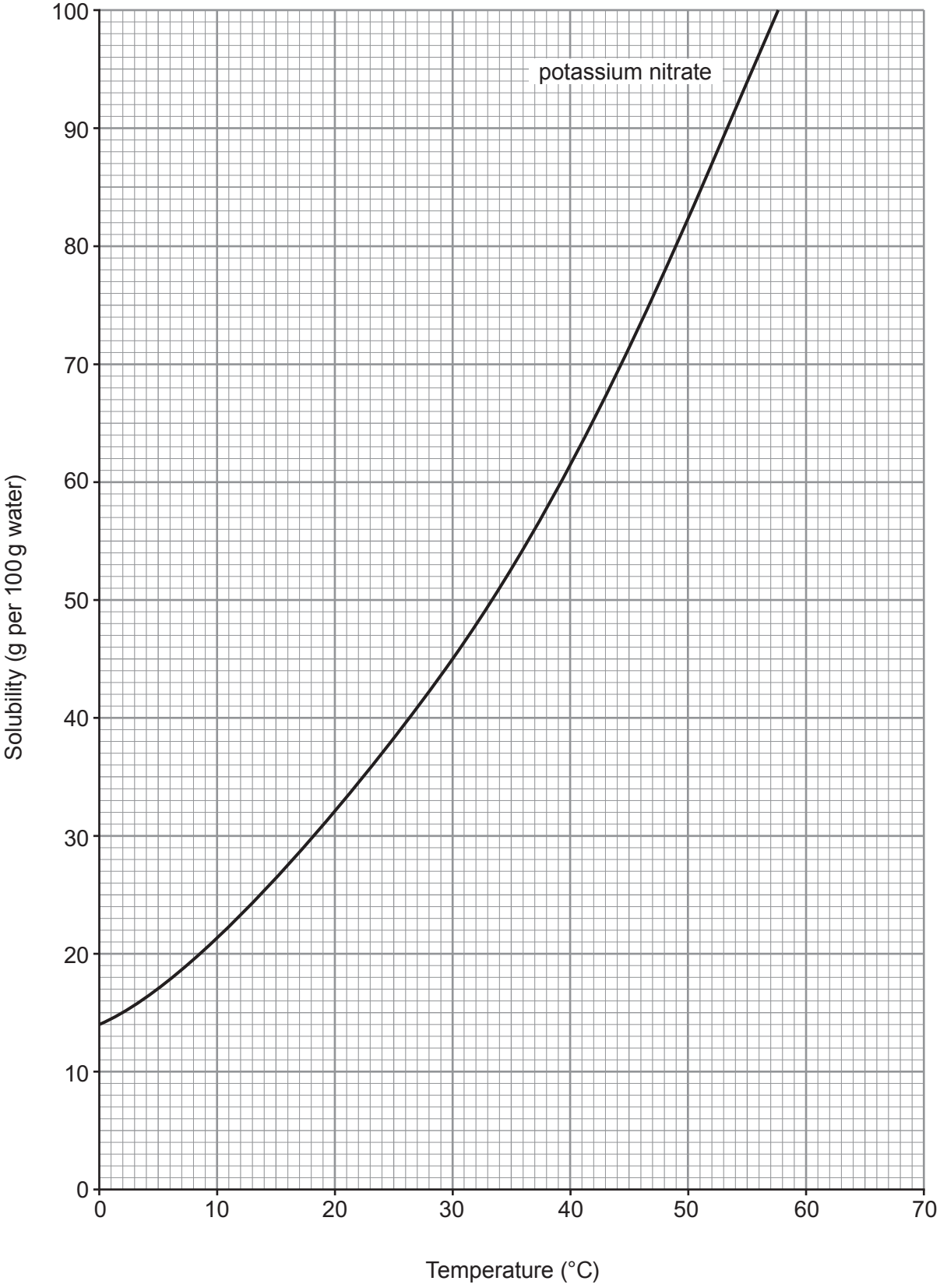
$M_r(NaHCO_3)$ = ...

5

BLANK PAGE

Examiner only

3. *(a)* The graph below shows how the solubility of potassium nitrate in water changes with temperature.



Examiner only

The table below shows the solubility of potassium bromide in water at different temperatures.

Temperature (°C)	0	20	40	60
Solubility (g per 100 g water)	53	64	75	86

(i) Plot the results from the table on the grid opposite and draw a suitable line. [3]

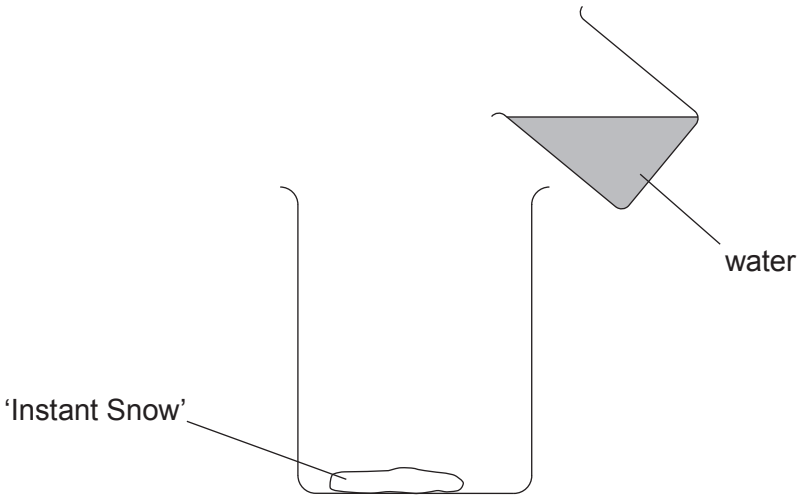
(ii) Use your line to predict the solubility of potassium bromide at 70 °C. [1]

Solubility = ... g per 100 g water

(iii) Give the temperature at which the two compounds have the **same** solubility. [1]

Temperature = ... °C

(b) 'Instant Snow' is a hydrogel and is used to make fake snow.



1 g of 'Instant Snow' is put into a beaker and 150 cm^3 of water added.

Describe what you would **see** when the water is added to the hydrogel. [2]

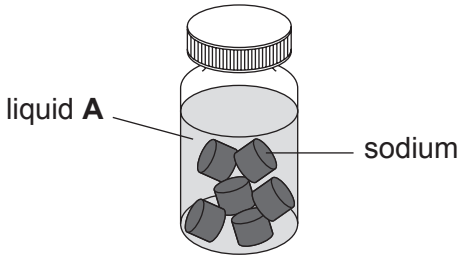
.....

.....

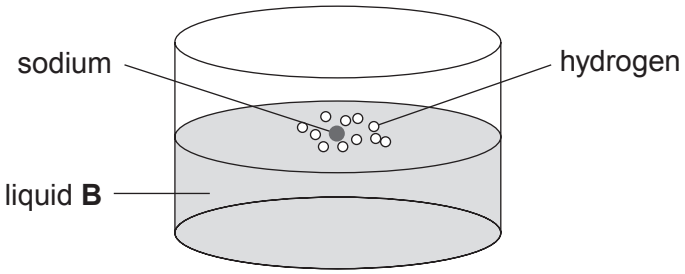
Turn over.

4472 010007

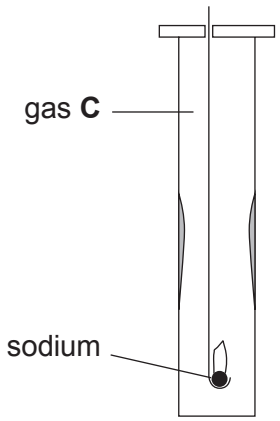
4. *(a)* The diagrams below show the storage and some reactions of the metal sodium.



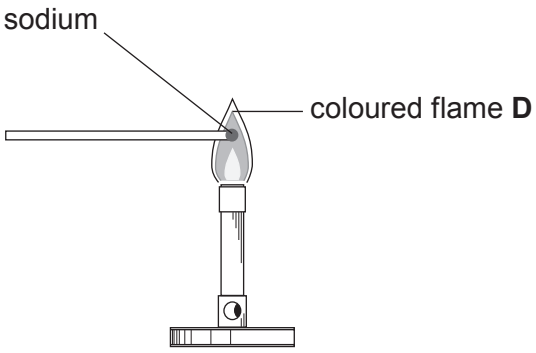
Sodium is stored in liquid **A**



Sodium reacts quickly with liquid **B** forming hydrogen gas and sodium hydroxide solution



Sodium forms sodium chloride when burned in gas **C**



A flame test using sodium gives coloured flame **D**

Examiner only

Use **only** words from the box below to answer parts (i) and (ii).

oxygen	**hydrogen**	**water**	**lilac**	
bromine	**oil**	**yellow**	**chlorine**	**red**

(i) Give the name of [3]

liquid **A**, ...

liquid **B**, ...

gas **C**. .....

(ii) Give the colour of flame **D**. ..... [1]

(b) State **one** safety precaution a teacher would take when using sodium in a laboratory. [1]

.....

(c) Complete and balance the equation for the reaction between sodium and oxygen. [2]

$$\square\,Na + O_2 \longrightarrow \square$$ .....

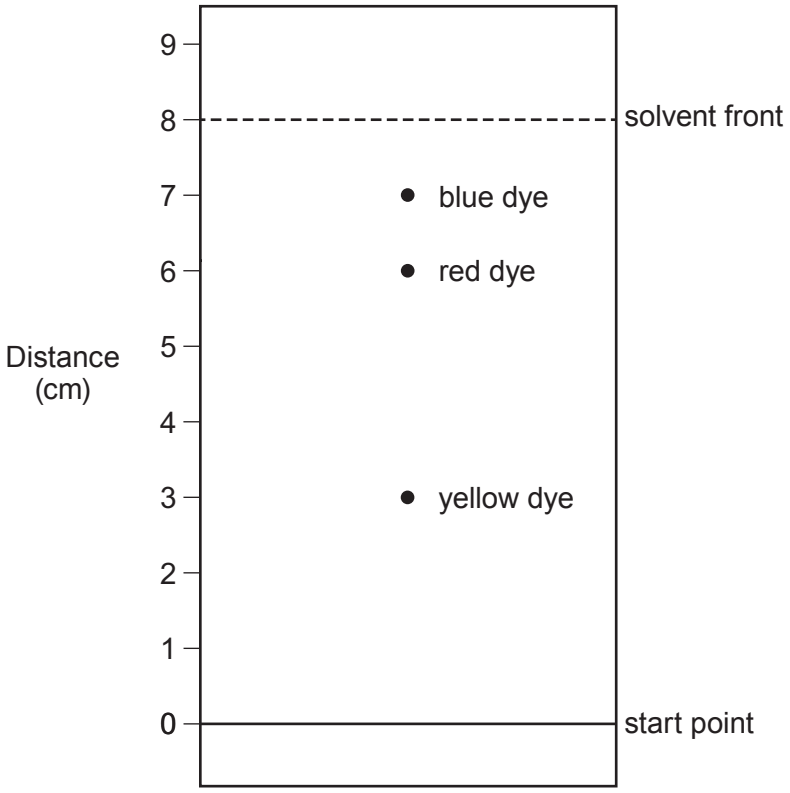
4472 010009

7

Turn over.

Examiner only

5. The chromatogram of a black ink is shown below.



(a) Explain why the different dyes separate. [2]

.....

.....

.....

(b) The R_f value of a substance is given by the formula:

$$R_f = \frac{\text{distance moved by the substance}}{\text{distance moved by the solvent front}}$$

State which dye has the R_f value of 0.75. Show your working. [2]

Dye .....

4

Examiner only

6. *(a)* The table below shows the ions present in four different bottled waters from Wales, France, Austria and Scotland.

Ions present	Typical analysis (mg/l)			
	Bottled water			
	Wales	France	Austria	Scotland
calcium	12	80	132	40
magnesium	8	26	63	10
potassium	2	1	3	1
sodium	12	6	16	6
hydrogencarbonate	67	360	413	150
chloride	15	7	5	6
sulfate	17	13	277	5

Explain, in terms of the ions present, which is the hardest water. [2]

.....

.....

(b) The pictures below show how water pipes and heating elements can be affected by hard water.

water pipe

electric kettle heating element

Give the name of the substance formed and state why its formation is considered a disadvantage in both of these examples. [3]

.....

.....

.....

5

Examiner only

7. *(a)* Complete the following table of information about atoms of some elements. [5]

Symbol	Number of protons	Number of neutrons	Number of electrons
$^{19}_{9}F$	9	10	9
$^{35}_{17}Cl$	.....	18	.....
$^{16}_{8}O$	8	.....	8
.....	8	10	.....

(b) **From the table** give the names of the two **different** elements found in the same period in the Periodic Table. [1]

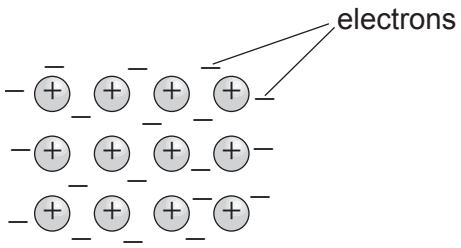
..... and .....

(c) Using × to represent an electron, draw the electronic structure of fluorine. [1]

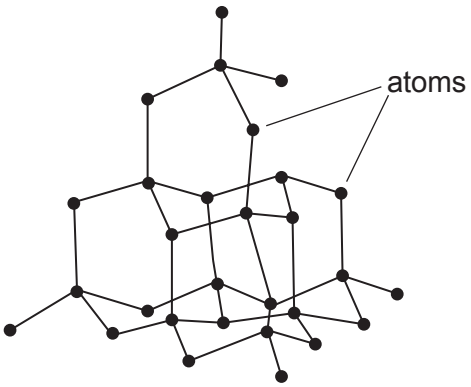
7

Examiner only

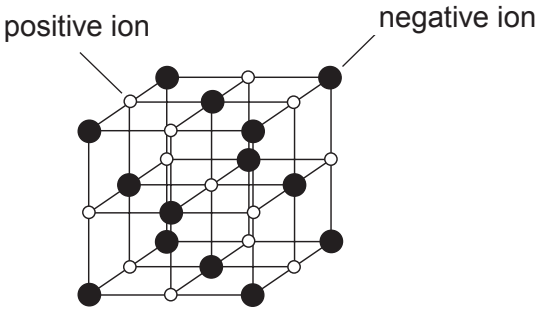
8. The following diagrams show the structures of some substances.



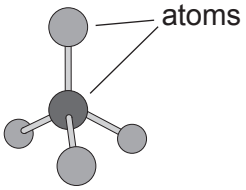
A



B



C



D

(a) Name the types of giant structure shown in **A** and **C**. [2]

A .....

C .....

(b) (i) State which substance, **A**, **B**, **C** or **D**, conducts electricity when solid. Give a reason for your answer. [2]

Letter .....

Reason .....

.....

(ii) State which substance, **A**, **B**, **C** or **D**, is a compound with a high melting point. Give a reason for your answer. [2]

Letter .....

Reason .....

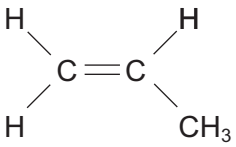
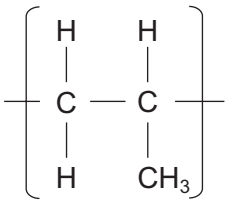
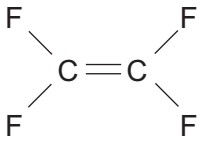
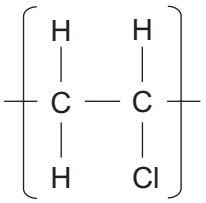
.....

Turn over.

Examiner only

9. *(a)* The table below shows some information about monomers and the polymers that can be made from them. [3]

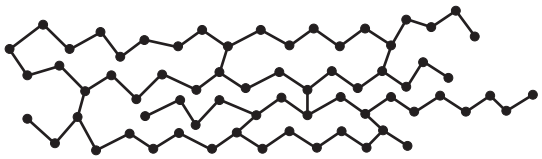
Complete the table.

Name of monomer	Structural formula of monomer	Name of polymer	Repeating unit for the polymer
propene		.....	
tetrafluoroethene		polytetrafluoroethene PTFE	.....
vinylchloride	.....	polyvinylchloride PVC	

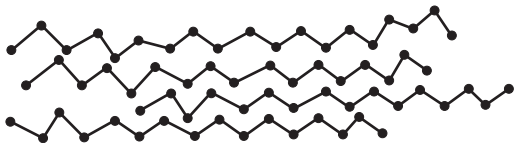
Examiner only

(b) 'PEX' is a form of polythene used to make domestic hot water pipes.

The structures below show the polymer structures of PEX and polythene.



PEX



polythene

Explain, in terms of structure, why PEX is better for making domestic hot water pipes than polythene. [2]

.....

.....

.....

5

Turn over.

Examiner only

10. The diagram below shows the main stages in the treatment of public water supplies.

Describe what happens in each stage of the process. [6 QWC]

6

END OF PAPER

BLANK PAGE

BLANK PAGE

FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

Turn over.

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}H$ Hydrogen									$^{4}_{2}He$ Helium
$^{7}_{3}Li$ Lithium	$^{9}_{4}Be$ Beryllium											$^{11}_{5}B$ Boron	$^{12}_{6}C$ Carbon	$^{14}_{7}N$ Nitrogen	$^{16}_{8}O$ Oxygen	$^{19}_{9}F$ Fluorine	$^{20}_{10}Ne$ Neon
$^{23}_{11}Na$ Sodium	$^{24}_{12}Mg$ Magnesium											$^{27}_{13}Al$ Aluminium	$^{28}_{14}Si$ Silicon	$^{31}_{15}P$ Phosphorus	$^{32}_{16}S$ Sulfur	$^{35}_{17}Cl$ Chlorine	$^{40}_{18}Ar$ Argon
$^{39}_{19}K$ Potassium	$^{40}_{20}Ca$ Calcium	$^{45}_{21}Sc$ Scandium	$^{48}_{22}Ti$ Titanium	$^{51}_{23}V$ Vanadium	$^{52}_{24}Cr$ Chromium	$^{55}_{25}Mn$ Manganese	$^{56}_{26}Fe$ Iron	$^{59}_{27}Co$ Cobalt	$^{59}_{28}Ni$ Nickel	$^{64}_{29}Cu$ Copper	$^{65}_{30}Zn$ Zinc	$^{70}_{31}Ga$ Gallium	$^{73}_{32}Ge$ Germanium	$^{75}_{33}As$ Arsenic	$^{79}_{34}Se$ Selenium	$^{80}_{35}Br$ Bromine	$^{84}_{36}Kr$ Krypton
$^{86}_{37}Rb$ Rubidium	$^{88}_{38}Sr$ Strontium	$^{89}_{39}Y$ Yttrium	$^{91}_{40}Zr$ Zirconium	$^{93}_{41}Nb$ Niobium	$^{96}_{42}Mo$ Molybdenum	$^{99}_{43}Tc$ Technetium	$^{101}_{44}Ru$ Ruthenium	$^{103}_{45}Rh$ Rhodium	$^{106}_{46}Pd$ Palladium	$^{108}_{47}Ag$ Silver	$^{112}_{48}Cd$ Cadmium	$^{115}_{49}In$ Indium	$^{119}_{50}Sn$ Tin	$^{122}_{51}Sb$ Antimony	$^{128}_{52}Te$ Tellurium	$^{127}_{53}I$ Iodine	$^{131}_{54}Xe$ Xenon
$^{133}_{55}Cs$ Caesium	$^{137}_{56}Ba$ Barium	$^{139}_{57}La$ Lanthanum	$^{179}_{72}Hf$ Hafnium	$^{181}_{73}Ta$ Tantalum	$^{184}_{74}W$ Tungsten	$^{186}_{75}Re$ Rhenium	$^{190}_{76}Os$ Osmium	$^{192}_{77}Ir$ Iridium	$^{195}_{78}Pt$ Platinum	$^{197}_{79}Au$ Gold	$^{201}_{80}Hg$ Mercury	$^{204}_{81}Tl$ Thallium	$^{207}_{82}Pb$ Lead	$^{209}_{83}Bi$ Bismuth	$^{210}_{84}Po$ Polonium	$^{210}_{85}At$ Astatine	$^{222}_{86}Rn$ Radon
$^{223}_{87}Fr$ Francium	$^{226}_{88}Ra$ Radium	$^{227}_{89}Ac$ Actinium															

Key: