Paper Reference (complete below)

| | | | . | / | | |

Surname

Initial(s)

Signature

Materials required for examination
Calculator

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, surname and initials, the paper reference and your signature. The paper reference is shown above. If more than one paper reference is shown, you should write the one for which you have been entered.
Answer ALL questions in the spaces provided in this book.
Show all stages in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for the various questions are shown in round brackets: e.g. (**2**).
This paper has eight questions. There are no blank pages.

Turn over

Edexcel
Success through qualifications

THE PERIODIC TABLE

Group

Period	1	2												3	4	5	6	7	0
1								1 **H** Hydrogen 1											4 **He** Helium 2
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
3	23 **Na** Sodium 11	24 **Mg** Magnesium 12												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
4	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	63.5 **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
5	85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	99 **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
6	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
7	223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89																

Key

Relative atomic mass
Symbol
Name
Atomic number

1. The diagram shows a cross-section through some layers of rock.

limestone

marble

igneous rock
(large crystals)

Not to
scale
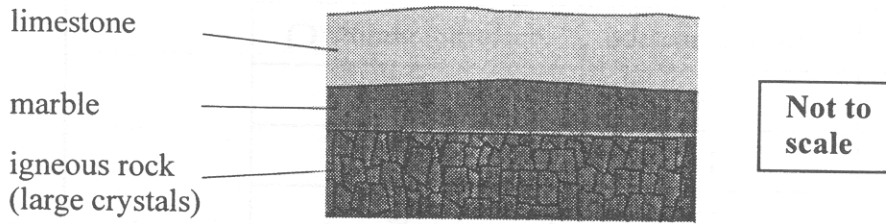
(a) Rocks may be classified as igneous, metamorphic or sedimentary.
What type of rock is

(i) limestone?

....

(1)

(ii) marble?

....

(1)

(b) (i) Explain how igneous rock is formed.

....

....

(2)

(ii) This igneous rock has formed as **large** crystals.
Explain why.

....

(1)

(c) Suggest how the marble was formed in the rock layers shown above.

....

....

....

....

....

(4)

(Total 9 marks)

Q1

Turn over

2. The table shows information about some metallic elements in the periodic table.

element	atomic number	melting point (°C)
lithium	3	180
sodium	11	98
rubidium	37	39
caesium	55	29

(a) (i) What is the name of this group of elements?

....

(1)

(ii) There are two elements in this group which are not listed in the table above.
One is potassium.
Use the periodic table to find the name of the other missing element.

....

(1)

(b) (i) Use the grid to draw a graph of melting point of the metals listed against the
atomic number.
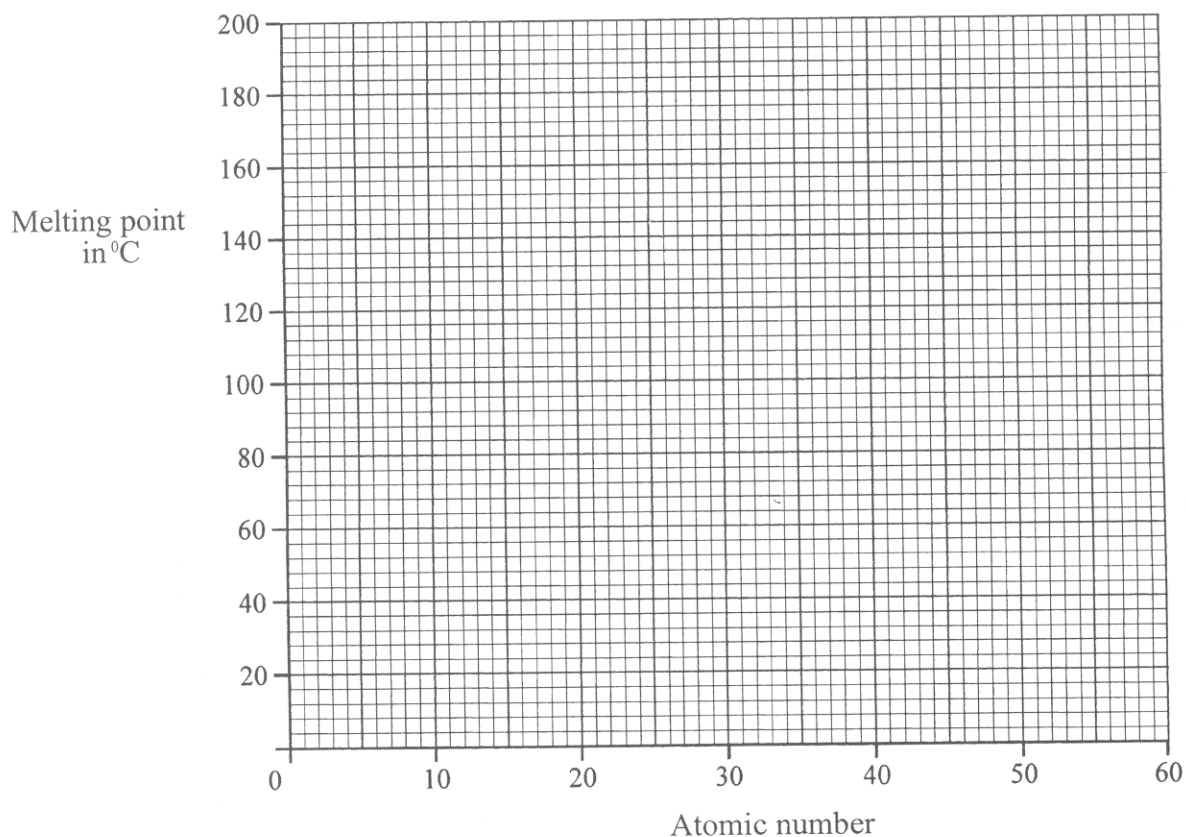
(3)

(ii) Use the graph to describe how the melting points of these elements change with the atomic number.

....

....

(2)

(iii) Use the periodic table to find the atomic number of potassium.
Then use the graph to suggest a value for the melting point of potassium.

atomic number...

melting point...

(3)

(iv) Suggest, in terms of the strength of the forces between the metal atoms, why sodium has a lower melting point than lithium.

....

....

(1)

(c) During the process of melting, heat is taken in from the surroundings.

(i) What is the name of this type of process, in which heat is taken in?

....

(1)

(ii) Explain why heat is needed to melt a substance.

....

....
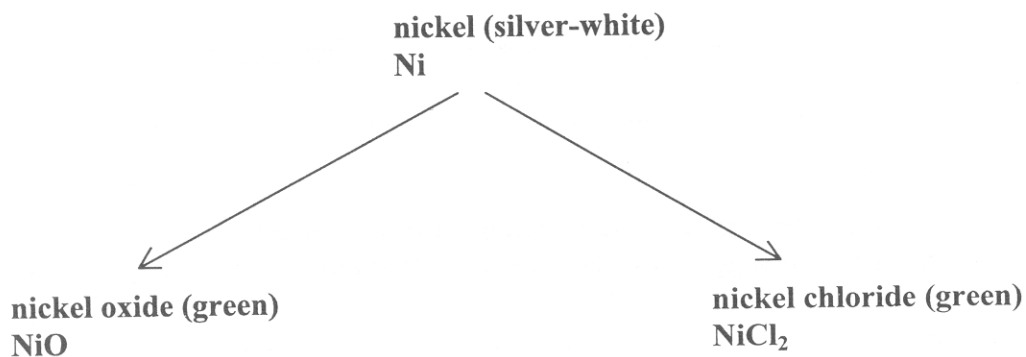
(1)

Q2

(Total 13 marks)

TURN OVER FOR QUESTION 3

Turn over

3. The diagram shows the colours and formulae of a transition metal and two of its compounds.

<div align="center">

nickel (silver-white)
Ni

nickel oxide (green)   **nickel chloride (green)**
NiO   **NiCl$_2$**

</div>

(a) Nickel reacts with oxygen to form nickel oxide.
Write the balanced equation for this reaction.

....

(2)

(b) Nickel chloride can be formed by passing a gas over heated nickel.
Suggest the name of the gas used for this reaction.

....

(1)

(c) State **one** typical property of transition metal compounds which is shown by nickel oxide and nickel chloride.

....

(1)

(d) Zinc displaces nickel from a solution of nickel chloride.
Copper does not react with nickel chloride solution.

(i) What does this information tell you about the reactivity of copper and of zinc compared with that of nickel?

....

....

(2)

(ii) Write the word equation for the reaction between zinc and nickel chloride.

....

....

(2)

(e) Margarine is made by reacting hydrogen gas with vegetable oil.
Nickel is used as a catalyst for this reaction.

(i) Explain what a catalyst does.

....

....

(1)

(ii) Another transition metal is used as a catalyst in the manufacture of ammonia by the Haber process.
Give the name of this catalyst and the names of the **two** gases used in the manufacture of ammonia.

catalyst...

gas 1 ....

gas 2 ....

(3)

Q3

(Total 12 marks)

TURN OVER FOR QUESTION 4

4. This question is about the element sulphur and some of its compounds.

(a) Sulphur exists as two different types of atoms, **X** and **Y**.

(i) Complete the table.

sulphur atom	atomic number	mass number	number of protons	number of neutrons	number of electrons
X	16	32	16	16	16
Y	....	34	....	....	....

(2)

(ii) What name is given to different types of atom of the same element?

....

(1)

(b) Sulphur atoms have six electrons in their outer shell.
They can form sulphide ions by gaining electrons.

How many electrons does each sulphur atom gain to form a sulphide ion?
Give a reason for your answer.

....

....

(2)

(c) Sulphur and hydrogen combine to form a poisonous gas called hydrogen sulphide.

(i) In this compound, hydrogen and sulphur atoms are bonded together by sharing pairs of electrons.

What is the name of this type of bonding?

....

(1)

(ii) Calculate the relative formula mass of hydrogen sulphide, H_2S.

(Relative atomic masses: H = 1.0; S = 32)

....

(1)

(d) Hydrogen sulphide is found as an impurity in natural gas.
Hydrogen sulphide reacts with oxygen to form sulphur dioxide, SO_2.
Sulphur dioxide gas causes pollution in the atmosphere.

(i) Explain why sulphur dioxide in the atmosphere is harmful.

....

....

(2)

(ii) Suggest reasons why hydrogen sulphide is removed from natural gas before the natural gas is used as a fuel.

....

....

....

(2)

Q4

(Total 11 marks)

**TURN OVER FOR QUESTION 5**

5. An experiment is carried out to investigate how the rate of reaction of magnesium with hydrochloric acid varies with temperature.

A 2 cm strip of magnesium ribbon is measured with a ruler and 50 cm³ of hydrochloric acid is measured with a measuring cylinder.

The beaker of acid is heated to the required temperature using a Bunsen burner.
The beaker is placed on a heatproof mat and the magnesium strip added immediately.
The time taken for all of the magnesium to react is measured with a stopwatch.

hydrochloric
acid

magnesium
ribbon
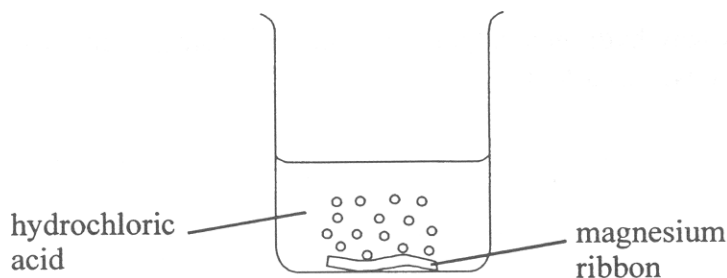
The results of the experiment are shown in the table.

temperature (°C)	reaction time (s)
20	58
30	42
40	30
50	23

(a) (i) Use the results to describe how the rate of reaction varies with temperature.

....

....

(2)

(ii) Explain, in terms of particles, why the rate varies in this way.

....

....

....

....

(3)

(iii) The reaction is exothermic.
Explain why this affects the validity of the results.

....

....

....

....

(2)

(b) Suggest **two** improvements in the experimental procedure indicated above, to improve the accuracy or validity of the results.

1..

....

2..

....

(2)

(c) The magnesium is in the form of a flat strip.
Predict and explain the effect on the rate of reaction, if any, of cutting the 2 cm magnesium strip into smaller pieces.

....

....

....

....

....

....

(3)

Q5

(Total 12 marks)

TURN OVER FOR QUESTION 6

6. A hydrogen chloride molecule, HCl, is covalent.

   (a) (i) Draw a dot and cross diagram of one molecule of hydrogen chloride.
           Show the outer electrons only.

                                                                              (2)

   (ii) Explain why liquid hydrogen chloride has a low boiling point.

   ....

   ....

   ....

                                                                              (1)

(b) When dissolved in water, hydrogen chloride forms hydrogen ions (H^+) and chloride ions (Cl^-).

(i) Draw a diagram of a chloride ion, showing the outer electrons only.

(1)

(ii) Electrolysis of this solution produces hydrogen.
Write the equation showing the formation of hydrogen from hydrogen ions.

....

(2)

(c) Hydrochloric acid is an aqueous solution of hydrogen chloride. Strontium metal, Sr, reacts vigorously with dilute hydrochloric acid to form strontium chloride, $SrCl_2$, and hydrogen.

What information does this reaction give about the position of strontium in the reactivity series? Explain your answer.

....

....

(2)

(Total 8 marks)

Q6

TURN OVER FOR QUESTION 7

7. (a) In industry, chlorine can be manufactured from sodium chloride.
Describe this process, starting from solid sodium chloride.

....

....

....

....

....

(4)

(b) Chlorine is toxic.

(i) Explain why it is used in the purification of water.

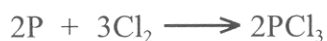...

....

(1)

(ii) Suggest why it is safe to drink this purified water, even though a toxic substance has been added.

....

....

(1)

(c) Phosphorus reacts with chlorine to form phosphorus trichloride, PCl_3.
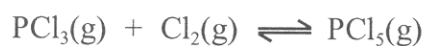The equation for the reaction is

$$2P + 3Cl_2 \longrightarrow 2PCl_3$$

Calculate the maximum mass of phosphorus trichloride that can be made from 0.93 g of phosphorus.
(Relative atomic masses: P = 31; Cl = 35.5)

....

....

....

....

(3)

(d) Phosphorus forms two chlorides which can exist as gases in equilibrium.

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$$

The formation of phosphorus pentachloride (PCl_5) in this way is exothermic.

State the effect on the amount of phosphorus pentachloride present at equilibrium if

(i) the temperature is increased..

(1)

(ii) the pressure is increased...

(1)

(iii) a catalyst is added...

(1)

(e) Carbon can form a chloride.
0.36 g of carbon is present in 4.62 g of carbon chloride.
Calculate the empirical formula of this chloride.

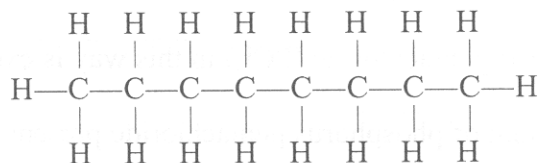(Relative atomic masses: C = 12; Cl = 35.5)

....

....

....

....

....

(4)

(Total 16 marks)

Q7

TURN OVER FOR QUESTION 8

8. Petrol is a mixture of hydrocarbons.
   The structure of a molecule of one hydrocarbon is:

$$H-C-C-C-C-C-C-C-C-H$$

(with H atoms above and below each of the 8 carbons)

(a) (i) What is the formula of this molecule?

   ....

   (1)

   (ii) Explain why this compound is an alkane.

   ....

   ....
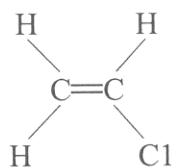
   (2)

   (iii) The formula of another alkane is C_6H_{14}.
   Write the balanced equation, including state symbols, for the complete combustion of this compound.

   ....

   (4)

(b) The molecule below is chloroethene.

   $$C=C$$
   (with H, H on left carbon; H, Cl on right carbon)

   Explain how chloroethene polymerises (forms a polymer).

   ....

   ....

   ....

   (2)

   (Total 9 marks)

   TOTAL FOR PAPER : 90 MARKS

Q8