Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

236/02

SCIENCE

HIGHER TIER (Grades D-A*)

CHEMISTRY 1

P.M. FRIDAY, 19 January 2007

(45 minutes)

For Examiner's use only	
Total Marks	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

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.

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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

Answer **all** *questions.*

1. *(a)* Use the **data** and **key** on the Periodic Table of Elements, shown on the **back page** of the examination paper, to complete the following sentences.

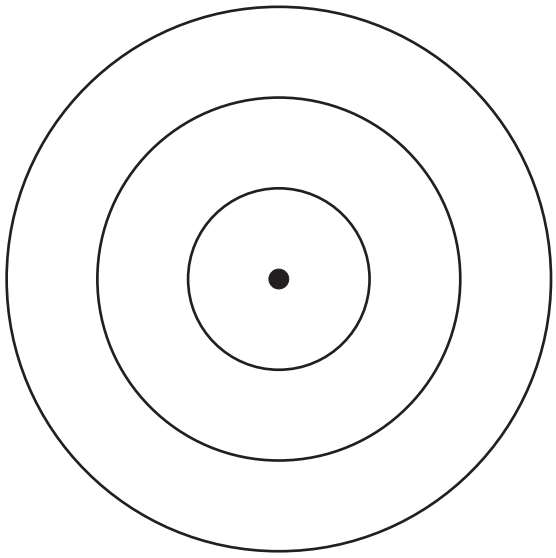
(i) The chemical symbol for caesium is ..... [1]

(ii) The element with the atomic number 5 is ..... [1]

(iii) The element which has the electronic structure 2, 8,7 is ..... [1]

(iv) The element which is in Group 2 and Period 2 is ..... [1]

(b) Using **X** to represent an electron, complete the following diagram to show the electronic structure for an atom of sulphur. [1]



(c) In 1869 Mendeleev published a periodic table of elements, although many elements known today had not been discovered at that time.

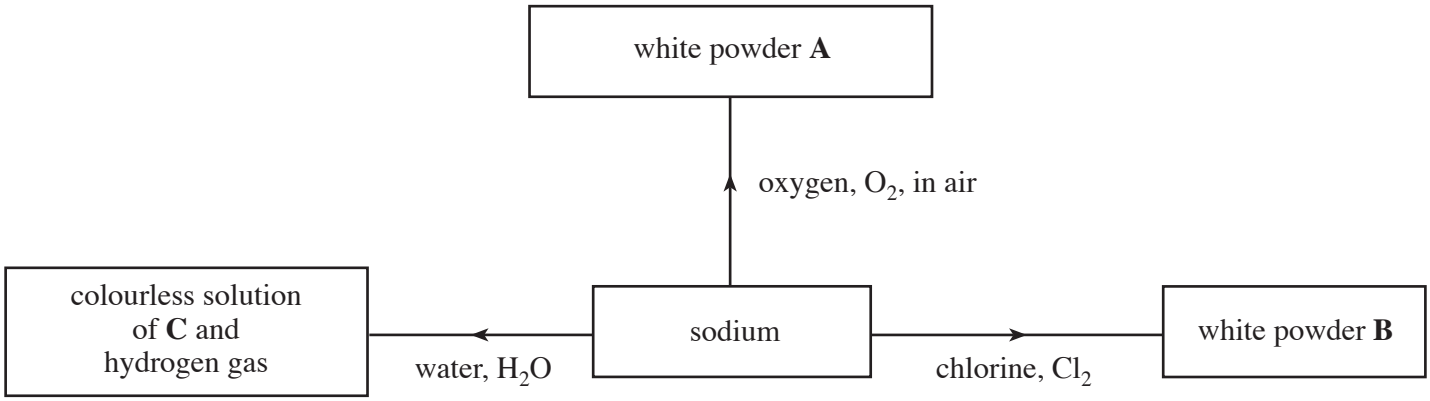
(i) How did Mendeleev overcome the problem of the unknown elements when constructing his periodic table? [1]

.....

(ii) What was Mendeleev able to predict about the unknown elements once he had constructed his periodic table? [1]

.....

2. The diagram below shows some reactions of sodium.



(i) Give the chemical **name** for

I. **A** ..... [1]

II. **B** ..... [1]

III. **C** ..... [1]

(ii) Balance the **symbol** equation for the reaction between sodium and oxygen. [1]

..... Na + ... O_2 ⟶ ..... Na_2O

(iii) A flame test was carried out on the white powder **B**. Describe what you would expect to see during the flame test and give the reason for the observation. [2]

Observation .....

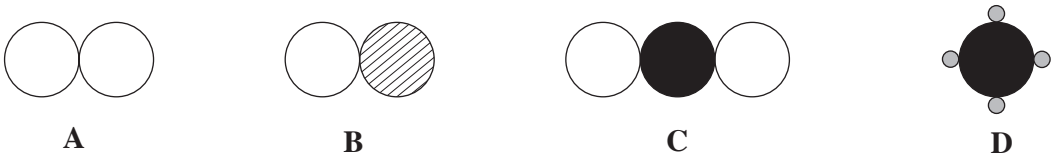
Reason .....

(iv) Before carrying out the experiment to show sodium reacting with water, a teacher needs to complete a risk assessment and take safety precautions to minimise the risk.
Give **one** safety risk and what can be done to minimise it. [2]

Safety risk .....

Action to minimise risk .....

3. *(a)* The diagrams below represent four different substances, carbon dioxide, CO_2, methane, CH_4, nitrogen oxide, NO, and oxygen, O_2, ***but not necessarily in that order***.



A **B** **C** **D**

(i) Give the letter **A**, **B**, **C** or **D** of the diagram which represents an element. Give the reason for your choice.

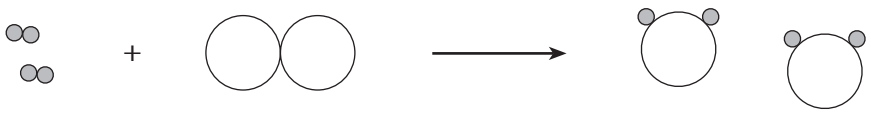
Diagram .....

Reason ..... [2]

(ii) Give the chemical formula for **D**. ..... [1]

(iii) Using the information above, draw a diagram which represents one molecule of ammonia, NH_3. [1]

(b) The diagram below represents the chemical reaction between hydrogen and oxygen.



State **two** ways in which this diagram shows the meaning of the term ***chemical reaction***. [2]

1. .....

2. .....

4. In 1912, Alfred Wegener suggested that all the continents must have once been joined together as one big land mass called Pangaea. Other scientists would not believe him.

Pangaea

Continents today

(i) Give the reason for other scientists not believing Wegener. [1]

.....

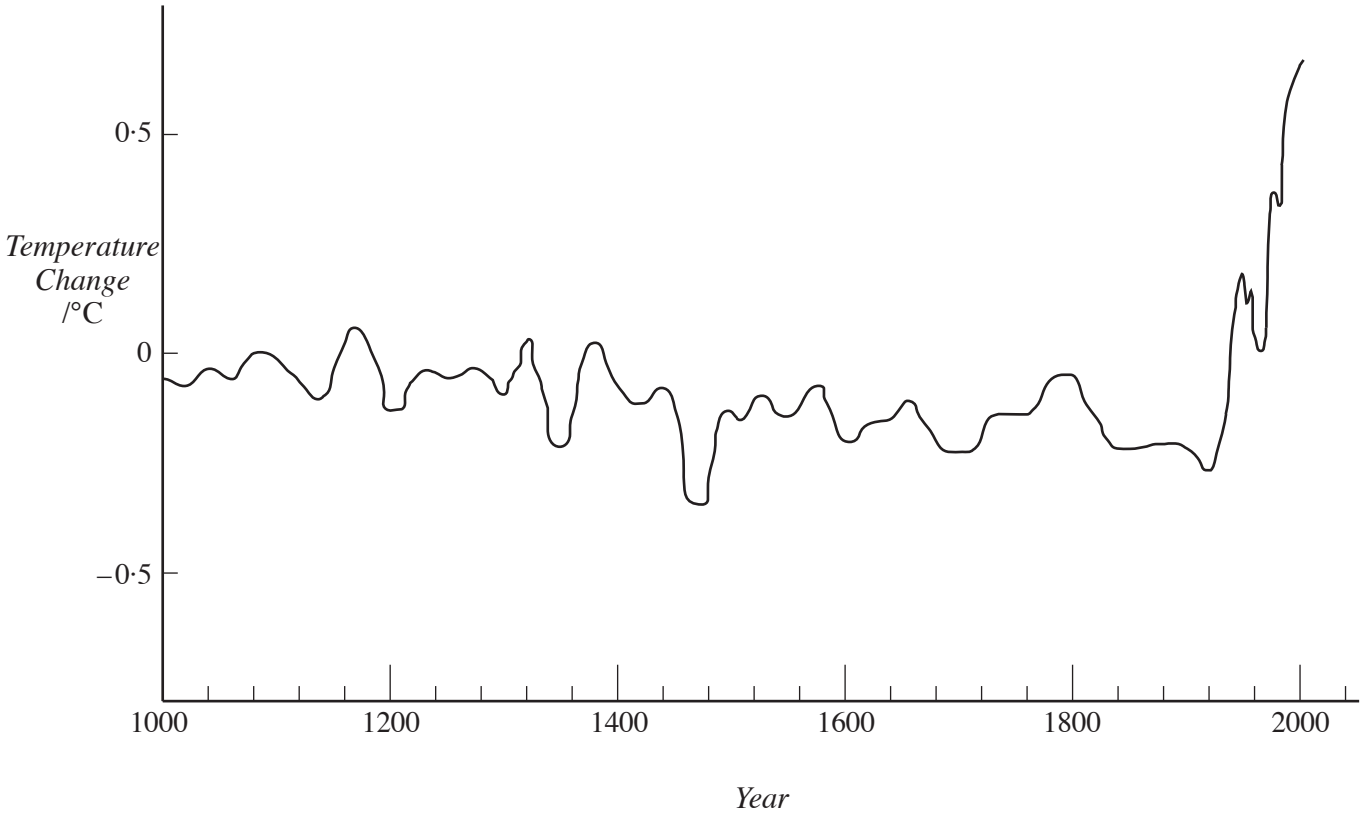
(ii) Wegener's idea that the continents were once joined together was finally accepted much later.
Give **three** pieces of evidence Wegener used to support his idea. [3]

1. .....

2. .....

3. .....

5. The graph below shows the temperature change of the Earth's surface over the last 1000 years and has been used as evidence that global warming is taking place. Scientists started to record the temperature of the atmosphere in England in 1659. Temperatures before 1659 are based on data from ice layers, trees, etc.



Use the information above to answer parts (i) and (ii).

(i) I. Between which **two** dates is the graph **most** reliable. ..... and ..... [1]

II. Give a reason for your choice of dates. [1]

.....

(ii) Give the **date** when the most significant change in the Earth's temperature began to occur. [1]

.....

(iii) If the trend continues as shown on the graph, the Earth's temperature will continue to increase.
State **one** consequence of the global warming caused by further increases in the Earth's temperature. [1]

.....

6. *(a)* The table below shows the results obtained from a series of experiments to investigate the reactivity of Group 7 elements (halogens).
Each halogen was added to a solution containing a different halide ion.

Halogen	**Solution of halide ion**		
	Sodium chloride	**Sodium bromide**	**Sodium iodide**
Chlorine, Cl_2		solution turns orange	solution turns brown
Bromine, Br_2	no reaction		solution turns brown
Iodine, I_2	no reaction	no reaction	

(i) I. Complete and balance the **symbol** equation for the reaction between chlorine and sodium bromide solution. [2]

Cl_2 + ... NaBr ⟶ ..... + ...

II. Give the name for this type of reaction. ..... [1]

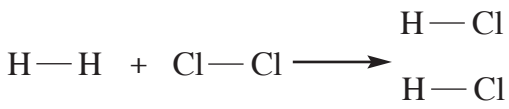
(ii) Use the results to describe a pattern in the reactions of halogens with different halide ions in solution. [1]

.....

.....

.....

(b) When chlorine reacts with hydrogen, hydrogen chloride is formed.



The relative amounts of energy needed to break the bonds in the above reaction are shown in the table.

Bond	*Amount of energy needed to break the bond*/kJ
H — H	436
Cl — Cl	243
H — Cl	432

Note: The amount of energy released in making a bond is equal and opposite to that needed to break the bond.

(i) Use the bond energy values in the table to calculate the relative energy

I. needed to break **all** the bonds **in the reactants**, [2]

.....

.....

II. released when the bonds **in the product** are formed. [2]

.....

.....

(ii) Using your answers to part (i) I and II, explain why the relative overall energy change for the reaction is exothermic. [1]

.....

.....

7. Nanoscience is the study of extremely small particles.

(i) Give the size **range** usually associated with nano-sized particles. [1]

.....

(ii) State an important difference between nano-sized materials and the same material at a larger size. [1]

.....

(iii) Nano-sized titanium dioxide and zinc oxide are used in some new sun creams which absorb U.V. rays and yet are transparent. Suggest a possible reason for some scientists being concerned about their use. [1]

.....

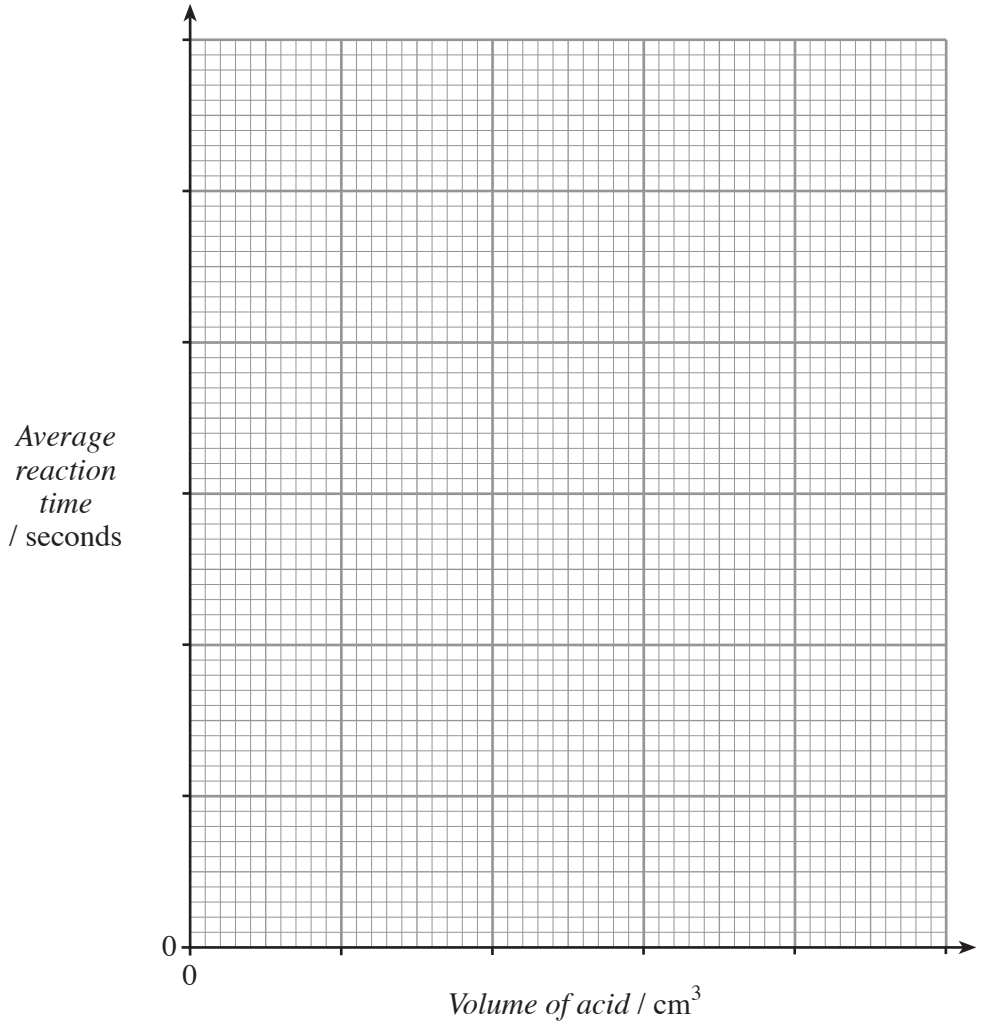
(iv) Nano-sized silver has been used for many years in infection control. Give **one** example where nano-sized silver particles are used to kill bacteria. [1]

.....

8. Five different volumes of hydrochloric acid were made up to 100 cm^3 with water. 0·1 g magnesium ribbon was then added to the five different concentrations of dilute hydrochloric acid.
The acid was in excess in each experiment. The temperature of the acid was kept the same in each experiment.
The time taken for all the magnesium ribbon to react was recorded. The reaction was repeated three times with each concentration and an average reaction time was calculated.
The table below shows the results obtained.

Volume of acid /cm^3	*Volume of water* /cm^3	*Time for 0·1g of magnesium to react* / seconds			
		Reaction 1	Reaction 2	Reaction 3	Average reaction time
10	90	117	121	122	120
20	80	60	58	122	80
30	70	42	40	44	42
40	60	30	30	29	30
50	50	20	19	20	22

(i) Draw the graph using the data provided. [4]



(ii) State which volume of acid gave an **unreliable** average reaction time. ..... cm^3 [1]

(iii) State what you would do to obtain a more reliable average reaction time for the volume of acid given in part (ii). [1]

.....

(iv) If the whole investigation was repeated using powdered magnesium instead of magnesium ribbon, explain, **using particle theory**, why all the rates of reaction would increase. [2]

.....

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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^{+}	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		

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 Sulphur	$^{35}_{17}$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: