ST EDWARD'S

OXFORD

Lower Sixth Entrance Assessment

November 2013

Chemistry

1 Hour

Candidates name: ……...

THE PERIODIC TABLE

Period	Group 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** Sulfur 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	86 **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	179 **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

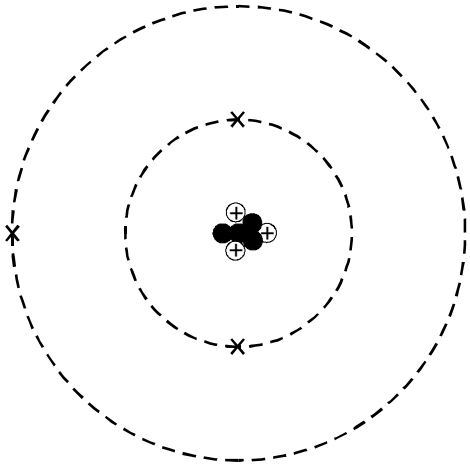
Relative atomic mass
Symbol
Name
Atomic number

1. Complete the table below.

Element	Symbol
calcium	
	Pb
	S

(Total 3 marks)

2. The diagram shows the structure of a lithium atom.



KEY

⊕ = proton

× = electron

(a) (i) What is represented by ● .....

(ii) What is represented by  .....

(2)

(b) What is the symbol for lithium? .....

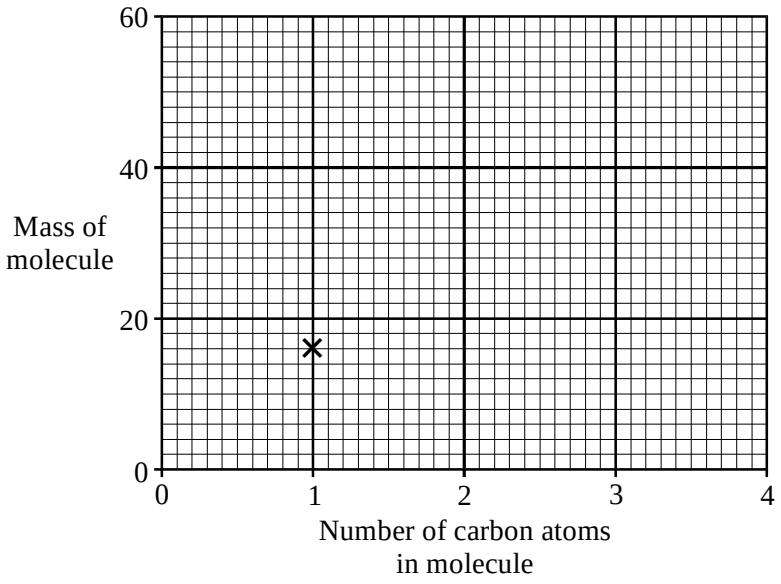
(1)

(Total 3 marks)

3. The table gives some information about a family of molecules in crude oil.

Number of carbon atoms in molecule	Mass of molecule in atomic units
1	16
2	30
4	58

(a) Use the information from the table to complete the graph.



(3)

(b) What is the mass of a molecule with three carbon atoms?

.....

(1)

(Total 4 marks)

4. Acids react with alkalis to form salts and water.

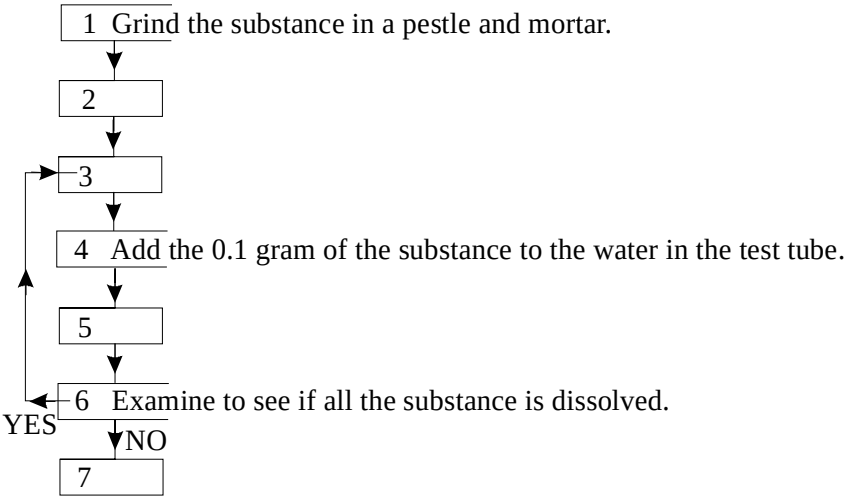
Complete the table below by writing in the name and formula of the salt formed in each reaction.

The first one has been done for you.

Acid	Alkali	Salt	Formula of salt
Hydrochloric acid	Sodium hydroxide	Sodium chloride	NaCl
Nitric acid	Sodium hydroxide		
Sulphuric acid	Potassium hydroxide		

(Total 4 marks)

5. A student wanted to find out how much of a substance, to the nearest 0.1 gram, dissolves in 15cm³ of water. His plan for the experiment is shown below, but the descriptions of some of the steps have been missed out.



The missing steps in his plan are written below, but not in the correct order.

A Shake thoroughly for some time.

B Measure out 0.1 gram of the substance.

C Record the amount of substance added.

D Measure out 15cm³ of water into a test tube.

(a) Write the letters A, B, C and D in the boxes in his plan, in the correct order.

(4)

(b) How would you know that the substance had dissolved?

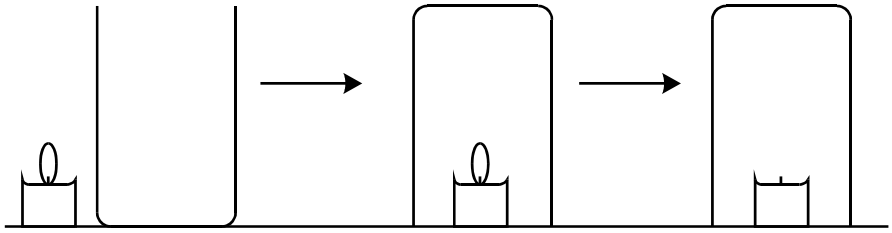
.....

.....

(2)

(Total 6 marks)

6. This experiment shows a candle burning then going out.



(a) Choose words from this list to complete the sentences in parts (i) and (ii) below.

air **carbon dioxide** **hydrogen** **nitrogen** **oxygen**

(i) When the candle wax is burning it is reacting with ..... from the ..... .

(2)

(ii) One product of the reaction is .....

(1)

(b) Complete the following sentence.

In another experiment a 200 cm^3 beaker is used. The candle will then burn for about ..... seconds.

(1)
(Total 4 marks)

7. You will find it helpful to use the information on the Periodic Table when answering this question.

In the nucleus of an aluminium atom are:

13 protons
and 14 neutrons.

(a) Complete these sentences.

(i) The mass number of the aluminium atom is ..... .

(ii) In an atom of aluminium there are ..... electrons.

(2)

(b) Why is an aluminium atom electrically neutral?

.....

.....

.....

(2)

(c) Complete the table for the element fluorine.

PARTICLE	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluorine atom	9		9
Fluoride ion		10	

(3)
(Total 7 marks)

8. Calculate the formula mass (Mr), of the compound

calcium hydroxide, $Ca(OH)_2$.

(Show your working)

.....

.....

.....

.....

.....

.....

(Total 3 marks)

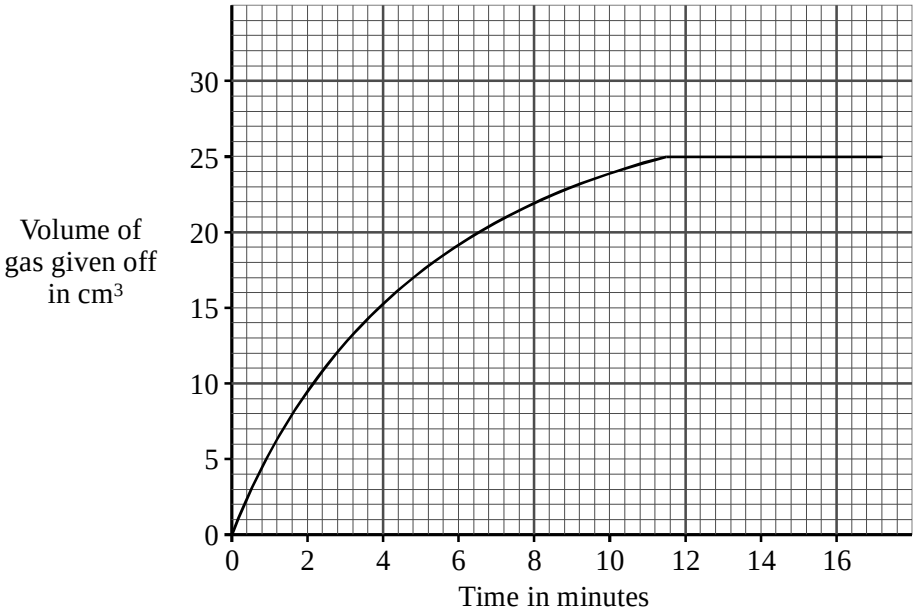
9. Zinc powder normally reacts slowly with hydrochloric acid.

(a) Balance the symbol equation for the reaction.

$$Zn \quad + \quad HCl \quad \rightarrow \quad ZnC1_2 \quad + \quad H_2$$

(1)

The graph shows the results from a reaction of 1.0 g of zinc powder with 20 cm^3 of dilute hydrochloric acid. It gives off a gas and forms zinc chloride, $ZnCl_2$. Some unreacted zinc is left at the end.



(b) Copper powder is a good catalyst for the reaction of zinc with hydrochloric acid.

(i) A mixture of 10 cm^3 of the same dilute hydrochloric acid and 1.0 g of copper powder was added to 1.0 g of zinc powder. What is the maximum volume of gas which could be given off?

..... cm^3

(1)

(ii) Draw a graph, on the axes above, for an experiment where 20 cm^3 of the same dilute hydrochloric acid was added to 1.0 g of copper powder mixed with 1.0 g of zinc powder.

(2)

(iii) Give **two** other ways the reaction described in part (i) could be made to go faster.

1. .....

2. .....

(2)

(c) Copper powder can be formed by adding copper sulphate solution to the mixture of zinc powder and acid.

(i) Why does zinc react with copper sulphate solution to produce copper?

.....

.....

(1)

(ii) Write the word equation for the reaction.

.....

(1)

(Total 8 marks)

10. Read the passage carefully and then answer the questions.

The electrolysis of acidified water

After a few drops of dilute sulphuric acid have been added to some distilled water, there will be three types of ion in solution:

from the water, $H_2O(l) \rightarrow H^+(aq) + OH^-(aq)$

from the acid, $H_2SO_4(aq) \rightarrow 2H^+(aq) + SO_4^{2-}(aq)$

When the electrodes (anode and cathode) in a circuit are put into the acidified water, the hydroxide ions and the sulphate ions are both attracted to the electrode called the anode. However, it is harder for the sulphate ions to give up their electrons than for the hydroxide ions to do this. So the hydroxide ions are the ones which react and bubbles of oxygen are formed at the anode.

There are only hydrogen ions to be attracted towards the cathode and, when they get there, they take up electrons to form hydrogen molecules.

From Chemistry Matters by Richard Hart, reproduced by permission of Oxford University Press

Even in a small volume of water acidified with dilute sulphuric acid there will be billions of ions. Some will be anions and some will be cations.

(i) Name the ions in water acidified with dilute sulphuric acid.

.....

(1)

(ii) Explain why only some of the ions are attracted to the anode.

.....

.....

.....

(2)

(iii) Balance the equation for the reaction of hydroxide ions at the anode.

$4OH^- \rightarrow H_2O + O_2 + e^-$

(1)

(Total 4 marks)

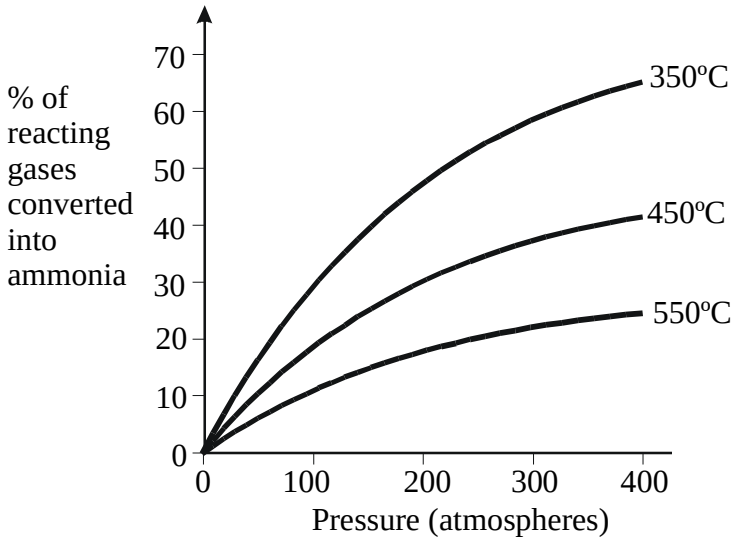
11. Ammonia is manufactured in the Haber Process, from nitrogen and hydrogen.

(a) Balance this symbol equation for the process.

$$N_2 + \quad H_2 \rightleftharpoons \quad NH_3$$

(2)

(b) The graph below shows the percentage of reacting gases converted into ammonia, at different temperatures and pressures.



(i) What does the graph suggest about the temperature and pressure needed to convert the maximum percentage of reacting gases into ammonia?

.....

.....

.....

(2)

(ii) Suggest reasons why the manufacture of ammonia in the Haber Process is usually carried out at about 400°C and 200 atmospheres pressure.

.....

.....

.....

(2)

(Total 6 marks)

12. The table shows the properties of four elements from Group VII of the Periodic Table.

Element	Proton Number	Electronic structure	Boiling point (°C)	Melting point (°C)	State at 20°C	Reaction with hydrogen	
						Ease	Product
Fluorine		2.7	–188	–218	gas	Explosive reaction in dull light	hydrogen fluoride
Chlorine	17		–34	–101		Explosive reaction in sunlight	hydrogen chloride
Bromine	35	2.8.18.7	+59	–7		React if heated	hydrogen bromide
Iodine	53	2.8.18.18.7	+185	+114	solid	React if heated strongly	hydrogen iodide

(a) Complete the spaces in the table.

(4)

(b) Comment briefly on the trend in melting points for these four elements.

.....

.....

(1)

(c) Explain, in as much detail as you can:

(i) why the reactions of these elements with hydrogen are similar.

.....

.....

.....

(ii) why their reactivity with hydrogen decreases from fluorine to iodine.

.....

.....

.....

.....

(4)

(Total 9 marks)