Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY

0620/33

Paper 3 (Extended)

October/November 2015

1 hour 15 minutes

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
A copy of the Periodic Table is printed on page 12.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **12** printed pages.

CAMBRIDGE International Examinations

1 **(a)** Describe a chemical test which shows the presence of water.

test .....

colour change if water is present .....

.....
[3]

(b) How could you show that a sample of water is pure?

..... [1]

(c) Describe how water is treated before it is supplied to homes and industry.

.....

..... [2]

(d) State **two** industrial uses of water.

.....

..... [2]

[Total: 8]

2 Choose from the following list of gases. A gas may be chosen once, more than once or not at all.

sulfur dioxide **hydrogen** **methane** **carbon monoxide**

argon **ethene** **butane**

(a) It is used to bleach wood pulp. ..... [1]

(b) When burned in oxygen, the only product is water. ..... [1]

(c) It can polymerise. ..... [1]

(d) It is used to provide an inert atmosphere for welding. ..... [1]

(e) When reacted with oxygen, the only product is carbon dioxide. ..... [1]

(f) It is produced by the decay of vegetation in the absence of oxygen. ..... [1]

[Total: 6]

3 Lithium bromide is an ionic compound. It can be electrolysed when it is molten or in aqueous solution. It cannot be electrolysed as a solid.

(a) Solid lithium bromide is a poor conductor of electricity. The ions cannot move to the electrodes, they are held in an ionic lattice by strong forces.

(i) Describe the motion of the ions in the solid state.

..... [1]

(ii) Define the term *ionic bonding*.

.....

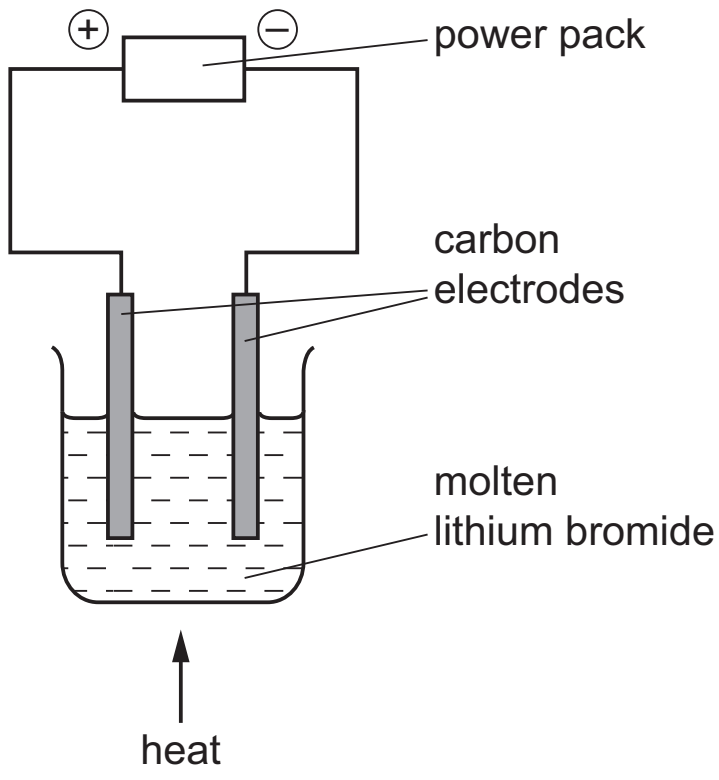
..... [2]

(iii) What is meant by the term *ionic lattice*?

.....

..... [2]

(b) The diagram shows the electrolysis of molten lithium bromide.



(i) Mark on the diagram the direction of the electron flow. [1]

(ii) Write an ionic equation for the reaction at the negative electrode (cathode).

..... [1]

(iii) Write an ionic equation for the reaction at the positive electrode (anode).

..... [2]

(iv) Which ion is oxidised? Explain your answer.

.....

..... [2]

(c) When aqueous lithium bromide is electrolysed, a colourless gas is formed at the negative electrode and the solution becomes alkaline.

Explain these observations and include an equation in your explanation.

.....

.....

.....

..... [3]

[Total: 14]

4 Two homologous series of hydrocarbons are the alkanes and the alkenes.

(a) (i) One general characteristic of a homologous series is that the physical properties vary in a predictable way.

State **three** other general characteristics of a homologous series.

.....

.....

..... [3]

(ii) How can the molecular formula of a hydrocarbon show whether it is an alkane or an alkene?

.....

..... [2]

(iii) How do alkanes and alkenes differ in their molecular structures?

.....

..... [2]

(b) Cracking is the thermal decomposition of alkanes into smaller hydrocarbons and possibly hydrogen.

(i) State **two** conditions required for the cracking of an alkane.

..... [2]

(ii) One type of cracking produces an alkane and an alkene.

Complete an equation for the cracking of heptane into an alkane and an alkene.

$C_7H_{16} \rightarrow$ ..... + ... [1]

(iii) Complete an equation for the cracking of heptane into hydrogen and two other products.

$C_7H_{16} \rightarrow$ ..... + ... + H_2 [1]

(iv) Suggest **one** reason why cracking is important.

..... [1]

(c) Hydrocarbons burn in excess oxygen to form carbon dioxide and water. 20 cm^3 of a gaseous hydrocarbon burned in an excess of oxygen, 200 cm^3. After cooling, the volume of the residual gas at r.t.p. was 150 cm^3, 50 cm^3 of which was oxygen.

(i) Determine the volume of the oxygen used.

..... [1]

(ii) Determine the volume of the carbon dioxide formed.

..... [1]

(iii) The hydrocarbon was an alkane.

Determine the formula of the hydrocarbon.

[1]

[Total: 15]

5 Sulfuric acid is a strong acid. In aqueous solution, it ionises as shown below.

$$H_2SO_4 \rightarrow 2H^+ + SO_4^{2-}$$

(a) (i) What is meant by the term *acid*?

..... [1]

(ii) Sulfurous acid, H_2SO_3, is a weak acid.

State the difference between a weak acid and a strong acid.

.....

..... [2]

(b) Sulfurous acid forms salts called sulfites, which contain the ion SO_3^{2-}.

When barium nitrate solution is added to aqueous sulfurous acid, a white precipitate, **A**, forms.

Bromine water changes from brown to colourless when added to aqueous sulfurous acid.

Bromine oxidises sulfurous acid. When this solution is tested with acidified barium nitrate solution, a different white precipitate, **B**, is formed.

(i) Identify the white precipitate, **A**.

..... [1]

(ii) Identify the white precipitate, **B**.

..... [1]

(iii) Write an ionic equation for the reduction of the bromine molecule.

..... [1]

(iv) Name the product formed by the oxidation of sulfurous acid.

..... [1]

(c) Complete the following word equations.

(i) magnesium hydroxide + dilute sulfuric acid

..... [1]

(ii) zinc + dilute sulfuric acid

..... [1]

(iii) copper carbonate + dilute sulfuric acid

..... [1]

(d) Write equations for the reaction of dilute sulfuric acid with each of the following.

(i) ammonia

..... [2]

(ii) sodium hydroxide

..... [2]

(iii) iron

..... [2]

[Total: 16]

6 A reactivity series of metals is given below.

	metal name	symbol
most reactive	sodium	Na
	lithium	Li
	magnesium	Mg
	zinc	Zn
	manganese	Mn
	iron	Fe
least reactive	copper	Cu
	rhodium	Rh

(a) Which **two** metals will react most vigorously with cold water?

..... [1]

(b) Which **two** metals will not react with dilute hydrochloric acid?

..... [1]

(c) Deduce the formula of iron(III) sulfate.

..... [1]

(d) What is the formula of a magnesium ion?

..... [1]

(e) Describe a test-tube experiment which will show that manganese is more reactive than copper.

.....

.....

..... [3]

(f) Manganese is a typical transition metal.

Predict **three** physical and **two** chemical properties of this metal.

physical properties

.....

.....

.....

chemical properties

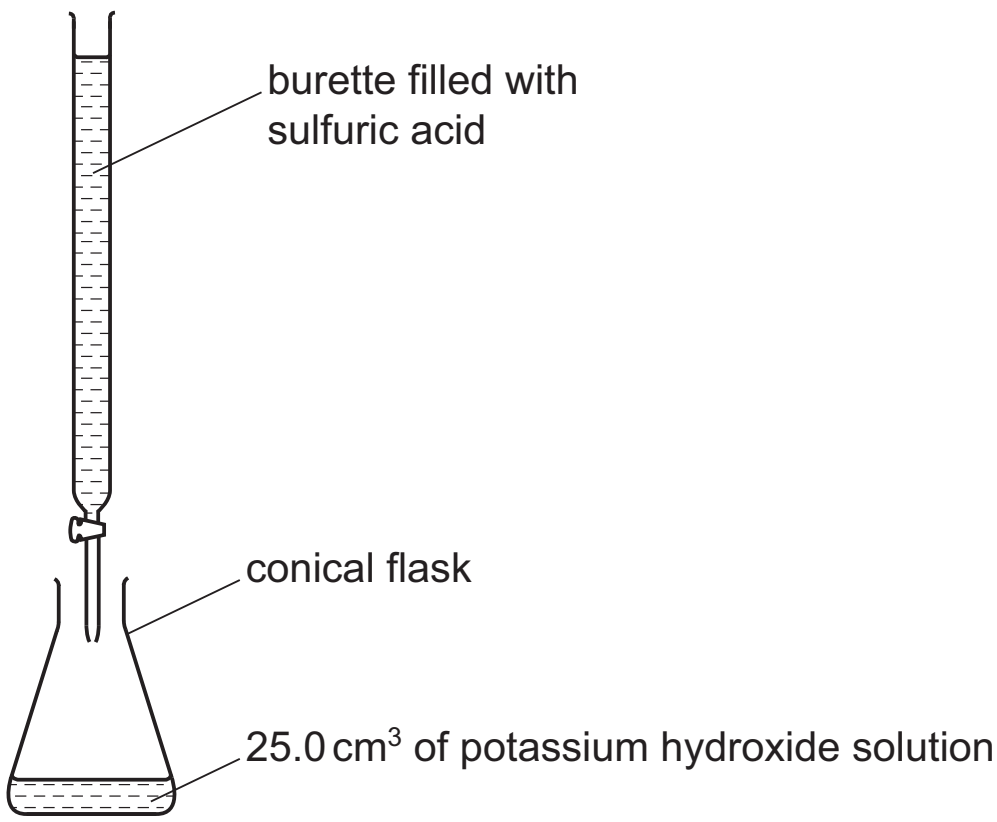
.....

.....

[5]

[Total: 12]

7 Two salts can be made from potassium hydroxide and sulfuric acid. They are potassium sulfate, K_2SO_4, and the acid salt potassium hydrogen sulfate, $KHSO_4$. They are both made by titration.



(a) 25.0 cm^3 of potassium hydroxide, concentration 2.53 mol/dm^3, was neutralised by 28.2 cm^3 of dilute sulfuric acid.

$$2KOH(aq) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$$

Calculate the concentration of the sulfuric acid.

number of moles of KOH used = ...

number of moles of H_2SO_4 needed to neutralise the KOH = ...

concentration of dilute sulfuric acid = ... mol/dm^3

[3]

(b) In the conical flask there is a neutral solution of potassium sulfate which still contains the indicator used in the titration.

(i) Describe how you could obtain a solution of potassium sulfate without the indicator.

.....

..... [2]

(ii) Potassium hydrogen sulfate can be made by the following reaction.

$$KOH(aq) + H_2SO_4(aq) \rightarrow KHSO_4(aq) + H_2O(l)$$

Suggest how you could make a solution of potassium hydrogen sulfate without using an indicator.

.....

.....

..... [2]

(c) Describe a test which would distinguish between aqueous solutions of potassium sulfate and sulfuric acid.

test .....

result .....
[2]

[Total: 9]

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.).