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.

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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? View solution

..... [1]

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

.....

..... [2]

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

.....

..... [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**

View solution

(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]

View solution [Total: 6]

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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.

View solution

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

..... [1]

View solution

(ii) Define the term *ionic bonding*.

.....

..... [2]

View solution

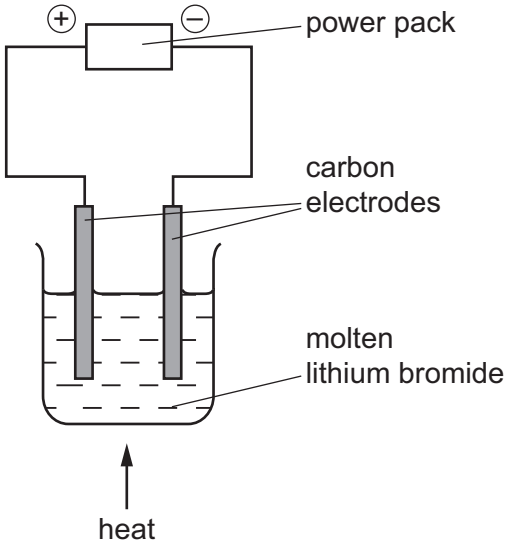
(iii) What is meant by the term *ionic lattice*?

.....

..... [2]

View solution

(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]

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

View solution

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.

View solution

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.

View solution

(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.

View solution

(i) Determine the volume of the oxygen used.

..... [1]

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

View solution

..... [1]

(iii) The hydrocarbon was an alkane.

View solution

Determine the formula of the hydrocarbon.

[1]

[Total: 15]

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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*?

View solution

..... [1]

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

View solution

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-}.

View solution

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**.

View solution

..... [1]

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

View solution

..... [1]

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

..... [1]

View solution

(c) Complete the following word equations.

View solution

(i) magnesium hydroxide + dilute sulfuric acid

..... [1]

(ii) zinc + dilute sulfuric acid View solution

..... [1]

(iii) copper carbonate + dilute sulfuric acid View solution

..... [1]

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

View solution

(i) ammonia

..... [2]

(ii) sodium hydroxide View solution

..... [2]

(iii) iron

..... [2]

[Total: 16]

View solution

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?

View solution

..... [1]

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

View solution

..... [1]

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

View solution

..... [1]

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

View solution

..... [1]

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

.....

.....

..... [3]

View solution

(f) Manganese is a typical transition metal.

View solution

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

physical properties

.....

.....

.....

chemical properties

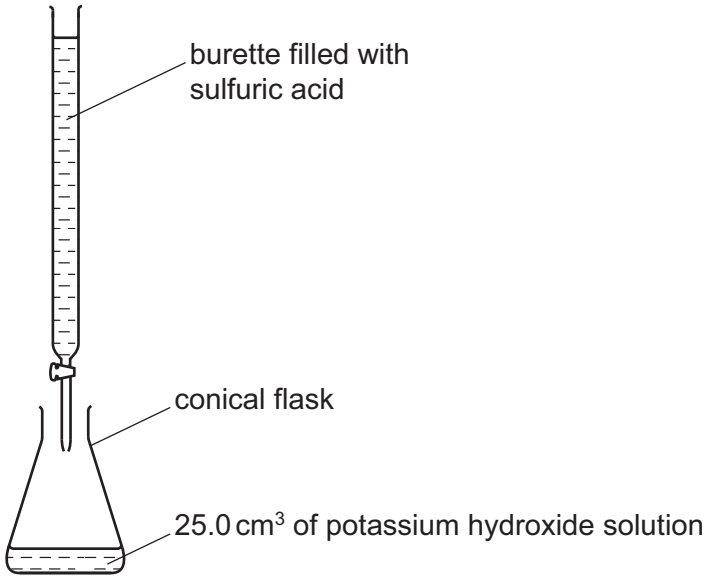
.....

.....

[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.

View solution

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

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.

View solution

.....

..... [2]

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

View solution

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

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]

View solution

DATA SHEET
The Periodic Table of the Elements

Group																		
I	II										III	IV	V	VI	VII	0
																4 **He** Helium 2
					1 **H** Hydrogen 1							11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
7 **Li** Lithium 3	9 **Be** Beryllium 4										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
23 **Na** Sodium 11	24 **Mg** Magnesium 12										70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
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	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
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	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
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						
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.).

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