



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

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CHEMISTRY

0620/32

Paper 3 (Extended)

February/March 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 **11** printed pages and **1** blank page.



2

1 For each of the following, give the name of an element from Period 3 (sodium to argon), which matches the description.

(a) an element which is gaseous at room temperature and pressure

..... [1]

(b) an element that is added to water to kill bacteria

..... [1]

(c) an element that forms a basic oxide of the type XO

..... [1]

(d) an element used as an inert atmosphere in lamps

..... [1]

(e) an element that forms an amphoteric oxide

..... [1]

(f) an element that reacts vigorously with cold water to produce hydrogen

..... [1]

[Total: 6]

2 (a) Define the term *isotope*.

.....

..... [2]

(b) The table gives information about four particles, **A**, **B**, **C** and **D**.

Complete the table.

The first line has been done for you.

particle	number of protons	number of electrons	number of neutrons	nucleon number	symbol or formula
A	6	6	6	12	C
B	11	10	12		
C	8		8		O^{2-}
D		10		28	Al^{3+}

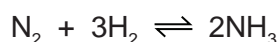
[7]

[Total: 9]

3

- 3 Ammonia is manufactured by the Haber process. Nitrogen and hydrogen are passed over a catalyst at a temperature of 450 °C and a pressure of 200 atmospheres.

The equation for the reaction is as follows.



The forward reaction is exothermic.

- (a) State **one** use of ammonia.

..... [1]

- (b) What is the meaning of the symbol \rightleftharpoons ?

..... [1]

- (c) What are the sources of nitrogen and hydrogen used in the Haber process?

nitrogen

hydrogen

[2]

- (d) Name the catalyst in the Haber process.

..... [1]

- (e) (i) If a temperature higher than 450 °C was used in the Haber process, what would happen to the **rate** of the reaction? Give a reason for your answer.

.....

.....

..... [2]

- (ii) If a temperature higher than 450 °C was used in the Haber process, what would happen to the **yield** of ammonia? Give a reason for your answer.

.....

.....

..... [2]

- (f) (i) If a pressure higher than 200 atmospheres was used in the Haber process, what would happen to the **yield** of ammonia? Give a reason for your answer.

.....

 [2]

- (ii) Explain why the rate of reaction would be faster if the pressure was greater than 200 atmospheres.

.....
 [1]

- (iii) Suggest **one** reason why a pressure higher than 200 atmospheres is not used in the Haber process.

.....
 [1]

- (g) Draw a dot-and-cross diagram to show the arrangement of the outer (valency) electrons in one molecule of ammonia.

[2]

- (h) Ammonia acts as a base when it reacts with sulfuric acid.

- (i) What is a base?

..... [1]

- (ii) Write a balanced equation for the reaction between ammonia and sulfuric acid.

..... [2]

[Total: 18]

5

4 (a) A compound **X** contains 82.76% of carbon by mass and 17.24% of hydrogen by mass.

(i) Calculate the empirical formula of compound **X**.

[2]

(ii) Compound **X** has a relative molecular mass of 58.

Deduce the molecular formula of compound **X**.

[2]

(b) Alkenes are unsaturated hydrocarbons.

(i) State the general formula of alkenes.

..... [1]

(ii) State the empirical formula of alkenes.

..... [1]

(c) What is meant by the term *unsaturated hydrocarbon*?

unsaturated

.....

hydrocarbon

.....

[2]

(d) Describe a test that would distinguish between saturated and unsaturated hydrocarbons.

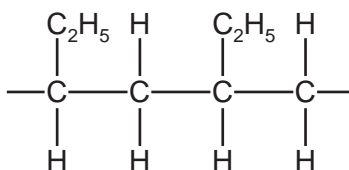
reagent

observation (saturated hydrocarbon)

observation (unsaturated hydrocarbon)

[3]

(e) Addition polymers can be made from alkenes. The diagram shows part of an addition polymer.



(i) Draw a circle on the diagram to show one repeat unit in this polymer. [1]

(ii) Give the structure and the name of the monomer used to make this polymer.

structure

name

[2]

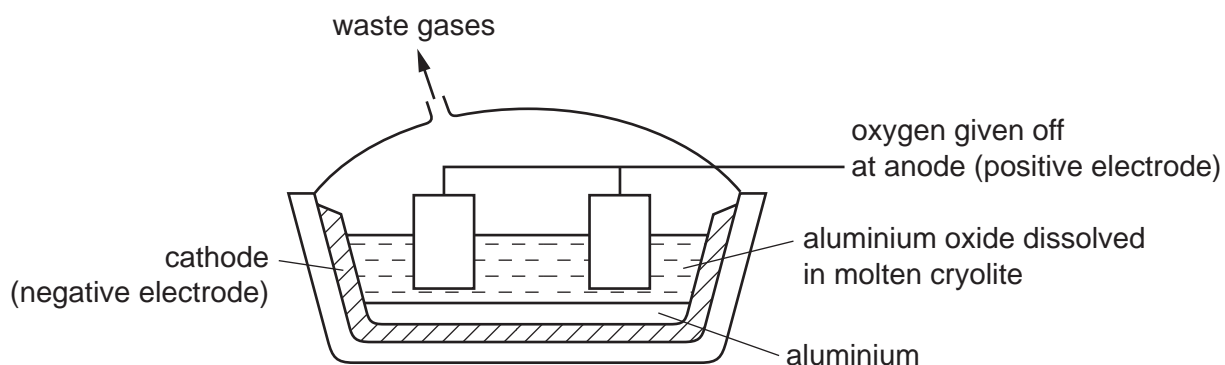
(iii) Give the structure of an isomer of the alkene in (e)(ii).

[1]

[Total: 15]

- 5 Aluminium and iron are extracted from their ores by different methods.

Aluminium is extracted from its purified oxide ore by electrolysis.



- (a) What is the name of the ore of aluminium which consists mainly of aluminium oxide?

..... [1]

- (b) The electrodes are both made of the same substance.

Name this substance.

..... [1]

- (c) Aluminium oxide is dissolved in molten cryolite before it is electrolysed.

Give **two** reasons why aluminium oxide dissolved in molten cryolite is electrolysed rather than molten aluminium oxide alone.

.....

..... [2]

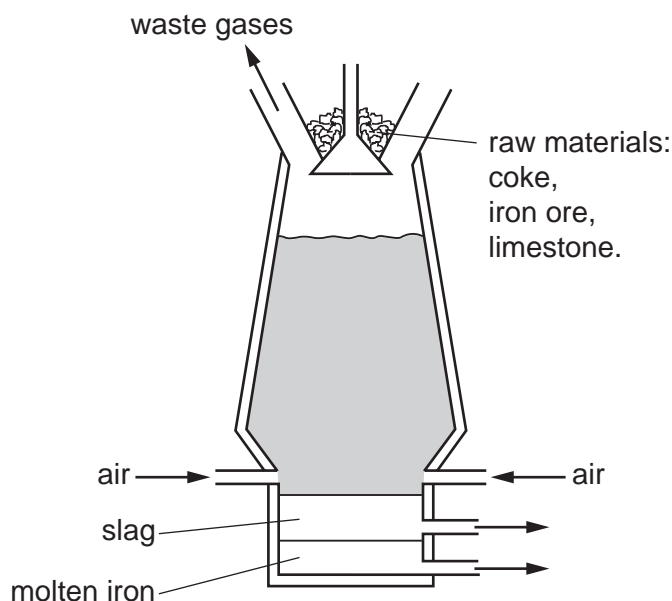
- (d) Write the **ionic** equations for the reactions at the electrodes in this electrolysis.

anode (positive electrode)

cathode (negative electrode)

[2]

- (e) Iron is extracted from its oxide ore by reduction using carbon in a blast furnace.



- (i) Place the elements aluminium, carbon and iron in order of reactivity with the **least** reactive element first.
- [1]
- (ii) Use your answer to (e)(i) to explain why iron is extracted by reduction using carbon but aluminium is not.
-
- [1]
- (f) What is the name of the ore of iron which consists mainly of iron(III) oxide?
- [1]
- (g) Write balanced equations for the reactions occurring in the blast furnace which involve
- (i) the complete combustion of coke (carbon),
- [1]
- (ii) the production of carbon monoxide from carbon dioxide,
- [1]
- (iii) the reduction of iron(III) oxide,
- [1]
- (iv) the formation of slag.
- [1]

[Total: 13]

- 6 A student is told to produce the maximum amount of copper from a mixture of copper and copper(II) carbonate.

The student adds the mixture to an excess of dilute sulfuric acid in a beaker and stirs the mixture with a glass rod. The copper(II) carbonate reacts with the sulfuric acid, forming a solution of copper(II) sulfate but the copper does not react with the sulfuric acid.

The student then

- removes the unreacted copper from the mixture,
- converts the solution of copper(II) sulfate into copper by a series of reactions.

- (a) Describe **two** things that the student would observe when the mixture is added to the dilute sulfuric acid.

.....
 [2]

- (b) Describe how the student can produce pure dry copper from the mixture of copper and copper(II) sulfate solution.

.....

 [3]

- (c) The student then adds sodium hydroxide solution to the copper(II) sulfate solution to produce copper(II) hydroxide.

- (i) Describe what the student would observe.

..... [1]

- (ii) Write an **ionic** equation for this reaction.

..... [1]

- (d) After separating the copper(II) hydroxide from the mixture, the copper(II) hydroxide is heated strongly. The copper(II) hydroxide decomposes into copper(II) oxide and steam.

- (i) Write an equation for the decomposition of copper(II) hydroxide. Include state symbols.

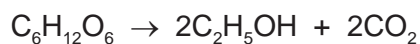
..... [2]

- (ii) Name a non-metallic element that can be used to convert copper(II) oxide into copper.

..... [1]

[Total: 10]

- 7 Ethanol is manufactured from glucose, $C_6H_{12}O_6$, by fermentation according to the following equation.



- (a) State the conditions required for this reaction.

.....
 [2]

- (b) In an experiment, 30.0g of glucose was fermented.

- (i) Calculate the number of moles of glucose in 30.0g.

..... mol [2]

- (ii) Calculate the maximum mass of ethanol that could be obtained from 30.0g of glucose.

..... g [2]

- (iii) Calculate the volume of carbon dioxide at room temperature and pressure that can be obtained from 30.0g of glucose.

..... dm^3 [1]

- (c) Ethanol can also be manufactured from ethene.

- (i) Name the raw material which is the source of ethene.

..... [1]

- (ii) Write a balanced equation for the manufacture of ethanol from ethene.

..... [1]

[Total: 9]

DATA SHEET
The Periodic Table of the Elements

		Group													
I	II	III	IV	V	VI	VII	0								
1 H Hydrogen											2 He Helium				
3 Li Lithium	4 Be Beryllium	5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon					11 Na Sodium			
11 Na Sodium	12 Mg Magnesium	13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon					19 K Potassium			
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium			
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium			
55 Cs Caesium	56 Ba Barium	57 La Lanthanum	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium			
87 Fr Francium	88 Ra Radium	89 Ac Actinium											82 Pb Lead		
												83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
												86 Rn Radon	87 Fr Francium	88 Ra Radium	89 Ac Actinium
												90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium
												94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium
												98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium
												102 No Nobelium	103 Lr Lawrencium	104 Rf Rutherfordium	105 Db Dubnium
												106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium
												110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium
												114 Fl Flerovium	115 Lv Livermorium	116 Og Oganesson	117 Ts Tennessine
												118 Uu Ununseptium	119 Uub Unbinetium	120 Uuq Unquettium	121 Uubk Unbihassium
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