



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
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CHEMISTRY

0620/43

Paper 4 Theory (Extended)

May/June 2016

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 16.

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.

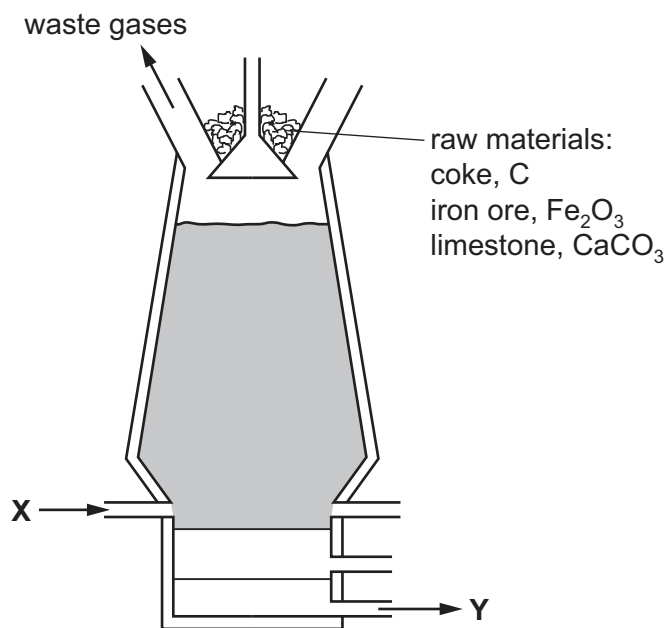
The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **14** printed pages and **2** blank pages.



2

1 The diagram shows a blast furnace.



(a) The following equations represent reactions which take place in the blast furnace.

- A** $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
B $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
C $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$
D $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$
E $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$

- (i) Which reaction is used to increase the temperature inside the blast furnace? [1]
 (ii) Which reaction is an example of thermal decomposition? [1]
 (iii) In which reaction is carbon both oxidised and reduced? [1]
 (iv) Which equation shows the removal of an impurity from the iron? [1]
 (v) Which equation shows the reaction of an acidic substance with a basic substance?
 [1]

(b) Use the diagram of the blast furnace to help you answer these questions.

- (i) What enters the blast furnace at X?
 [1]
 (ii) What leaves the blast furnace at Y?
 [1]

3

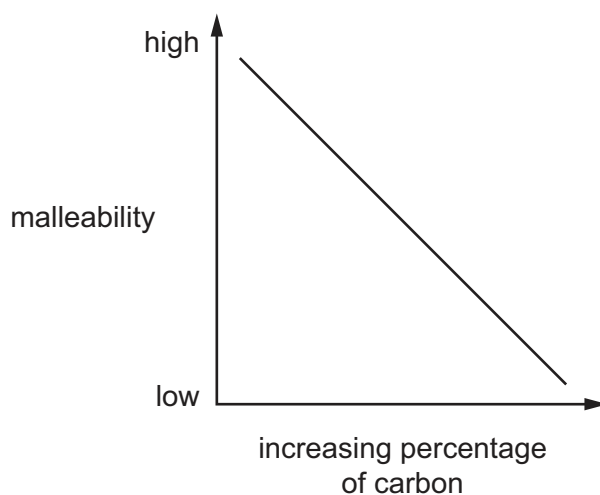
(iii) Name **two** waste gases that leave the blast furnace.

1.

2.

[2]

(c) The graph shows how the malleability of iron changes as the percentage of carbon in the iron changes.



(i) Describe how the malleability of iron changes as the percentage of carbon changes.

.....

..... [1]

(ii) Iron obtained from the blast furnace contains high levels of carbon.

Explain how the amount of carbon in the iron can be decreased.

.....

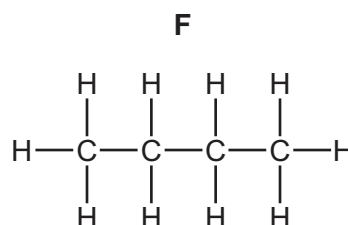
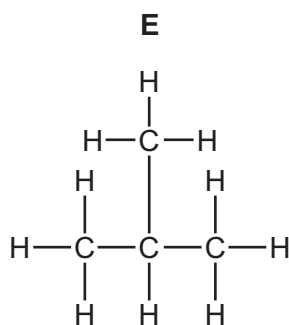
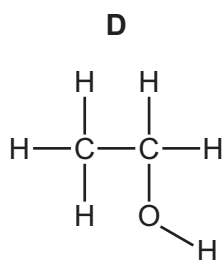
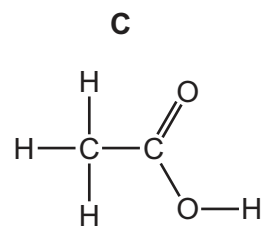
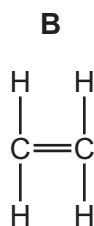
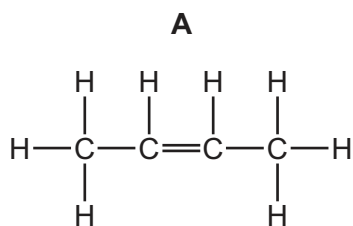
.....

..... [2]

[Total: 12]

4

2 The structures of six organic compounds are shown.



(a) Give the name of **F**.

..... [1]

(b) Identify **two** of the compounds that are members of the same homologous series.
Give the general formula of this homologous series.

compounds

general formula

[2]

(c) Which **two** compounds are isomers of each other?
Explain why they are isomers.

compounds

explanation

.....

[3]

(d) Explain why **B** is an unsaturated hydrocarbon.

.....

.....

..... [2]

5

(e) Describe how **D** is manufactured from **B**. Give a chemical equation for the reaction.

.....

.....

..... [3]

(f) Compound **A** forms an addition polymer.

Draw **two** repeat units of the addition polymer formed from **A**.

[2]

[Total: 13]

6**3** Clean dry air contains mainly nitrogen and oxygen.**(a)** Name **two** other gases that are in clean dry air.

.....
..... [2]

(b) Air often contains pollutants.

Identify **three** common gaseous pollutants in air and state how each of these pollutants are produced.

pollutant gas 1

how it is produced

.....

pollutant gas 2

how it is produced

.....

pollutant gas 3

how it is produced

.....

[6]**[Total: 8]**

7**4 (a)** Potassium iodide is an ionic compound.

- (i)** Describe what happens, in terms of electron loss and gain, when a potassium atom reacts with an iodine atom.

.....

.....

.....

..... [2]

- (ii)** Describe the structure of solid potassium iodide. You may draw a diagram.

.....

.....

..... [2]

- (iii)** Explain why potassium iodide has a high melting point.

.....

.....

..... [2]

(b) Potassium iodide and lead nitrate are both soluble. Lead iodide is insoluble.

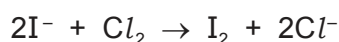
- (i) Describe how a pure dry sample of lead iodide could be made from solid potassium iodide and solid lead nitrate.

.....
.....
.....
.....
.....
..... [4]

- (ii) Write an ionic equation for the formation of lead iodide, PbI_2 , when potassium iodide and lead nitrate react with each other.
State symbols are **not** required.

..... [2]

(c) When chlorine gas is bubbled through an aqueous solution of potassium iodide, a redox reaction takes place.



- (i) State the colour change expected in this reaction.

start colour
end colour [2]

- (ii) Identify the reducing agent in this reaction. Explain your answer.

.....
.....
..... [2]

[Total: 16]

5 Dilute hydrochloric acid reacts with sodium carbonate solution.



(a) Explain why effervescence is seen during the reaction.

.....
..... [1]

(b) Dilute hydrochloric acid was titrated with sodium carbonate solution.

- 10.0 cm³ of 0.100 mol/dm³ hydrochloric acid were placed in a conical flask.
- A few drops of methyl orange indicator were added to the dilute hydrochloric acid.
- The mixture was titrated with sodium carbonate solution.
- 16.2 cm³ of sodium carbonate solution were required to react completely with the acid.

(i) What colour would the methyl orange indicator be in the hydrochloric acid?

..... [1]

(ii) Calculate how many moles of hydrochloric acid were used.

..... mol [1]

(iii) Use your answer to **(b)(ii)** and the equation for the reaction to calculate the number of moles of sodium carbonate that reacted.

..... mol [1]

(iv) Use your answer to **(b)(iii)** to calculate the concentration of the sodium carbonate solution in mol/dm³.

..... mol/dm³ [2]

(c) In another experiment, 0.020 mol of sodium carbonate were reacted with excess hydrochloric acid.

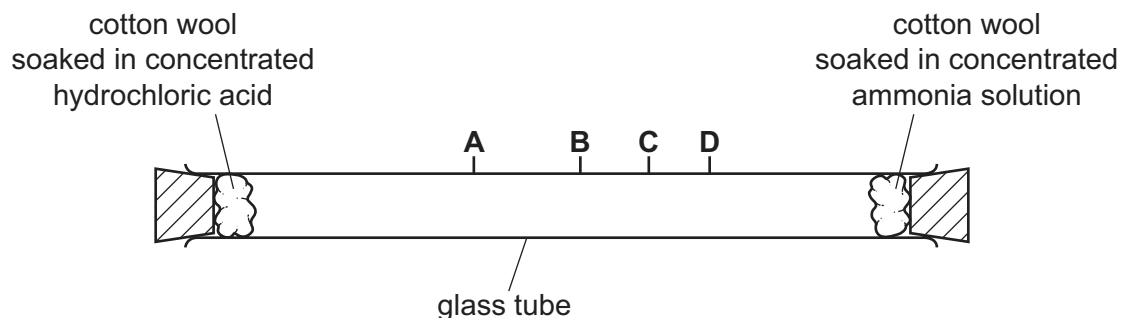
Calculate the maximum volume (at r.t.p.) of carbon dioxide gas that could be made in this reaction.

..... dm³ [3]

[Total: 9]

- 6** Concentrated ammonia solution gives off ammonia gas. Concentrated hydrochloric acid gives off hydrogen chloride gas. Ammonia, NH_3 , and hydrogen chloride, HCl , are both colourless gases. Ammonia reacts with hydrogen chloride to make the white solid ammonium chloride.

Apparatus is set up as shown.



After ten minutes a white solid forms in the tube where the gases meet.

- (a) (i)** Write the chemical equation for the reaction of ammonia with hydrogen chloride.

..... [1]

- (ii)** Name the process by which the ammonia and hydrogen chloride gases move in the tube.

..... [1]

- (iii)** At which point, **A**, **B**, **C** or **D**, does the white solid form? Explain why the white solid forms at that point.

the solid forms at

explanation

..... [3]

- (iv)** The experiment was repeated at a higher temperature.

Predict how the results of the experiment would be different. Explain your answer.

.....

.....

..... [3]

- (b) Some of the white solid is removed from the tube and dissolved in water.

Describe how the white solid could be tested to show it contains,

- (i) ammonium ions,

test

.....

result

.....

[3]

- (ii) chloride ions.

test

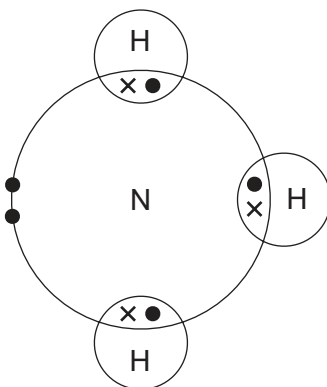
.....

result

.....

[3]

- (c) The diagram shows the electron arrangement in a molecule of ammonia, showing only outer shell electrons.

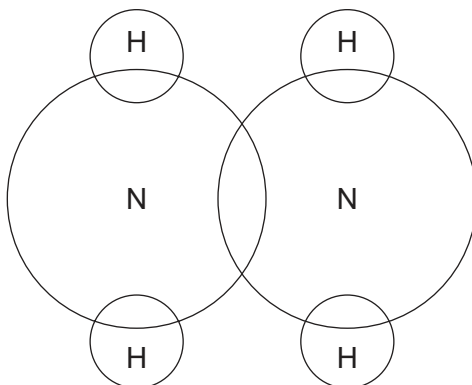


- (i) State the type of bonding in ammonia.

..... [1]

- (ii) Hydrazine, N_2H_4 , is another compound of nitrogen and hydrogen.

Complete the diagram to show the electron arrangement in a molecule of hydrazine, showing only outer shell electrons.



[3]

- (d) Nylon and proteins are both polymers containing nitrogen.

- (i) Name the linkages found in the polymers of nylon and protein.

..... [1]

- (ii) Describe **one** difference in the structures of nylon and protein.

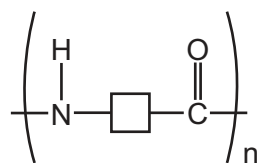
..... [1]

- (iii) What is the general name given to the products of hydrolysis of proteins?

..... [1]

13

(e) Suggest the structure of the monomer used to make the polymer shown.



[1]

[Total: 22]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
1Hhydrogen1 Key atomic number atomic symbol name relative atomic mass																	
3Li lithium 7	4Be beryllium 9											5B boron 11	6C carbon 12	7N nitrogen 14	8O oxygen 16	9F fluorine 19	10Ne neon 20
11Na sodium 23	12Mg magnesium 24											13Al aluminium 27	14Si silicon 28	15P phosphorus 31	16S sulfur 32	17Cl chlorine 35.5	18Ar argon 40
19K potassium 39	20Ca calcium 40	21Sc scandium 45	22Ti titanium 48	23V vanadium 51	24Cr chromium 52	25Mn manganese 55	26Fe iron 56	27Co cobalt 59	28Ni nickel 59	29Cu copper 64	30Zn zinc 65	31Ga gallium 70	32Ge germanium 73	33As arsenic 75	34Se selenium 79	35Br bromine 80	36Kr krypton 84
37Rb rubidium 85	38Sr strontium 88	39Y yttrium 89	40Zr zirconium 91	41Nb niobium 93	42Mo molybdenum 96	43Tc technetium —	44Ru ruthenium 101	45Rh rhodium 103	46Pd palladium 106	47Ag silver 108	48Cd cadmium 112	49In indium 115	50Sn tin 119	51Sb antimony 122	52Te tellurium 128	53I iodine 127	54Xe xenon 131
55Cs caesium 133	56Ba barium 137	57–71 lanthanoids	72Hf hafnium 178	73Ta tantalum 181	74W tungsten 184	75Re rhenium 186	76Os osmium 190	77Ir iridium 192	78Pt platinum 195	79Au gold 197	80Hg mercury 201	81Tl thallium 204	82Pb lead 207	83Bi bismuth 209	84Po polonium —	85At astatine —	86Rn radon —
87Fr francium —	88Ra radium —	89–103 actinoids	104Rf rutherfordium —	105Db dubnium —	106Sg seaborgium —	107Bh bohrium —	108Hs hassium —	109Mt meitnerium —	110Ds darmstadtium —	111Rg roentgenium —	112Cn copernicium —						

lanthanoids

actinoids

57La lanthanum 139	58Ce cerium 140	59Pr praseodymium 141	60Nd neodymium 144	61Pm promethium —	62Sm samarium 150	63Eu europium 152	64Gd gadolinium 157	65Tb terbium 159	66Dy dysprosium 163	67Ho holmium 165	68Er erbium 167	69Tm thulium 169	70Yb ytterbium 173	71Lu lutetium 175
89Ac actinium —	90Th thorium 232	91Pa protactinium 231	92U uranium 238	93Np neptunium —	94Pu plutonium —	95Am americium —	96Cm curium —	97Bk berkelium —	98Cf californium —	99Es einsteinium —	100Fm fermium —	101Md mendelevium —	102No nobelium —	103Lr lawrencium —

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.)