



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

CANDIDATE  
NAME

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NUMBER

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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.

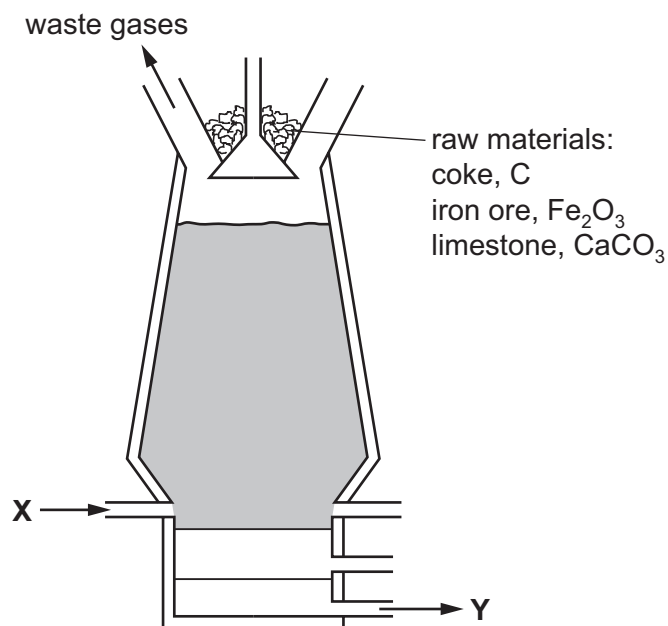
The number of marks is given in brackets [ ] at the end of each question or part question.

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.



1 The diagram shows a blast furnace.



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

- A**  $C + O_2 \rightarrow CO_2$   
**B**  $CaCO_3 \rightarrow CaO + CO_2$   
**C**  $CaO + SiO_2 \rightarrow CaSiO_3$   
**D**  $CO_2 + C \rightarrow 2CO$   
**E**  $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

- (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]

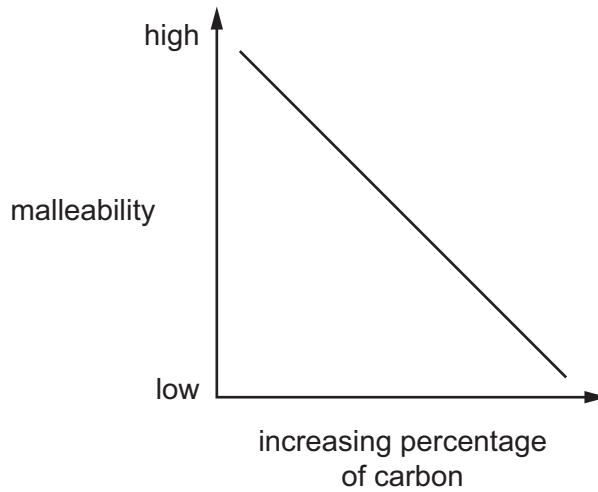
(b) Use the diagram of the blast furnace to help you answer these questions.

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

(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]

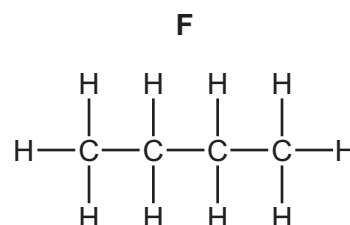
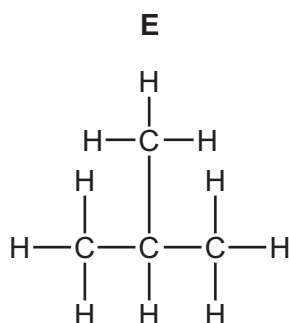
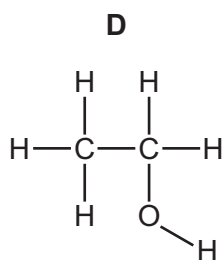
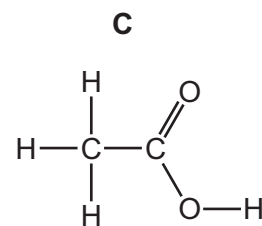
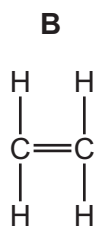
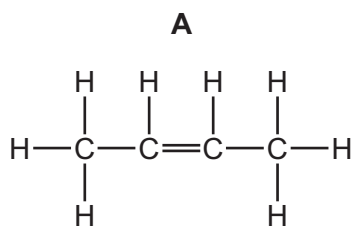
(ii) Iron obtained from the blast furnace contains high levels of carbon.

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

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

[Total: 12]

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]

(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]

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]

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.

.....

.....

.....

.....

.....

.....

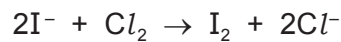
.....

..... [4]

(ii) Write an ionic equation for the formation of lead iodide,  $\text{PbI}_2$ , 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 cm<sup>3</sup> of 0.100 mol/dm<sup>3</sup> 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 cm<sup>3</sup> 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/dm<sup>3</sup>.

..... mol/dm<sup>3</sup> [2]

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

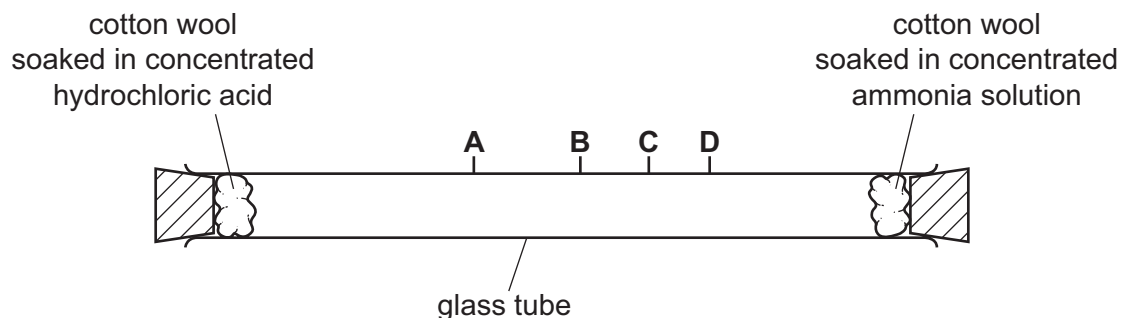
Calculate the maximum volume (at r.t.p.) of carbon dioxide gas that could be made in this reaction.

..... dm<sup>3</sup> [3]

[Total: 9]

- 6 Concentrated ammonia solution gives off ammonia gas. Concentrated hydrochloric acid gives off hydrogen chloride gas. Ammonia,  $\text{NH}_3$ , and hydrogen chloride,  $\text{HCl}$ , 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 .....

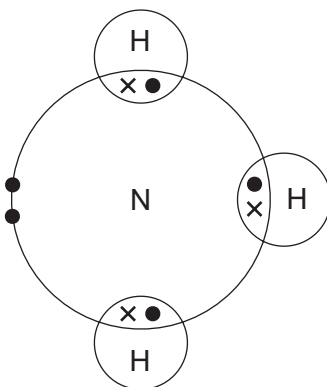
.....

result .....

.....

[3]

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

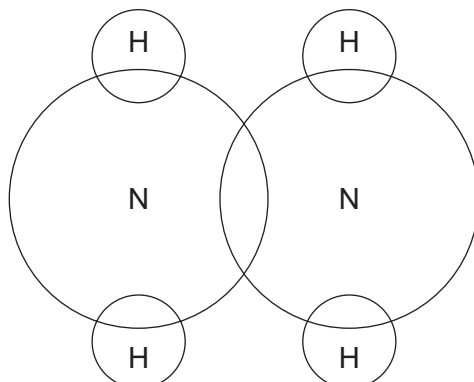


(i) State the type of bonding in ammonia.

..... [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]

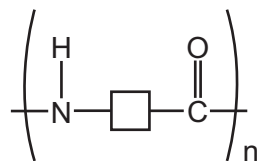
- (ii) Describe **one** difference in the structures of nylon and protein.

..... [1]

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

..... [1]

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



[1]

[Total: 22]

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