

CANDIDATE
NAME

CENTRE
NUMBER

| | | | | |
|--|--|--|--|--|
| | | | | |
|--|--|--|--|--|

CANDIDATE
NUMBER

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

* 4 1 8 2 0 2 1 4 2 0 *



CHEMISTRY

0620/33

Paper 3 (Extended)

May/June 2014

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.

bestexamhelp.com

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.

- 1 Choose a gas from the following list to answer the questions below. Each gas may be used once, more than once or not at all.

ammonia carbon dioxide carbon monoxide fluorine
hydrogen krypton nitrogen propene sulfur dioxide

- (a) It is a product of respiration. [1]
- (b) It polymerises to form a poly(alkene). [1]
- (c) It is a noble gas. [1]
- (d) It is the main component of air. [1]
- (e) It is a very reactive non-metal. [1]
- (f) It is used to kill micro-organisms in fruit juice. [1]
- (g) It burns to form water as the only product. [1]

[Total: 7]

2 Explain each of the following in terms of the kinetic particle theory.

(a) The rate of most reactions increases at higher temperatures.

.....

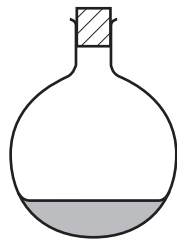
.....

.....

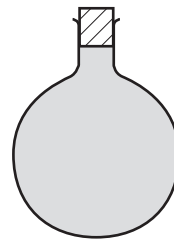
..... [3]

(b) A liquid has a fixed volume but takes up the shape of the container. A gas takes up the shape of the container but it does not have a fixed volume.

liquid



gas



.....

.....

.....

.....

..... [3]

[Total: 6]

3 (a) Biological catalysts produced by microbes cause food to deteriorate and decay.

(i) What is the name of these biological catalysts?

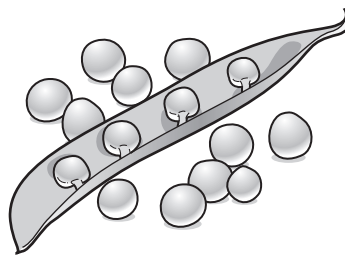
..... [1]

(ii) Freezing does not kill the microbes.

Suggest why freezing is still a very effective way of preserving food.

.....
 [2]

(b) Pea seeds grow in pods on pea plants.



Freshly picked pea seeds contain a sugar. The sugar can form a polymer.

Give the structural formula of the polymer and name the other product of this polymerisation reaction.

You may represent the sugar by the formula:



structural formula of the polymer

other product [3]

(c) Describe how the pea plant makes a sugar such as glucose.

.....
.....
.....
.....
..... [3]

[Total: 9]

4 Iron from a blast furnace contains about 5% of the impurities – carbon, silicon, phosphorus and sulfur. Most of this impure iron is used to make steels, such as mild steel, and a very small percentage is used to make pure iron.

(a) Calcium oxide and oxygen are used to remove the impurities from the iron produced in the blast furnace.

(i) State how these chemicals are manufactured.

calcium oxide
.....
oxygen
..... [3]

(ii) Describe how these two chemicals remove the four impurities. Include at least one equation in your answer.

.....
.....
.....
.....
.....
.....
..... [5]

(b) (i) Describe the structure of a typical metal such as iron. You may include a diagram.

.....
.....

[2]

(ii) Explain why pure iron is malleable.

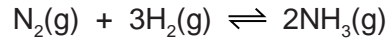
.....
..... [2]

(iii) Mild steel is an alloy of iron and carbon.
Suggest why mild steel is harder than pure iron.

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

[Total: 14]

5 Ammonia is made by the Haber process.



The forward reaction is exothermic.

The conditions in the reaction chamber are:

- a pressure of 200 atmospheres,
- a catalyst of finely divided iron,
- a temperature of 400 to 450 °C.

(a) What are the **two** advantages of using a high pressure? Give a reason for both.

advantage 1

reason

.....

advantage 2

reason

.....

[4]

(b) A higher temperature would give a faster reaction rate.

Why is a higher temperature **not** used?

.....

.....

..... [3]

(c) (i) Why is the iron catalyst used as a fine powder?

.....

..... [1]

(ii) Give **two** reasons why a catalyst is used.

.....

.....

.....

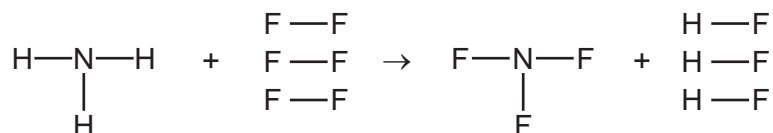
..... [2]

- (d) The equilibrium mixture leaving the reaction chamber contains 15% ammonia. Suggest how the ammonia could be separated from the mixture.

| | boiling point/°C |
|----------|------------------|
| hydrogen | -253 |
| nitrogen | -196 |
| ammonia | -33 |

.....
 [2]

- (e) Ammonia is used to make nitrogen trifluoride, NF_3 .
 Nitrogen trifluoride is essential to the electronics industry. It is made by the following reaction.



Determine if the above reaction is exothermic or endothermic using the following bond energies and by completing the following table. The first line has been done as an example.
 Bond energy is the amount of energy, in kJ/mole, needed to break or make one mole of the bond.

| bond | bond energy in kJ/mole |
|------|------------------------|
| N-H | 390 |
| F-F | 155 |
| N-F | 280 |
| H-F | 565 |

| bond | energy change/kJ |
|------|-------------------------|
| N-H | $(3 \times 390) = 1170$ |
| F-F | |
| N-F | |
| H-F | |

.....
 [4]

[Total: 16]

6 The alkanes are a family of saturated hydrocarbons. Their reactions include combustion, cracking and substitution.

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

..... [1]

(ii) What is meant by the term *saturated*?

..... [1]

(b) (i) What is the general formula for the homologous series of alkanes?

..... [1]

(ii) Calculate the mass of one mole of an alkane with 14 carbon atoms.

.....

..... [2]

(c) The complete combustion of hydrocarbons produces carbon dioxide and water only.

(i) Write the equation for the complete combustion of nonane, C_9H_{20} .

..... [2]

(ii) 20 cm^3 of a gaseous hydrocarbon was mixed with an excess of oxygen, 200 cm^3 . The mixture was ignited. After cooling, 40 cm^3 of oxygen and 100 cm^3 of carbon dioxide remained. Deduce the formula of the hydrocarbon and the equation for its combustion. All volumes were measured at r.t.p..

.....

.....

.....

.....

..... [3]

(d) Cracking is used to obtain short-chain alkanes, alkenes and hydrogen from long-chain alkanes.

(i) Give a use for each of the three products listed above.

short-chain alkanes

alkenes

hydrogen [3]

(ii) Write an equation for the cracking of decane, $C_{10}H_{22}$, which produces two different alkenes and hydrogen as the only products.

..... [1]

(e) Chlorine reacts with propane in a substitution reaction to form 1-chloropropane.



(i) What is the essential condition for the above reaction?

..... [1]

(ii) There is more than one possible substitution reaction between chlorine and propane. Suggest the structural formula of a different product.

..... [1]

[Total: 16]

7 Aluminium is obtained from purified alumina, Al_2O_3 , by electrolysis.

(a) Alumina is obtained from the main ore of aluminium.
State the name of this ore.

..... [1]

(b) Describe the extraction of aluminium from alumina. Include the electrolyte, the electrodes and the reactions at the electrodes.

.....

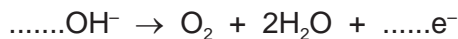
 [6]

(c) Aluminium is resistant to corrosion. It is protected by an oxide layer on its surface.
The thickness of this oxide layer can be increased by anodising.

(i) State a use of aluminium due to its resistance to corrosion.

..... [1]

(ii) Anodising is an electrolytic process. Dilute sulfuric acid is electrolysed with an aluminium object as the anode. The thickness of the oxide layer is increased. Complete the equations for the reactions at the aluminium anode.



[Total: 12]

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 | | 48 Ti Titanium 22 | 45 Sc Scandium 21 | 59 Co Cobalt 27 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 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 | | 91 Zr Zirconium 40 | 89 Y Yttrium 39 | 103 Rh Rhodium 45 | 101 Ru Ruthenium 44 | 106 Pd Palladium 46 | 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 | | 178 Hf Hafnium 72 | 139 La Lanthanum 57 | 192 Ir Iridium 77 | 186 Re Rhenium 75 | 195 Pt Platinum 78 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | 210 Po Polonium 84 | 210 At Astatine 85 | 222 Rn Radon 86 | |
| 87 Fr Francium | 226 Ra Radium | | | 227 Ac Actinium | | | | | | | | | | | |
| | | *58-71 Lanthanoid series †90-103 Actinoid series | | | | | | | | | | | | | |
| | | 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | 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 | 238 U Uranium 92 | 238 Pa Protactinium 91 | 238 Np Neptunium 93 | 238 Pu Plutonium 94 | 238 Am Americium 95 | 238 Cm Curium 96 | 238 Bk Berkelium 97 | 238 Cf Californium 98 | 238 Es Einsteinium 99 | 238 Fm Fermium 100 | 238 Md Mendelevium 101 | 238 No Nobelium 102 | 238 Lr Lawrencium 103 |

a X b
 Key
 a = relative atomic mass
 X = atomic symbol
 b = proton (atomic) number

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

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included the publisher will be pleased to make amends at the earliest possible opportunity.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.