

Second Variant Question Paper



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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CHEMISTRY

0620/32

Paper 3 (Extended)

October/November 2008

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 a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES

Answer **all** questions.

A copy of the Periodic Table is printed on page 12.

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 questions.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
Total	

This document consists of **12** printed pages.



1 Complete the following table.

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gas	test for gas
	turns damp red litmus paper blue
	bleaches damp litmus paper
hydrogen	
oxygen	
carbon dioxide	

[Total: 5]

2 There are three types of giant structure – ionic, metallic and macromolecular.

- (a) Sodium sulphide is an ionic compound. Draw a diagram that shows the formula of the compound, the charges on the ions and the arrangement of the valency electrons around the negative ion.

Use x to represent an electron from a sodium atom.

Use o to represent an electron from a sulphur atom.

[3]

- (b) (i) Describe metallic bonding.

.....
 [3]

- (ii) Use the above ideas to explain why
 metals are good conductors of electricity,

..... [1]

metals are malleable.

..... [2]

- (c) Silicon(IV) oxide has a macromolecular structure.

- (i) **Describe** the structure of silicon(IV) oxide (a diagram is not acceptable).

.....

 [3]

- (ii) Diamond has a similar structure and consequently similar properties.
 Give **two** physical properties common to both diamond and silicon(IV) oxide.

.....
 [2]

[Total: 14]

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3 Steel is an alloy made from impure iron.

(a) Both iron and steel rust. The formula for rust is $\text{Fe}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$.
It is hydrated iron(III) oxide.

(i) Name the **two** substances that must be present for rusting to occur.

..... and [2]

(ii) Painting and coating with grease are two methods of preventing iron or steel from rusting. Give **two** other methods.

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

(b) (i) Name a reagent that can reduce iron(III) oxide to iron.

..... [1]

(ii) Write a symbol equation for the reduction of iron(III) oxide, Fe_2O_3 , to iron.

..... [2]

(c) (i) Calculate the mass of one mole of $\text{Fe}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$.

..... [1]

(ii) Use your answer to (i) to calculate the percentage of water in rust.

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

(d) Iron from the blast furnace is impure. Two of the impurities are carbon and silicon. These are removed by blowing oxygen through the molten iron and adding calcium oxide.

(i) Explain how the addition of oxygen removes carbon.

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

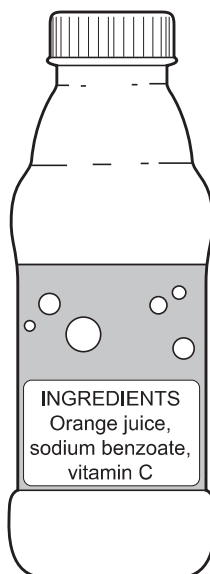
(ii) Explain how the addition of oxygen and calcium oxide removes silicon.

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

[Total: 13]

- 4 Across the world, food safety agencies are investigating the presence of minute traces of the toxic hydrocarbon, benzene, in soft drinks. It is formed by the reduction of sodium benzoate by vitamin C.

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- (a) Sodium benzoate is a salt, it has the formula C_6H_5COONa . It can be made by the neutralisation of benzoic acid by sodium hydroxide.

- (i) Deduce the formula of benzoic acid.

..... [1]

- (ii) Write a word equation for the reaction between benzoic acid and sodium hydroxide.

..... [1]

- (iii) Name **two** other compounds that would react with benzoic acid to form sodium benzoate.

..... [2]

(b) Benzene contains 92.3% of carbon and its relative molecular mass is 78.

(i) What is the percentage of hydrogen in benzene?

..... [1]

(ii) Calculate the ratio of moles of C atoms: moles of H atoms in benzene.

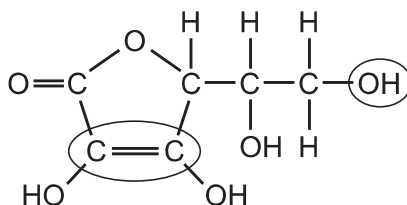
.....
 [2]

(iii) Calculate its empirical formula and **then** its molecular formula.

The empirical formula of benzene is

The molecular formula of benzene is [2]

(c) The structural formula of Vitamin C is drawn below.



(i) What is its molecular formula?

..... [1]

(ii) Name the two functional groups which are circled.

..... [2]

[Total: 12]

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5 The electrolysis of concentrated aqueous sodium chloride produces three commercially important chemicals; hydrogen, chlorine and sodium hydroxide.

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(a) The ions present are $\text{Na}^+(\text{aq})$, $\text{H}^+(\text{aq})$, $\text{Cl}^-(\text{aq})$ and $\text{OH}^-(\text{aq})$.

(i) Complete the ionic equation for the reaction at the negative electrode (cathode).



(ii) Complete the ionic equation for the reaction at the positive electrode (anode).



(iii) Explain why the solution changes from sodium chloride to sodium hydroxide.

..... [1]

(b) (i) Why does the water supply industry use chlorine?

..... [1]

(ii) Name an important chemical that is made from hydrogen.

..... [1]

(iii) Sodium hydroxide reacts with fats to make soap and glycerine
What type of compound are fats?

..... [1]

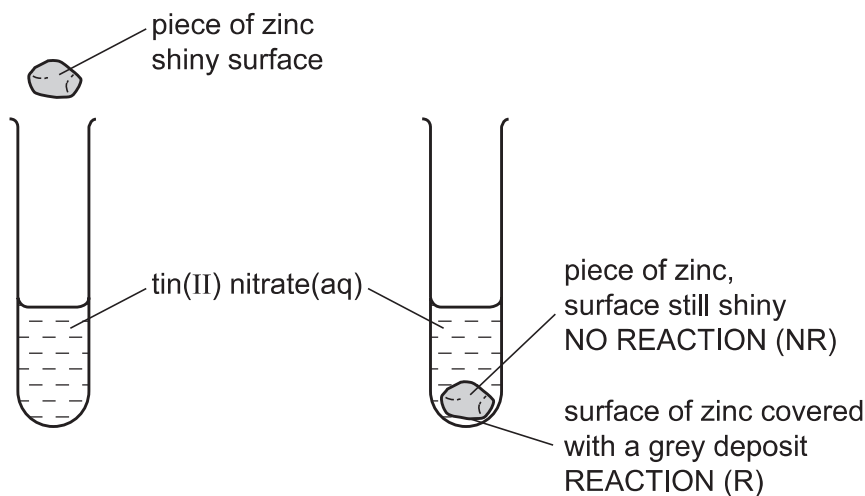
What type of the reaction is this?

..... [1]

[Total : 7]

6 The reactivity series lists metals in order of reactivity.

- (a) To find out which is the more reactive metal, zinc or tin, the following experiment could be carried out.



This experiment could be carried out with other metals and the results recorded in a table. Then the order of reactivity can be deduced.

- (i) The order was found to be:
 manganese most reactive
 zinc
 tin
 silver least reactive

Complete the table of results from which this order was determined.

aqueous solution	tin Sn	manganese Mn	silver Ag	zinc Zn
tin(II) nitrate		R	NR	R
manganese(II) nitrate				
silver(I) nitrate				
zinc nitrate				

[3]

- (ii) Write the equation for the reaction between zinc and silver(I) nitrate.

.....

[2]

- (iii) The following is a redox reaction.



Indicate on the equation which reagent is the oxidant or oxidizing agent.
Give a reason for your choice.

..... [2]

- (iv) Explain why experiments of this type cannot be used to find the position of aluminium in the reactivity series.

.....

..... [2]

- (b) Potassium and calcium are very reactive metals at the top of the series. Because their ions have different charges, K^+ and Ca^{2+} , their compounds behave differently when heated.

- (i) Explain why the ions have different charges.

.....

..... [2]

- (ii) Their hydroxides are heated.
If the compound decomposes, complete the word equation.
If it does not decompose, write "no reaction".

Potassium hydroxide \longrightarrow

Calcium hydroxide \longrightarrow [2]

- (iii) Complete the equations for the decomposition of their nitrates.

$2\text{KNO}_3 \longrightarrow$ +

$2\text{Ca}(\text{NO}_3)_2 \longrightarrow$ + + [4]

[Total: 17]

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7 The alkanes are generally unreactive. Their reactions include combustion, substitution and cracking.

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(a) The complete combustion of an alkane gives carbon dioxide and water.

- (i) 20 cm³ of butane is mixed with 150 cm³ of oxygen, which is an excess. The mixture is ignited. What is the volume of unreacted oxygen left and what is the volume of carbon dioxide formed?



Volume of oxygen left = cm³

Volume of carbon dioxide formed = cm³ [2]

- (ii) Why is the incomplete combustion of any alkane dangerous, particularly in an enclosed space?

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

(b) The equation for a substitution reaction of butane is given below.



- (i) Name the organic product.

..... [1]

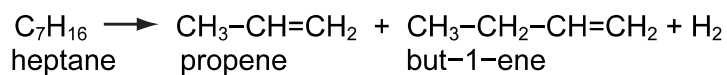
- (ii) This reaction does not need increased temperature or pressure. What is the essential reaction condition?

..... [1]

- (iii) Write a different equation for a substitution reaction between butane and chlorine.

..... [1]

- (c) Alkenes are more reactive and industrially more useful than alkanes. They are made by cracking alkanes.



- (i) Draw the structural formula of the polymer poly(propene).

[2]

- (ii) Give the structural formula and name of the alcohol formed when propene reacts with steam.

name

[1]

structural formula

[1]

- (iii) Deduce the structural formula of the product formed when but-1-ene reacts with hydrogen chloride.

[1]

[Total: 12]

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DATA SHEET
The Periodic Table of the Elements

		Group															
I	II	III	IV	V	VI	VII	0					0					
7 Li Lithium 3	9 Be Beryllium 4	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	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulphur 16	17 Cl Chlorine 17	18 Ar Argon 18			
19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36
37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54
55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86
87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	145 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	238 Pa Protactinium 91	238 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

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

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

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