London Examinations GCE

Chemistry

Ordinary Level

Paper 1

Tuesday 25 May 2010 – Afternoon

Time: 1 hour 15 minutes

Materials required for examination	**Items included with question papers**
Nil	Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.

Information for Candidates

A Periodic Table is printed on the back cover of this question paper.
Calculators may be used.
The total mark for this paper is 100.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 12 questions in this question paper.
There are 16 pages in this question paper.

DATA

One mole of any gas occupies 24 000 cm^3 at room temperature and atmospheric pressure.
One mole of electrons carries a charge of 96 500 coulombs or 1 faraday.

Advice to Candidates

Write your answers neatly and in good English.
In calculations, show **all** the steps in your working.

Turn over

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Answer ALL the questions.

1. Complete the table.

Name of compound	Formula of compound	Formula of cation	Formula of anion
calcium chloride	$CaCl_2$	Ca^{2+}	Cl^-
lead(II) carbonate		Pb^{2+}	
	$Fe(OH)_3$	Fe^{3+}	
chromium(III) oxide	Cr_2O_3		

(Total 6 marks)

2. Identify, by name or formula, the elements or compounds that fit the following descriptions.

(a) A pale yellow non-metallic element.

....
(1)

(b) An element that consists of diatomic molecules and is purple in the vapour state.

....
(1)

(c) A monatomic gas in Period 5 of the Periodic Table.

....
(1)

(d) The product of the reaction between hot iron metal and dry chlorine gas.

....
(1)

(e) The least reactive element in Group 2 of the Periodic Table.

....
(1) **Q2**

(Total 5 marks)

N 3 5 9 1 9 A 0 3 1 6

3. Complete the following statements by inserting the missing colours.

(a) At room temperature, bromine is a .... liquid.

(1)

(b) When concentrated nitric acid is added to copper, ... nitrogen dioxide is evolved.

(1)

(c) When water is added to anhydrous copper(II) sulphate, the solid

turns ....

(1)

(d) When aqueous sodium carbonate is added to aqueous calcium chloride,

a .... precipitate is formed.

(1)

(e) When damp pieces of red and blue litmus are placed in a gas jar of hydrogen

chloride, one piece changes from .... to ....

(1)

(Total 5 marks)

4. Complete the table.

Particle	Number of protons	Number of neutrons	Number of electrons
$^{19}_{9}F$			9
$^{80}_{35}Br^{-}$	35		
	19	20	18

(Total 7 marks)

5. Give the number of

(a) electrons in the outer energy level of antimony (atomic number = 51)

....
(1)

(b) atoms in one molecule of $(CH_3)_2CHCH_2CHBr_2$

....
(1)

(c) carbon atoms in one molecule of an alkane that contains ten hydrogen atoms

....
(1)

(d) moles of oxygen molecules required to react completely with four moles of hydrogen molecules

....
(1)

(e) moles of sodium hydroxide needed to neutralise 500 cm^3 of 0.25 mol dm^{-3} nitric acid.

....
(1)   **Q5**

(Total 5 marks)

6. Write balanced equations for the following reactions.

(a) magnesium + oxygen → magnesium oxide

....

(2)

(b) potassium hydroxide + carbon dioxide → potassium carbonate + water

....

(2)

(c) aluminium sulphate + sodium hydroxide → aluminium hydroxide + sodium sulphate

....

(2)

(d) ethanol + sodium → sodium ethoxide + hydrogen

....

(2) **Q6**

(Total 8 marks)

7. (a) State and explain what you would observe when zinc granules are added to a solution of copper(II) sulphate. Write an equation for the reaction, including state symbols.

Change in appearance of the zinc:

....

....

....

Change in appearance of the solution:

....

....

....

(4)

Equation: ....

(2)

(b) State what would be seen when bromine water is added in turn to aqueous sodium chloride and to aqueous sodium iodide. Write an equation for a reaction that occurs.

Observation with sodium chloride: ....

....

Observation with sodium iodide: ....

....

Equation: ....

....

(4)

(Total 10 marks)

Q7

8. (a) Describe how concentrated aqueous ethanol can be manufactured by fermentation of sugar and by hydration of ethene.

(i) Starting from sugar solution.

....

....

....

....

....

....

Equation: $C_6H_{12}O_6 \rightarrow$ .... C_2H_5OH + ...

(5)

(ii) Starting from ethene and steam.

....

....

....

....

Equation: ....

(4)

(b) (i) Give **one** environmental advantage of the fermentation method.

....

(1)

(ii) Give **two** advantages of the method using hydration of ethene.

....

....

(2)

Q8

(Total 12 marks)

9. (a) When a piece of iron is placed in a beaker of water, it becomes covered in rust and the water turns yellow. When a piece of iron is placed in a sealed test tube of water that has been boiled for several minutes, no reaction occurs.

(i) Explain the difference in behaviour of the iron in the two experiments.

....

....

....

....

(2)

(ii) Give a test and the result to show that the yellow solution formed contains iron(III) ions. Write an **ionic** equation for the reaction that occurs.

Test: ....

Result: ....

Equation: ....

(3)

(b) (i) Explain why an iron nail that has a strip of magnesium ribbon wrapped around it before being placed in a beaker of water does not rust.

....

....

....

....

(2)

(ii) Give **two** other ways by which rusting can be prevented.

....

....

(2)

(Total 9 marks)

10. Zinc can be obtained from its ore by a process which includes electrolysis of aqueous zinc sulphate using inert electrodes. Zinc is obtained at the cathode and oxygen at the anode.

(a) Complete the following ionic equations for the reactions that occur at the electrodes.

(i) Reaction at the cathode: Zn^{2+} + ... $\rightarrow$ ....

(ii) Reaction at the anode: $4OH^- - 4e^- \rightarrow$ .... $+ O_2$

(2)

(b) 20 faradays of electrical charge were passed through the solution.

(i) Calculate the number of moles of zinc formed at the cathode.

....

....

....

(2)

(ii) Calculate the mass of zinc formed at the cathode.

....

....

(1)

(iii) How many moles of oxygen gas were evolved?

....

....

....

(1)

(iv) Calculate the volume of oxygen evolved at room temperature and atmospheric pressure.

....

....

....

(2)

Q10

(Total 8 marks)

11. (a) (i) The rate of the reaction between marble chips and hydrochloric acid can be increased by breaking the chips into smaller pieces. Explain, using the kinetic theory, why this happens.

....

....

....

(2)

(ii) State, and explain, one other way by which the rate of this reaction can be increased.

....

....

....

....

(3)

(b) Some chemical reactions reach equilibrium under a given set of conditions. Consider the reaction represented below.

$$A_2(g) + B_2(g) \rightleftharpoons 2AB(g) \quad \Delta H \text{ is negative}$$

(i) State with a reason what effect, if any, an increase in temperature would have on the position of equilibrium.

....

....

....

(2)

(ii) State with a reason what effect, if any, an increase in pressure would have on the position of equilibrium.

....

....

....

(2)

(iii) State with a reason what effect, if any, an increase in pressure would have on the rate of reaction.

....

....

....

(3)

(Total 12 marks)

Q11

12. Some average bond dissociation energies are given in the table below.

Bond	Average Bond Dissociation Energy / kJ mol^{-1}
C—H	410
C—C	350
C—O	360
C=O	745
O—H	465
O=O	495
Si—Si	230
Si—H	318
Si—O	374

(a) Use the average bond dissociation energies in the table to calculate the enthalpy of combustion of propane.

$$\begin{array}{ccc} H & H & H \\ | & | & | \\ H-C-C-C-H + 5\,O{=}O & \rightarrow & 3\,O{=}C{=}O + 4\,H{-}O{-}H \\ | & | & | \\ H & H & H \end{array}$$
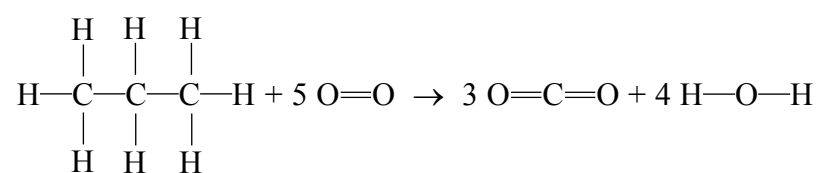
(i) Calculate the energy needed to break the bonds in

1 mole of propane:...

....

....

5 moles of oxygen: ....

....

Total energy needed:..

(4)

(ii) Calculate the energy released when the bonds are formed in

3 moles of carbon dioxide: ....

....

4 moles of steam: ....

....

Total energy released: ....

(3)

(iii) Calculate the enthalpy of combustion, ΔH, for the reaction.

....

....

(2)

(b) Carbon and silicon are in the same group of the Periodic Table. Carbon forms compounds in which there are long chains of carbon atoms. Silicon does not form compounds in which there are long chains of silicon atoms. Use the values in the table to suggest an explanation for this difference.

....

....

....

(2)

(c) The compound silane, SiH_4, spontaneously oxidises in air to form a compound containing Si—O bonds. Use the values in the table to suggest an explanation for this.

....

....

....

(2)

(Total 13 marks)

Q12

TOTAL FOR PAPER: 100 MARKS

END

THE PERIODIC TABLE

Period	Group 1	Group 2																		Group 3	Group 4	Group 5	Group 6	Group 7	Group 0
1									1 H Hydrogen 1																2 He Helium 4
2	3 Li Lithium 7	4 Be Beryllium 9																		5 B Boron 11	6 C Carbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
3	11 Na Sodium 23	12 Mg Magnesium 24																		13 Al Aluminium 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulphur 32	17 Cl Chlorine 35.5	18 Ar Argon 40
4	19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 63.5	30 Zn Zinc 65								31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
5	37 Rb Rubidium 86	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium 99	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112								49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131
6	55 Cs Caesium 133	56 Ba Barium 137	57 La Lanthanum 139	72 Hf Hafnium 179	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201								81 Tl Thallium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium 210	85 At Astatine 210	86 Rn Radon 222
7	87 Fr Francium 223	88 Ra Radium 226	89 Ac Actinium 227																						

Key

Atomic number
Symbol
Name
Relative atomic mass

16

N35919A01616