



DOWNE HOUSE
16+ ENTRANCE PAPER 2012/2013

CHEMISTRY
Time: 75 minutes

Name _____

School _____

INSTRUCTIONS TO CANDIDATES

Please put your name, subject and school at the top of each page used.

Answer ALL the questions.

Write your answers in the spaces provided on the paper.

A Periodic Table is provided on Page 2.

Maximum mark 75

THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

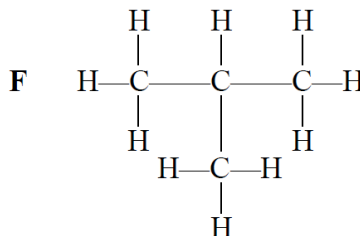
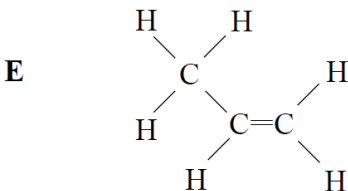
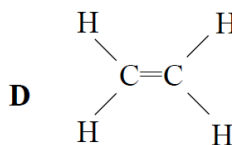
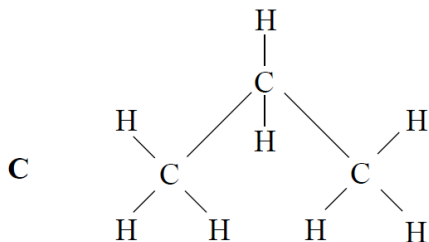
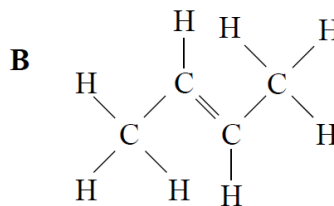
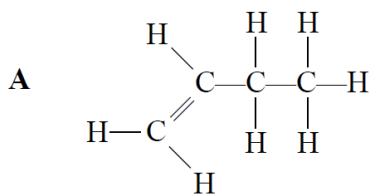
			1 H Hydrogen 1														4 He Helium 2	
								59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	127 I Iodine 53	131 Xe Xenon 54	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
					96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	131 Xe Xenon 54	131 Xe Xenon 54	
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
					89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
					181 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	
4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
					223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	227 Ac Actinium 89	

Key

Relative atomic mass
Symbol
Name
Atomic number

ANSWER ALL QUESTIONS

1. These are the structures of six hydrocarbons.



(a) Use the letters of the hydrocarbons to answer these questions.

(i) Give the letter of a hydrocarbon which is **not** an alkene. (1)

(ii) Which two hydrocarbons are isomers? (1)

(iii) Which structure is propene? (1)

(b) Hydrocarbon **D** forms a polymer. Give the name of this polymer and draw a diagram to represent the structure of the polymer.

Name of polymer

Structure of polymer

(3)

Q1

(Total 6 marks)

2. (a) Atoms contain smaller particles. Complete the table to show the relative mass and relative charge of each particle.

Particle	Relative mass	Relative charge
electron		
neutron	1	
proton		+1

(4)

(b) Use the Periodic Table on page 2 to name an element whose atoms

(i) contain equal numbers of protons and neutrons (1)

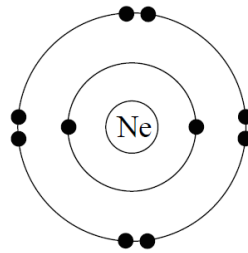
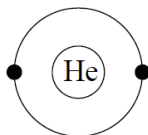
(ii) have the electronic configuration 2.8.4 (1)

(iii) have no neutrons. (1)

(c) Scientists think they will soon make an element that will go directly below astatine in the Periodic Table. Suggest how many electrons an atom of this element would have in its outer electron shell.

..... (1)

(d) The diagrams show the electronic configuration of helium and of neon.



(i) What is the similarity in the outer electron shells of these two atoms?
 (1)

(ii) What effect does this similarity have on the chemical reactivity of helium and neon?
 (1)

(Total 10 marks)

Q2

3. Use information from the table to answer this question.

 increasing reactivity	Name of metal	Colour of solid metal	Colour of a solution of the metal(II) sulphate
	magnesium	grey	colourless
	zinc	grey	colourless
	iron	dark grey	green
	copper	pink-brown	blue

(a) When zinc is added to magnesium sulphate solution, no reaction occurs. Explain why.

.....

 (1)

(b) When iron filings are added to copper(II) sulphate solution, a reaction takes place.

(i) Write a chemical equation for this reaction.

.....
 (2)

(ii) Describe the colour changes during this reaction.

Colour change of solid

.....

Colour change of solution

.....
 (4)

(c) When copper is added to dilute sulphuric acid, no reaction occurs. When iron is added to dilute sulphuric acid, hydrogen gas and iron(II) sulphate solution are formed. What does this show about the reactivity of hydrogen compared to the reactivity of copper and the reactivity of iron?

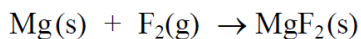
.....

 (2)

(Total 9 marks)

Q3

4. Magnesium and fluorine react together to form magnesium fluoride.



(a) (i) Describe the structure of a metal such as magnesium.

.....

 (2)

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

.....

 (1)

(iii) Explain, in terms of its structure, why magnesium is malleable.

.....

 (2)

(b) The atoms of fluorine in the F₂ molecule are joined by a covalent bond.

Describe how the atoms are held together by this bond.

.....

 (2)

(c) Give the electronic configuration of

(i) a fluorine atom

.....

(ii) a fluoride ion

.....
 (2)

(d) Draw a diagram to show the arrangement of electrons in a magnesium ion, showing its charge.

(2)

(e) Suggest why magnesium fluoride, MgF_2 , has a higher melting point than sodium fluoride, NaF .

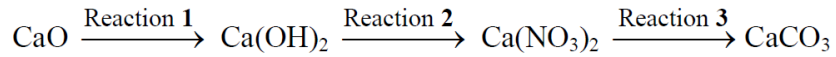
.....
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(2)

Q8

(Total 13 marks)

5. Some reactions of calcium compounds are shown in this sequence.



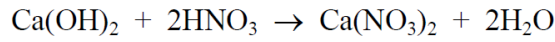
(a) What colour do calcium compounds give in a flame test?

.....
(1)

(b) What is added to calcium oxide in Reaction 1?

.....
(1)

(c) The chemical equation for Reaction 2 is



A 14.8 g sample of calcium hydroxide is neutralised by a solution of nitric acid of concentration 1.6 mol dm⁻³.

(i) Calculate the relative formula mass of calcium hydroxide and the amount, in moles, of calcium hydroxide in the 14.8 g sample.

(2)

(ii) Calculate the minimum volume, in cm^3 , of this solution of nitric acid needed to neutralise the sample of calcium hydroxide.

(3)

(iii) Reaction 2 is used to prepare 0.050 moles of calcium nitrate.

Calculate the mass of this amount of calcium nitrate.

(2)

(d) Sodium carbonate solution is used as the reagent in Reaction 3.

Write a chemical equation for the reaction and state **one** observation that can be made.

Equation

Observation

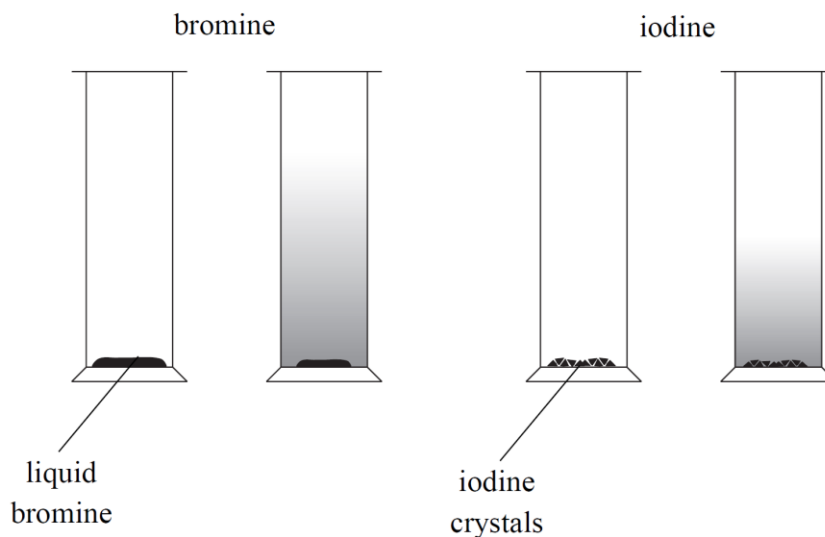
(3)

Q10

(Total 12 marks)

6. A few drops of liquid bromine and a few crystals of solid iodine are placed in the bottom of separate gas jars and the open ends covered with lids. The jars are left for some time under the same conditions.

The diagrams show the jars just after the bromine and iodine are added, and after some time.



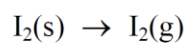
- (a) State the colour of
 liquid bromine
 solid iodine
(2)

- (b) The diagrams show that the particles of bromine and iodine spread out in the jars.

- (i) What is the name of this process?

(1)

- (ii) The iodine changes into a gas before this process occurs.
 The chemical equation for this change is



The change involving bromine is called evaporation.
 Write a chemical equation, including state symbols, for this change.

.....
(2)

(iii) Describe how the movement and spacing of the particles in $I_2(g)$ is different from that in $I_2(s)$.

Movement

Spacing

(2)

(c) The gases chlorine and hydrogen react together to form hydrogen chloride gas. Hydrogen chloride gas dissolves in water to form hydrochloric acid.

Bromine reacts in a similar way to chlorine.

(i) Write a word equation for the reaction between bromine and hydrogen.

.....

.....

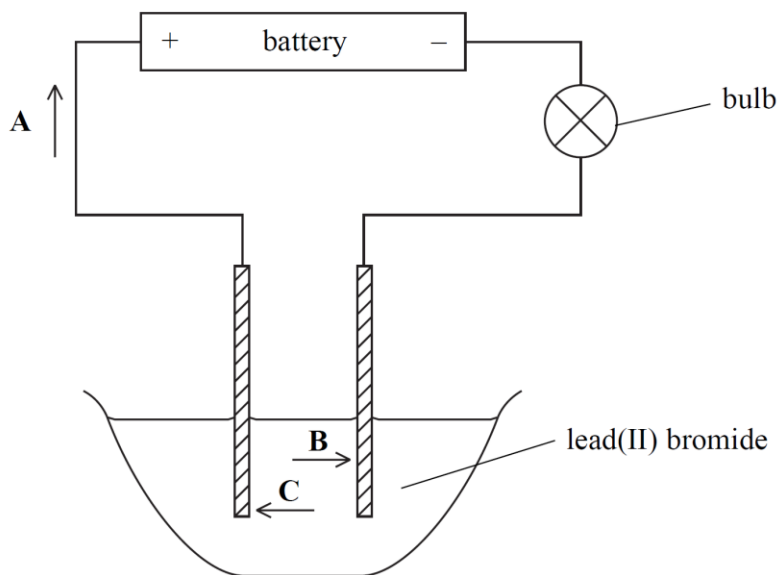
(1)

(ii) Suggest the name of the acid formed when the product in (c)(i) dissolves in water.

.....

(1)

(d) The diagram shows apparatus for electrolysing lead(II) bromide.



(i) When the apparatus is set up as shown, electrolysis does not occur. State what must be done before electrolysis can occur.

.....

 (1)

(ii) When electrolysis occurs, particles **A**, **B** and **C** move in the directions shown by the arrows in the diagram. Identify each of these particles.

A

B

C

(3)

(e) Explain why the reaction at the negative electrode is described as reduction.

.....
 (1)

(Total 14 marks)

Q2

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TURN OVER FOR NEXT QUESTION

7. Iron is extracted from iron ore in a blast furnace using three raw materials, **J**, **K** and **L**.

J is a black solid, **K** is a white solid composed mostly of calcium carbonate, and **L** is a colourless mixture of gases.

(a) Give the names of these raw materials.

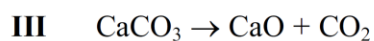
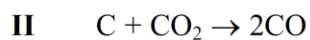
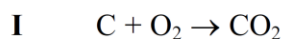
J

K

L

(3)

(b) The chemical equations for three reactions that occur in the blast furnace are:



(i) Explain why reaction **I** is important in the blast furnace.

.....

(1)

(ii) State the function of the product of reaction **II**.

.....

(1)

(iii) The function of the CaO formed in reaction **III** is to remove impurities in the iron ore. Write a chemical equation to show the reaction that occurs.

.....

(2)

(c) Two molten substances, **M** and iron, collect at the bottom of the blast furnace. Give the name of **M** and suggest why it floats on top of the molten iron.

.....

.....

.....

(2)

(d) Iron has many uses.

Suggest one property of iron, different in each case, that makes it suitable for:

making railway lines

.....

using in the Haber process

.....

(2)

(Total 11 marks)

Q8

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END OF PAPER

Total 75 marks

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