Class	Register Number	Name

南洋女子中学校

NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2010
Secondary Three

CHEMISTRY **1 hour 45 minutes**

Paper 2 **Theory Paper** **09 15 – 11 00**

Friday **15 October 2010**

Additional materials: Writing papers

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, register number and class in the spaces at the top of this page and on any separate answer paper used.

Section A (40 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B (30 marks)
Answer **all** questions including questions **9, 10** and **11** ***Either*** or **11** ***Or*****.**
Write your answers on the separate writing paper provided.
At the end of the examination,
1. Hand in **Section A** and **Section B** separately;
2. Write an **E** (for Either) or an **O** (for Or) next to the number 11 in the grid below to indicate which question you have answered.

INFORMATION FOR CANDIDATES

The intended number of marks is given in the brackets [ ] at the end of each question or part question. You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

You are allowed to use an approved scientific calculator.

Examiner's Use		
Section A		
Section B		
9		
10		
11		
Total		

Section A

Answer **all** questions.

Write your answers in the spaces provided.

A1 **(a)** What are the differences in the arrangement and motion of the particles in a solid as compared to that in a gas? Give a reason for these differences.

_____

_____

_____ [2]

(b) A certain gas **X**, has a relative molecular mass of 64. Another gas, **Y** has a relative molecular mass of 28. Both are at the same temperature. Are the particles in the two gases moving at the same speed? Explain your reasoning.

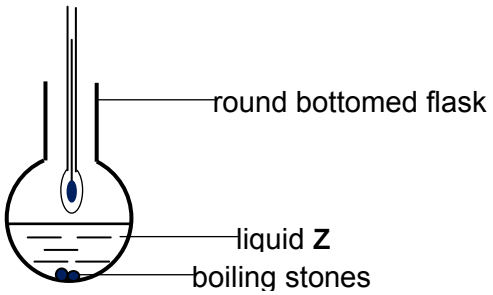
_____

_____

_____ [2]

[Total:4]

A2 **(a)** The figure below shows an experiment to find the boiling point of a liquid **Z**.



(i) Would this method be suitable for finding the boiling point of a volatile liquid? Explain your answer.

_____

_____

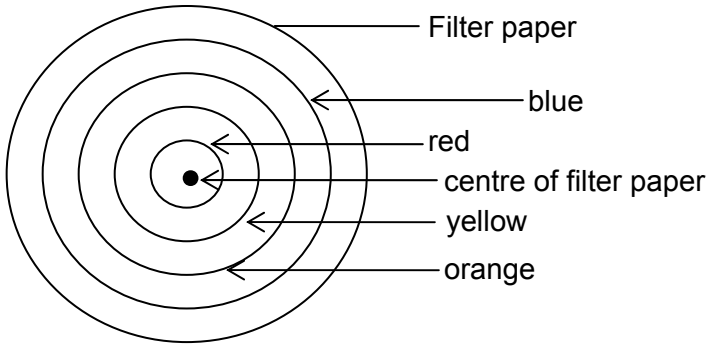
_____ [2]

(ii) The thermometer showed a constant reading at 70°C and then again at 120°C. What conclusion can you draw from this observation?

_____

_____ [1]

(b) The colouring in a fizzy drink was extracted by a solvent. Two drops of the solution were placed at the centre of a circular filter paper and allowed to dry. Drops of pure solvent were slowly added to the centre of the filter paper. After some time, four coloured circles were seen, as shown in the diagram below.



(i) What is the name of the process described above?

_____ [1]

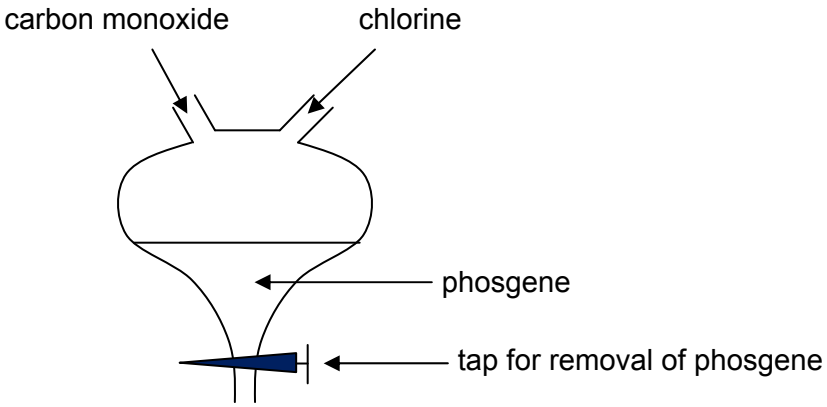
(ii) How many different dyes are there in the fizzy drink?

_____ [1]

[Total:5]

A3 Carbonyl chloride, $COCl_2$, is a colourless and poisonous gas that is also known as phosgene. It is needed for the production of insecticides and plastics.

It is produced from the reaction of carbon monoxide and chlorine gas in the reaction vessel as shown in the diagram below. The reaction vessel is cooled below 8^{o}C to collect the phosgene liquid.



(a) Draw a dot and cross diagram to show the bonding in $COCl_2$. Your diagram should only show the ***valence*** electrons.

[2]

(b) Would you expect phosgene to be a solid, a liquid or a gas at room temperature? Give a reason in terms of its structure and bonding.

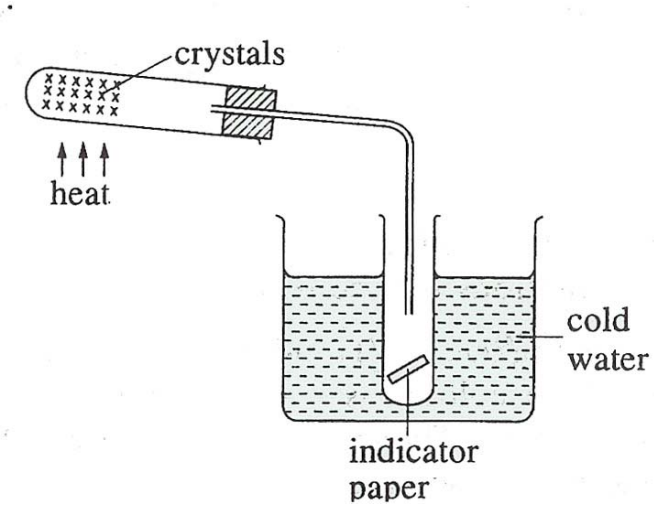
_____

_____

_____ [2]

[Total:4]

A4 **(a)** A sample of hydrated copper(II) sulfate, $CuSO_4.5H_2O$, was heated in the apparatus shown below.



On gentle heating, the blue crystals changed to a white solid **P** and a neutral liquid **Q** was collected in the tube cooled by cold water.

Name the white solid **P** and the neutral liquid **Q**.

White solid **P**: _____

Neutral liquid **Q**: _____ [2]

(b) On stronger heating, the white solid **P** changed to a black solid **R** and a gas was evolved which dissolved in liquid **Q** to from solution **S**. The indicator paper turned red as solution **S** was formed.

Addition of aqueous barium chloride to solution **S** gave a white precipitate, **W**.

(i) Name the white precipitate, **W**.

_____ [1]

(ii) Suggest an identity for solution **S**.

_____ [1]

[Total:4]

A5 **(a)** Sodium nitrate is a salt which can be prepared by reacting an alkali with an acid, using the titration method.

(i) Name an alkali and an acid which would react together to produce sodium nitrate.

alkali: _____

acid: _____ [2]

(ii) Write an ionic equation, with state symbols, for the reaction.

_____ [2]

(b) Lead(II) chloride is a salt which can be prepared by the precipitation method.

(i) Name suitable reagents for the precipitation of lead(II) chloride.

Reagent 1: _____

Reagent 2: _____ [2]

(ii) Explain why the precipitation method is suitable for the preparation of lead(II) chloride.

_____

_____

_____ [2]

[Total:8]

A6 In a reaction, silver nitrate decomposed on heating according to the equation below.

$$2AgNO_3 \rightarrow 2Ag + 2NO_2 + O_2$$

Given that 42.5 g of silver nitrate completely decomposed when heated in an experiment:

(a) Calculate the mass of silver metal formed. [2]

(b) Calculate the volume of nitrogen dioxide, in dm^3, gas formed at r.t.p. [2]

(c) Calculate the number of moles of oxygen gas formed. [2]

[Total:6]

A7 A solution contains 5.00 g of impure phosphoric acid, H_3PO_4, per dm^3. In a titration, 25.0 cm^3 of the acid solution reacted with 20.80 cm^3 of 0.12 mol/dm^3 sodium hydroxide according to the equation shown below.

$$H_3PO_4(aq) + 3NaOH(aq) \rightarrow Na_3PO_4(aq) + 3H_2O(l)$$

(a) Calculate the number of moles of sodium hydroxide that reacts with the acid. [2]

(b) Calculate the concentration of pure phosphoric acid in g/dm^3, present in the solution. [2]

(c) Calculate the percentage purity of the phosphoric acid. [1]

[Total:5]

A8 The reaction between zinc granules and dilute sulfuric acid at 25^{o}C can be made to go faster by adding a small amount of copper powder.

In the experiment, 0.65 g of zinc granules and 100 cm^3 of 0.2 mol/dm^3 sulfuric acid are allowed to react.

(a) Calculate the number of moles of zinc in 0.65 g. [1]

(b) Calculate the number of moles of sulfuric acid in 100 cm^3 of 0.2 mol/dm^3 solution. [1]

(c) Explain why the reaction stops. [2]

[Total:4]

Section B

Answer all **three** questions from this section.

The last question is in the form of either/or and only **one** of the alternatives should be attempted. Each question carries **ten** marks.

B 9 Acids can be neutralised by metal hydroxides.

(a) A metal hydroxide when reacted with hydrochloric acid produces a salt which is used in sewage treatment and drinking water production.

(i) Find the molecular formula of the metal hydroxide if 12.00 g of the metal hydroxide containing 6.28 g of iron and 5.39 g of oxygen, have a molar mass of 107 g/mol. [3]

(ii) Write the ionic equation, including the state symbols, for the reaction between this metal hydroxide and dilute hydrochloric acid. [2]

(b) 25.0 cm^3 of a solution containing 9.00 g/dm^3 of another metal hydroxide, **X**OH, reacted with 33.35 cm^3 of 0.12 mol/dm^3 of dilute hydrochloric acid.

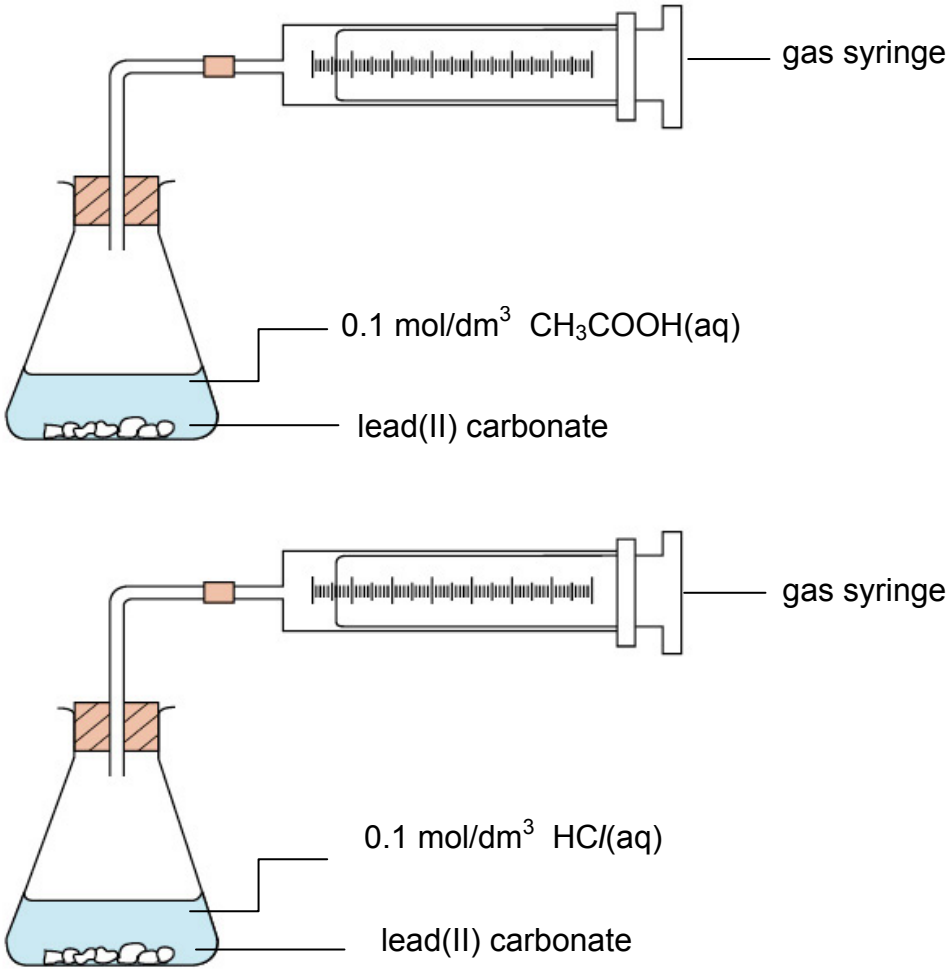
(i) Calculate the concentration of the alkali in mol/dm^3. [2]

(ii) Calculate the relative molecular mass of **X**OH. [1]

(iii) Identify the metal **X**. [2]

[Total:10]

B 10 An experiment is conducted using ethanoic acid and hydrochloric acid to prepare two different salts according to the set-up below.



Source: Longman Rate of Reaction

(a) Slower effervescence is observed with ethanoic acid at the beginning of the experiment. However, its gas syringe is pushed further away from its initial position at the end of the experiment.

(i) Name all the products formed in the reaction between ethanoic acid and lead(II) carbonate. [2]

(ii) Write the chemical equation, including state symbols, for the reaction between hydrochloric acid and lead(II) carbonate. [2]

(iii) Based on your answers for (i) and (ii), explain the two observations stated above. [3]

(b) Describe how a pure and dry sample of the salt formed between lead(II) carbonate and hydrochloric acid can be prepared in a more efficient way. [3]

[Total:10]

B 11

Either

(a) The table below shows the number of electrons and neutrons for ions $\mathbf{A}^{2-}$, $\mathbf{B}^{+}$, $\mathbf{C}^{3-}$and $\mathbf{D}^{2+}$.

Ion	Number of electron	Number of neutron
$\mathbf{A}^{2-}$	10	11
$\mathbf{B}^{+}$	10	12
$\mathbf{C}^{3-}$	18	17
$\mathbf{D}^{2+}$	18	20

(i) State the nucleon number of the 4 ions. [2]

(ii) Give the electronic configuration of **D**. [1]

(iii) What is the formula of the compound formed between **A** and **B**? [1]

(b) Some physical properties of iron, sulphur and iron(II) sulphide are shown in the table below.

	Iron	Sulfur	Iron(II) sulfide
Melting point /^{o}C	1540	113	1195
Electrical conductivity in the solid state	Conductor	Non-conductor	Non-conductor
Electrical conductivity in the liquid state	Conductor	Non-conductor	

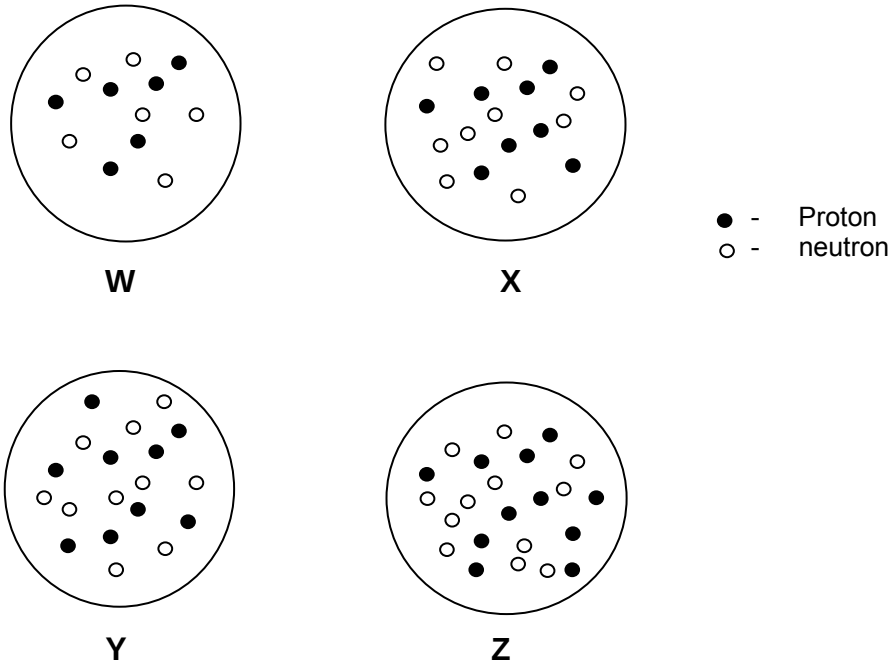
(i) Do you expect iron(II) sulfide to conduct electricity in the liquid state? Give a reason for your answer. [2]

(ii) Account for the difference in the electrical conductivity between iron and iron(II) sulfide in the solid state. [2]

(iii) Explain, in terms of the structure and bonding, the difference in the melting points between sulfur and iron(II) sulfide. [2]

[Total: 10]

B 11 *Or* The diagram below shows the nuclei of atoms **W**, **X**, **Y** and **Z**.



(a) Write the electronic configuration of [2]

(i) **W**

(ii) **Z**

(b) What is the formula for the compound formed between [2]

(i) **X** and **Y ?**

(ii) **W, X** and **Z ?**

(c) The table below shows some properties of four substances.
Use this information to answer the following questions.

Substance	Melting point /^{o}C	Electrical conductivity
S	44	Not at all
T	1650	Not at all
U	2800	In molten state
V	3377	In solid and molten states

(i) Compare the particles responsible for the conduction of electricity in molten state for **U** and **V**. [2]

(ii) Explain, with reasons, which substance is silicon dioxide. [2]

(iii) Explain, in terms of structure and bonding, the difference in the melting points between **S** and **U**. [2]

[Total: 10]

END OF PAPER

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	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	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	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	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Halnium 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	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

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

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

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

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).