Class	Register Number	Name

南洋女子中學校

NANYANG GIRLS' HIGH SCHOOL

Mid Year Examination 2014
Secondary Three

CHEMISTRY **1 hour 30 minutes**

Section B and C Theory Paper

Tuesday **6 May 2014** **1145-1315**

Additional materials: Writing paper

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 B (30 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section C (10 marks)
Answer **all** questions. Write your answers on the separate writing paper provided.
At the end of the examination,
Hand in the writing paper separately.

INFORMATION FOR CANDIDATES

The intended number of marks is given in the brackets [ ] at the end of each question or part question.

Examiner's Use	
Section A	
Section B	
Section C	
Total	

Section B

Answer **all** questions.

Write your answers in the spaces provided.

B1 A few drops of concentrated nitric acid were added to pieces of copper at the bottom of a tall bell jar. A reddish-brown nitrogen dioxide gas was formed and all the copper reacted in a very short time. The red-brown colour slowly moved up the gas jar but initially the colour remained darkest at the bottom. After thirty minutes, the reddish-brown colour was uniform throughout the gas jar.

(a) Bromine is another reddish brown gas. Which gas, bromine or nitrogen dioxide, will fill up the whole jar in a lesser time? Give a reason for your answer. [2]

_____

_____

_____

_____

(b) Explain how and why the results would differ if the gas jar was placed in hot water before carrying out the experiment. [2]

_____

_____

_____

_____

Total [4]

B2 Four elements **P**, **Q**, **R** and **T,** have proton numbers between 2 and 12. An atom of **P** has one electron less than a noble gas (Group 0 element). An atom of **Q** has three electrons less than a noble gas. An atom of **R** has one electron more than a noble gas. The atom of **T** has the same total number of electrons as **P** but the mass number of **T** is 1 more than that of **P**.

(a) Write the chemical formula of the compound formed between

(i) **P** and **Q** : _____ [1]

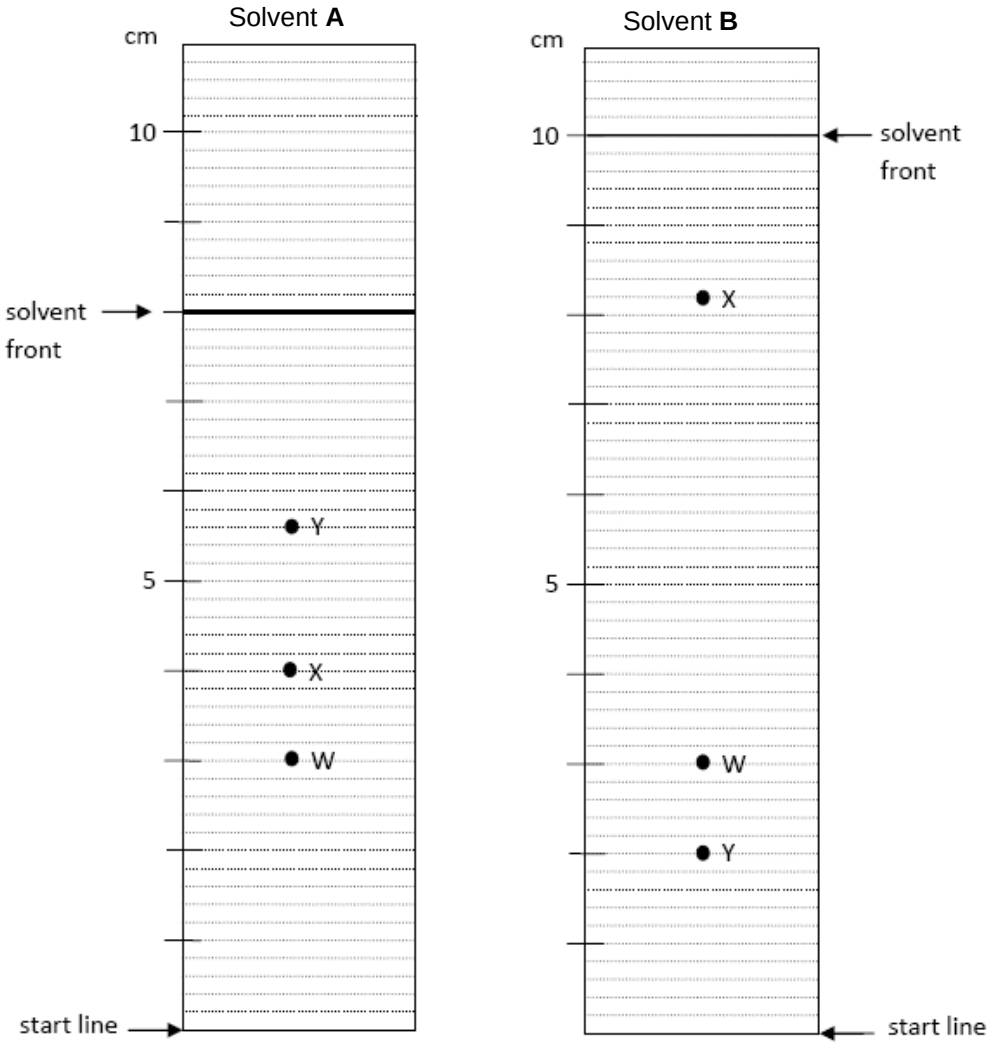
(ii) **P** and **R** : _____ [1]

(b) Draw the Lewis dot diagram of the compound formed in **(a)(i)** [1]

(c) What is the relationship between **P** and **T**? [1]

Total [4]

B3 A mixture of amino acid was separated by paper chromatography using two different solvents. After treating with a locating agent, the results are shown below. The position of the amino acids on the two chromatograms are labelled **W**, **X** and **Y.**



(a) From the chromatograms, explain in term of R_f value, whether **X** is more soluble in solvent **A** or **B**? [2]

(b) The R_f values of a number of amino acids in the two solvents are listed below.

Amino acid	R_f value in solvent A	R_f value in solvent B
Alanine	0.72	0.38
Glutamic acid	0.38	0.30
Tyrosine	0.66	0.45

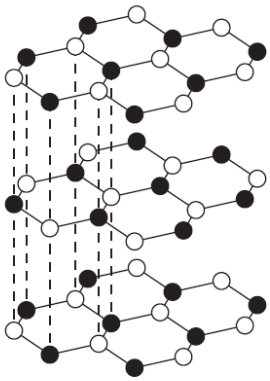
[1]

State the identity of **W** based on the values above.

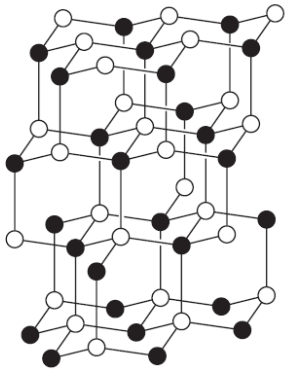
W : _____

Total [3]

B4 Boron nitride, BN, exists in two physical forms. The structures of these forms are shown below.



structure **A**



structure **B**

(a) Suggest why boron nitride with structure **A** can be used as a lubricant. [2]

(b) Suggest a use of boron nitride with structure **B**. [1]

Total [3]

B5 Campden tablets are composed of a mixture of sodium metabisulfate $Na_2S_2O_5$, and various preservatives. They are used during wine-making to sterilise equipment by dissolving them in water and adding a monobasic organic acid **HA**. These two components react together to produce sulfur dioxide, a sodium salt of the organic acid, **NaA,** and water.

(a) Write a chemical equation for the reaction of sodium metabisulfate with the acid. [1]

(b) **HA** is a weak organic acid. Explain what is meant by a "weak acid". [1]

(c) Write the chemical equation for the dissociation of the acid. [1]

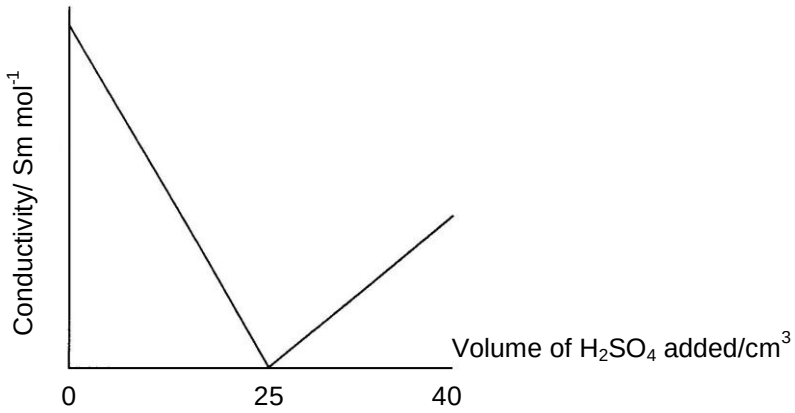
(d) What is the nature of sulfur dioxide? Describe a reaction that can be used to determine the nature of sulfur dioxide. [2]

Total [5]

B6 Salts can be prepared by various methods depending on the chemical nature of the salt.

(a) Alex was given copper(II) sulfate solution and he was asked to prepare pure copper(II) nitrate crystals. State briefly how this could be done. [2]

(b) A 20 cm^3 sample of aqueous barium hydroxide was titrated with 40 cm^3 of 0.12 mol/dm^3 of dilute sulfuric acid. [3]
The conductivity of the solution, which is its ability to conduct electricity, was measured throughout the titration and the results shown in the graph below. Explain the changes in conductivity shown by the graph.



(c) Outline the steps you will take to obtain a pure sample of the salt formed from the reaction mixture after 40 cm^3 of sulfuric acid is added. [2]

Total [7]

B7 A brown compound **E** is insoluble in water. When dilute hydrochloric acid is added to **E**, effervescence of a colourless and odourless gas **G** is observed. The brown compound dissolves in acid to form a yellow solution.

(a) State with reasons, a cation and an anion that could **not** be present in compound **E**. [2]

_____

_____

_____

(b) What is the identity of **E** ? _____ [1]

(c) Using your answer in **(b),** write an ionic equation for the reaction of **E** with hydrochloric acid. [1]

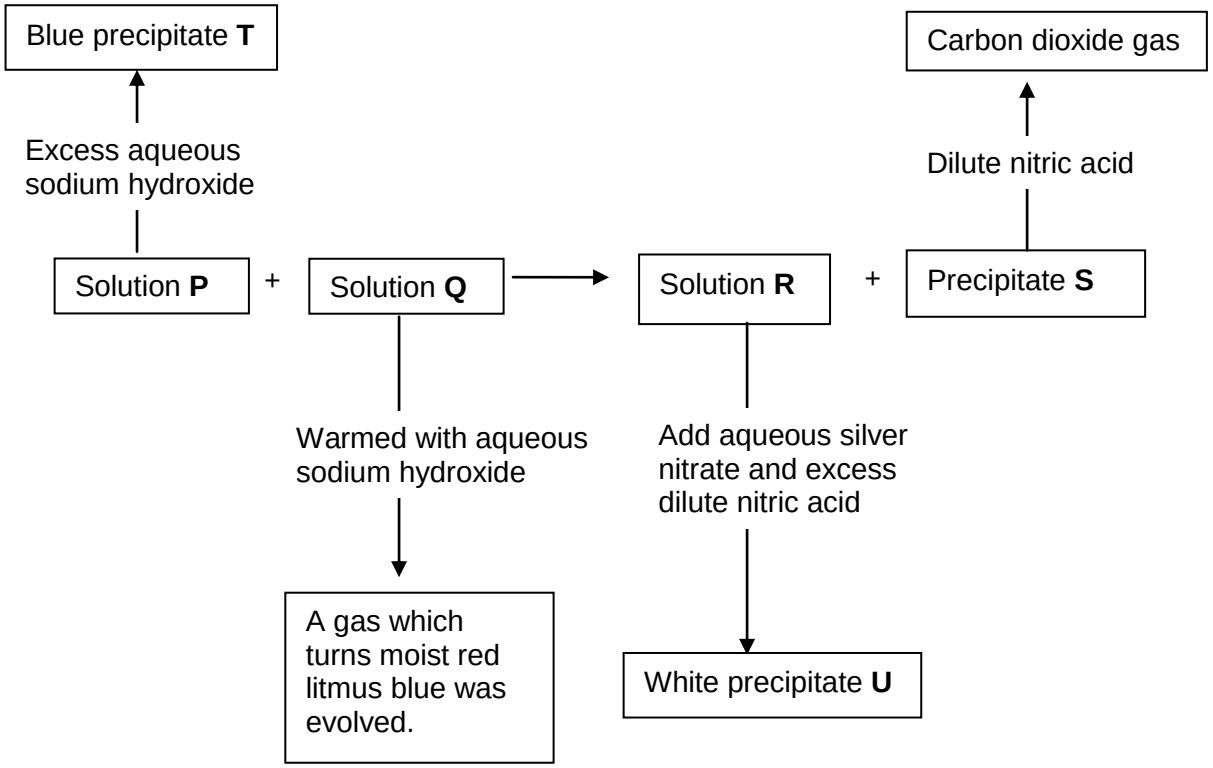
_____

Total [4]

Section C

Answer all questions from this section in the writing paper provided.

C8 The reaction scheme below shows the relationship between compounds **P** to **U**.
Solution **P** and **Q** react together to produce Solution **R** and Precipitate **S**.
P, **Q**, **R** and **S** are also subjected to other tests individually to deduce their identities.



(a) State the formulas of the cations in **P** and **Q** [2]

(b) State the formulas of anions in **R** and **S** [2]

(c) Hence deduce the identities of **R** and **S**. [2]

(d) Write the ionic equation for the reaction between **P** and aqueous sodium hydroxide. [1]

(e) State the effect of carbon dioxide gas on moist red litmus paper and give a reason for your answer. [2]

(f) Describe the observations that will be made when excess aqueous ammonia is added dropwise to Solution **R**. [1]

End of paper

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		Key: relative atomic mass / atomic symbol / name / atomic number								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	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 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	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

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

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