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南洋女子中學校
NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2011
Secondary Three

CHEMISTRY

Paper 1

Multiple Choice

Thursday

13 October 2011

Additional materials: Multiple Choice Answer Sheet

45 Minutes

08 00 to 08 45h

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.

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

Write your name, class and register number on the Multiple Choice Answer Sheet provided.

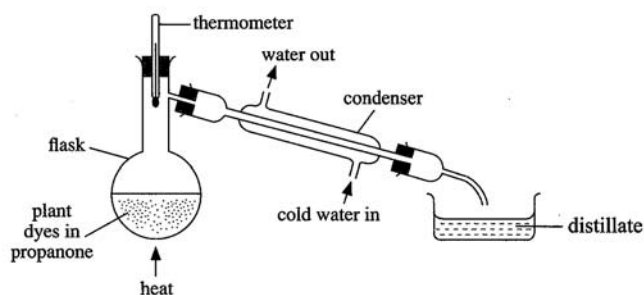
There are **thirty** questions in this paper. Answer **all** questions. For each question there are four possible answers, **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the answer sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. No mark will be deducted for a wrong answer. Any rough working should be done in this booklet.

A copy of the Periodic Table is found on **page 10**.

- 1 The apparatus below can be used to extract propanone, C_3H_6O , (boiling point $56^\circ C$) from a solution of propanone containing plant dyes.



During the separation process, the plant dyes

- A are collected as the distillate.
B react to form a colourless product.
C remain in the flask.
D are removed by the cooling water.
- 2 Two liquids, dichloromethane and water, are separated using separating funnel. Dichloromethane is drained off first.

Which statement about dichloromethane is correct?

- A It is miscible with water and is denser than water.
B It is immiscible with water and is less dense than water.
C It is miscible with water and is less dense than water.
D It is immiscible with water and is denser than water.
- 3 The table shows four elements, **W**, **X**, **Y** and **Z** with their atomic numbers.

Element	W	X	Y	Z
Atomic Number	6	8	11	17

What are the likely formulae of ionic compounds and covalent compounds formed from the above elements?

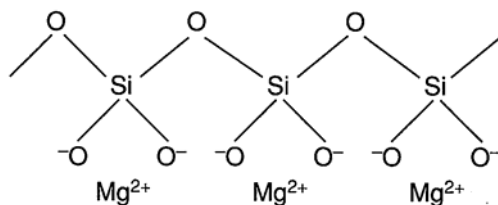
	Ionic Compound of formula	Covalent compound of formula
A	WX	YZ
B	Y_2X	WX_2
C	YW	WZ_4
D	YZ	ZX

- 4 The following properties of compound **R** were given in a chemistry report written by a student. Which property shows that **R** contains ionic bonds?
- A **R** has high melting and boiling points.
B Solid **R** dissolves in water.
C Solid **R** does not conduct electricity.
D Molten **R** conducts electricity but solid **R** does not.

- 5 Element **X** is a gas at room temperature and pressure. It reacts with calcium metal to form a white solid with the chemical formula Ca_3X_2 . Which of the following is a possible electronic configuration of **X**?

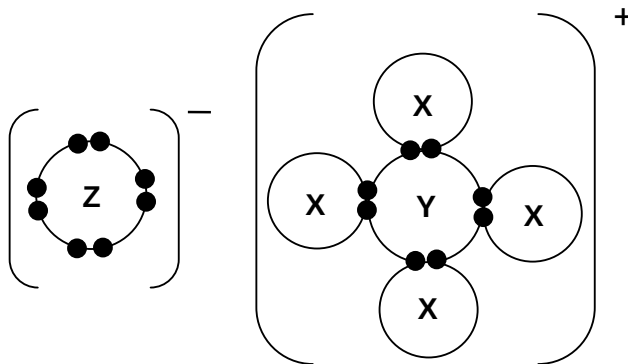
- A 2.3
- B 2.5
- C 2.8.3
- D 2.8.5

- 6 The diagram below shows a simplified structure for asbestos.



What type(s) of bonding is/are found in asbestos?

- A covalent and ionic
 - B covalent and metallic
 - C covalent only
 - D ionic only
- 7 **X**, **Y** and **Z** are three different elements. The diagram below shows the arrangement of electrons in the compound formed by **X**, **Y** and **Z**. (Only electrons in the outermost shells are shown.)



Which of the following statements are correct?

- I There is one electron in the outermost shell of an atom of **X**.
- II There are 5 electrons in the outermost shell of an atom of **Y**.
- III There are 8 electrons in the outermost shell of an atom of **Z**.

- A I and II only
- B I and III only
- C II and III only
- D All of the above

- 8 Both ammonia and oxygen are covalent molecules with low melting and boiling points. How many electrons are **NOT** involved in the bonding of each molecule?

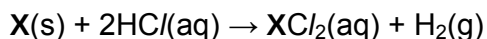
	Ammonia, NH ₃	Oxygen, O ₂
A	2	8
B	2	12
C	4	8
D	4	12

- 9 Elements **X** and **Y** are both non-metallic elements in the Periodic Table. Element **X** combines with carbon to give the structural formula of **X=C=X**. Element **Y** combines with hydrogen to give the structural formula of **H-Y**.

What is the most likely structural formula of the covalent compound **X₂Y₂**?

- A **X-Y-Y-X**
 B **X=Y-Y=X**
 C **Y-X-X-Y**
 D **Y-X-Y-X**

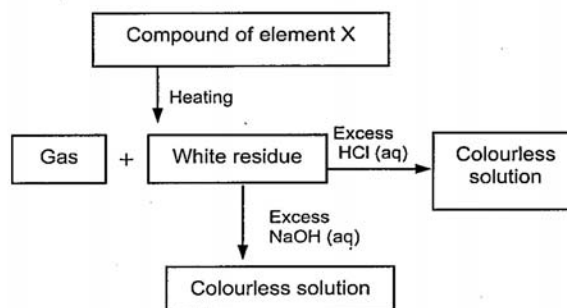
- 10 The equation shows the reaction between element **X** and dilute hydrochloric acid.



Which types of bonding are present in element **X** and in compound **XCl₂**?

	Type of Bonding	
	in element X	in compound XCl₂
A	covalent	covalent
B	covalent	ionic
C	metallic	covalent
D	metallic	ionic

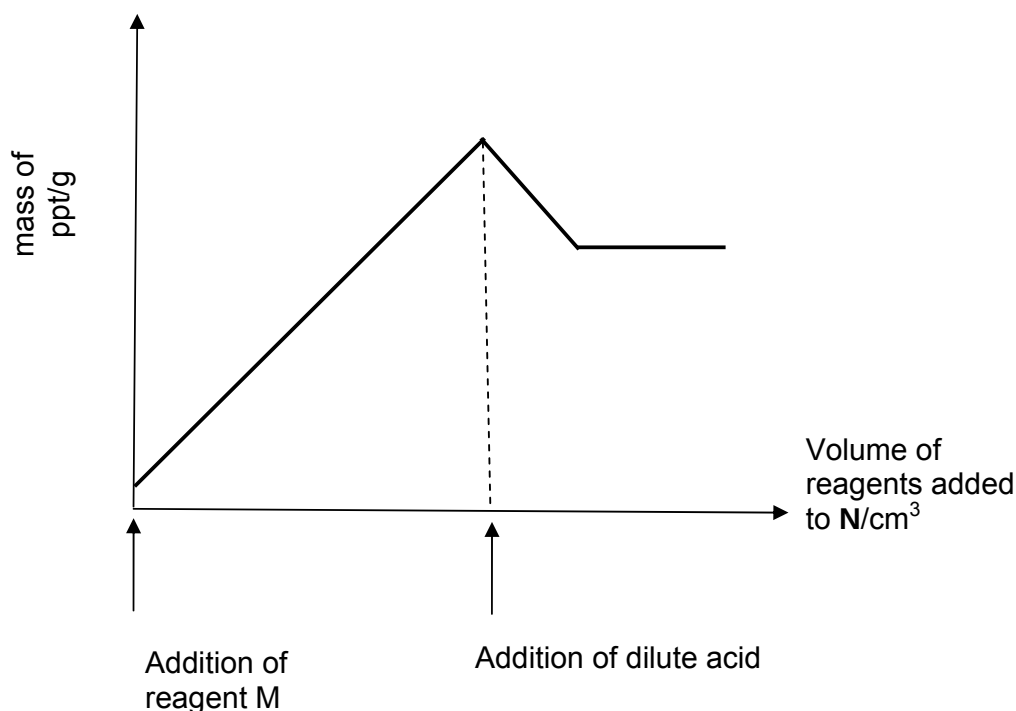
- 11 The scheme below shows some reactions of a compound of element **X**.



What could the compound of element **X** have been?

- A lead(II) oxide
 B aluminium oxide
 C zinc carbonate
 D calcium carbonate

- 12** In a qualitative analysis, reagent **M** is gradually added to a salt solution **N** (that contains either 1 anion or 2 different anions), followed by the addition of dilute acid. The graph shows how the mass of precipitate formed changes with the reagents added.



Which of the following combinations would produce the given results?

- | | Addition of M followed by dilute acid | Anion(s) in N |
|----------|--|------------------------------------|
| A | Aqueous barium chloride (M), followed by dilute hydrochloric acid | Cl^- |
| B | Aqueous barium chloride (M), followed by hydrochloric acid | CO_3^{2-} |
| C | Aqueous silver nitrate (M), followed by dilute nitric acid | Cl^- , CO_3^{2-} |
| D | Aqueous silver nitrate (M), followed by dilute nitric acid | I^- |
- 13** Excess aqueous barium nitrate is added to dilute sulfuric acid. The precipitate formed is removed by filtration. What ions are present in the filtrate?
- A** Ba^{2+} and NO_3^- only
B Ba^{2+} , H^+ and NO_3^- only
C H^+ and NO_3^- only
D H^+ , NO_3^- and SO_4^{2-} only
- 14** Which pair of solutions will **NOT** produce an insoluble salt when mixed together?
- A** barium nitrate and sodium sulfate
B calcium chloride and silver nitrate
C magnesium nitrate and sodium sulfate
D zinc nitrate and potassium carbonate

- 15** Hydrochloric acid reacts with each of the following substances under suitable conditions. Which substance reacts to give a colourless solution only?

- A** calcium carbonate
- B** iron(II) hydroxide
- C** potassium hydroxide
- D** silver nitrate

- 16** The diagram below shows the pH ranges of two indicators, methyl orange and methyl red.

Methyl orange	red		yellow			
pH	2	3	4	5	6	
Methyl red	red					yellow

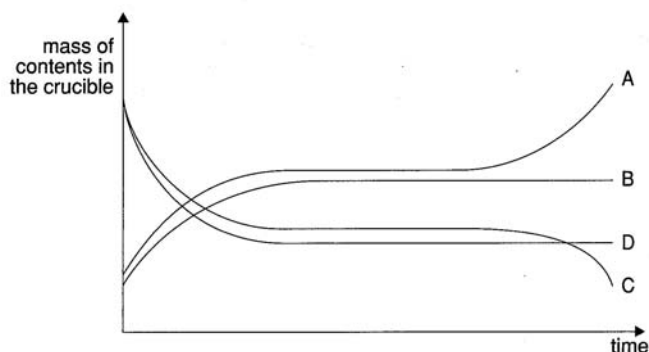
The table below shows the pH of four solutions. In which of the solutions will both indicators be yellow?

Solution	W	X	Y	Z
pH	2.0	3.0	5.0	6.0

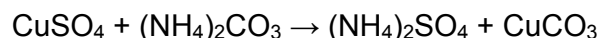
- A** W only
 - B** W and X
 - C** X and Y
 - D** Z only
- 17** Which of the following reaction produces the best yield of calcium sulfate?
- A** Add dilute nitric acid to calcium carbonate, followed by dilute sulfuric acid.
 - B** Mixing solid calcium nitrate and solid potassium sulfate.
 - C** Add dilute sulfuric acid to calcium carbonate.
 - D** Titrate aqueous calcium hydroxide with dilute sulfuric acid.
- 18** Which gas is evolved when an alkaline solution of sodium nitrate is warmed with aluminium powder?
- A** ammonia
 - B** nitrogen
 - C** nitrogen dioxide
 - D** oxygen
- 19** The haemoglobin in mammals contain 0.33% by mass of iron. It is found that the relative molecular mass of a haemoglobin molecule is 68,000. How many iron atoms are there in one molecule of haemoglobin?
- A** 5
 - B** 4
 - C** 3
 - D** 2

- 20** 400 g of hydrated potassium sulfide ($K_2S \cdot nH_2O$) contains 180 g of water of crystallisation. What is the formula of this compound?
- A** $K_2S \cdot 3H_2O$
B $K_2S \cdot 5H_2O$
C $K_2S \cdot 7H_2O$
D $K_2S \cdot 10H_2O$
- 21** If the number of molecules in 35.5 g of chlorine is x , what is the number of molecules in 36 g of water?
- A** $0.5x$
B x
C $2x$
D $4x$
- 22** One mole of hydrated copper(II) sulfate, $CuSO_4 \cdot 5H_2O$, is dissolved in water. How many moles of ions does the solution contain?
- A** 1
B 2
C 6
D 7
- 23** Which of the following has the same number of atoms as 6 dm^3 of nitrogen gas at room temperature and pressure?
- A** 20 g of argon
B 0.25 g of hydrogen
C 23 g of sodium
D 8.5 g of ammonia
- 24** When 12.0 g of magnesium ribbon reacts with excess sulfuric acid, 55.5 g of magnesium sulfate is produced. What is the percentage yield of magnesium sulfate?
- A** 55.5%
B 72.5%
C 92.5%
D 97.5%

- 25 Magnesium is heated in air in an open crucible. Which graph correctly shows the change in the mass of the contents in the crucible?



- 26 In an experiment, 2.00 cm^3 of 1.00 mol/dm^3 aqueous copper(II) sulfate was mixed with 4.00 cm^3 of 1.00 mol/dm^3 aqueous ammonium carbonate. The chemical equation for this reaction is shown below:



What did the reaction flask contain after the reaction was completed?

- A white precipitate and a blue solution
B green precipitate and a blue solution
C green precipitate and a colourless solution
D a colourless solution only
- 27 A volume of ethane, C_2H_6 , has a mass of 20 g measured at room temperature and pressure. What is the mass of the same volume of propene, C_3H_6 , measured at room temperature and pressure?
- A 20.3 g
B 21.3 g
C 29.3 g
D 42.3 g
- 28 An 8 g sample of oxygen gas contains the same number of atoms as 16 g of element X. What is the relative atomic mass of X?
- A 4
B 8
C 16
D 32

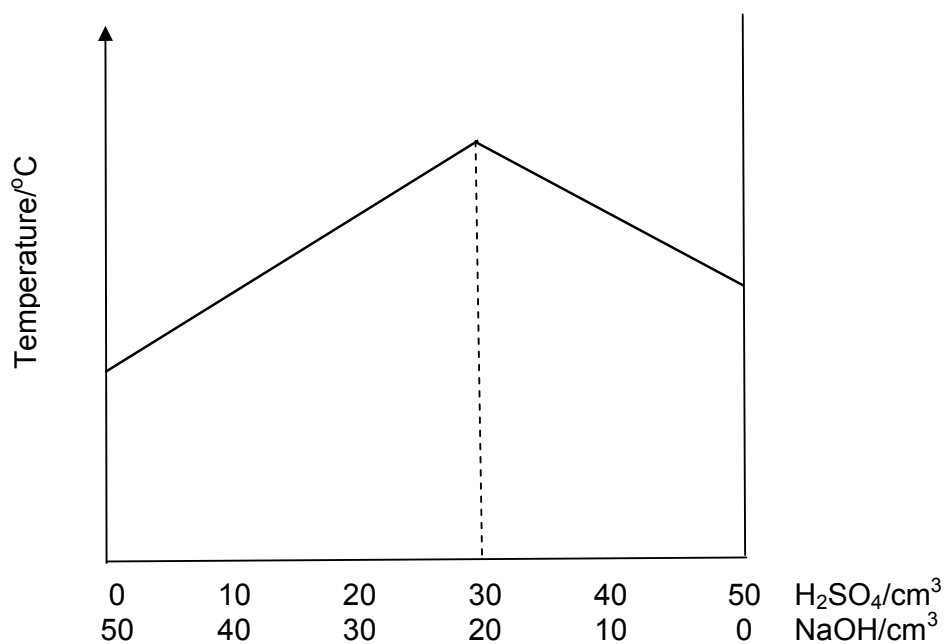
- 29** 40.0 cm^3 of aqueous 1.00 mol/dm^3 solution of the hydroxide of metal **X** neutralises exactly 80 cm^3 of 0.250 mol/dm^3 sulfuric acid. What is the formula for the sulfate of **X**?

- A** X_2SO_4
- B** XSO_4
- C** $\text{X}_2(\text{SO}_4)_3$
- D** $\text{X}(\text{SO}_4)_2$

- 30** A solution of sulfuric acid has a concentration of 1 mol/dm^3 .

Different volumes of the acid are added to different volumes of aqueous sodium hydroxide. The temperature of the solution is measured after each addition. Complete neutralisation occurs at the point where the temperature reached is a maximum.

The graph below shows the results.



What is the approximate concentration of the aqueous sodium hydroxide?

- A** 0.667 mol/dm^3
- B** 1.33 mol/dm^3
- C** 1.50 mol/dm^3
- D** 3.00 mol/dm^3

End of paper

The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
1 H Hydrogen 1																	
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	101 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	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86
Fr Francium 87	Ra Radium 88	Ac Actinium 89															

a

X

b

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

*58-71 Lanthanoid series

†90-103 Actinoid 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
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

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Key

a	X
b	X

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

140	Ce	Cerium	58	141	Pr	Praseodymium	59	144	Nd	Neodymium	60	150	Sm	Samarium	62	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	238	Pu	Plutonium	94	238	Cm	Curium	96	238	Bk	Berkelium	97	238	Cf	Californium	98	238	Es	Einsteinium	99	238	Fm	Fermium	100	238	Md	Mendelevium	101	238	No	Nobelium	102	238	Lr	Lawrencium	103

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