

Class	Register Number	Name
-------	-----------------	------



南洋女子中學校
NANYANG GIRLS' HIGH SCHOOL

**End-of-Year Examination 2016
Secondary Three**

Chemistry

Paper 1

Multiple Choice

Wednesday

5 October 2016

45 minutes

0845-0930

Additional materials: Multiple Choice Answer Sheet

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 Multiple Choice Answer Sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

The use of approved scientific calculators is allowed.

A copy of the periodic table is found on page 11.

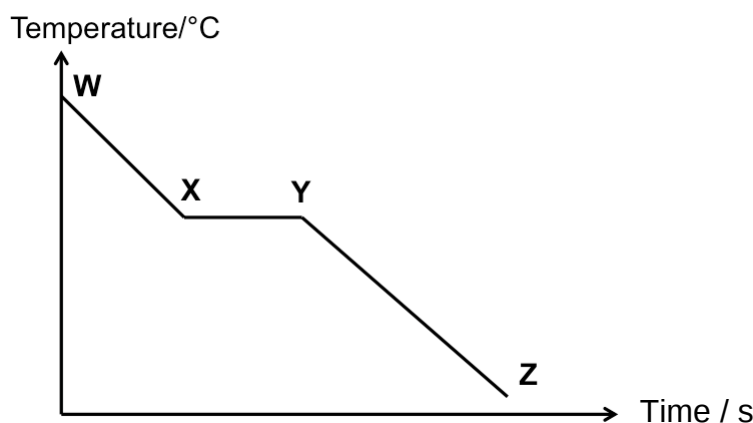
This document consists of 11 printed pages and 1 blank page.

Setters: KXY

NANYANG GIRLS' HIGH SCHOOL

[Turn over]

- 1 When a balloon filled with helium gas is left alone for a few days, it no longer floats in the air but sinks to the floor and looks deflated. Which of the following best explains this phenomenon?
- A Air diffused into the balloon.
B Helium gas became denser than air.
C Helium gas diffused out of the balloon.
D Helium gas diffused out of the balloon faster than air diffused in.
- 2 Buckminsterfullerene, C_{60} , sublimes at 600°C . Below is a temperature against time graph when buckminsterfullerene is cooled from 1000°C to 25°C .



Which of the following options best describes the movement of the particles from Y to Z?

- A Carbon atoms are sliding past one another.
B Carbon molecules are sliding past one another.
C Carbon atoms are vibrating in fixed positions.
D Carbon molecules are vibrating in fixed positions
- 3 The following table gives some information on substance X and Y:

substance	melting point / $^{\circ}\text{C}$	boiling point / $^{\circ}\text{C}$	density / g cm^{-3}	solubility in water
X	40.5	181.7	1.07	soluble
Y	-38.8	674.11	2.65	insoluble

Which one of the following method is **most** suitable for separating a mixture of X and Y at room temperature?

- A decantation
B filtration
C separating funnel
D simple distillation

- 4 Which of the following properties is separation by paper chromatography based on?
- A colours
 - B densities
 - C boiling points
 - D solubilities in the same solvent
- 5 An accident occurred in a factory and some nitric acid was spilled. Which substance, when added in excess, neutralises the acid **without** leaving behind an alkaline solution?
- A aqueous ammonia
 - B calcium carbonate
 - C sodium hydroxide
 - D water

- 6 The following table gives some information on different pH indicators:

indicator	colour at pH 1	pH at which colour changes	colour at pH 14
congo red	blue	5	red
bromothymol blue	yellow	6	blue
phenolphthalein	colourless	10	red

What colours would be observed if each of these indicators were added separately to samples of pure water?

	congo red	bromothymol blue	phenolphthalein
A	blue	yellow	red
B	blue	blue	red
C	red	yellow	colourless
D	red	blue	colourless

- 7 When fully dissociated, one mole of a compound **X** gives four moles of ions in solution. **X** reacts with ammonium carbonate to give an acidic gas. What is compound **X**?
- A aluminium hydroxide
 - B calcium hydroxide
 - C phosphoric acid
 - D ethanoic acid
- 8 What is the most suitable method to prepare a pure sample of zinc chloride?
- A titrate zinc hydroxide with hydrochloric acid
 - B add zinc metal in excess to hydrochloric acid
 - C add zinc carbonate to excess hydrochloric acid
 - D add zinc nitrate solution to sodium chloride solution

- 9 Which of the following options uses the correct reagents to prepare the desired salt?

	salt	reagents
A	calcium nitrate	calcium chloride and nitric acid
B	lead(II) chloride	lead(II) nitrate and silver chloride
C	silver sulfate	silver and sulfuric acid
D	magnesium carbonate	magnesium nitrate and potassium carbonate

- 10 To prepare a sample of blue copper(II) sulfate crystals, Jane thought of this procedure:

1. Add copper(II) hydroxide in excess to sulfuric acid.
2. Filter to remove excess solids.
3. Heat the filtrate to dryness to get the crystals.

What is the problem with her procedure?

- A Instead of copper(II) hydroxide, copper should be used.
 B Copper(II) hydroxide should not be added in excess.
 C There is no need to filter to remove excess solids.
 D Instead of evaporation to dryness, crystallisation should be used.
- 11 When an acid is added to an unknown substance, effervescence was observed. When this gas is bubbled in limewater, white precipitate was observed. How would this gas affect moist litmus papers?

- I turns moist red litmus paper blue
 II turns moist blue litmus paper red
 III moist red litmus paper remains red
 IV moist blue litmus paper remains blue

- A I and II
 B I and IV
 C II and III
 D III and IV

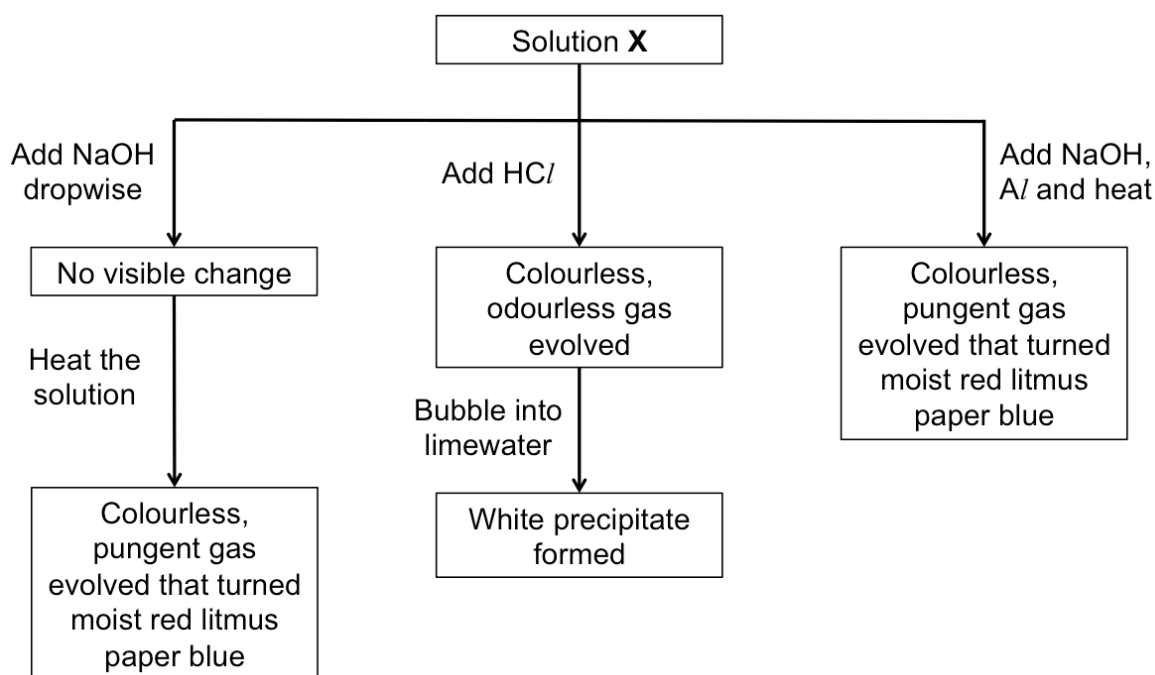
- 12 In an experiment, 8.0 cm^3 of 1 mol dm^{-3} of sodium hydroxide solution is added to 6.0 cm^3 of 1 mol dm^{-3} of copper(II) sulfate solution. What are the expected observations?

- A a colourless solution only
 B a blue precipitate and a blue solution
 C a blue precipitate and a colourless solution
 D a white precipitate and a colourless solution

- 13** When sodium hydroxide is added dropwise to a sample of solution **X**, a white precipitate **Y** is formed. **Y** dissolved in excess sodium hydroxide. The test is repeated with aqueous ammonia, and a white precipitate **Z** which is soluble in excess aqueous ammonia was formed. What are the identities of **Y** and **Z**?

	Y	Z
A	Zn^{2+}	Zn^{2+}
B	$\text{Al}^{3+}, \text{Pb}^{2+}, \text{Zn}^{2+}$	Zn^{2+}
C	$\text{Zn}(\text{OH})_2$	$\text{Zn}(\text{NH}_4)_2$
D	$\text{Zn}(\text{OH})_2$	$\text{Zn}(\text{OH})_2$

- 14** The flowchart below shows the results of a qualitative analysis of solution **X**, which is a mixture of more than one type of salts.



The same tests were also conducted on solutions **R**, **S** and **T**, which contained the respective ions:

- R:** $\text{K}^+, \text{NH}_4^+$ and CO_3^{2-}
S: $\text{K}^+, \text{CO}_3^{2-}$ and NO_3^-
T: $\text{NH}_4^+, \text{CO}_3^{2-}$ and NO_3^-

Which of the solution(s) would share the same observations as Solution **X**?

- A** **T** only
B **S** and **T** only
C **R** and **T** only
D **R**, **S** and **T**

15 Two tests were conducted on a sample of sodium carbonate:

- I Add nitric acid, followed by a few drops of barium chloride.
- II Add a few drops of barium chloride, followed by nitric acid.

Which of the following describes the expected observations of tests I and II?

	I	II
A	no observable change with nitric acid and barium chloride	no observable change with barium chloride and nitric acid
B	no observable change with nitric acid; white precipitate formed with barium chloride	white precipitate formed with barium chloride, insoluble in nitric acid
C	effervescence observed with nitric acid; no precipitate was formed with barium chloride	no precipitate was formed with barium chloride; effervescence observed with nitric acid
D	effervescence observed with nitric acid; no precipitate was formed with barium chloride	white precipitate formed with barium chloride; white precipitate dissolved in nitric acid, effervescence observed

Use the following information to answer **Q16** and **Q17**:

The table below gives some information on particles **P**, **Q** and **R**:

particle	no. of protons	no. of neutrons	no. of electrons
P	40	44	38
Q	40	44	40
R	44	40	40

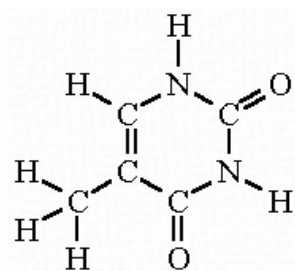
16 Which of the following statements about **P**, **Q**, and **R** is correct?

- A** **P** and **R** are ions whereas **Q** is an atom.
- B** **P** is an ion whereas **Q** and **R** are atoms.
- C** **P** and **Q** are isotopes of the same element.
- D** **Q** and **R** are isotopes of the same element.

17 **P** forms an ionic compound with ion **S** to give the chemical formula, **P₂S**. What is the charge of ion **S**?

- A** **S**⁻
- B** **S**²⁻
- C** **S**³⁻
- D** **S**⁴⁻

- 18** Below is the structure of thymine, a nitrogenous base in deoxyribonucleic acids (DNA).



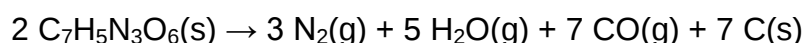
Based on the structural formula, what is the relative molecular mass of thymine?

- | | | | |
|----------|-----|----------|-----|
| A | 125 | B | 126 |
| C | 130 | D | 134 |
- 19** A newly discovered element, Bananium (Bn), has a relative atomic mass of 137.15. It has three isotopes: ^{136}Bn , ^{137}Bn and ^{138}Bn . The relative abundance of ^{136}Bn is twice of that of ^{137}Bn . What is the relative abundance of ^{136}Bn ?

- | | | | |
|----------|-----|----------|-----|
| A | 15% | B | 17% |
| C | 28% | D | 34% |

Use the following information to answer **Q20** and **Q21**:

Trinitrotoluene (TNT), $\text{C}_7\text{H}_5\text{N}_3\text{O}_6$, is an explosive used since the 1900s. Upon detonation, TNT decomposes as follows:



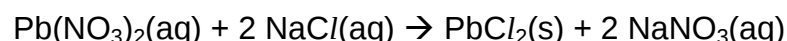
36.32 g of TNT was used in an explosion. At the point of detonation, temperature increased to 4273°C .

- 20** What is the mass of carbon produced from the reaction?
- | | | | |
|----------|---------|----------|----------|
| A | 6.72 g | B | 10.59 g |
| C | 13.44 g | D | 127.12 g |
- 21** At 4273°C , the molar volume of gases is $328 \text{ dm}^3 \text{ mol}^{-1}$. What is the total volume of gases produced at the point of detonation?
- | | | | |
|----------|----------------------|----------|----------------------|
| A | 28.8 dm^3 | B | 262.4 dm^3 |
| C | 393.6 dm^3 | D | 787.2 dm^3 |

22 Which of the following compounds have the same number of oxygen atoms / ions as 21.93 g of aluminium oxide?

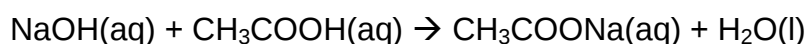
- A** 4.955 g of lithium oxide
- B** 15.48 g of iron (III) oxide
- C** 7.74 dm³ of nitrogen dioxide gas
- D** 12.24 dm³ of carbon monoxide gas

23 0.993 g of lead(II) nitrate was dissolved in 10 cm³ of water. 10 cm³ of 0.5 mol dm⁻³ of sodium chloride solution was then added to the lead(II) nitrate solution. 0.603 g of precipitate was obtained. What is the percentage yield of the precipitate?



- A** 58.8%
- B** 72.3%
- C** 86.8%
- D** 99.5%

24 0.15 mol dm⁻³ of sodium hydroxide was titrated against 25 cm³ of ethanoic acid, CH₃COOH, of unknown concentration with methyl orange. When 19.30 cm³ of sodium hydroxide was added, the solution turned from red to orange. What is the concentration of the ethanoic acid solution?



- A** 2.9 x 10⁻³ mol dm⁻³
- B** 5.79 x 10⁻² mol dm⁻³
- C** 0.116 mol dm⁻³
- D** 0.194 mol dm⁻³

25 When an excess of calcium carbonate is added to dilute hydrochloric acid, the reaction gradually becomes slower and finally stops.
Which statement best explains why this happens?

- A** The pieces of calcium carbonate gradually become smaller.
- B** The concentration of hydrochloric acid gradually reduces to zero.
- C** The concentration of calcium carbonate gradually reduces to zero.
- D** An insoluble layer of calcium chloride is formed on the calcium carbonate.

26 Which of the following options has a chemical reaction paired with a suitable method of measuring the rate of reaction?

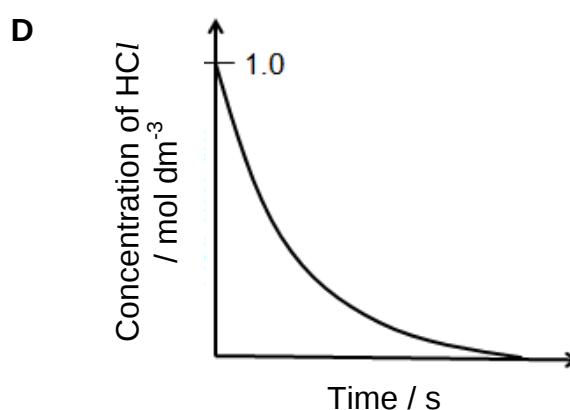
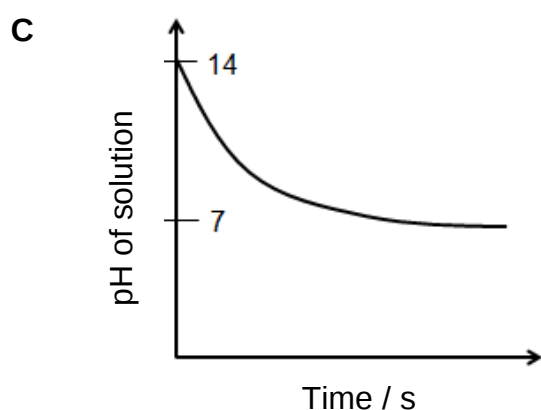
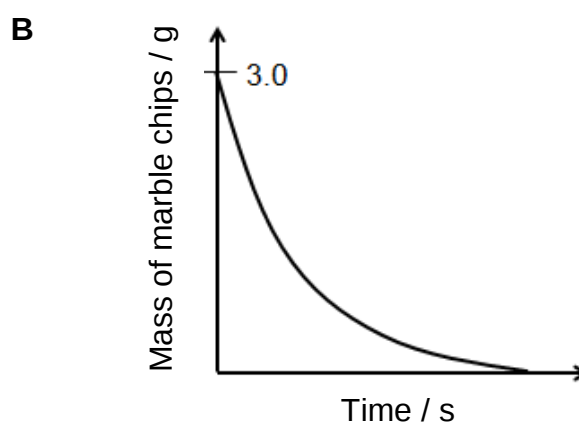
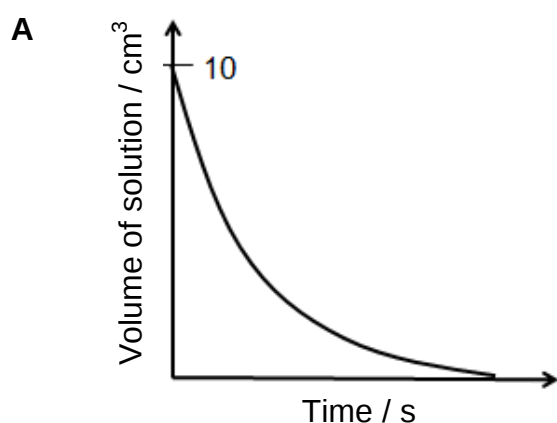
	reaction	method of measurement
A	3 H ₂ (g) + N ₂ (g) → 2NH ₃ (g)	change in mass
B	MgCO ₃ (s) → MgO(s) + CO ₂ (g)	change in colour
C	Al(NO ₃) ₃ (aq) + 3 NaOH(aq) → Al(OH) ₃ (s) + 3 NaNO ₃ (aq)	change in pH
D	C(s) + O ₂ (g) → CO ₂ (g)	change in volume

- 27** In four separate experiments, **A, B, C, D**, identical samples of magnesium ribbon were added to an excess of sulfuric acid. Which experiment would give off hydrogen most rapidly?

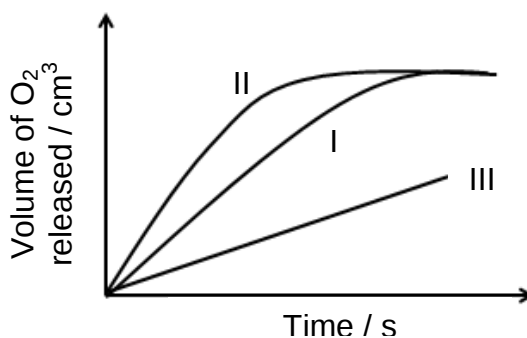
	volume of acid/ cm^3	concentration of acid/ mol dm^{-3}
A	10	4.0
B	20	0.2
C	30	1.5
D	40	3.0

- 28** 3.0 g of marble chips, CaCO_3 , are added to 10 cm^3 of 1.0 mol dm^{-3} hydrochloric acid.

Which of the following graphs could be obtained from this experiment?



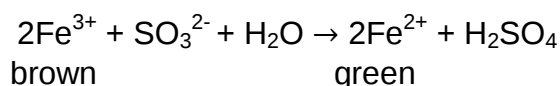
- 29** The following diagram is a graph of the volume of oxygen released over time from the decomposition of hydrogen peroxide under the same conditions, with different catalysts:



- I Fe_2O_3 used as catalyst
II MnO_2 used as catalyst
III No catalyst

What can you infer from the graph?

- A** Fe_2O_3 is a more effective catalyst than MnO_2 .
B MnO_2 is a more effective catalyst than Fe_2O_3 .
C Both catalysts are not effective for this reaction.
D Both MnO_2 and Fe_2O_3 catalyse the reaction at the same rate.
- 30** The reaction between Fe^{3+} and SO_3^{2-} is represented by the ionic equation:



It is found that the change of colour from brown to green occurs at a faster rate when the reaction mixture is heated. The following statements were made by students to explain this phenomenon:

This is due to the

- I decrease in activation energy.
II increase in frequency of effective collisions.
III increase in the kinetic energy of Fe^{3+} and SO_3^{2-} ions.
IV increase in frequency of collisions between Fe^{3+} and SO_3^{2-} ions.

Which of the statements best explain the phenomenon?

- | | |
|-----------------------------|------------------------------|
| A I and II only | B II and III only |
| C I, II and III only | D II, III and IV only |

End of paper

The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
																	4 He helium 2
7 Li lithium 3	9 Be beryllium 4											1 H hydrogen 1					
23 Na sodium 11	24 Mg magnesium 12															19 F fluorine 9	20 Ne neon 10
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 Ru ruthenium 44	101 Rh rhodium 45	103 Pd palladium 46	106 Ag silver 47	108 Cd cadmium 48	112 In indium 49	115 Sn tin 50	119 Sb antimony 51	122 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	222 Rn radon 86
87 Fr francium	88 Ra radium	89 Ac actinium															

*58-71 Lanthanoid series †90-103 Actinoid series																	
140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	146 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	177 Hf hafnium 72	179 Ta tantalum 73	181 W tungsten 74	183 Re rhenium 75
232 Th thorium 90	234 Pa protactinium 91	238 U uranium 92	238 Np neptunium 93	242 Pu plutonium 94	244 Am americium 95	247 Cm curium 96	251 Bk berkelium 97	254 Cf californium 98	259 Es einsteinium 99	263 Fm fermium 100	267 Md mendelevium 101	271 No nobelium 102	274 Lr lawrencium 103	287 Nh nihonium 113	289 Fl flerovium 114	293 Lv livermorium 116	294 Ts tennessine 117

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

The volume of one mole of any gas is 24 dm³ at room temperature and

BLANK PAGE