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| Class | Register Number | Name |
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南洋女子中學校  
**NANYANG GIRLS' HIGH SCHOOL**  
**End-of-Year Examination 2017**  
**Secondary Three**

**Chemistry**

**Paper 1**

Multiple Choice

**Wednesday**

**4 October 2017**

**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, 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 10 printed pages and 2 blank page.

**Setters: OWJ**

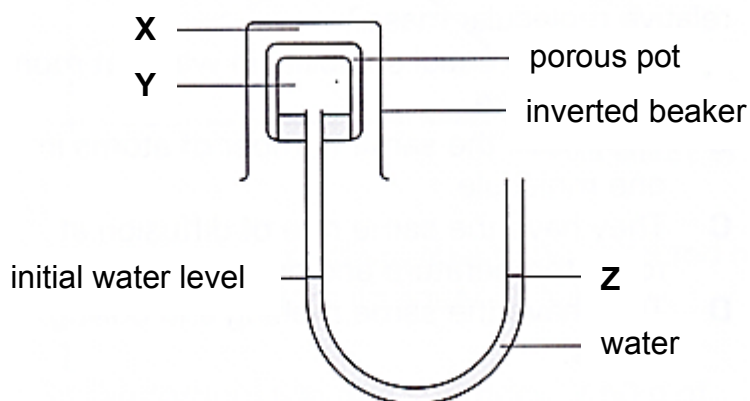
**NANYANG GIRLS' HIGH SCHOOL**

**[Turn over]**

- 1 Which of the following accurately describes the arrangement of particles in a **dilute** aqueous solution of ethanol?

|          | water particles | ethanol particles |
|----------|-----------------|-------------------|
| <b>A</b> | close together  | close together    |
| <b>B</b> | close together  | far apart         |
| <b>C</b> | far apart       | close together    |
| <b>D</b> | far apart       | far apart         |

- 2 The diagram below shows an experimental set-up involving gases **X** and **Y**.



After some time the water level at **Z** becomes lower. Which of the following could be the identities of **X** and **Y**?

|          | <b>X</b>         | <b>Y</b>          |
|----------|------------------|-------------------|
| <b>A</b> | carbon monoxide  | oxygen            |
| <b>B</b> | fluorine         | argon             |
| <b>C</b> | nitrogen         | nitrogen monoxide |
| <b>D</b> | nitrogen dioxide | carbon dioxide    |

- 3 Which of the following is a set of two mixtures?

- A** air, carbon dioxide
- B** bronze, hydrogen
- C** hydrogen chloride, seawater
- D** steel, sodium chloride solution

- 4 Which of the following is true for covalent and ionic substances?

|          | <u>covalent</u>     | <u>ionic</u>        |
|----------|---------------------|---------------------|
| <b>A</b> | compound only       | compound only       |
| <b>B</b> | compound only       | element or compound |
| <b>C</b> | element or compound | compound only       |
| <b>D</b> | element or compound | element or compound |

5 Which of the following properties provide the basis for separation using fractional distillation?

- A boiling points
- B colours
- C densities
- D solubilities in the same solvent

6 The properties of three unknown substances **A**, **B** and **C** are shown below.

| substance | solubility in water | melting point/°C | boiling point/°C |
|-----------|---------------------|------------------|------------------|
| <b>A</b>  | insoluble           | 5                | 93               |
| <b>B</b>  | insoluble           | 82               | 438              |
| <b>C</b>  | soluble             | −13              | 67               |

When substances **A**, **B**, **C** and water are mixed together at room temperature and pressure, which of the following sequence of steps should be conducted to obtain substances **A**, **B** and **C** from the mixture?

- A filter → separating funnel → evaporation to dryness
- B filter → separating funnel → fractional distillation
- C separating funnel → filter → evaporation to dryness
- D separating funnel → filter → fractional distillation

7 An ion of element **X** with the formula  $\text{X}^{3+}$ , contains 18 electrons and has a nucleon number of 45. How many neutrons are present in an atom of **X**?

- A 18
- B 24
- C 27
- D 30

8 Magnesium has a relative atomic mass of 24.3 and has three isotopes,  $^{24}\text{Mg}$ ,  $^{25}\text{Mg}$  and  $^{26}\text{Mg}$ . The relative abundance of  $^{26}\text{Mg}$  is 10%. What is the relative abundance of  $^{24}\text{Mg}$ ?

- A 70%
- B 75%
- C 80%
- D 85%

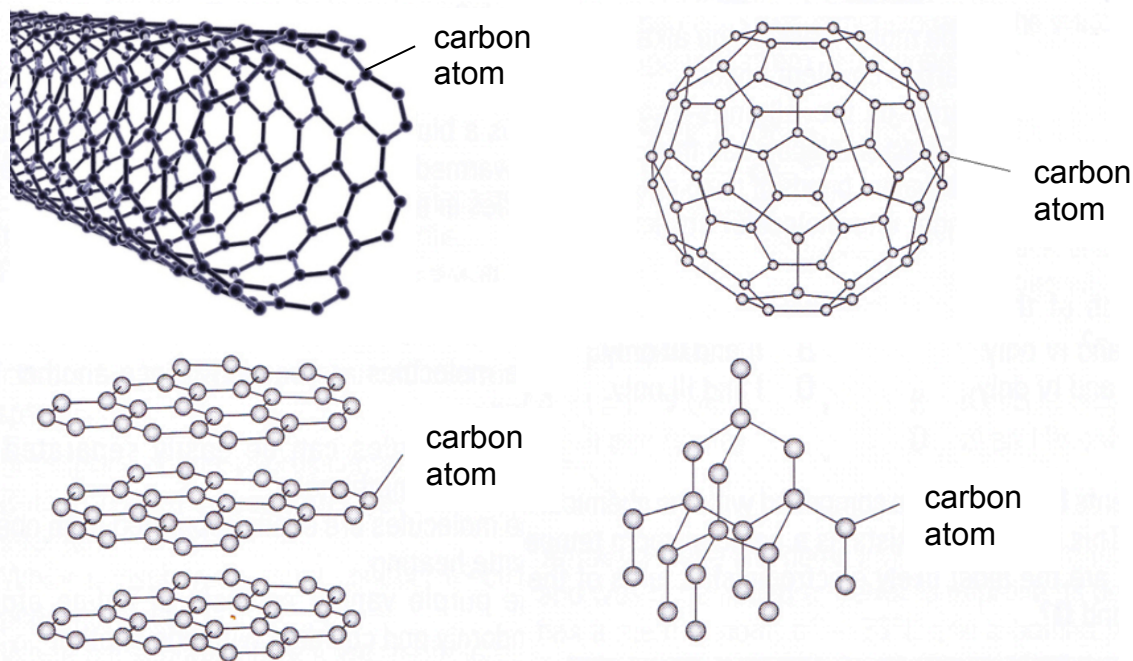
9 Which of the following apparatus is most suitable for measuring a volume of  $22.80 \text{ cm}^3$ ?

- A Beaker
- B Burette
- C Measuring cylinder
- D Pipette

- 10 Which of the following will produce the most number of moles of **mobile ions** when placed in water?
- A 17.5 g of barium sulfate  
B 25.7 g of barium hydroxide  
C 32.0 g of aluminium nitrate  
D 20.4 g of aluminium oxide
- 11 A gas occupies  $6 \text{ dm}^3$  at room temperature and pressure. Given that the mass of the gas is 8 g, what is the relative molecular mass of the gas?
- A 8.0  
B 16.0  
C 32.0  
D 64.0
- 12 Which of the following substances has the highest percentage by mass of nitrogen?
- A  $\text{NH}_4\text{Cl}$   
B  $\text{NH}_4\text{NO}_3$   
C  $(\text{NH}_4)_2\text{SO}_4$   
D  $(\text{NH}_4)_3\text{PO}_4$
- 13 A compound with a mass of 16 g contains only nitrogen and 2 g of hydrogen. Given that the relative molecular mass of the compound is 32.0, what is the molecular formula of the compound?
- A  $\text{NH}_2$   
B  $\text{NH}_3$   
C  $\text{N}_2\text{H}_4$   
D  $\text{N}_3\text{H}_8$
- 14 11.7 g of sodium chloride is dissolved in  $100 \text{ cm}^3$  of water to form sodium chloride solution.  $20 \text{ cm}^3$  of this solution is reacted with excess lead(II) nitrate solution and 3.34 g of lead(II) chloride precipitate is formed. What is the percentage yield for the reaction?
- A 6 %  
B 12 %  
C 30 %  
D 60 %
- 15 10.0 g of an impure barium carbonate sample is heated to form a colourless, odourless gas that forms a white precipitate in limewater. The remaining solid weighs 8.1 g. What is the percentage purity of the barium carbonate sample?
- A 80 %  
B 85 %  
C 90 %  
D 95 %

- 16 Which of the following will **not** react with dilute hydrochloric acid?
- A silver
  - B silver carbonate
  - C silver hydroxide
  - D silver oxide
- 17 Which of the following salts **cannot** be formed directly from copper(II) chloride?
- A copper(II) carbonate
  - B copper(II) sulfate
  - C lead(II) chloride
  - D silver chloride
- 18 Which of the following metals will produce the greatest volume of gas when the same number of moles of the metals are reacted with excess sulfuric acid of the same concentration and volume?
- A barium
  - B copper
  - C magnesium
  - D potassium
- 19 Which of the following ionic equations is **incorrect**?
- A  $2\text{MnO}_4^- + 5\text{H}_2\text{O}_2 + 8\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 5\text{O}_2 + 4\text{H}_2\text{O}$
  - B  $\text{Cr}_2\text{O}_7^{2-} + 6\text{Fe}^{2+} + 14\text{H}^+ \rightarrow 2\text{Cr}^{3+} + 6\text{Fe}^{3+} + 7\text{H}_2\text{O}$
  - C  $\text{H}_2\text{O}_2 + 2\text{I}^- + 2\text{H}^+ \rightarrow \text{I}_2 + 2\text{H}_2\text{O}$
  - D  $2\text{S}_2\text{O}_3^{2-} + \text{I}_2 \rightarrow 2\text{I}^- + \text{S}_4\text{O}_6^{2-}$
- 20 Which of the following elements in Period 3 of the Periodic Table is likely to have the highest melting point?
- |            |             |
|------------|-------------|
| A sodium   | B magnesium |
| C chlorine | D argon     |

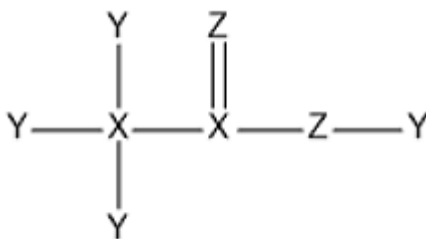
21



How many of the above structures can conduct electricity?

- |          |          |
|----------|----------|
| <b>B</b> | <b>2</b> |
| <b>D</b> | <b>4</b> |

22



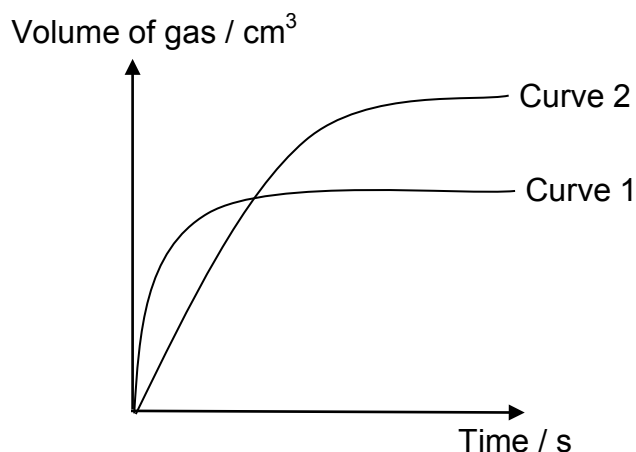
|          | <b>X</b> | <b>Y</b> | <b>Z</b> |
|----------|----------|----------|----------|
| <b>A</b> | 4        | 17       | 16       |
| <b>B</b> | 14       | 17       | 16       |
| <b>C</b> | 14       | 17       | 2        |
| <b>D</b> | 14       | 1        | 16       |

- 23** The table below shows the properties of four substances.

| substance | melting point / °C | boiling point / °C | electrical conductivity |           | solubility in water |
|-----------|--------------------|--------------------|-------------------------|-----------|---------------------|
|           |                    |                    | as solid                | as liquid |                     |
| <b>W</b>  | 17                 | 118                | Poor                    | Poor      | Soluble             |
| <b>X</b>  | 455                | 1547               | Poor                    | Good      | Insoluble           |
| <b>Y</b>  | 1064               | 2970               | Good                    | Good      | Insoluble           |
| <b>Z</b>  | 3550               | 4830               | Poor                    | Poor      | Insoluble           |

Which of the following statements about the structure of the substances is true?

- A** **W** has a simple covalent structure.  
**B** **X** has a giant covalent structure.  
**C** **Y** has a giant ionic structure.  
**D** **Z** has a giant metallic structure.
- 24** Curve 1 in the graph below shows the volume of gas produced when 2 dm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> hydrogen peroxide is decomposed, with manganese(IV) oxide as a catalyst.



Which of the following changes could have resulted in curve 2 being obtained instead of curve 1?

- A** using 2 dm<sup>3</sup> of 1.00 mol/dm<sup>3</sup> hydrogen peroxide  
**B** using 3 dm<sup>3</sup> of 0.75 mol/dm<sup>3</sup> hydrogen peroxide  
**C** using 4 dm<sup>3</sup> of 0.20 mol/dm<sup>3</sup> hydrogen peroxide  
**D** using 5 dm<sup>3</sup> of 0.30 mol/dm<sup>3</sup> hydrogen peroxide

- 25** The equation below shows the reaction between excess calcium carbonate and hydrochloric acid.



Which of the following methods **cannot** be used to measure the rate of this reaction?

- A** change in pH
  - B** loss in mass
  - C** time taken for solid to disappear
  - D** volume of gas formed
- 26** When excess aqueous sodium hydroxide is added to an unknown solution **X** and warmed, no visible reaction is observed and no gas is produced.

When aluminium is subsequently added to the mixture and warmed, a colourless, pungent gas that turns moist red litmus paper blue is evolved.

Which of the following compounds could have been present in unknown solution **X**?

- A** ammonium chloride
  - B** ammonium nitrate
  - C** calcium nitrate
  - D** sodium nitrate
- 27** 2 moles of iron(III) chloride is reacted with 5 moles of sodium hydroxide. Which of the following will be observed at the end of the reaction?
- A** reddish brown precipitate in colourless solution
  - B** reddish brown precipitate in yellow solution
  - C** yellow precipitate in colourless solution
  - D** yellow precipitate in reddish brown solution
- 28** When acidified barium nitrate is added to an unknown solution **X**, a white precipitate is formed. When excess aqueous ammonia is added to unknown solution **X**, a white precipitate is formed that is insoluble in excess aqueous ammonia. Which of the following cation is present in unknown solution **X**?

- |                           |                           |
|---------------------------|---------------------------|
| <b>A</b> $\text{Al}^{3+}$ | <b>B</b> $\text{Ca}^{2+}$ |
| <b>C</b> $\text{Pb}^{2+}$ | <b>D</b> $\text{Zn}^{2+}$ |



- 29** Which of the following statements about Group 1 metals is **incorrect**?
- A** Group 1 metals react with oxygen to form a metal oxide that is insoluble in water.
  - B** Group 1 metals react with water to form a solution that turns red litmus paper blue.
  - C** Melting points of Group 1 metals decrease down the group.
  - D** The tendency of Group 1 metals to lose electrons increases down the group.
- 30** Based on the trends in physical and chemical properties of elements in Group 17, which of the following is likely to be a property of astatine?
- A** brown in colour
  - B** exists as diatomic molecules
  - C** liquid at room temperature
  - D** more reactive than iodine

**End of paper**

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The Periodic Table of Elements

| Group                  |                         |                                                                |                         |                          |                          |                         |                          |                        |                          |                         |                        |                        |                             |                         |                               |                       |                       |                  |    |
|------------------------|-------------------------|----------------------------------------------------------------|-------------------------|--------------------------|--------------------------|-------------------------|--------------------------|------------------------|--------------------------|-------------------------|------------------------|------------------------|-----------------------------|-------------------------|-------------------------------|-----------------------|-----------------------|------------------|----|
| 1                      | 2                       | 1<br>H<br>hydrogen<br>1.0                                      |                         |                          |                          |                         |                          |                        |                          |                         |                        |                        |                             | 13                      | 14                            | 15                    | 16                    | 17               | 18 |
|                        |                         | Key                                                            |                         |                          |                          |                         |                          |                        |                          |                         |                        |                        |                             |                         |                               |                       |                       |                  |    |
| 3                      | 4                       | atomic number<br>atomic symbol<br>name<br>relative atomic mass |                         |                          |                          |                         |                          |                        |                          |                         |                        |                        |                             |                         |                               |                       |                       |                  |    |
| Li<br>lithium<br>6.9   | Be<br>beryllium<br>9.0  |                                                                |                         |                          |                          |                         |                          |                        |                          |                         |                        |                        |                             |                         |                               |                       |                       |                  |    |
| 11                     | 12                      |                                                                |                         |                          |                          |                         |                          |                        |                          |                         |                        |                        |                             |                         |                               |                       |                       |                  |    |
| Na<br>sodium<br>23.0   | Mg<br>magnesium<br>24.3 |                                                                |                         |                          |                          |                         |                          |                        |                          |                         |                        |                        |                             |                         |                               |                       |                       |                  |    |
| 3                      |                         | 4                                                              | 5                       | 6                        | 7                        | 8                       | 9                        | 10                     | 11                       | 12                      |                        |                        |                             |                         |                               |                       |                       |                  |    |
| 19                     | 20                      | 21                                                             | 22                      | 23                       | 24                       | 25                      | 26                       | 27                     | 28                       | 29                      | 30                     | 31                     | 32                          | 33                      | 34                            | 35                    | 36                    |                  |    |
| K<br>potassium<br>39.1 | Ca<br>calcium<br>40.1   | Sc<br>scandium<br>45.0                                         | Ti<br>titanium<br>47.9  | V<br>vanadium<br>50.9    | Cr<br>chromium<br>52.0   | Mn<br>manganese<br>54.9 | Fe<br>iron<br>55.8       | Co<br>cobalt<br>58.9   | Ni<br>nickel<br>58.7     | Cu<br>copper<br>63.5    | Zn<br>zinc<br>65.4     | Ga<br>gallium<br>69.7  | Ge<br>germanium<br>72.6     | As<br>arsenic<br>74.9   | Se<br>selenium<br>79.0        | Br<br>bromine<br>79.9 | Kr<br>krypton<br>83.8 |                  |    |
| 37                     | 38                      | 39                                                             | 40                      | 41                       | 42                       | 43                      | 44                       | 45                     | 46                       | 47                      | 48                     | 49                     | 50                          | 51                      | 52                            | 53                    | 54                    |                  |    |
| Rb<br>rubidium<br>85.5 | Sr<br>strontium<br>87.6 | Y<br>yttrium<br>88.9                                           | Zr<br>zirconium<br>91.2 | Nb<br>niobium<br>92.9    | Mo<br>molybdenum<br>95.9 | Tc<br>technetium<br>—   | Ru<br>ruthenium<br>101.1 | Rh<br>rhodium<br>102.9 | Pd<br>palladium<br>106.4 | Ag<br>silver<br>107.9   | Cd<br>cadmium<br>112.4 | In<br>indium<br>114.8  | Sn<br>tin<br>118.7          | Sb<br>antimony<br>121.8 | Te<br>tellurium<br>127.6      | I<br>iodine<br>126.9  | Xe<br>xenon<br>131.3  |                  |    |
| 55                     | 56                      | 57–71<br>lanthanoids                                           |                         | 72                       | 73                       | 74                      | 75                       | 76                     | 77                       | 78                      | 79                     | 80                     | 81                          | 82                      | 83                            | 84                    | 85                    | 86               |    |
| Cs<br>caesium<br>132.9 | Ba<br>barium<br>137.3   |                                                                |                         | Hf<br>hafnium<br>178.5   | Ta<br>tantalum<br>180.9  | W<br>tungsten<br>183.8  | Re<br>rhenium<br>186.2   | Os<br>osmium<br>190.2  | Ir<br>iridium<br>192.2   | Pt<br>platinum<br>195.1 | Au<br>gold<br>197.0    | Hg<br>mercury<br>200.6 | Tl<br>thallium<br>204.4     | Pb<br>lead<br>207.2     | Bi<br>bismuth<br>209.0        | Po<br>polonium<br>—   | At<br>astatine<br>—   | Rn<br>radon<br>— |    |
| 87                     | 88                      | 89–103<br>actinoids                                            |                         | 104                      | 105                      | 106                     | 107                      | 108                    | 109                      | 110                     | 111                    | 112                    | 114<br>Fl<br>flerovium<br>— |                         | 116<br>Lv<br>livermorium<br>— |                       |                       |                  |    |
| Fr<br>francium<br>—    | Ra<br>radium<br>—       |                                                                |                         | Rf<br>rutherfordium<br>— | Db<br>dubnium<br>—       | Sg<br>seaborgium<br>—   | Bh<br>bohrium<br>—       | Hs<br>hassium<br>—     | Mt<br>meitnerium<br>—    | Ds<br>darmstadtium<br>— | Rg<br>roentgenium<br>— | Cn<br>copernicium<br>— |                             |                         |                               |                       |                       |                  |    |

|             |                                |                              |                                   |                                |                             |                               |                               |                                 |                              |                                 |                              |                             |                               |                                |                               |
|-------------|--------------------------------|------------------------------|-----------------------------------|--------------------------------|-----------------------------|-------------------------------|-------------------------------|---------------------------------|------------------------------|---------------------------------|------------------------------|-----------------------------|-------------------------------|--------------------------------|-------------------------------|
| lanthanoids | 57<br>La<br>lanthanum<br>138.9 | 58<br>Ce<br>cerium<br>140.1  | 59<br>Pr<br>praseodymium<br>140.9 | 60<br>Nd<br>neodymium<br>144.2 | 61<br>Pm<br>promethium<br>— | 62<br>Sm<br>samarium<br>150.4 | 63<br>Eu<br>europium<br>152.0 | 64<br>Gd<br>gadolinium<br>157.3 | 65<br>Tb<br>terbium<br>158.9 | 66<br>Dy<br>dysprosium<br>162.5 | 67<br>Ho<br>holmium<br>164.9 | 68<br>Er<br>erbium<br>167.3 | 69<br>Tm<br>thulium<br>168.9  | 70<br>Yb<br>ytterbium<br>173.1 | 71<br>Lu<br>lutetium<br>175.0 |
|             | 89<br>Ac<br>actinium<br>—      | 90<br>Th<br>thorium<br>232.0 | 91<br>Pa<br>protactinium<br>231.0 | 92<br>U<br>uranium<br>238.0    | 93<br>Np<br>neptunium<br>—  | 94<br>Pu<br>plutonium<br>—    | 95<br>Am<br>americium<br>—    | 96<br>Cm<br>curium<br>—         | 97<br>Bk<br>berkelium<br>—   | 98<br>Cf<br>californium<br>—    | 99<br>Es<br>einsteinium<br>— | 100<br>Fm<br>fermium<br>—   | 101<br>Md<br>mendelevium<br>— | 102<br>No<br>nobelium<br>—     | 103<br>Lr<br>lawrencium<br>—  |

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