2017 2E Science MYE
Fuchun Secondary School

Section A [25 marks]

Answer **all** questions.

1. Mr Kelvin wants to find out if there is a chemical reaction when he mixes solution X with solution Y. Which of the following result would **confirm** that there has been a chemical reaction?

   A The resulting solution changes in colour.
   B The resulting solution appears lighter.
   C A new substance is formed.
   D There is no visible change.

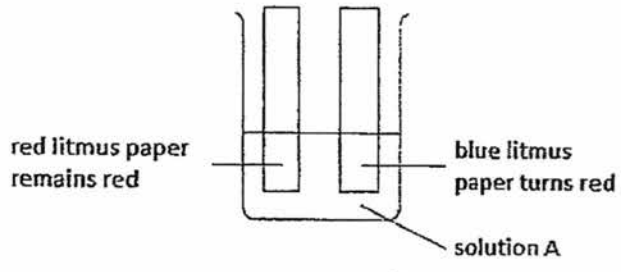
2. Which of the following is **not** an example of a chemical change?

   A forming ice cubes in the freezer
   B burning of petroleum in a car
   C heating sugar in a metal pot
   D rusting of iron chain

3. Which of the following reactions does **not** involve oxygen?

   A respiration in cells
   B decomposition of sugar upon heating
   C combustion of fuel
   D oxidation of iron nails

4. Eddy wanted to identify an unknown solution A. He dipped both red and blue litmus papers into solution A. The results obtained are shown in the diagram below. Which of the following substances could solution A be?



   A vinegar (pH 3)
   B distilled water (pH 7)
   C bleach (pH 12)
   D detergent (pH 13)

5. What would **most** likely happen when there is insufficient oxygen present when carbon is burned?

   A Carbon cannot be burned.

   B Carbon monoxide would be produced.

   C Carbon would burn with moisture in the air.

   D Carbon would burn with carbon dioxide in the air.

6. Timmy wanted to separate the components of a mixture using a filtration experiment. However, he found out that there was no residue when he poured the mixture through the filter paper. What is a possible explanation for this observation?

   A The mixture contains an insoluble solid.

   B The mixture contains a soluble solid.

   C The filter paper has holes that allow small liquid particles to pass through.

   D The solid is stuck to the liquid particles in the mixture.

7. Which of the following statements about chemical change is **false**?

   A Chemical changes result in the formation of new substances.

   B Certain conditions are required for some chemical changes to occur.

   C Reactants interact with one another to form products.

   D Chemical changes are reversible.

8. Wendy has a mixture of sand and salt. She wants to obtain both sand and salt from the mixture. Which of the following is the **correct** sequence for her to do so?

   I evaporate the mixture

   II filter the mixture

   III add water and stir

   A I → II → III

   B III → I → II

   C III → II → I

   D II → III → I

9. Due to the limited water supply, Singapore uses desalination plants to produce portable water. Which of the following statements is **not** true about the desalination process?

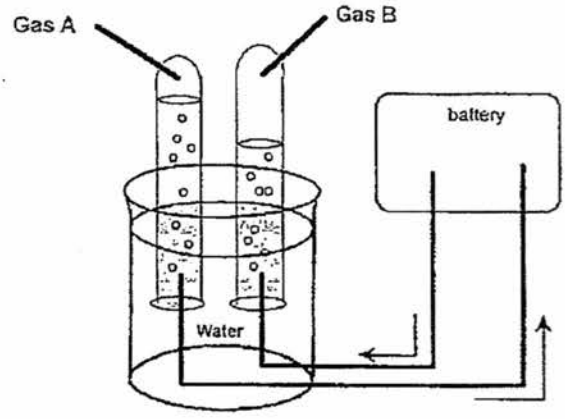
   A Dissolved salts are removed from seawater.

   B Distillation is expensive and requires a lot of energy.

   C Distillation is used in desalination.

   D Desalination does not necessarily require heat.

10. Dani set up an electrolysis experiment on water as shown in the diagram below:



He observed that there was more gas B than gas A produced during the electrolysis process. Which of the following could be gas A and gas B?

	gas A	gas B
A	O	H
B	H_2	O_2
C	H_2O	H_2
D	O_2	H_2

11. Jane accidentally dropped her house keys made of metal into a recycling container filled with paper products. Which of the following separation techniques will allow her to pick up her keys easily from the pile of rubbish?

   A evaporation

   B distillation

   C magnetic attraction

   D filtration

12. Which of the following statements **correctly** explains why chromatography is not a suitable technique for separating an unknown Sample Q?

A Sample Q is a mixture.

B Sample Q is insoluble in the provided solvent.

C Sample Q is too little.

D Sample Q is impure.

13. John blew air into a balloon. Which of the following statement best describes the behaviour of air particles in the balloon?

A The particles vibrate in their fixed positions.

B More particles will be found at the bottom of the balloon.

C More particles will be found at the top of the balloon.

D The particles are far apart from one another.

14. Why are water and steam similar?

A They can be compressed.

B They consist of the same type of particles.

C They can take the shape of the containers that they are in.

D The particles have the same amount of energy.

15. Bob noticed that the spaces between the particles of substance X started to decrease after process Y. Which of the following could process Y be?

A boiling substance X

B evaporating substance X

C melting substance X

D freezing substance X

16. Which of the following substance has the **strongest** forces of attraction between its particles?

A cotton

B detergent

C alcohol

D carbon dioxide

17. Joel decided to fix a dented ping-pong ball by putting it into a pot of boiling water for a few seconds. However, he was unable to fix the ping-pong ball. Which of the following could **not** be a possible reason for this?

A Joel did not leave the ping-pong ball in the hot water long enough.

B The hot water was not hot enough.

C The material of the ping-pong ball only allows for contraction.

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18. Which of the following statements about atoms is **false**?

A The heaviest part of the atom is its nucleus.

B The electrons are found in the nucleus of an atom.

C A proton has similar relative mass as a neutron.

D An atom is neutrally charged.

19. Some of the ingredients found in a carbonated drink are listed below:

ingredient	chemical formula
sugar	$C_{12}H_{22}O_{11}$
carbon dioxide	CO_2
carbonic acid	H_2CO_3

Which of the following statements is **not** true about the substances listed in the table above?

A The sugar molecule contains the highest number of atoms.

B All three substances contain atoms of carbon and oxygen.

C All three substances are molecules of compounds.

D The atomic mass of Carbon is different in each substance.

20. An element X has an electronic configuration of 2.8.2. What is the formula of the ion X?

A X^+

B X^-

C X^{2+}

D X^{2-}

21. Which of the following is not directly obtained from a chemical formula?

A number of each type of atom in the molecule.

B number of atoms in the molecule.

C type of atoms in a molecule.

D chemical properties of the molecule.

22. The equation below shows a chemical equation:

$$CH_4 + x\,O_2 \rightarrow CO_2 + y\,H_2O$$

What are the values for x and y?

	x	y
A	1	2
B	2	2
C	2	1
D	1	1

23. Photosynthesis is a process where plants use sunlight to make food in the form of glucose.

The following is a word equation for photosynthesis:

A + water → glucose + B + water

What are A and B?

	A	B
A	oxygen	carbon dioxide
B	carbon dioxide	carbon monoxide
C	carbon dioxide	oxygen
D	oxygen	carbon monoxide

24. Mr Ho found an unknown liquid X and noted down the following properties:

- Liquid X tasted sour.
- Liquid X reacted with magnesium strip and produces a gas.
- Liquid X reacted with calcium carbonate and produces a gas.

Which of the following is **most** probably liquid X?

A lemon juice

B detergent

C oil

D water

25. Which of the following is not a benefit of chemical changes?

A production of medicines

B cooking food

C burning of fuel to move vehicles

D decay of food

End of Section A

Section B [25 marks]

Answer all questions.

Write your answer in the spaces provided.

1. After a science class, Mr Kelvin found an unknown solution on one of the laboratory benches.

   (a) He decided to use the following set-up, shown in Fig. 1 below, to separate pure water from the unknown solution.

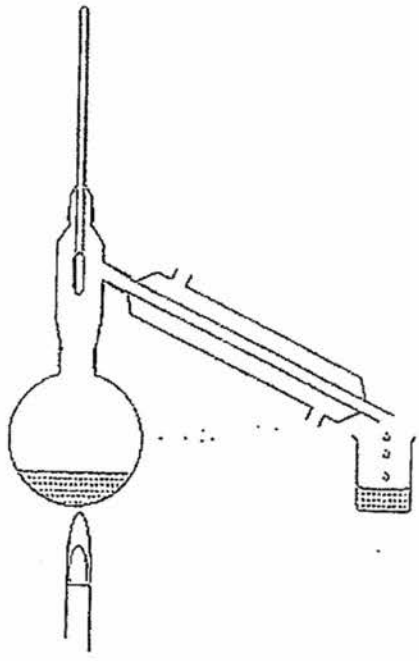


Fig. 1

(i) Label the direction of water, using "water in" and "water out", on Fig. 1. [1]

(ii) What is the purpose of the thermometer in this set-up?

.....

..... [1]

(iii) Explain how the above set-up is able to separate pure water from the unknown solution.

.....

.....

.....

.....

.....

..... [4]

(b) After removing pure water from the unknown solution, Mr Kelvin realised that the solute, in the unknown solution, is a mixture of dyes. He conducted an experiment on the mixture of dyes.

Fig. 2 shows the results of his experiment:

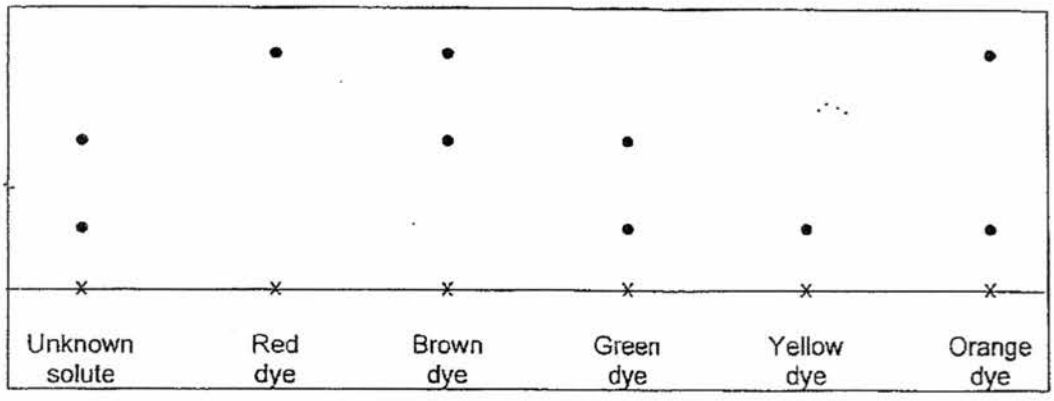


Fig. 2

(i) Based on the result above, which dye(s) was/ were pure?

..... [1]

(ii) Based on Mr Kelvin's result, which dye(s) was/were found in the unknown solute?

..... [1]

(iii) Mr Kelvin realised that the red dye contains harmful properties and is not suitable for use in food products.

Which of the other dye(s) should be avoided in food products?

.....

..... [1]

2. Using a measuring cylinder, Mr Tan measured 100 cm^3 of alcohol and 100 cm^3 of water.

(a) He mixed the two liquids together but realised that the total volume did not add up to 200 cm^3. Explain why the mixture that Mr Tan prepared did not add up to 200 cm^3.

.....

.....

.....

..... [2]

(b) Mr Tan proceeded to measure the mass of the mixture and found out that the total mass was equal to the sum of the individual mass of 100 cm^3 of water and 100 cm^3 of alcohol. Explain why.

.....

.....

..... [1]

3. Ali noticed that a glass jar with a metal lid, shown in Fig. 3, was difficult to open after being left in the refrigerator for a long period of time.

Fig. 3

(a) Based on your understanding of particle theory, explain why it is more difficult to open the lid after the glass jar was left in the refrigerator for a long period of time.

.....

.....

.....

..... [3]

(b) Suggest **one** method which Ali can use to open the lid of the glass jar.

.....

..... [1]

4. (a) Using the Periodic Table, complete the table below.

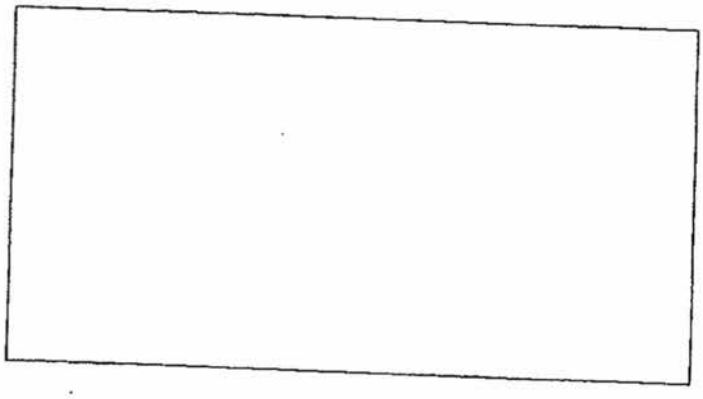
atom	atomic number	atomic mass	protons	electrons	neutrons
sodium	11				
	35	80			
		131		54	

[3]

(i) Draw the electronic structure of the sodium atom. Show all electrons.

[1]

(ii) Draw the electronic structure of the sodium ion. Show only the valence electrons.



[2]

5. Balance the following chemical equations by adding numbers where necessary.

(a) ___ $NaOH$ + ___ H_2SO_4 → ___ Na_2SO_4 + ___ H_2O

(b) ___ H_2SO_4 + ___ $Pb(NO_3)_2$ → ___ $PbSO_4$ + ___ HNO_3

(c) ___ Fe + ___ O_2 → ___ Fe_2O_3

[3]

Section C [20 marks]

Answer any **two** questions.

Write your answer in the spaces provided.

6. Fig. 4 below shows the process whereby used water is converted into drinking water.

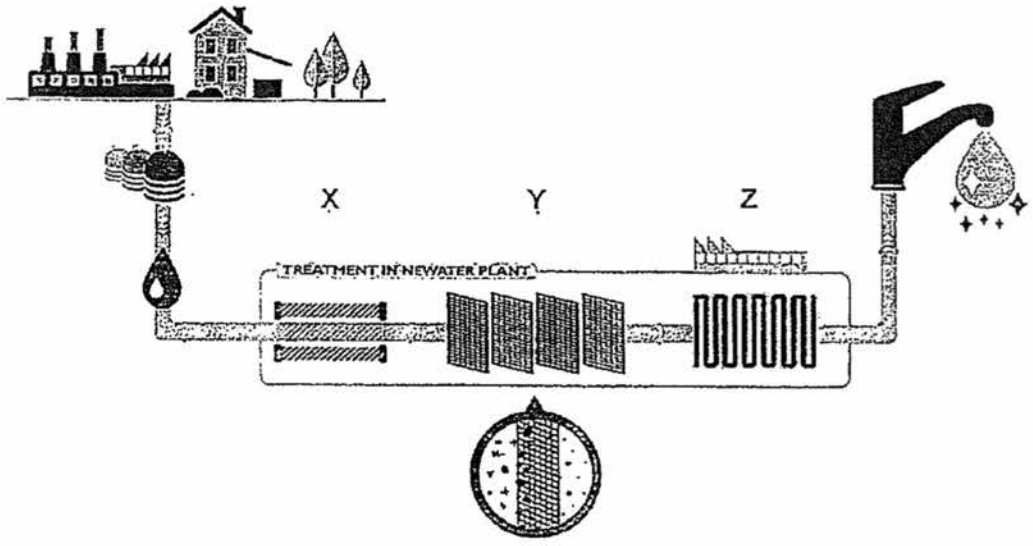


Fig. 4

(a) The following are processes found in water treatment.

I ultraviolet treatment

II microfiltration

III reverse osmosis

Identify stages X, Y and Z.

(i) X ..... [1]

(ii) Y ..... [1]

(iii) Z ..... [1]

(b) Explain how the different stages of water treatment in (a) will help to obtain drinking water.

(i) X:

.....

.....

..... [2]

(i) Y:

.....

.....

.....

..... [3]

(ii) Z:

.....

..... [1]

(c) Other than using this method, name one other method that Singapore uses to obtain drinking water.

..... [1]

7. Mr Kelvin wants to boil some water using an electric kettle shown in the Fig. 5 below.

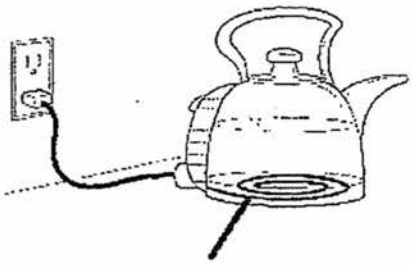
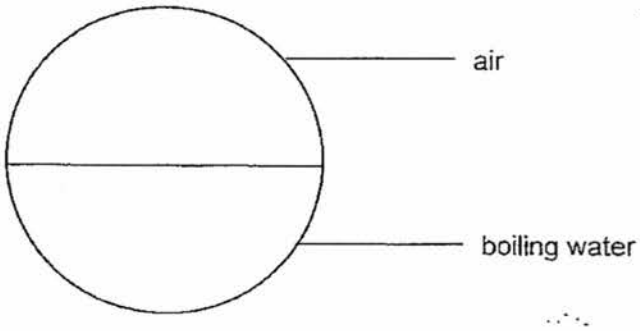


Fig. 5

(a) Draw the particle arrangement at the surface of the boiling water.



[1]

(b) Using your understanding of particle theory, explain how water changes from liquid state to gaseous state in an electric kettle.

.....

.....

.....

.....

.....

..... [5]

(c) Without increasing the electrical current flowing through the heating coil, suggest **one** way to increase the speed of boiling water.

.....

..... [1]

(d) Once the water has been boiled and cooled, Mr Kelvin poured the boiled water into containers of different shapes. He realised that the water could take the different shapes of the containers.

Using your understanding of particulate nature of liquids, explain how water can take up different shapes.

.....

.....

.....

..... [3]

8. Mrs Lim found an unknown substance, X, on the laboratory bench. Mrs Lim poured some dilute hydrochloric acid into a test tube with substance X. She noticed that bubbles were produced from the reaction as shown in Fig. 6.

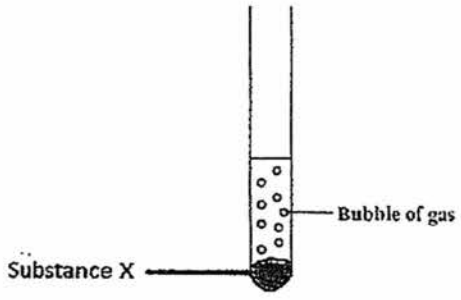


Fig. 6

(a) Using your understanding of reactions with acids, what are the two possible gases that could have been produced from the reaction?

gas 1: ..... [1]

gas 2: ..... [1]

(b) For each gas stated in (a), describe the test for the gas, and the observation to expect in the presence of the gas.

gas 1: .....

.....

..... [2]

gas 2: .....

.....

..... [2]

(c) Based on your experiments above, write down a general **word equation** for the reaction between X and hydrochloric acid that produces the named gas in (a).

gas 1 : ..... [1]

gas 2 : ..... [1]

(d) Mrs Lim wants to mix dilute hydrochloric acid with another solution to produce a solution of pH7.

(i) What type of solution should she use?

..... [1]

(ii) Name the type of reaction between hydrochloric acid and the solution in (d)(i).

..... [1]

End of paper

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Section A [25 marks]

Answer **all** questions.

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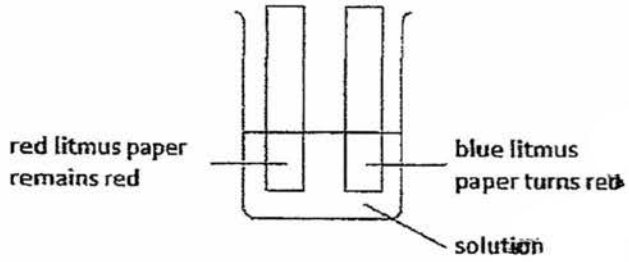

A vinegar (pH 3)

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5. What would **most** likely happen when there is insufficient oxygen present when carbon is burned?

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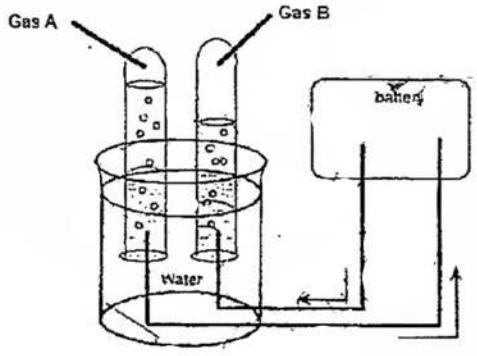

He observed that there was more gas B than gas A produced during the electrolysis process. Which of the following could be gas A and gas B?

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C	H_2O	H_2
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B They consist of the same type of particles.

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B Evaporating substance X.

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C	All three substances are molecules of compounds.
D	The atomic mass of C atom is different in each substance.

20. An element **X** has an electronic configuration of 2.8.2. What is the formula of the ion **X**?

A X^{+}

B X^{-}

C X^{2+}

D X^{2-}

21. Which of the following is **not** directly obtained from a chemical formula?

A Number of each type of atom in the molecule.

B Number of atoms in the molecule.

C Type of atoms in a molecule.

D Chemical properties of the molecule.

22. Which of the following option would create a balanced equation for the equation below:

$CH_4 + X\ O_2 \rightarrow CO_2 + Y\ H_2O$

	X	Y
A	1	2
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C	2	1
D	1	1

23. Photosynthesis is a process where plants use sunlight to make food in the form of glucose. The following is a word equation for photosynthesis:

A + water → glucose + B + water

Identify A and B.

	A	B
A	oxygen	carbon dioxide
B	carbon dioxide	carbon monoxide
C	carbon dioxide	oxygen
D	oxygen	carbon monoxide

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- Liquid X tasted sour.
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Which of the following is most probably liquid X?

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B detergent

C soap

D water

25. Which of the following is **not** a benefit of chemical changes?

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Section B [25 marks]

Answer **all** questions.

Write your answer in the spaces provided.

1. After a science class, Mr Kelvin found an unknown solution on one of the laboratory benches.

(a) He decided to use the following experiment, as shown in Fig. 1 below, to separate pure water from the unknown solution.

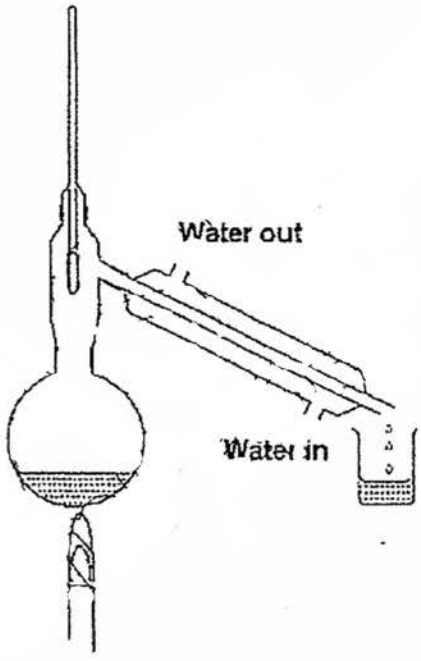


Fig. 1

(i) Label the direction of water, water in or water out, on the diagram on the diagram. [1]

(ii) What is the purpose of having a thermometer in this experiment?
It is used to **measure the boiling point** of the vapour entering the condenser, which is collected as the liquid/ distillate. [1]

(iii) Explain how the above experiment is able to separate pure water from the unknown solution.

As the unknown solution gets heated up, it will **start to boil**. **[1]** **Water changes into steam** and passes into the condenser. **[1]** The running water in the **condenser helps to cool down** the **hot steam/water vapour** and **changes them back into liquid state**. **[1]**The water droplets are then **collected as distillate** in the beaker. **[1]**

(b) After removing pure water from the unknown solution, Mr Kelvin realised that the solute, in the unknown solution, is a mixture of dyes. He conducted an experiment on the mixture of dyes.

Fig. 2 shows the results of his experiment:

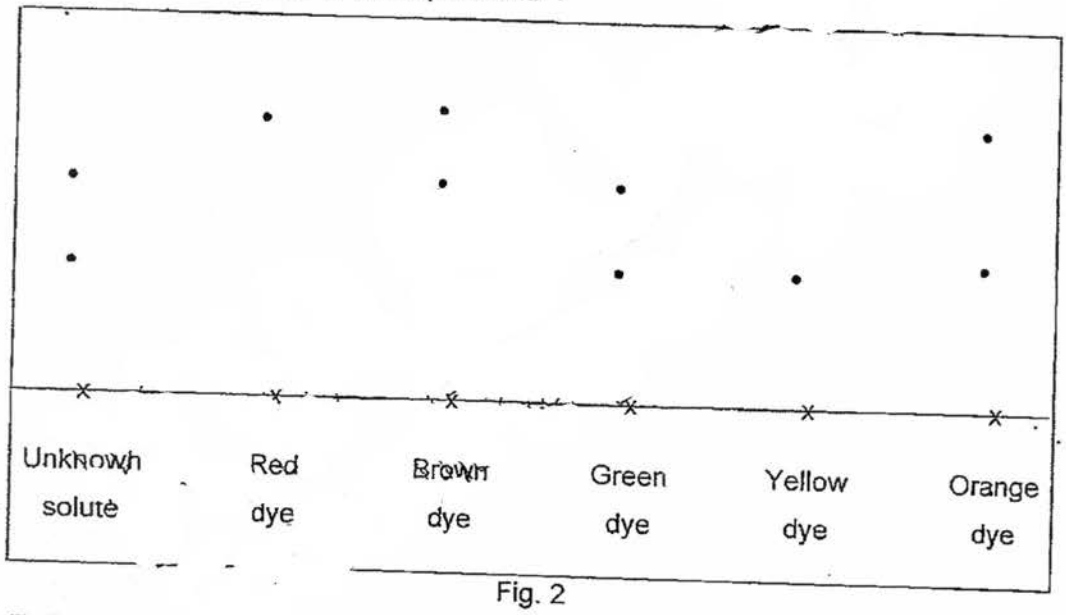


Fig. 2

(i) Based on the result above, which dye(s) or solute is pure?

Red and yellow. [1]

(ii) Based on Mr Kelvin's result, which dye(s) is/are found in unknown solute?

Green and yellow. [1]

(iii) Mr Kelvin realised that the red dye contains harmful properties and is not suitable to be used in food products. Which of the other dye(s) should be avoided in food products?

Brown and orange. [1]

2. Using a measuring cylinder, Mr Tan measured 100 cm^3 of alcohol and 100 cm^3 of water.

(a) He mixed the 2 liquids together but realised that the total volume did not add up to 200 cm^3. Explain why the mixture that Mr Tan prepared did not add up to 200 cm^3.

The size of alcohol and water particles is different [1] and this allows the smaller particles to take up spaces in between the larger particles [1]

(b) Mr Tan proceeded to measure the mass of the mixture and found out that the mass was equal to the sum of the individual mass of 100 cm^3 of water and 100 cm^3 of alcohol. Explain why.

Even though the volume does not add up to 200 cm^3, the number of particles for both water and alcohol remain the same. [1] That is why the mass remains the same

3. Ali noticed that a glass jar with a metal lit, shown in Fig. 3, was difficult to open after being left in the refrigerator for a long period of time.

Fig. 3

(a).Based on your understanding of particle theory, explain why it is more difficult to open the lid after it has been left in the refrigerator for a long period of time.

As the metal lid **loses heat energy** [1], the **particles move closer to one another** [1] and this causes the lid to **contract in size.** [1] Due to the contraction, the lid becomes difficult to open.

(b) Suggest **one** method which Ali can use to open the lid of the glass jar.

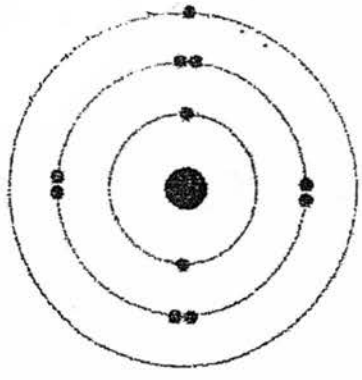
Ali can **heat up the metal lid** of the glass jar by running hot water over the metal lid. [1]

4. (a) Using the provided periodic table, complete the table below

atom	atomic number	atomic mass	protons	electrons	neutrons
Sodium	11	23	11	11	12
Bromine	35	80	35	35	45
Xenon	54	131	54	54	77

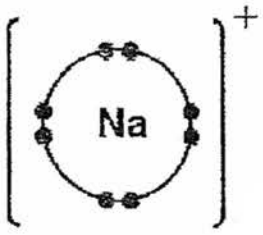
[3]

(b) (i) Draw the atomic structure of Sodium. Show all electrons.



[1]

(ii) Draw the atomic structure of Sodium ion. Show only the valence electrons.



1m – valence electrons; 1m charge

5. Balance the following chemical equations by adding numbers where necessary.

(a) 2 NaOH + 1 H_2SO_4 → 1 Na_2SO_4 + 2 H_2O

(b) 1 H_2SO_4 + 1 $Pb(NO_3)_2$ → 1 $PbSO_4$ + 2 HNO_3

(c) 4 Fe + 3 O_2 → 2 Fe_2O_3

[3]

Section C [20 marks]

Answer any two questions.

Write your answer in the spaces provided.

6. Fig. 4 below shows the process whereby used water is converted into drinking water.

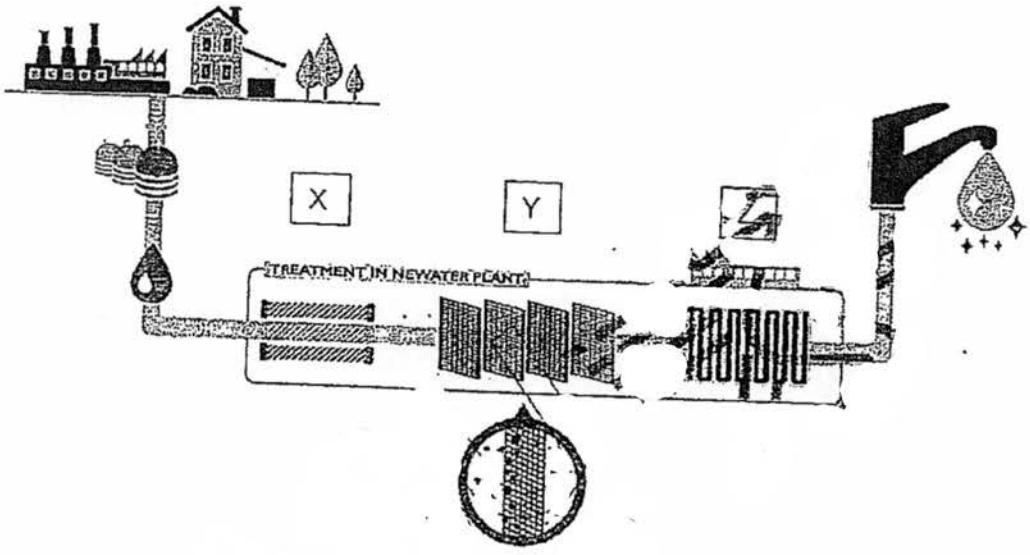


Fig 4

(a) The following are processes found in water treatment.

I ultraviolet treatment

II microfiltration

III reverse osmosis

Identify stages X, Y and Z.

(i) X: **Microfiltration [1]**

(ii) Y: **Reverse Osmosis [1]**

(iii) Z: **Ultraviolet** disinfection [1]

(b) Explain how the different stages of water treatment in (a) will help to obtain drinking water.

(i) X: Remove small particles [1] in the water using a membrane with tiny pores. [1]

(ii) Y: Water is pumped at high pressure [1] through a special membrane. The pores of the membrane are very small [1] such that only certain molecules such as water can pass through. [1]

(iii) Z: Ultraviolet rays are used to kill any remaining bacteria in the water. [1]

(c) Other than using this method, name one other method that Singapore uses to obtain drinking water.

Desalination, imported water and local catchment water (either 1 will award 1 mark) [1]

7. Mr Kelvin wants to boil some water using an electric kettle shown in Fig. 5 below.

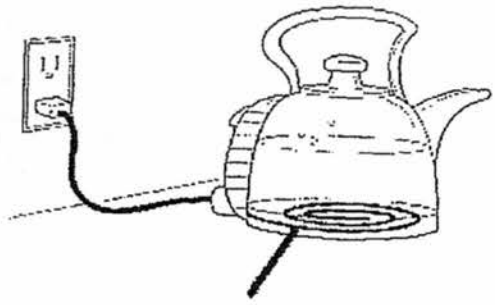
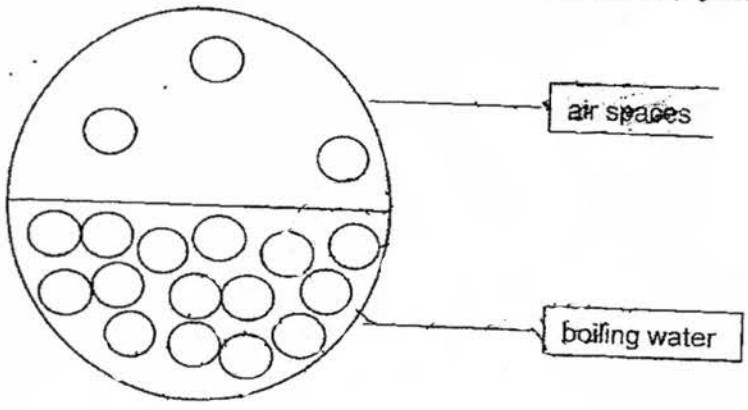


Fig. 5

(a) Draw the particle arrangement at the surface of the boiling water. [1]



(1 mark will only be awarded for accurate drawings for both steam and water particles; water particles, for boiling water, must be in contact with one another)

(b) With your understanding of particle theory, explain how water changes from liquid state to gaseous state in an electric kettle.

Water particles **gain heat energy** [1] and **vibrate more vigorously** [1]
Eventually, they are able to **overcome the forces of attraction** [1] and **break free from one another**. [1] They start to **move randomly** and becomes steam. [1]

(c) Without increasing the electrical current flowing through the heating coil, suggest one way to increase the speed of boiling water.

Reduce amount of water to be boiled. [1] OR

Increasing the number of coils for surface area. [1]

Other acceptable answers:

Stir the water while boiling/heating: changing the environment by putting it under the sun/sunlight

(Either answer will be awarded 1 mark)

(d) Once the water has been boiled and cooled, Mr Kelvin poured the boiled water into containers of different shapes. He realised that the water could take the different shapes of the containers. Using your understanding of particulate nature of liquids, explain how water can take up different shapes

Particles in liquids do not have any fixed arrangements [1] and they can slide across/over one another [1] taking up spaces in between to take up shapes of the containers. [1]

7. Mrs Lim found an unknown substance, X, on the laboratory bench. Mrs Lim poured some diluted hydrochloric acid into a test tube with substance X and she noticed that bubbles were produced from the reaction as shown in Fig. 6.

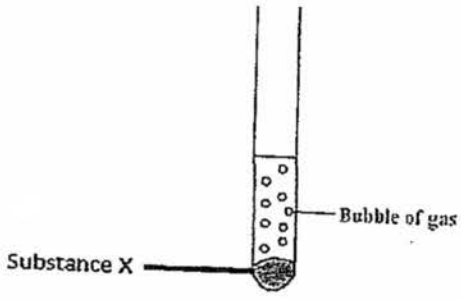


Fig. 6

(a) Based on your understanding of reactions with acids, what are the possible gases that could have been produced from the reaction?

Hydrogen [1] and carbon dioxide [1]

(b) Describe 2 experiments that could help Mrs Lim to test for the type of gases in (a).

Using a **burning splint** [1], **hydrogen gas** extinguishes with a **pop sound** [1].

Passing the gas through **lime water** [1], **carbon dioxide** turns the lime water **chalky** [1]

(c) Based on your experiments above, write down the **general word equation** for the possible reactions between X and hydrochloric acid.

Acid + Metal → Salt + Hydrogen gas [1]

Acid + Carbonate → Salt + water + Carbon dioxide [1]

(d) Mrs Lim wants to adjust the pH value of dilute hydrochloric acid to pH 7.

(i) What type of solution should she use?

Alkaline solution/ alkali [1]

(ii) What is the name of the reaction between hydrochloric acid and the solution in d(i)?

Neutralisation. [1]