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Name	Class	Register Number



Sembawang Secondary School

MID YEAR EXAMINATION 2017

SECONDARY 3 EXPRESS

SCIENCE(CHEMISTRY)

Additional materials: NIL

5076

08 May 2017

1 hour 30 minutes

0800 - 0930

READ THESE INSTRUCTIONS FIRST

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

Write your name, class and register number on the answer sheet in the spaces provided.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

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

Section A

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

Section B

Answer **all** questions. Write your answers in the spaces provided on the question paper.

Section C

Answer any **two** questions. Write your answers in the spaces provided on the question paper.

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

Use of electronic calculators are allowed.

A copy of the Periodic Table is printed on page 15.

FOR EXAMINER'S USE	
Section A	
Section B	
Section C	
TOTAL	

PARENT'S SIGNATURE

Setter: Mrs Jessica Tan

This document consists of **15** printed pages including this cover page and **1** blank page.

[Turn over

Section A: Multiple Choice Questions [15 marks]

Shade the answers in the answer sheet provided.

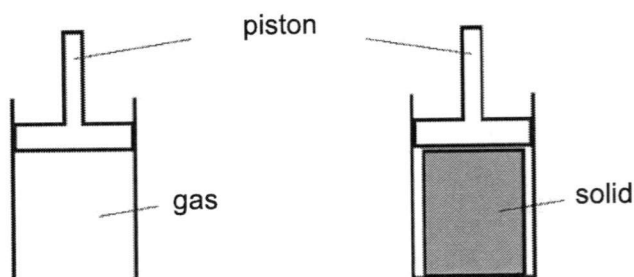
1. Which substance in the table below would show a change of state if cooled from room temperature to 0 °C?

	melting point / °C	boiling point / °C
A	15	110
B	35	79
C	55	81
D	-20	-5

2. Which of the following best matches the apparatus to the purpose of measuring a given volume of liquid?

	measuring approximately 25cm ³	measuring exactly 25.0cm ³	measuring exactly 26.80cm ³
A	beaker	measuring cylinder	pipette
B	conical flask	beaker	burette
C	measuring cylinder	pipette	burette
D	pipette	burette	measuring cylinder

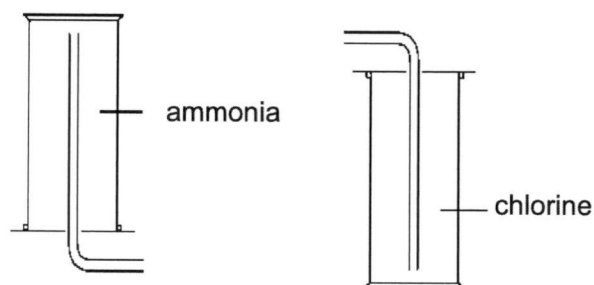
3. An attempt was made to compress a gas and a solid using the apparatus shown.



Which substance would be compressed and what is the reason for this?

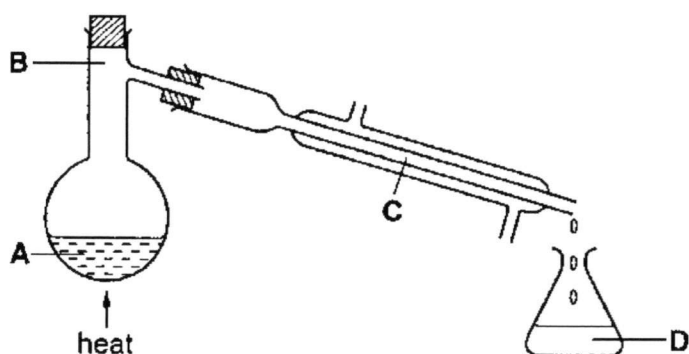
	substance	reason
A	gas	the gas particles are close together
B	gas	the gas particles are far apart
C	solid	the solid particles are close together
D	solid	the solid particles are far apart

- 4 Ammonia and chlorine gas can be collected by the methods as shown in the diagrams below.



From the diagrams, what can you conclude about ammonia and chlorine?

- A Ammonia is less dense than chlorine.
 - B Both gases are less dense than air.
 - C Both gases are soluble in water.
 - D Chlorine is less dense than ammonia.
- 5 Which of the following is the correct reason why crystallization is used to obtain sugar from sugar solution instead of evaporation?
- A Evaporation forms impure sugar.
 - B Sugar decomposes on heating.
 - C Sugar is a compound, not a mixture.
 - D Evaporation takes a longer time than crystallization.
- 6 The diagram shows a solution of sea water being separated by distillation. At which point will the particles move the fastest?



- 7 **X** and **Y** are miscible liquids and their melting and boiling points are shown in the table below.

substance	melting point / °C	boiling point / °C
X	-114	78
Y	12	105

Which of the following separation techniques can be used to separate a mixture of **X** and **Y**?

- A crystallisation
- B evaporation
- C filtration
- D fractional distillation

- 8 Which of the following row contains an element, a mixture and a compound?

A	magnesium	steel	pure water
B	sodium chloride	steel	sugar
C	pure water	steel	carbon dioxide
D	pure water	sugar	sodium chloride

- 9 Which statement best supports the fact that air is a mixture and **not** a compound?

- A Air contains different elements.
- B Air can be separated by physical methods.
- C The composition in air remains constant throughout the world.
- D The water vapour is a chemical compound.

- 10 Element **X** has an electronic structure of 2.8.3.
 Element **Y** has an electronic structure of 2.6.
 What would be the formula of the compound formed between **X** and **Y**?

- A XY_3
- B X_3Y
- C X_2Y_3
- D X_3Y_2

- 11 Which of the following ions has the most number of electron shells?

- A Al^{3+}
- B Be^{2+}
- C N^{3-}
- D S^{2-}

- 12 The table contains four elements and their atomic numbers.

element	W	X	Y	Z
atomic number	7	14	15	18

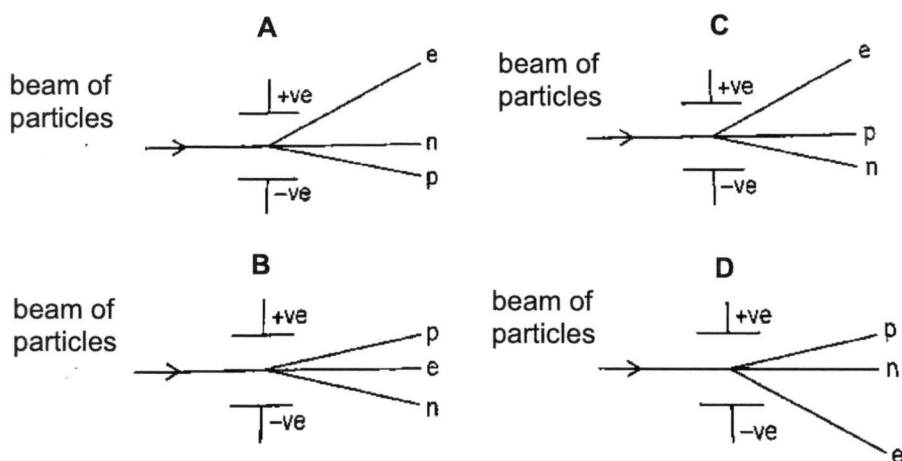
Which elements are in the same group in the Periodic Table?

- A W and X
 B W and Y
 C X and Y
 D X and Z
- 13 The nucleon and proton numbers of atoms P and Q are shown in the table below.

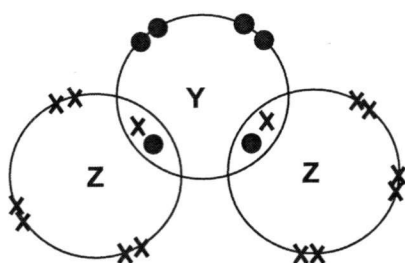
atoms	P	Q
nucleon number	39	40
proton number	19	20

Which statement about P and Q is correct?

- A An atom of P has more electrons than an atom of Q.
 B An atom of P has fewer neutrons than an atom of Q.
 C P is above Q in the same group of the Periodic Table.
 D P is in the same period in the Periodic Table as Q.
- 14 A beam of particles contains neutrons, n, protons, p, and electrons, e. The beam is passed between charged plates.
 Which diagram shows how the particles are affected by the plates?



- 15 The diagram shows the arrangement of electrons in a molecule of compound YZ_2 .



What are elements **Y** and **Z**?

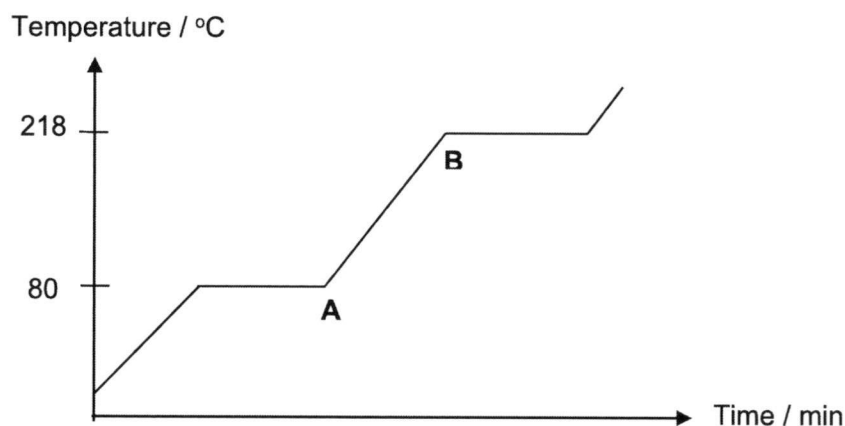
	Y	Z
A	calcium	chlorine
B	carbon	oxygen
C	oxygen	hydrogen
D	sulfur	chlorine

– End of Section A –

Section B: Short Structured Questions [30 marks]
 Answer all questions in this section in the spaces provided.

- 16** Naphthalene is a white, volatile, solid polycyclic compound with a strong odour. It is used in making mothballs. Acute (short-term) exposure of humans to naphthalene by inhalation and ingestion can cause damage to the liver.

The graph below shows the temperature of a sample of solid naphthalene as it is heated at room temperature.



- (a) Name the process happening at 80 °C and explain why the temperature remains constant at that temperature.

.....

[2]

- (b) Using kinetic particle theory, describe the arrangement and the movement of the naphthalene particles in the region A-B.

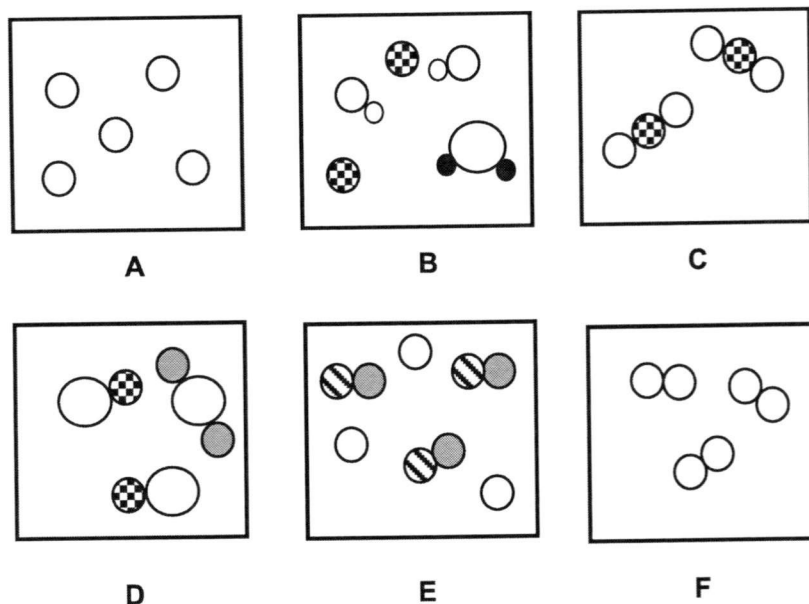
.....

[2]

- (c) Indicate on the graph above the section at which naphthalene is

- (i) entirely a solid, label this section as **C**;
 (ii) a mixture of gas and liquid, label this section as **D**. [2]

- 17 The figure below represents the particles in different substances, **A**, **B**, **C**, **D**, **E** and **F**.



Which one of **A**, **B**, **C**, **D**, **E** and **F** best represents

- (a) argon gas
 (b) oxygen gas
 (c) a mixture of compounds
 (d) a mixture of one element and one compound

[4]

- 18 Some physical properties of a substance **W** are as follows:

- It melts at 56 °C and boils at 92 °C.
- It does not dissolve in water.

Briefly explain how you can obtain table salt from a mixture of **W** and table salt.

.....

[4]

- 19 The melting points of a few substances are given in the table below:

substance	melting point/°C
hexane	69
ethanol	78
propanamide	81
3-nitrophenol	95

An impure sample of a solid **P** melts at 92°C.

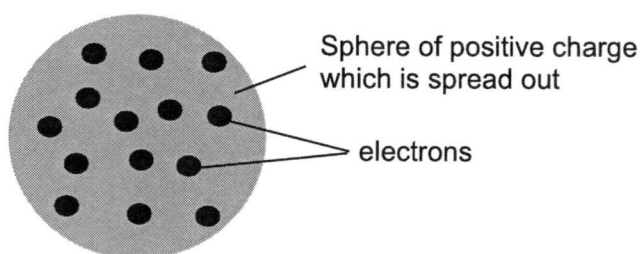
- (a) Which substance in the table is most likely to be **P**?

.....[1]

- (b) Briefly explain your answer to (a).

.....
[1]

- 20 In 1904, J.J.Thomson suggested a model of the atom. He called this the 'plum pudding' model. This model of an atom, containing 14 electrons, is shown below.

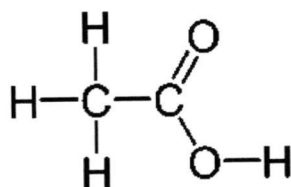


Describe how Thomson's model of the atom differs from our present ideas of the structure of an atom.

.....

[3]

- 21 Ethanoic acid is also commonly known as acetic acid. It is a colourless acid with a strong smell that is found in vinegar which is used in preserving food. The structural formula of ethanoic acid is shown below.



Determine which statements are true and which are false.

	statement	true / false
(a)	It contains 8 atoms.	
(b)	There are 16 total number of electrons used for bonding in this molecule	
(c)	It is a crystalline solid at room temperature.	

[3]

- 22 The table below lists the information of four chlorides. Use the data to answer the following questions.

substance	formula	melting point / °C
sodium chloride	NaCl	801
calcium chloride	CaCl ₂	772
Carbon tetrachloride	CCl ₄	-23
Silicon tetrachloride	SiCl ₄	-70

- (a) Which of the following chlorides

- (i) contain ions?

.....[2]

- (ii) do not conduct electricity?

.....[2]

- (iii) soluble in water?

.....[2]

- (b) Explain why sodium chloride has a high melting point.

.....

.....

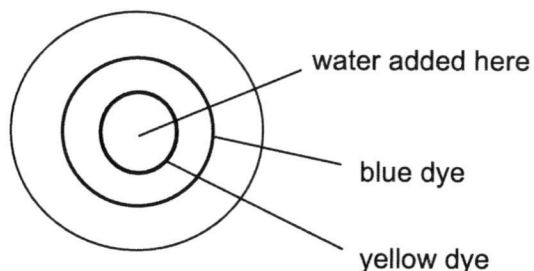
.....

.....[2]

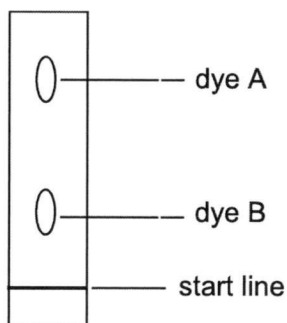
Section C [20 marks]

Answer any **two** questions.
Write your answers in the spaces provided.

- 23 (a) A few drops of screened methyl orange solution is placed in the centre of filter paper and a few drops of solvent is added to the centre of the filter paper. Blue and yellow dyes are formed as shown below.



- (i) What is the name of the separation method?
..... [1]
- (ii) What is the colour of the screened methyl orange?
..... [1]
- (iii) Suggest a suitable solvent for this experiment.
.....[1]
- (iv) Why does the blue dye travel further than the yellow dye?
..... [1]
- (v) The experiment is done in another way as shown below.



What are the colours of dye A and dye B?

dye A: [1]

dye B: [1]

- (b) The composition of a sample of milk is given below.

	proteins	carbohydrate	water	fats	minerals & vitamins
percentage (%)	3.3	4.8	87.5	3.8	0.6

- (i) Is milk an element, mixture or compound? Explain your answer.

.....
.....
.....
.....[2]

- (ii) Explain how you can carry out a simple experiment and use the result obtained to support your answer for (b)(i).

.....
.....
.....
.....[2]

- 24** Carbon is an element with nucleon number 12. Each of its atoms has 6 electrons and a nucleus containing two types of particles.

(a) State the names and number of each type of particles in the nucleus.

.....

.....[2]

(b) Compare the masses and electrical charges of these particles found in the nucleus and tabulate your answers.

[4]

(c) Carbon has an isotope with atoms that have a nucleon number 13.
Compare the similarity and the difference of the nuclei of these two isotopes and tabulate your answers.

[4]

25 Fluorine has an atomic number of 9 and a relative atomic mass of 19.

- (a) When atoms of fluorine form chemical bonds they form a stable electronic structure. Name the **two** different types of chemical bonds. Explain how atoms of fluorine are chemically combined to form a stable electronic structure.

(i) bond type

explanation.....

.....

.....[2]

(ii) bond type

explanation.....

.....

.....[2]

- (b) Draw 'dot and cross' diagrams to show the electronic structures of the substances formed when

(i) atoms of carbon and hydrogen combine to form methane. [3]

(ii) atoms of sodium and oxygen combine to form sodium oxide. [3]

– End of Paper –

The Periodic Table of Elements

Group

The Periodic Table of Elements																	
I		II	Group									III	IV	V	VI	VII	0
Key proton (atomic) number atomic symbol name relative atomic mass							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	51 – 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 F/ Radium -		116 Lv livermorium -		

lanthanoids

actinoids

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
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 dm³ at room temperature and pressure (r.t.p.).

Mark Scheme for SA1 Sec 3E Science Chemistry 2017

Section A

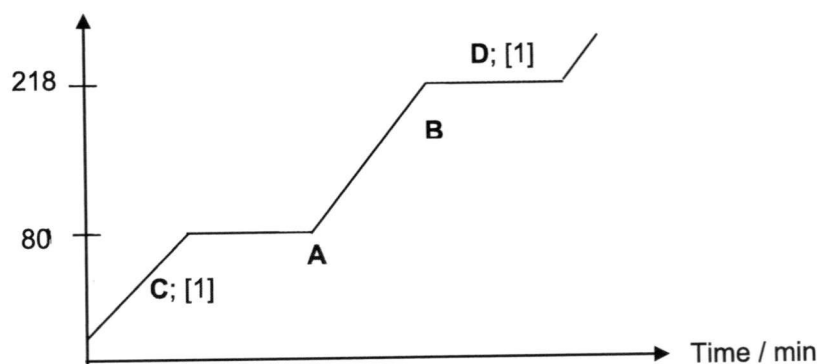
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	C	B	A	B	B	D	A	B	C	D	B	D	A	D

Section B

- 16 (a) melting; [1]
heat is used to overcome the forces of attraction holding the particles together; [1]

- (b) Particles are closely packed in a disorderly arrangement; [1]
Particles are sliding over one another; [1]

(c)

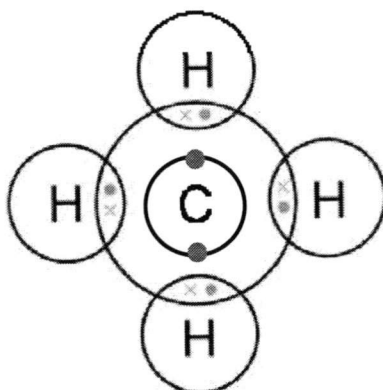


- 17 (a) A; [1]
(b) F; [1]
(c) D; [1]
(d) E; [1]
- 18 Add in water to the mixture; [1]
Stir to dissolve the salt; [1] and filter the mixture; [1]
Evaporate the filtrate to dryness; [1]
- 19 (a) P is 3-nitrophenol; [1]
(b) Impurities decreased melting point of the substance; [1]

- 20 Thomson's model of the atom has no electron shells; [1]
no nucleus; [1]
no protons/neutrons; [1] compared to our present idea of the structure of an atom.
- 21 (a) true; [1]
(b) true; [1]
(c) false; [1]
- 22 (a) (i) sodium chloride/NaCl; [1] calcium chloride/CaCl₂; [1]
(ii) carbon tetrachloride/CCl₄; [1] silicon tetrachloride/SiCl₄; [1]
(iii) sodium chloride/NaCl; [1] calcium chloride/CaCl₂; [1]
- (b) A lot of energy is required to overcome the strong forces of electrostatic attraction; [1]
between the oppositely charged ions; [1]
- 23 (a) (i) chromatography; [1]
(ii) green; [1]
(iii) water/ ethanol; [1]
(iv) The blue dye is more soluble than the yellow dye; [1]
(v) Dye A: blue; [1]
Dye B: yellow; [1]
- (b) (i) Milk is a mixture; [1] because the substances composition is in any ratio by mass; [1]
(ii) Test the boiling point of milk; [1] Milk will boil over a range of temperature; [1]
- 24 (a) There are 6 protons; [1] and 6 neutrons; [1] in the nucleus
- (b)
- | | mass | charge | marks |
|---------|------|--------|---------|
| proton | 1 | +1 | [1],[1] |
| neutron | 1 | 0 | [1],[1] |
- (c)
- | | protons | neutrons | marks |
|-----------|---------|----------|---------|
| carbon 13 | 6 | 7 | [1],[1] |
| carbon 12 | 6 | 6 | [1],[1] |

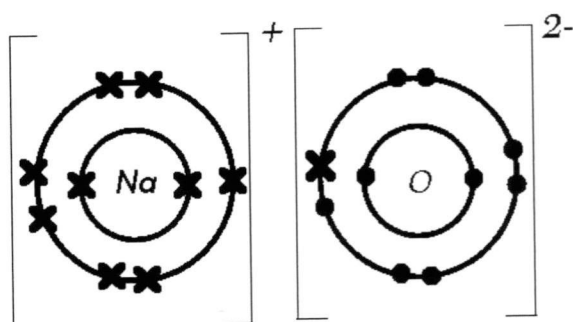
- 25 (a) (i) covalent bond; [1]
 It shares one pair of electrons with another non-metal; [1]
- (ii) ionic bond; [1]
 It gains one electron by forming an ion with a charge of 1-; [1]

(b) (i)



Correct sharing of the electron pairs; [1]
 Correct no. of hydrogen atoms; [1]
 Correct no. of electrons for all the atoms; [1]

(ii)



Correct no. of electrons; [1] and charges of the two ions; [1]
 Correct ratio of the ions; [1]