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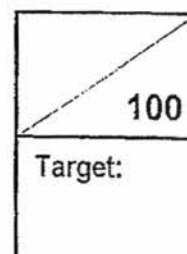
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REGENT SECONDARY SCHOOL
MID-YEAR EXAMINATION - 2017
SECONDARY 2 EXPRESS
SCIENCE



REGENT SECONDARY SCHOOL
MID-YEAR EXAMINATION - 2017
SECONDARY 2 EXPRESS
SCIENCE

Name: _____ () Date: 08 May 2017

Class: Sec 2 – ____

Duration: 1 hour 45 minutes

Setter: Mr. Eric Lee

Parent's Signature: _____

INSTRUCTIONS TO CANDIDATES:

1. This paper consists of Section A, B and C.
2. Section A consists of 30 multiple choice questions.
Answer **all** questions in this section on the OMR Answer sheet by shading the appropriate oval with a 2B pencil.
3. Section B consists of 6 structured questions.
Answer **all** questions in this section in the spaces provided.
4. Section C consists of 4 structured questions.
Answer **all** questions in this section in the spaces provided.
5. The marks allocated to each question or parts of a question are given in the brackets [].
6. Hand in the OMR Answer Sheet and the Question paper **separately**.
7. A copy of the Periodic Table is printed on page 27.
8. Calculators may be used for this paper.

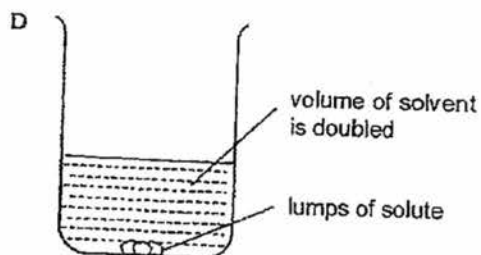
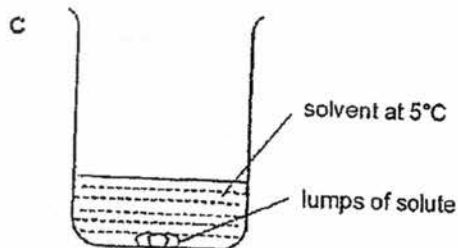
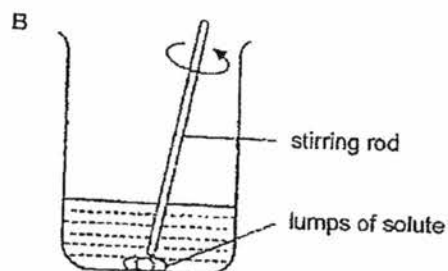
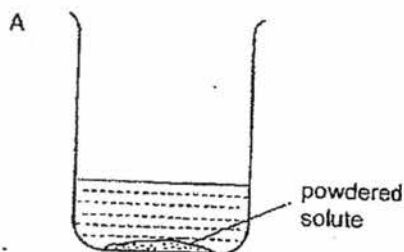
This paper consists of 40 questions on 27 printed pages.

Section A [30 marks]

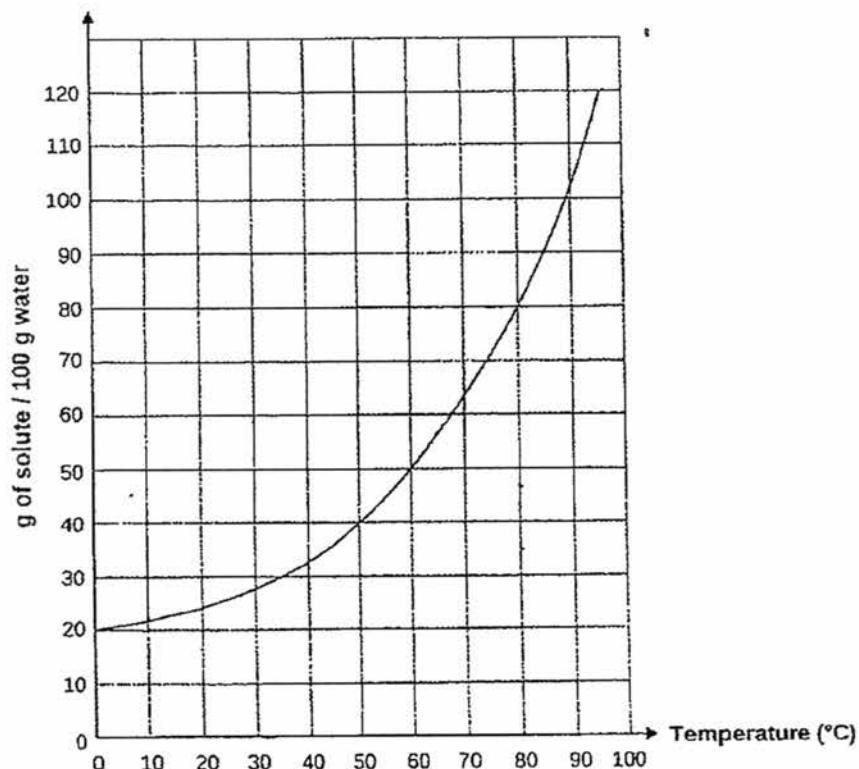
Answer all the questions in this section.

For each question, there are four possible answers A, B, C and D. Choose the one you consider correct and record your choice in 2B pencil on the OMR Answer Sheet.

- 1 Which of the following descriptions best describes the solubility of a substance?
- A It is the maximum volume of solvent required to dissolve a given amount of solute at a fixed temperature.
 - B It is the amount of substance that can dissolve in a specific volume of solvent at a fixed temperature to form a saturated solution.
 - C It is the volume of solvent that can dissolve a given amount of solute at any temperature.
 - D It is the minimum amount of solute that can dissolve in a specific volume of solvent at a fixed temperature.
- 2 Which of the following would have the lowest rate of dissolving of the solute?



- 3 The graph shows the solubility curve of substance X.

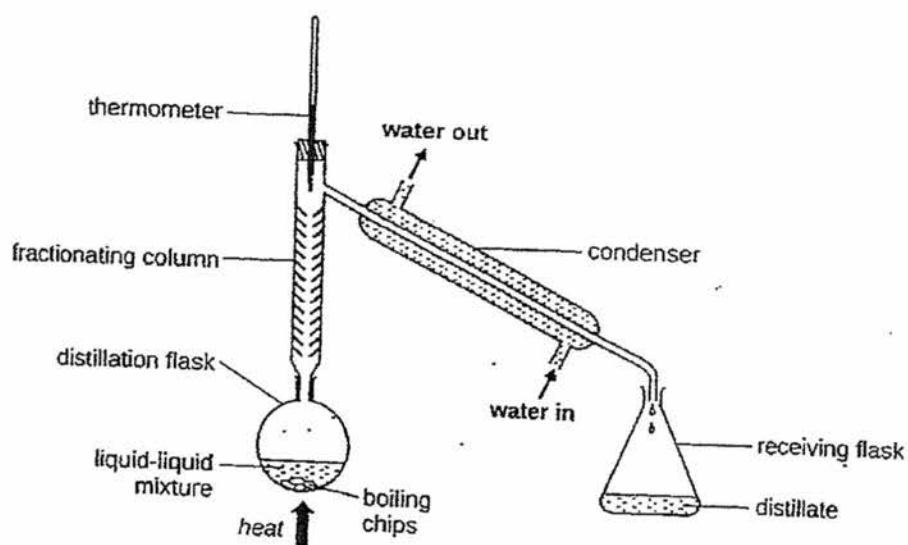


A hot saturated solution of X is allowed to cool from 80°C to 60°C.

What is the mass of crystallised X found in the solution of 60°C in 100 g of water?

- A 30 g
 - B 50 g
 - C 60 g
 - D 80 g
- 4 For two substances to be separable by paper chromatography, it is necessary that _____.
- A they are both liquids
 - B they have different solubility in the same solvent
 - C they have different densities
 - D they have different colours

- 5 The diagram below shows the experimental setup used to separate water and hexanol. The boiling point of water is 100°C while the boiling point of hexanol is 174°C .



The mixture was heated from room temperature. Which of the following statements is true?

- A The temperature reading of the thermometer increases from room temperature to 100°C , where it stays constant for a while, before rising again.
- B At the end of the separation, the distillate only contains water.
- C The same method of separation above would be more effective without the fractionating column.
- D Heating should only be stopped when all the mixture in the distillation flask has boiled.

- 6 During Valentine's day, a nurseryman's catalogue claims that a new rose he is offering for sale contains the same colouring matter as the flowers of the scarlet geranium.

To test the truth of the claim, Iffah dissolves the colouring matter out of the new rose to form Solution A. She also dissolves the colouring matter out of the flowers of the scarlet geranium to form Solution B.

Which of the following methods would you advise her to do?

- A Mix the two solutions together and see if they are miscible.
 - B Perform crystallisation to determine if they give the same crystals.
 - C Check if the two solutions distill over at the same temperature.
 - D Place a few drops of each solution on separate pieces of filter paper and watch how the colouring matter spreads out in a suitable solvent.
- 7 Eugene separates chloroform and water using a separating funnel.

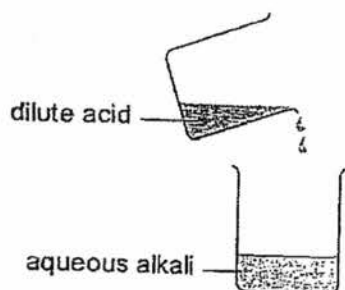
Which conclusion can be made from this observation **alone**?

- A Chloroform and water are colourless.
 - B Chloroform and water do not mix.
 - C Chloroform has a higher density than water.
 - D Chloroform and water have different boiling points.
- 8 Copper(II) sulfate, which is soluble in water, can be separated from chalk using three processes below. The order which these processes should be used is
-

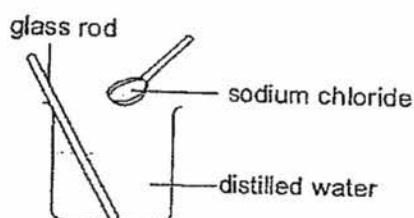
- A dissolving, evaporation, crystallisation
- B dissolving, filtration, crystallisation
- C filtration, crystallisation, evaporation
- D filtration, dissolving, evaporation

- 9 The following diagrams show four different experimental set-ups. Which of the following will **not** result in a chemical change?

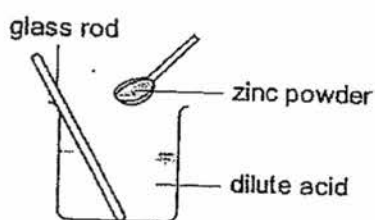
A



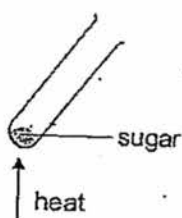
B



C



D



- 10 Bubbles form in a solution due to various reasons. In which of the following situations will bubbles form as a result of a chemical change?

- A Boiling milk in a saucepan
- B Opening a can of soft drink
- C Blowing into a cup of water with a straw
- D Placing a strip of magnesium ribbon into dilute acid

- 11 The Universal Indicator can be used to show the strength of an acid or alkali. What will be the colour of the indicator in each of the following liquids?

	Distilled water	Lemon juice	Soap water
A	Red	Orange	Blue
B	Blue	Green	Orange
C	Green	Orange	Blue
D	Green	Blue	Red

- 12 Dilute hydrochloric acid reacts with both sodium hydroxide solution and magnesium.

In both reactions, _____.

- A a salt is produced
- B a gas is released
- C no gas is released
- D water is produced

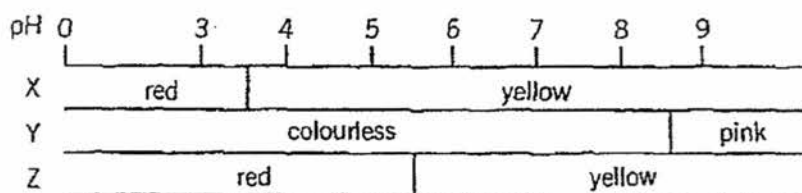
- 13 The table shows the pH values of different substances.

Substances	pH value
Ammonia	11
Vinegar	3
Detergents	14
Car battery acid	1
Soft drinks	5
Distilled water	7

Which of the following would likely to cause Universal Indicator to show pale green when they are mixed equally?

- A ammonia and detergents
- B soft drinks and vinegar
- C detergents and car battery acid
- D vinegar and distilled water

- 14 The diagram below shows the pH ranges of three indicators, X, Y and Z.



The three indicators are mixed together in a beaker. What pH value of the solutions would **only** produce yellow colour when it is added to a mixture of these indicators?

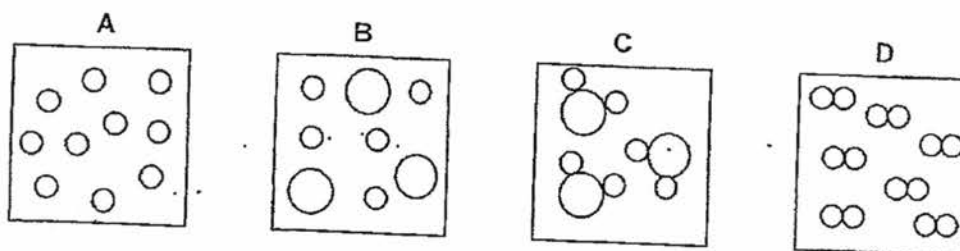
- A pH 2
- B pH 4
- C pH 8
- D pH 10

15 Ammonia gas is produced when ammonium chloride is heated with _____.

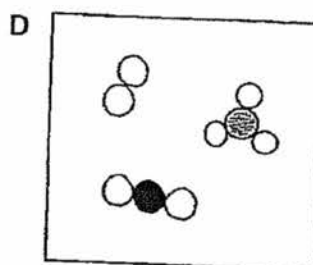
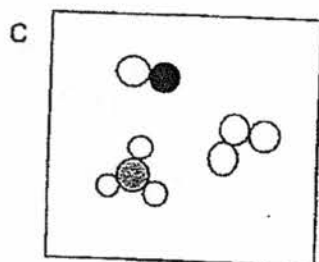
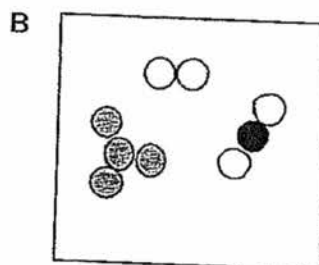
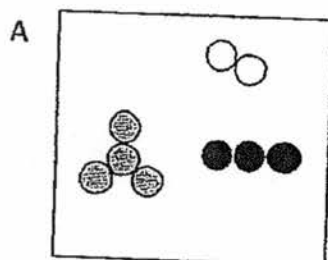
- A calcium hydroxide
- B calcium sulfate
- C hydrochloric acid
- D magnesium nitrate

16 In the diagrams below, each circle represents an atom. Circles of different sizes represent different elements.

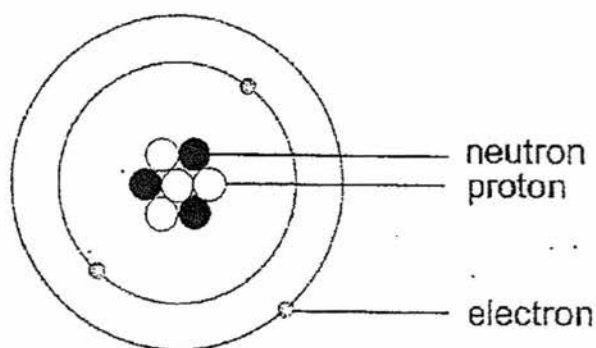
Which diagram represents a compound?



17 Which of the following best represents a mixture of oxygen (O_2), ammonia (NH_3) and carbon dioxide (CO_2) gases?



- 18 A caffeine molecule is represented by $C_8H_{10}N_4O_2$. Which of the following statements is **not** true?
- A It consists of four different types of atoms.
 - B There are 24 atoms in one caffeine molecule.
 - C It consists of carbon, hydrogen, nitrogen and oxygen atoms.
 - D There are 2 molecules of oxygen in caffeine.
- 19 A model of a particle is shown below.



Which of the following can be deduced about the particle from the diagram above?

- A It is a lithium atom.
 - B It has a mass number of 10.
 - C It is not electrically neutral.
 - D It has an atomic number of 3.
- 20 Which row shows the correct relative mass of an electron, a neutron and a proton?

	electron	neutron	proton
A	-1	0	+1
B	$\frac{1}{1840}$	1	1
C	$\frac{1}{1840}$	0	+1
D	-1	1	1

21 Which of the following statement(s) is / are true about potassium atom?

- I It is bigger than an atom of chlorine.
- II It has 20 neutrons.
- III It has a positive electric charge.

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

22 An atom of element X has a proton number 13 and mass number 27.

Which symbol is correct for the ion of X when it loses 3 electrons?

- A ${}_{13}^{27}\text{X}^{3-}$
- B ${}_{13}^{27}\text{X}^{3+}$
- C ${}_{13}^{24}\text{X}^{3-}$
- D ${}_{13}^{24}\text{X}^{3+}$

23 Which of the following three particles have the same number of electrons each?

	Particle 1	Particle 2	Particle 3
A	Cl^-	Br^-	I^-
B	F^-	Ne	Na^+
C	K^+	Ca^{2+}	Br^-
D	Li^+	Na^+	K^+

24 A newly found atom of element Z has the following subatomic particles:

- (i) x number of electrons
- (ii) y number of neutrons

It can be placed under the same group as chlorine.

Which symbol of an ion of Z is correct?

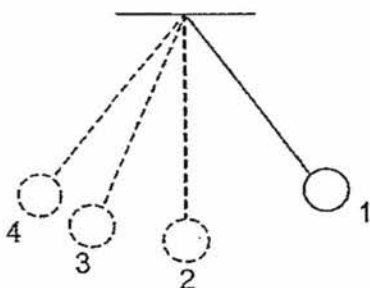
- A ${}^y_x\text{Z}^-$
- B ${}^{x+y}_x\text{Z}^-$
- C ${}^{2x+y}_x\text{Z}^-$
- D ${}^{x+y}_x\text{Z}^+$

25 An atom of an element has a proton number of 17 and mass number of 35.

Which statement is **definitely true** to describe the atomic structure of **another** isotope of this element?

- A It has a proton number of 17 and mass number of 35.
- B Its number of electrons is 18.
- C Its number of neutrons is 19.
- D Its number of protons is 17.

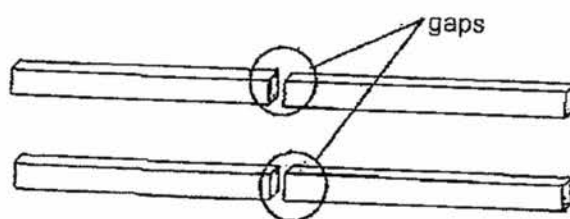
For Questions 26 and 27, refer to the diagram of a swinging pendulum below.



26 At which position does the pendulum bob have the **maximum** amount of kinetic energy?

- A 1
- B 2
- C 3
- D 4

- 27 At which two positions does the pendulum bob have the same amount of potential energy?
- A Positions 1 and 2
 - B Positions 1 and 3
 - C Positions 1 and 4
 - D Positions 2 and 3
- 28 When Jane poured boiling water into a glass cup with thick walls that are **not** heat resistant, the glass cup cracked quickly. Which of the following statements best explains this?
- A The heat from the water molecules caused all the surfaces to expand equally but too rapidly.
 - B The heat spread unevenly between the top and bottom of the glass cup.
 - C The inner surface of the glass expanded slower than the outer surface.
 - D The outer surface of the glass expanded slower than the inner surface.
- 29 Which of the following is **correct** about the expansion and contraction of metal?
- (Hint: Density = $\frac{\text{Mass}}{\text{Volume}}$)
- A The density of metal increases upon cooling due to a decrease in volume.
 - B The density of metal increases upon heating due to an increase in volume.
 - C The mass of metal decreases upon cooling due to a decrease in density.
 - D The mass of metal decreases upon heating due to an increase in density.
- 30 Joseph works at the Mass Rapid Transit (MRT) station. At the station, he checks the gaps along the train track as shown.



a section of the MRT track

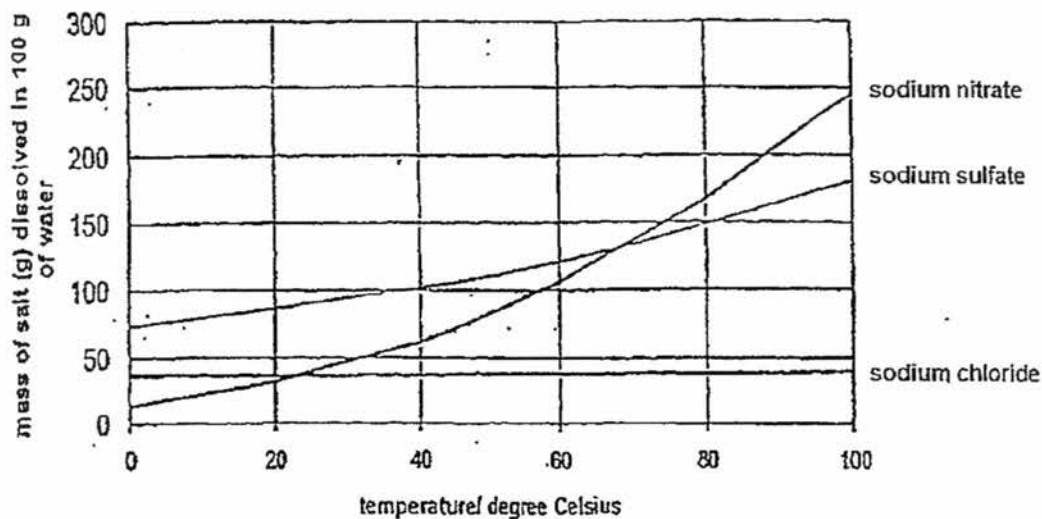
What is the purpose of placing gaps in the train track?

- A It allows for contraction of the track during cold weather.
- B It allows for expansion of the track during hot weather.
- C It allows for the train to travel smoothly.
- D It allows for the track to be easily removed for repair.

Section B [40 marks]

Answer all questions in the spaces provided.

- 1 The graph below shows the solubility, in water, of three salts at different temperatures.



- (a) What is the relationship between the solubility of sodium nitrate in water and temperature?

.....
[1]

- (b) Using the information from the graph, calculate the mass of sodium sulfate crystals obtained when a **saturated** solution of sodium sulfate at 80°C is cooled to 40°C?

[2]

- (c) From the graph, explain why sodium chloride crystals **cannot** be obtained from its solution by crystallisation.

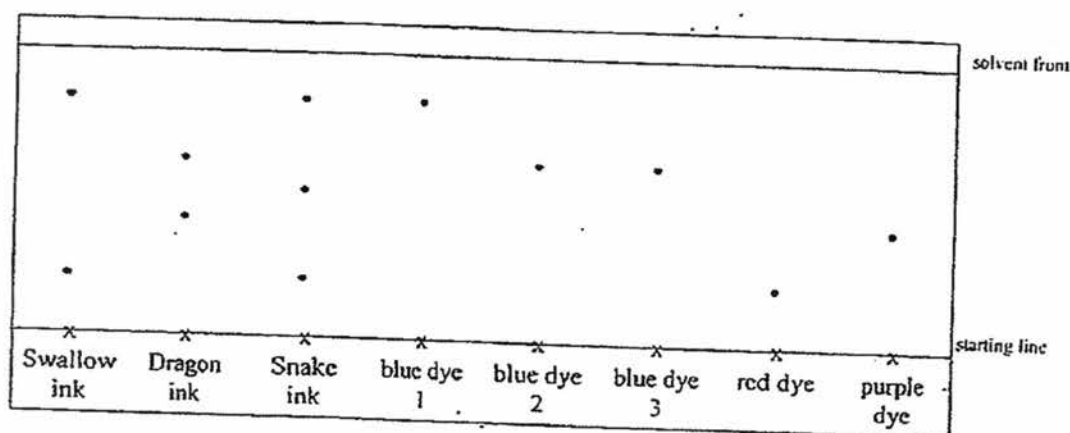
.....
[1]

- (d) Hence, name a method you would use to obtain a solid sample of sodium chloride from its solution.

.....[1]

[Total: 5]

- 2 An experiment was carried out to investigate the dyes present in three inks (Swallow Ink, Dragon Ink and Snake Ink) by paper chromatography. The resulting chromatogram is shown in the diagram below.



- (a) Which ink(s) could contain blue dye 1?

.....[1]

- (b) Explain why it **cannot** be concluded that Dragon Ink must contain blue dye 2.

.....
[1]

- (c) How does the results of the chromatogram show that the three inks are mixtures?

.....[1]

- (d) Which dye is the **most** soluble? Give a reason for your answer.

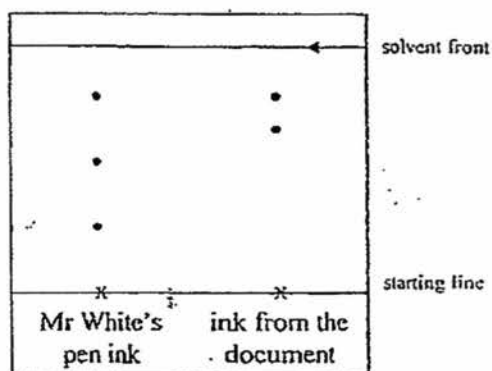
.....
[2]

- (e) Only a small amount of sample is used for paper chromatography. Explain the reason why it is important that the spots are small.

.....
[1]

- (f) Mr White was accused of forging Mr Black's signature document. Mr Black always uses Swallow Ink. The ink on the document was tested by chromatography in the same way, together with the ink from Mr White's pen.

The result is shown in the chromatogram below.



Did Mr White forge Mr Black's signature document? Give a reason for your answer.

.....
[2]

[Total: 8]

- 3 Classify the following changes into physical change or chemical change.

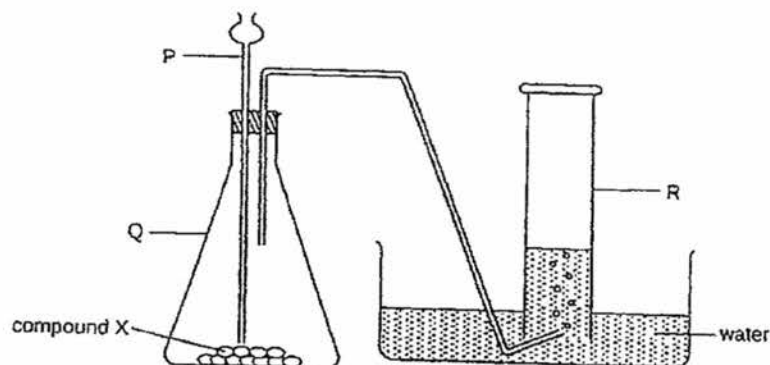
A rusting bridge	A firework display	Melting iron metal
Evaporation of perfume	Burning sugar	

Physical Change	Chemical Change

[5]

[Total: 5]

- 4 The diagram shows the apparatus used to investigate a chemical reaction. Dilute hydrochloric acid was added to compound X. A gas is collected in the apparatus R.



- (a) X is a compound. Suggest the identity of X.

[1]

- (b) (i) Name the gas collected in the apparatus R.

[1]

- (ii) Describe a test and state the observation to confirm the identity of this gas.

[2]

- (c) When a few drops of Universal Indicator was added to dilute hydrochloric acid, state the change in colour that is observed.

.....[1]

- (d) Alkalis and acids have different chemical reactions.

When sodium hydroxide solution is warmed with ammonium nitrate, a gas is produced.

- (i) Name the gas produced.

.....[1]

- (ii) Describe a test and state the observation to confirm the identity of this gas.

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

- (iii) Write a word equation for the chemical reaction between sodium hydroxide and ammonium nitrate.

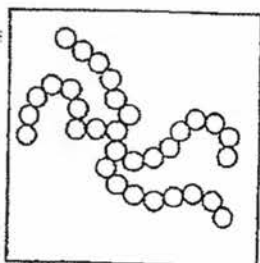
.....[1]

- (iv) Suggest the pH value of sodium hydroxide solution.

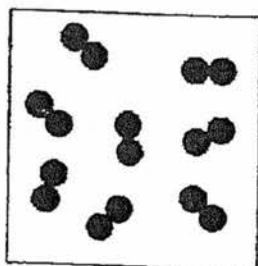
.....[1]

[Total: 10]

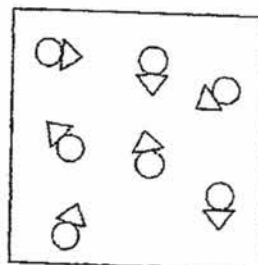
- 5 Using "molecules of element" or "molecules of compound", classify the following molecules.



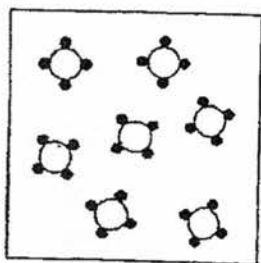
(a)



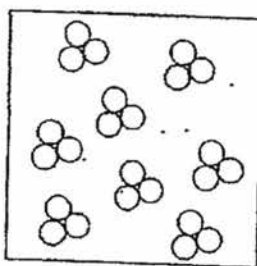
(b)



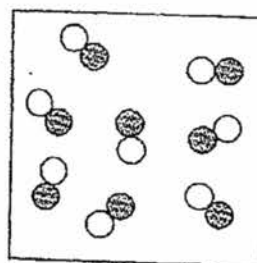
(c)



(d)



(e)



(f)

[6]

[Total: 6]

- 6 The table shows the atomic structure of six particles, represented by the letters A to F. The particles are **either** atoms or ions.

The letters are **not** the symbols of the elements.

Particle	Electrons	Protons	Neutrons
A	20	20	20
B	18	17	18
C	28	29	35
D	20	20	22
E	29	29	35
F	31	31	39

- (a) Which of these particles are ions?

.....[1]

- (b) (i) Which two particles are an atom and an ion of the **same** element?

.....[1]

- (ii) Using information from the table above, give a reason for your answer.

.....
[1]

- (c) (i) Which of these particles are isotopes?

.....[1]

- (ii) Using information from the table above, give a reason for your answer.

.....
[1]

- (d) Which particle has the **highest** atomic mass?

.....[1]

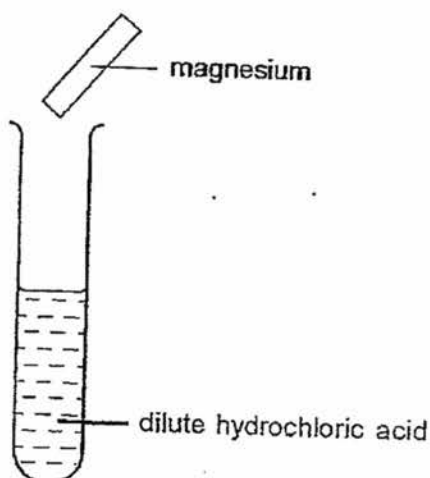
[Total: 6]

Section C [30 marks]

Answer **all** questions in the spaces provided.

- 1 A student investigated the effect of temperature on the speed of reaction between magnesium and dilute hydrochloric acid.

At the start of the experiment, she measured the temperature of dilute hydrochloric acid. Next, she added a piece of magnesium to the acid and immediately started the stopwatch.



She continued timing until the reaction was completed.

She then repeated the experiment four times, using dilute hydrochloric acid that had been heated to different temperatures.

The results of the experiment are given in **Table 1.1** below.

Experiment	Temperature of the acid / °C	Time / s
1	20	39
2	35	30
3	40	27
4	50	21
5	60	15

Table 1.1

- (a) Suggest how the student could tell when the reactions were completed.

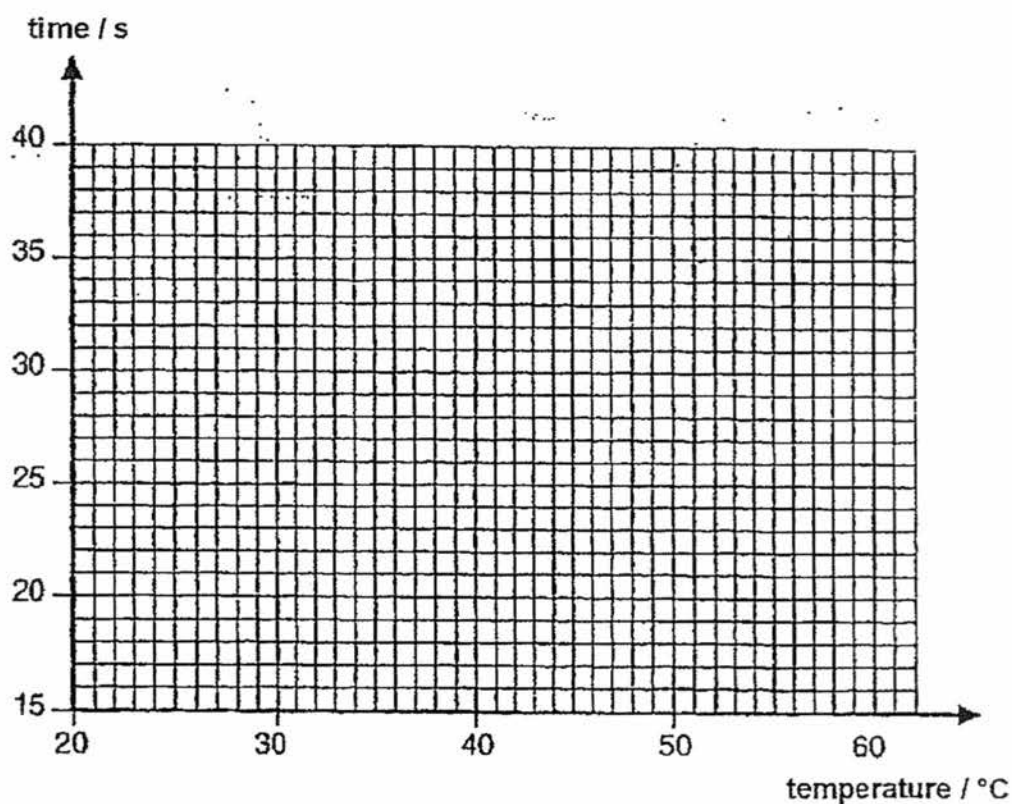
.....[1]

- (b) The student carried out five separate experiments. State **two** conditions she had kept constant to ensure that the investigation was fair.

.....

.....[2]

- (c) Using information from **Table 1.1**, plot the results of the experiments on the graph below.



[2]

- (d) Using the results in (c), predict the time taken for the reaction to be completed at 30°C.

.....[1]

- (e) Explain how the liquid in the thermometer is able to measure the temperature of the acid.

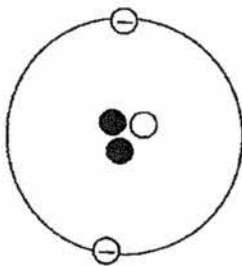
.....[2]

- (f) If the acid is changed to dilute citric acid, predict whether the time taken for the reaction to be completed will become longer or shorter. Explain your answer.

.....[2]

[Total: 10]

- 2 Tritium is an isotope of hydrogen. An ion of tritium has the following structure.



- (a) Complete the table to show the names and charges of the particles in the tritium ion.

symbol	name	charge
●		
○		
⊖		

[3]

- (b) Using the symbol T to represent tritium, give the formula of the ion shown.

.....[1]

[Total: 4]

- 3 (a) A soft rubber ball of mass 0.15 kg is dropped, in a vacuum, from a height of 2.0 m on to a hard surface. The ball then bounces.

State the **main** energy change taking place when:

- (i) the ball is falling,

.....[1]

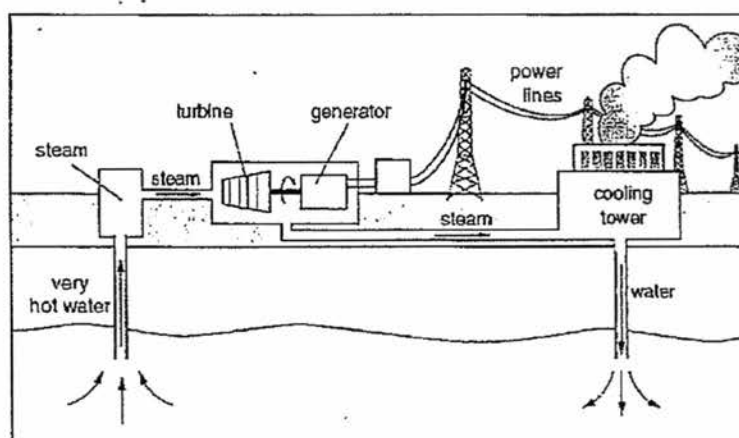
- (ii) the ball hits the surface,

.....[1]

- (iii) the ball is bouncing off the surface.

.....[1]

- (b) The figure below is a simplified diagram of a geothermal power station.

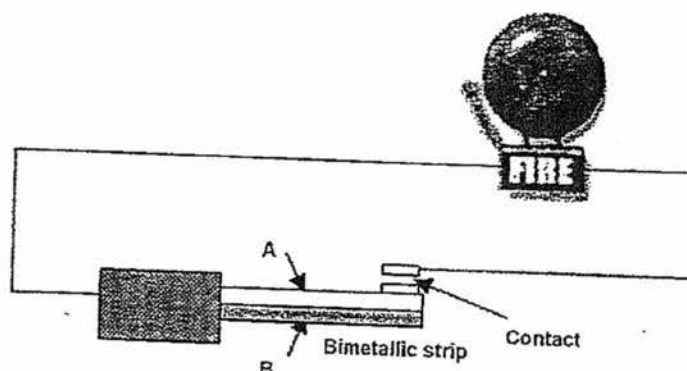


Identify the useful energy transformation that takes place in the geothermal power station. Tick one box in each column.

input energy		output energy	
chemical	☐	chemical	☐
electrical	☐	electrical	☐
gravitational	☐	gravitational	☐
sound	☐	sound	☐
thermal	☐	thermal	☐

[2]

- (c) The diagram below shows the circuit that is used in a fire alarm.



The bimetallic strip usually consists of two strips of different alloys, such as steel and brass, joined together.

Brass expands **more** than steel when the bimetallic strip is heated.

- (i) Suggest the alloy for A and B so that the fire alarm can operate.

A:

B:

[2]

- (ii) Explain how the fire alarm works when there is a fire.

.....

 [2]

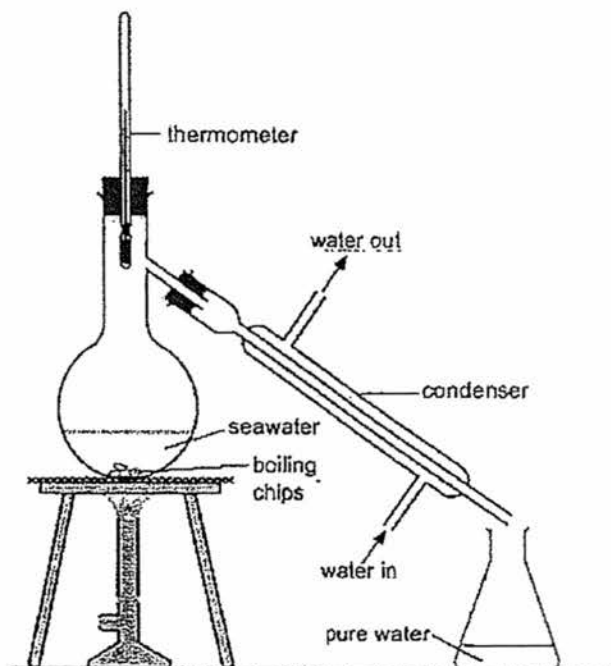
- (iii) Explain what would happen after the fire has been put out.

.....

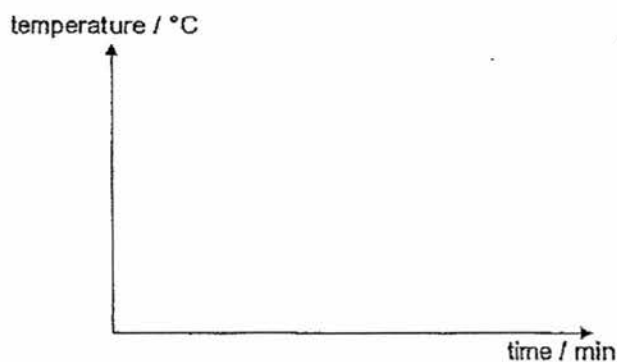
 [2]

[Total: 11]

- 4 (a) Water from seawater can be obtained using the following set-up.



- (i) Sketch a graph on the axes below to show how the thermometer readings vary when the mixture undergoes distillation. Label the initial and final temperature readings on the vertical axis.



[2]

- (ii) What is the function of the condenser in the experimental set-up?

.....
 [1]

- (b) Some zinc powder is accidentally mixed with some sulfur powder. The properties of sulfur and zinc are given in the table below,

Sulfur	Zinc
yellow powder	grey powder
insoluble in water	insoluble in water
not magnetic	not magnetic
no reaction with acids	reacts with acids to form a solution

Using the information above, describe how you can obtain **sulfur** from the mixture. You can use any common laboratory chemicals and apparatus.

.....

.....

.....

.....[2]

[Total: 5]

END OF PAPER

Seek to understand first, then Apply Past Knowledge to New Situations

The Periodic Table of Elements

Group																																				
I	II	Key										III	IV	V	VI	VII	0																			
3 Li lithium 7	4 Be beryllium 9	proton (atomic) number atomic symbol name relative atomic mass										1 H hydrogen 1	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 -																						

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
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 -

actinoids

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

Mark Scheme for Teachers

Secondary 2 Express – Science

Mid-Year Examination (MYE) – 2017

Section A (30 marks)

1	B	2	C	3	A	4	B	5	A
6	D	7	B	8	B	9	B	10	D
11	C	12	A	13	C	14	C	15	A
16	C	17	D	18	D	19	C	20	B
21	B	22	B	23	B	24	B	25	D
26	B	27	C	28	D	29	A	30	B

Section B (40 marks)

1	(a)	When the temperature increases, the solubility of sodium nitrate in water increases. Note: No marks awarded if the answer is "when the solubility of sodium nitrate increases the temperature increases" as the concept is wrong. Temperature affects solubility, not the other way round	[1]	0.5 mark if "sodium nitrate" is not written.
	(b)	Mass of sodium sulfate crystals = $150 - 100$ $= 50 \text{ g}$	[1] [1]	Minus 0.5 mark if there is no unit.
	(c)	The solubility of sodium chloride in water remains relatively constant when the temperature increases / decreases / changes Note: No marks awarded if the answer is "the mass of sodium chloride remains constant when temperature changes". It must be "the mass of sodium chloride DISSOLVED IN WATER remains constant when temperature changes.	[1]	
	(d)	Evaporation to dryness [Accept: Evaporation]	[1]	
2	(a)	Swallow Ink and Snake Ink.	[1]	Deduct 0.5 mark for each wrong answer or missing answer.
	(b)	The distance travelled by blue dye 2 and 3 is the same / identical. Hence, Dragon Ink may contain either blue dye 2 or blue dye 3.	[0.5] [0.5]	

Prepared by: Mr. Eric Lee

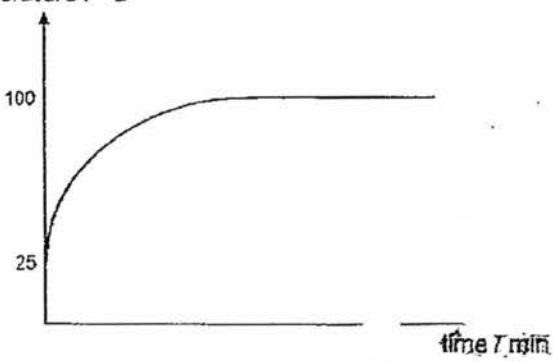
	(c)	There are more than one spot on the chromatogram. Hence, they are mixtures / impure.	[1]	No marks for "more than one INK ". It should be dyes / spots.
	(d)	Blue dye 1 is the most soluble. It travels the furthest from the start line.	[1] [1]	Accept: highest point / closest to the solvent front Reject: top of the chromatography paper.
	(e)	The spots are small to prevent smudging and overlapping of the spots on the chromatogram. Accept: mix / mixing of spots / merge	[1]	0.5 mark for each keyword
	(f)	No. The spots obtained from Mr White's pen ink do not completely match with the ink from the document. Reject: the spots are different / not the same. Students need to say "the NUMBER of spots is different" & the SOLUBILITY of the dyes is different".	[1]	
3		<u>Physical Change</u> Melting iron metal, Evaporation of perfume <u>Chemical Change</u> A rusting bridge, Fireworks displaying, Burning sugar	[1] [3]	1 mark for each correct answer.
4	(a)	X is any metal carbonate Reject: metal (X is a compound not element)	[1]	0.5 mark if no metal is written.
	(b)(i)	Carbon dioxide gas Note. no error carry forward from (a).	[1]	
	(b)(ii)	Bubble the gas through limewater. A white precipitate is observed. Reject: chalky / milky Note: <u>error carry forward</u> is practised here. For hydrogen gas, place a lighted / burning splint towards the gas. The gas will extinguish the flame on the lighted splint with a ' pop ' sound.	[1] [1]	
	(c)	Red Reject: yellow / orange	[1]	
	(d)(i)	Ammonia gas	[1]	0.5 mark if spelling is wrong.

	(d)(ii)	Place a <u>damp</u> red litmus paper towards the gas. The damp red litmus paper will turn <u>blue</u> .	[1] [1]	Deduct 1 mark if "damp" is missing.
	(d)(iii)	sodium hydroxide + ammonium nitrate → sodium nitrate + ammonia gas + water	[1]	Deduct 0.5 mark for every mistake / missing answer.
	(d)(iv)	14	[1]	Reject all other pH values.
5	(a)	Molecules of element	[1]	
	(b)	Molecules of element	[1]	
	(c)	Molecules of compound	[1]	
	(d)	Molecules of compound	[1]	
	(e)	Molecules of element	[1]	
	(f)	Molecules of compound	[1]	
6	(a)	B and C [Deduct 0.5 mark for any additional wrong answer]	[1]	0.5 mark each.
	(b)(i)	E and C	[1]	
	(b)(ii)	Both E and C have 29 protons. However, E has 29 electrons while C has 28 electrons. Hence, E is an atom while C is a positive ion of the same element. Accept: They have the same number of protons but different number of electrons.	[0.5] [0.5]	
	(c)(i)	A and D [Deduct 0.5 mark for any additional wrong answer]	[1]	0.5 mark each.
	(c)(ii)	Both A and D have 20 protons (and electrons). However, A has 20 neutrons while D has 22 neutrons. Since the number of protons and electrons is the same but the number of neutrons is different, A and D are isotopes. Accept They have the same number of protons (and electrons) but different number of neutrons.	[0.5] [0.5]	
	(d)	F	[1]	

Section C (30 marks)

1	(a)	No more bubbling of gas observed / Constant temperature readings on the thermometer / Magnesium dissolves completely.	[1]	
	(b)	Volume of dilute hydrochloric acid / Concentration of dilute hydrochloric acid / Mass of magnesium ribbon / Size of magnesium ribbon / Volume of water in the beaker Accept: same type of metal, same type of acid Reject: same magnesium, same hydrochloric acid, same acid. Reject: size of test tube (vague answer)	[2]	1 mark for each correct condition
	(c)		[2]	4 mark for correct plots 1 mark for drawing a neat, straight line
	(d)	33 s	[1]	Based on the graph for (c). It should only defer by 0.5.
	(e)	The liquid in the thermometer expands when the temperature is higher and contracts when the temperature is lower.	[1] [1]	
	(f)	The time taken will be longer. Dilute citric acid is a weak acid. Hence, it will react slower than dilute hydrochloric acid which is a strong acid. Reject: less acidic	[1] [1]	

2	(a)	<table border="1"> <thead> <tr> <th>symbol</th> <th>name</th> <th>charge</th> </tr> </thead> <tbody> <tr> <td>●</td> <td>neutron</td> <td>0</td> </tr> <tr> <td>○</td> <td>proton</td> <td>+1</td> </tr> <tr> <td>⊖</td> <td>electron</td> <td>-1</td> </tr> </tbody> </table> Numbers must be present. Sign must be present.	symbol	name	charge	●	neutron	0	○	proton	+1	⊖	electron	-1	[3]	0.5 mark for each correct answer in the table.
symbol	name	charge														
●	neutron	0														
○	proton	+1														
⊖	electron	-1														
	(b)	T- Ignore mass number and atomic number 0.5 mark if "1" is written or bracket is written.	[1]													
3	(a)(i)	Gravitational potential energy to kinetic energy	[1]	No marks if only the initial or the final type of energy is written.												
	(a)(ii)	Kinetic energy to sound energy / heat energy	[1]	No marks if only the initial or the final type of energy is written.												
	(a)(iii)	Kinetic energy to gravitational potential energy	[1]	No marks if only the initial or the final type of energy is written.												
	(b)	Input energy: thermal energy Output energy: electrical energy No marks if more than one box is ticked.	[1] [1]													
	(c)(i)	A: steel B: brass	[1] [1]													
	(c)(ii)	When there is a fire, the bimetallic strip gains heat energy and it expands. Since brass expands more than steel, the bimetallic strip will curve upwards and touches the contact. The circuit is completed to allow electricity to flow to the fire alarm for it to work.	[1] [1]	Similar ideas are also accepted for the answer.												
	(c)(iii)	After the fire has been put out, the bimetallic strip loses heat energy and it contracts. Since brass contracts less than steel, the bimetallic strip will return to its original shape and the contact is broken. The circuit is now an open circuit and no electricity flows to the fire alarm.	[1] [1]	Similar ideas are also accepted for the answer.												

4	(a)(i)	temperature / °C  time / min The increase in temperature from 25°C to 100°C can be a straight line [0.5 mark] A horizontal line must be drawn (constant temperature at 100°C) for 0.5 mark. 0.5 mark for correct labelling of initial temperature (20°C to 30°C) 0.5 mark for correct labelling of final temperature (100°C)	[2]	
	(a)(ii)	The function is to <u>provide a cooling environment</u> for <u>maximum condensation</u> of the water vapour to water droplets.	[0.5] [0.5]	
	(b)	<u>Add dilute acids</u> (any acid) to the mixture of sulfur and zinc. <u>Only</u> zinc will react with the acid to form a solution. <u>Filter</u> the mixture to obtain sulfur as the residue.	[1] [1]	