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Name : _____ () Class : _____



**DAMAI SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2016**

Secondary Three Express

CHEMISTRY(SPA)
Paper 1

5073/01

Thursday 13 October 2016

11.30 am – 12.30 pm

1 hour

INSTRUCTIONS TO CANDIDATES

Write your full name, register number and class in the spaces provided on the cover of this question paper.

Write in dark blue or black pen.

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

There are **forty** questions on 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 separate Answer Sheet.

INFORMATION FOR CANDIDATES

A copy of the Periodic Table will be provided separately.

This question paper consists of 14 printed pages including this page.

- 1 You are given a mixture of liquid cyclohexane, an organic compound, and dilute sodium chloride solution. Cyclohexane boils at 80.7°C and is immiscible in water. To obtain samples of cyclohexane and sodium chloride crystals, which of the following two techniques would you use?

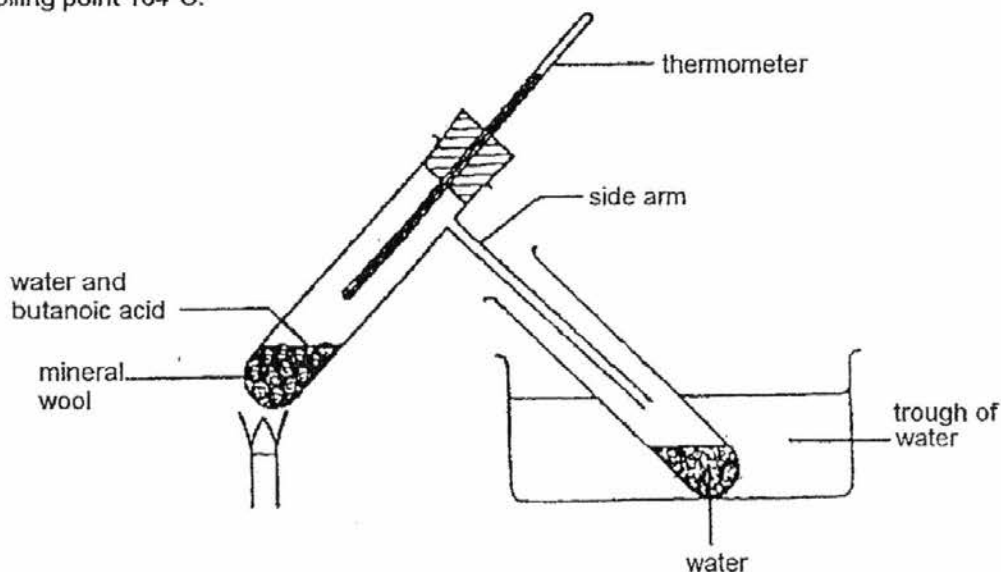
first technique

second technique

- A distillation
- B distillation
- C separating funnel
- D separating funnel

- crystallisation
- evaporation
- crystallisation
- evaporation

- 2 The diagram shows a set up to separate water from a mixture of water and butanoic acid of boiling point 164°C .



Identify the mistake in the set-up.

- A The side arm is of the wrong length.
- B The fraction should be collected in a flask.
- C The trough should contain oil and not water.
- D The bulb of the thermometer is in the wrong position.

- 3 The sun-lit side of the planet Venus has a temperature of 355°C . The night side of the planet has a temperature of -130°C .

Which substance may be found on one side of Venus as a liquid and the other side as a gas?

	substance	melting point / $^{\circ}\text{C}$	boiling point / $^{\circ}\text{C}$
A	ethane	-183	-87
B	lead	328	1744
C	nitrogen	-210	-196
D	phosphorus	44	280

- 4 The labels describe four samples A, B, C and D.

sample A
contains molecules which
produce carbon dioxide and
water when burned in air

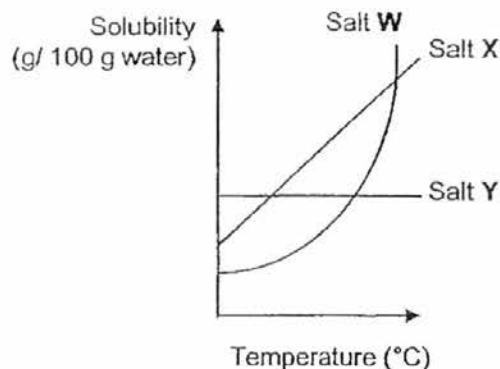
sample B
contains molecules which
produce only water when
burned in air

sample C
contains particles which
dissolve in water and conduct
electricity in aqueous state

sample D
contains two substances
which can be separated by
filtration

Which sample contains a pure element?

- 5 From the solubility curves shown, which salt(s) can be prepared by crystallization?



- A X only
B W only
C X and Y only
D W and X only

- 6 Devarda's alloy is used to test for the presence of nitrates in salts. The alloy contains aluminium, copper and tin.

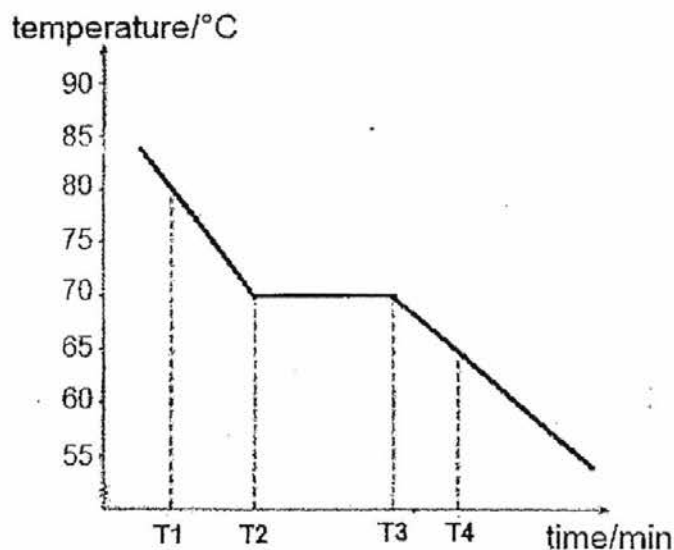
Which of the following best describes the properties of Devarda's alloy?

	electrical conductivity in solid state	electrical conductivity in liquid state	melting point / °C
A	poor	poor	490 - 560
B	good	good	490
C	poor	good	560
D	good	good	490 - 560

- 7 In which set do all the substances contain delocalised electrons?

- A copper, graphite, sodium
- B diamond, graphite, sodium
- C aluminum oxide, graphite, sodium
- D aluminum oxide, copper, diamond

- 8 Stearic acid is a solid at room temperature. The cooling curve of hot liquid stearic acid is shown below.



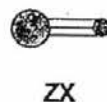
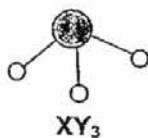
From the graph, we can infer that,

- A at time T1, all the stearic acid exists as a solid.
- B at the time interval T2 to T3, all the stearic acid exists as a solid.
- C at the time interval T2 to T3 crystals of stearic acid are being formed.
- D at the time interval T3 to T4, heat is absorbed from the surroundings.

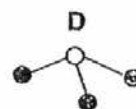
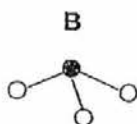
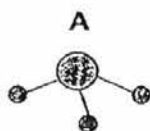
9 Which reactants could be used safely to prepare potassium sulfate?

- A potassium and sulfuric acid
- B potassium and aqueous rubidium sulfate
- C aqueous potassium hydroxide and dilute sulfuric acid
- D aqueous rubidium sulfate and aqueous potassium nitrate

10 The model and formulae for some molecules involving X, Y and Z atoms are shown below.

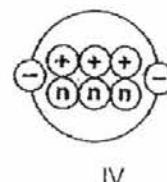
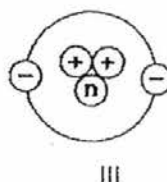
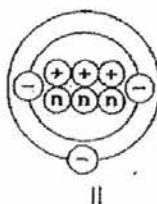
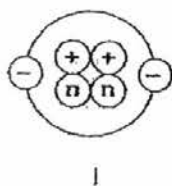


Which of the following shows the correct model and formulae for a molecule of the compound formed between Y and Z?



11 The diagrams below show 4 different atomic structures.

Which two are atomic structures of isotopes?



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

- 12 Four substances have the following electrical properties:

substance	property
J	conducts in both solid and molten states
Q	conducts electricity only in aqueous solution
R	conducts in both aqueous and molten states
L	does not conduct electricity under any conditions

What are these four substances?

	J	Q	R	L
A	KCl	HCl	CO	Pb
B	KCl	CO	Zn	HCl
C	Zn	HCl	KCl	CO
D	Zn	KCl	Pb	CO

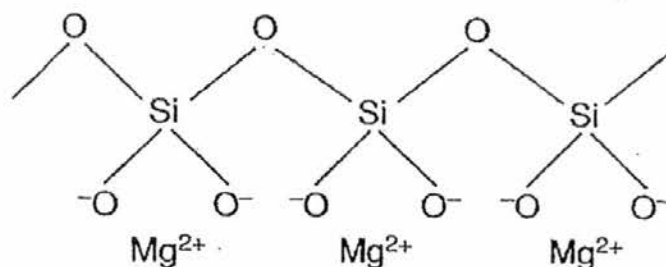
- 13 The formulae of the ions of four unknown elements are shown below.



Which statement about these ions is correct?

- A They all have more electrons than protons.
- B They all have the same number of neutrons.
- C They all have the same number of protons.
- D They all have the same electronic structure as a noble gas.

- 14 The diagram below shows a simplified structure of asbestos.



What type(s) of chemical bonding is/are found in asbestos?

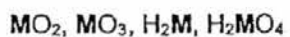
- A ionic bonding only
 B covalent bonding only
 C metallic and ionic bonding
 D covalent and ionic bonding
- 15 P, Q, R and S are four consecutive elements in the Periodic table. P is a halogen. Which of the following formulae is correct?
- A SP_2
 B S_2P
 C RP_2
 D R_2P
- 16 Fluorine is a halogen. The table shows some of the properties of other halogens.

element	Mr	number of valence electrons	melting point / °C	boiling point / °C	colour of vapour
chlorine	71	7	-101	-35	yellow-green
bromine	160	7	-7	+59	red-brown
iodine	254	7	+114	+184	violet

Which statement about fluorine is likely to be correct?

- A The M_r of fluorine is 19.
 B At r.t.p., fluorine is a black solid.
 C The boiling point of fluorine is -188°C .
 D The melting point of fluorine is $+212^\circ\text{C}$.

- 17 An element, **M**, forms substances with the following formulae:



Which Group in the Periodic table does the element **M**, belong to?

- A I
- B II
- C V
- D VI

- 18 What is the number of pairs of shared electrons in one molecule of carbon dioxide?

- A 2
- B 3
- C 4
- D 6

- 19 The formula of manganese chloride is MnCl_2 , and the formula of lithium nitride is Li_3N .

What is the chemical formula for manganese nitride?

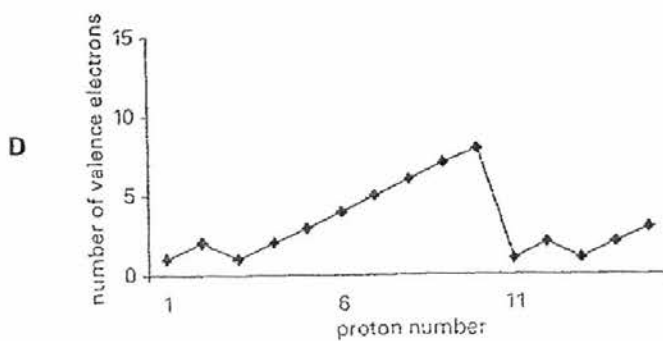
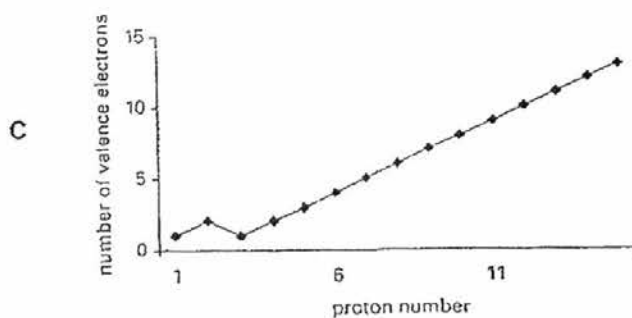
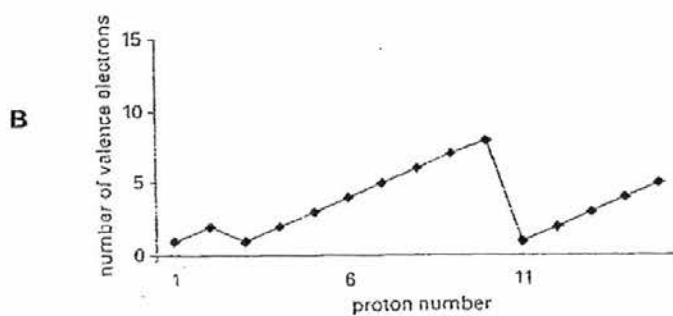
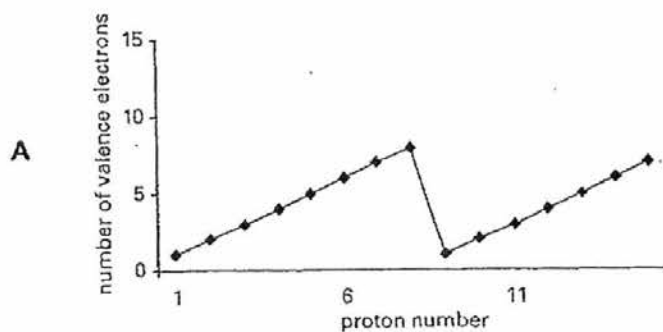
- A MnN
- B MnN_2
- C Mn_2N_3
- D Mn_3N_2

- 20 Hydrogen can form both H^+ ions and H^- ions.

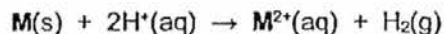
Which statement about these two ions is correct?

- A A H^+ ion has no electron in its first shell.
- B A H^+ ion has more protons than an H^- ion.
- C A H^- ion has one more electron than an H^+ ion.
- D A H^- ion is formed when a hydrogen atom loses an electron.

- 21 Which of the following graphs shows the number of valence electrons plotted against the proton number for the first fifteen elements in the Periodic table?



- 22 Which one of the following reactions could be represented by the ionic equation below in which **M** is the symbol for a metallic element?



- A iron and steam
B copper and dilute nitric acid
C lead and dilute sulfuric acid
D iron and hydrochloric acid
- 23 An element **E** is burned in air. A white solid oxide is formed. The oxide is dissolved in water and tested with damp red litmus paper. The paper turns blue.

What is element **E**?

- A sulfur
B iodine
C carbon
D calcium
- 24 A compound **R** is the only substance formed when two volumes of dry ammonia gas react with one volume of dry carbon dioxide.

What is the most likely formula of **R**?

- A $(\text{NH}_2)_2\text{CO}$
B $(\text{NH}_4)_2\text{CO}_3$
C $\text{NH}_2\text{COONH}_4$
D $\text{NH}_4\text{COONH}_4$
- 25 7.8 g of element **T** reacts with oxygen to form 9.4 g of an oxide, T_2O .

What is the relative atomic mass of **T**?

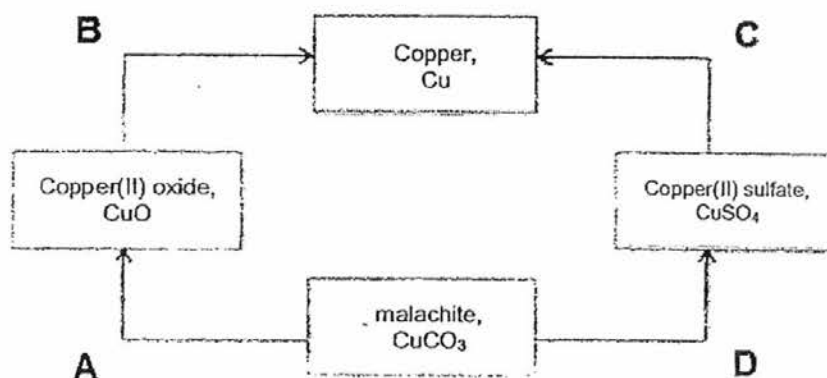
- A 15.6
B 17.2
C 39
D 78
- 26 What is the resulting product when citric acid, $\text{C}_6\text{H}_8\text{O}_7$, is dissolved in an organic solvent?
- A It consists of partially ionised H^+ ions.
B It consists of high concentration of H^+ ions.
C It consists of covalent molecules of $\text{C}_6\text{H}_8\text{O}_7$.
D It produces carbon dioxide with metal carbonates.

- 27 Solutions **U** and **V** were tested with a few drops of methyl orange. Solution **U** turned the indicator red while solution **V** turned the indicator yellow.

- I Solution **U** has a lower pH than solution **V**.
- II Solution **U** has a higher pH than solution **V**.
- III Solution **U** has a lower concentration of hydrogen ions than solution **V**.
- IV Solution **U** has a higher concentration of hydrogen ions than solution **V**.

Which statements are correct?

- A I and III only
 - B I and IV only
 - C II and III only
 - D II and IV only
- 28 The diagram shows some reactions of copper compound.



Which change is made by adding an acid?

- 29 A mixture of magnesium chloride and magnesium sulfate is known to contain 3 moles of magnesium and 4 moles of chloride ions.

What is the amount of sulfate ions in this mixture?

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

- 30 Which solution contains the greatest number of chloride ions?
- A 20 cm³ of 1 mol/dm³ barium chloride
 - B 20 cm³ of 1 mol/dm³ sodium chloride
 - C 10 cm³ of 1 mol/dm³ hydrochloric acid
 - D 10 cm³ of 1 mol/dm³ aluminium chloride
- 31 In an experiment, 4.0 cm³ of 1.0 mol/dm³ aqueous copper(II) sulfate was mixed with 8.0 cm³ of 1.0 mol/dm³ aqueous sodium carbonate. The equation for the reaction is as shown below:



What did the reaction vessel contain when the reaction was completed?

- A A blue solution only.
 - B A green precipitate and a blue solution.
 - C A white precipitate and a blue solution.
 - D A green precipitate and a colourless solution.
- 32 Which of the following substance has the most number of atoms?
- A 10 g oxygen
 - B 10 g nitrogen
 - C 10 g magnesium
 - D 10 g carbon dioxide
- 33 Aqueous potassium hydroxide reacts with a certain metal chloride (MCl_n) solution to form a precipitate of the metal hydroxide according to the following equation.



10 cm³ of 3.0 mol/dm³ aqueous potassium hydroxide were found to react with 10 cm³ of 1.5 mol/dm³ (MCl_n) solution.

What is the formula of the metal chloride?

- A MCl
- B MCl_2
- C MCl_3
- D MCl_4

- 34 The pH of an aqueous solution of ammonia is 11.

What will be the pH of ammonia after the addition of 10 g of sodium chloride?

- A 4
- B 7
- C 11
- D 14

- 35 Element X occurs in nature as two isotopes ^{63}X and ^{65}X .

If the relative atomic mass of X is 63.5, what is the relative abundance of the ^{63}X isotope?

- A 25%
- B 60%
- C 75%
- D 90%

- 36 Ammonia burns in oxygen, forming nitrogen and water, according to the equation:



If 40.0 cm³ of ammonia was burnt in 50.0 cm³ of oxygen, what will the total volume of gases be after combustion?

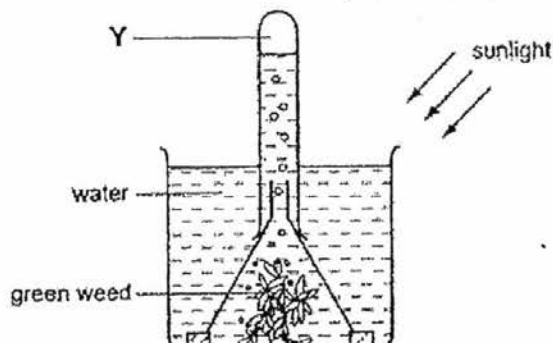
- A 20.0 cm³
- B 40.0 cm³
- C 60.0 cm³
- D 80.0 cm³

- 37 An excess solid reacts with 50 cm³ of 0.2 mol/dm³ of an acid to produce a volume of 360 cm³ of gas.

Which of the following equation represents this chemical reaction?

- A $\text{Mg}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{MgCl}_2(\text{aq}) + \text{H}_2(\text{g})$
- B $\text{Al}(\text{s}) + 2\text{H}_3\text{PO}_4(\text{aq}) \rightarrow \text{AlPO}_4(\text{aq}) + 3\text{H}_2(\text{g})$
- C $\text{MgCO}_3(\text{s}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{Mg}(\text{NO}_3)_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
- D $\text{Al}_2(\text{CO}_3)_3(\text{s}) + 3\text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{Al}_2(\text{SO}_4)_3(\text{aq}) + 3\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$

- 38 The diagram shows a common laboratory experiment.



Which of the following is the property of the gas that is being collected at Y?

- A It relights a glowing splint.
 - B It bleaches moist litmus paper.
 - C It forms white precipitate in limewater.
 - D It extinguishes lighted splint with a 'pop' sound.
- 39 When an unknown solid **S** is placed in an unknown acid **T**, a chemical reaction occurs, but stops after a few seconds. What could **S** and **T** be?

	solid S	acid T
A	zinc oxide	sulfuric acid
B	copper(II) carbonate	sulfuric acid
C	lead(II) oxide	hydrochloric acid
D	calcium carbonate	hydrochloric acid

- 40 A sample of potassium oxide, K_2O , is dissolved in 250 cm^3 of distilled water. 25.0 cm^3 of the solution is neutralised by 15.0 cm^3 of 2.00 mol/dm^3 of dilute sulfuric acid.

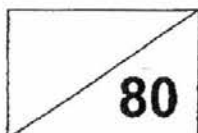
What is the mass of potassium oxide dissolved in 250 cm^3 of distilled water?

- A 2.82 g
- B 5.64 g
- C 28.2 g
- D 56.4 g

End of Paper 1

Name of setter: Nur Diyana Osman

Name : _____ () Class : _____



Parent's Signature



DAMAI SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2016

Secondary Three Express

CHEMISTRY(SPA)
Paper 2

5073/02

Monday 10 October 2016

8.15 am – 10.00 am

1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Write your full name, register number and class in the spaces provided on the cover of this question paper.

Write in dark blue or black pen.

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

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer three questions, the last question is in the form **either/or**.

Write **all** answers in the spaces provided.

At the end of the examination, fasten all your answers securely together.

INFORMATION FOR CANDIDATES

The number of marks is given in the brackets [] at the end of each question or part question.
A copy of the Periodic Table will be provided separately.

For Examiner's Use	
Section A	
B7	
B8	
B9	

This question paper consists of 16 printed pages.

Section A (50 marks)Answer **all** questions.

Write your answers in the spaces provided.

A1 The list below shows some substances.

aluminium	ammonia	iron	helium	oxygen
potassium hydroxide	graphite	sulfur dioxide	magnesium oxide	

Use the above substances to answer the following questions. Note that each substance can be used once, more than once, or not at all.

Choose a substance which

- (a) is an allotrope of diamond;
..... [1]
- (b) forms an amphoteric oxide;
..... [1]
- (c) is used to fill up meteorological balloons;
..... [1]
- (d) forms diatomic molecules;
..... [1]
- (e) is used in lining of furnaces due to its high melting and boiling points;
..... [1]
- (f) has the formula of the type XY_2 ;
..... [1]
- (g) is a gas that reacts with dilute sulfuric acid;
..... [1]
- (h) is an alkali that neutralises dilute hydrochloric acid to form a soluble salt;
..... [1]

- A2** Barium, Ba, was discovered by Davy in 1808. The element gets its name from the Greek word 'barys' meaning 'heavy'.

The table below compares some properties of barium with caesium.

element	Cs	Ba
group	1	2
atomic number	55	56
atomic radius / pm*	531	435

*1pm = 1×10^{-12} m

- (a) Why do caesium and barium have different atomic numbers?
 [1]
- (b) The table shows that the atomic radius of barium is less than the atomic radius of caesium. Mandy does not agree with this data. Suggest a possible reason for her disagreement.

 [1]
- (c) State one difference in the physical properties between caesium and barium.

 [1]
- (d) Predict and explain whether a barium ion is *larger*, *smaller* or the *same size* as a barium atom.

 [2]

A3 The melting points of the oxides of third period elements are given below.

compound	Na ₂ O	MgO	Al ₂ O ₃	SiO ₂	P ₂ O ₃	SO ₂	Cl ₂ O
melting point / °C	1275*	2800	2045	1700	24	-73	-20

*sublimes

- (a) Briefly describe the trends in the melting points of the oxides across period three of the Periodic table.

.....

 [2]

- (b) Explain why the melting point of MgO is higher than the melting point of Na₂O.

.....

 [2]

- (c) Explain, in terms of structure and bonding, why the melting points of SiO₂ and P₂O₃ are so different.

.....

 [3]

- (d) Draw a 'dot-and-cross' diagram to show the bonding in the Cl₂O, showing only the valence electrons.

- (e) Which oxides can conduct electricity in the liquid state?

..... [1]

- (f) Oxide J neutralizes both nitric acid and sodium hydroxide while oxide H only reacts with sodium hydroxide. Oxide H dissolves in rainwater to form a substance that corrodes buildings and structures made of metal and marble. From the list of period three oxides given, identify oxide J and H.

..... [2]

- (g) Draw the arrangement of particles of Na_2O at 1300°C .

[1]

A4 Zinc sulfate can be prepared by reacting excess zinc carbonate with 10 cm³ of 2.0 mol/dm³ of dilute sulfuric acid.

- (a) Construct, with state symbols, a balanced chemical equation of the reaction.

..... [2]

- (b) State one observation seen during the reaction.

..... [1]

- (c) Calculate the expected mass of zinc sulfate produced.

[2]

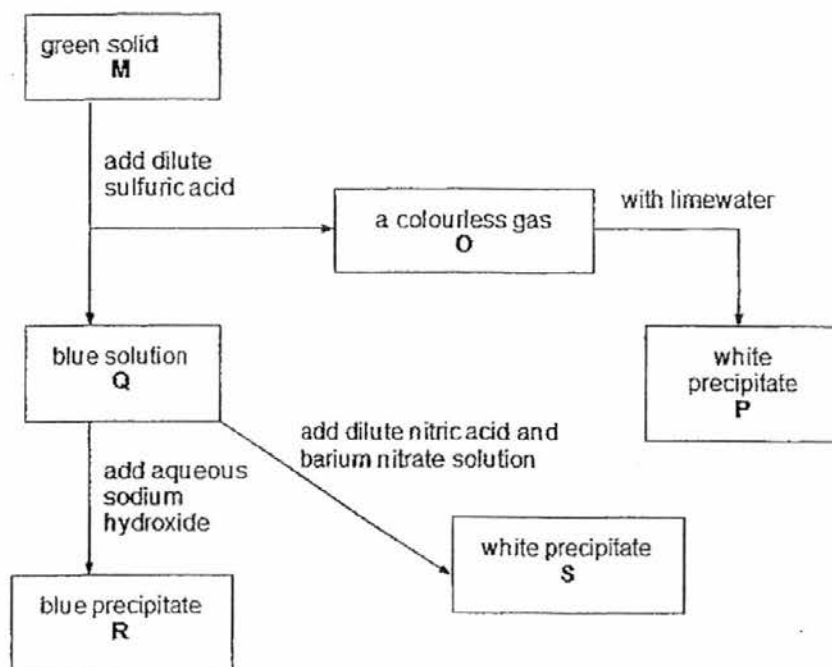
- (d) Outline the preparation of pure zinc sulfate crystals in the laboratory starting from the sample of zinc carbonate and dilute sulfuric acid stated above.

.....
.....
.....
..... [3]

- (e) Describe a physical test to confirm the purity of zinc sulfate.

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

A5 The flowchart below describes the properties and reactions of substances **M**, **O**, **P**, **Q**, **R** and **S**.



(a) Name the

- (i) green solid **M**,
- (ii) colourless gas **O**,
- (iii) white precipitate **P**,
- (iv) blue solution **Q**,
- (v) blue precipitate **R**,
- (vi) white precipitate **S**, [6]

(b) (i) Construct an ionic equation for the formation of the blue precipitate **R**.

..... [1]

(ii) What observations would you expect when aqueous sodium hydroxide is added in excess to the sample of blue precipitate **R**.

..... [1]

A6 Chlorine is the third element in Group VII of the Periodic Table

- (a) Explain in terms of electron configuration why chlorine belongs to Group VII of the Periodic table.

.....
..... [1]

- (b) Suggest **two** trends in the physical properties exhibited by elements in Group VII.

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

- (c) Element **A** lies in Group II in the Periodic table. Chlorine reacts with element **A** to form a compound **B** with high melting and boiling points. Give the possible formula of compound **B** and explain in terms of its bonding and structure, why it has high melting and boiling points

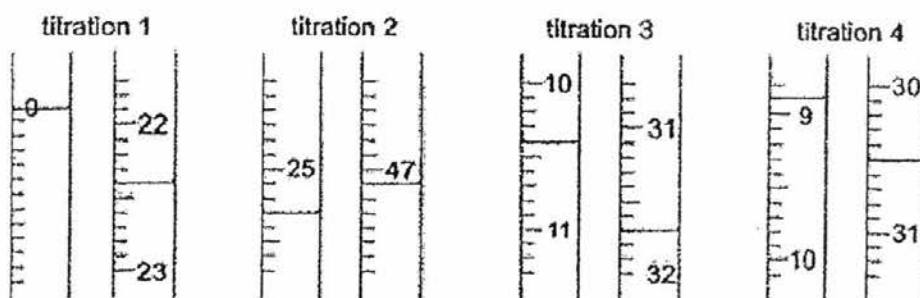
.....
.....
.....
..... [3]

End of Section A

Section B [30 marks]Answer **three** questions in this section.

The last question is the form of an either/or and only one alternative should be attempted.

- B7** 20 cm³ of an unknown concentration of dilute sulfuric acid was titrated with 0.1 mol/dm³ aqueous sodium hydroxide. The results of the experiment are shown below.



- (a) (i) Fill in the table accordingly to the burette readings shown above. Record your answers to one decimal place.

Titration number	1	2	3	4
Final reading of NaOH (aq) / cm ³				
Initial reading of NaOH (aq) / cm ³				
Volume of NaOH (aq) used / cm ³				

[2]

- (ii) Choose a suitable set of values and calculate the average volume of aqueous sodium hydroxide needed for complete neutralisation of the dilute sulfuric acid.

[1]

- (iii) Construct an ionic equation, with state symbols, for the neutralisation reaction.

..... [2]

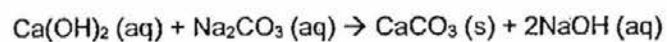
- (iv) Calculate the concentration of the dilute sulfuric acid in mol/dm³.

[2]

- (v) Suggest the volume of a 0.2 mol/dm^3 dilute hydrochloric acid required to completely neutralize the volume of aqueous sodium hydroxide in (a)(ii). Support your answer with relevant chemical equation(s).

[2]

- (b) In the past, aqueous sodium hydroxide was produced by the reaction between aqueous calcium hydroxide and sodium carbonate as shown in the balanced chemical equation below.



15.0 g of impure sodium carbonate was dissolved in water and was used to prepare 2 dm^3 of 0.1 mol/dm^3 aqueous sodium hydroxide. Calculate the percentage purity of sodium carbonate.

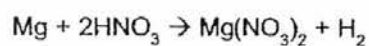
[3]

- B8 (a)** Elemental analysis of an unknown compound shows that it contains 85.7% of carbon and 14.3% of hydrogen by mass.

Given that the relative molecular mass of the compound is 70, determine the molecular formula of this compound.

[3]

- (b)** The equation for a given reaction is as follows:



1.2 g of magnesium ribbon was added to 250 cm³ of 0.3 mol/dm³ dilute nitric acid.

- (i)** State and explain which is the limiting reagent by showing your calculations clearly

[2]

(ii) Calculate the volume of hydrogen gas produced in this experiment.

(iii) Describe a test to confirm hydrogen gas was produced. [2]

.....

..... [1]

EITHER

- B9 100% gold is called '24 carat' gold. The percentage of gold present in a gold alloy depends upon the carat value.

Carat value	Alloy
22 carat	91.6% Au, 5.6% Ag, 2.8% Cu
18 carat	75.0% Au, 12.5% Ag, 12.5% Cu
14 carat	58.5% Au, 20.5% Ag, 21.0% Cu
9 carat	37.5% Au, 31.25% Ag, 31.25% Cu

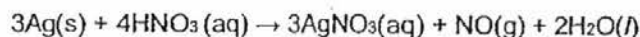
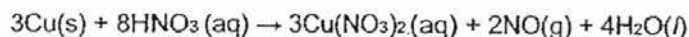
An analyst was trying to determine the composition of a gold alloy comprising gold, silver and copper.

He warmed 15 g of finely powdered alloy with excess concentrated nitric acid. This dissolved the copper and silver components.

- (a) Would you expect the silver and copper components to dissolve in dilute acids as stated above? Explain your answer.

.....
 [2]

The equations of the reactions are as shown below.



- (b) Suggest a separation technique to obtain the gold component from the reaction mixture after the two reactions have completed.

..... [1]

- (c) Draw a diagram to show the structure of pure gold. Use your diagram to explain why 100% gold is soft.

.....

 [3]

- (d) The pure gold obtained was weighed and its mass was found to be 8.77 g. What is the carat value of the gold alloy? Show your workings clearly.

[2]

- (e) The dissolved silver salt was mixed with dilute hydrochloric acid to form a precipitate.

(i) Write the ionic equation of the precipitation reaction.

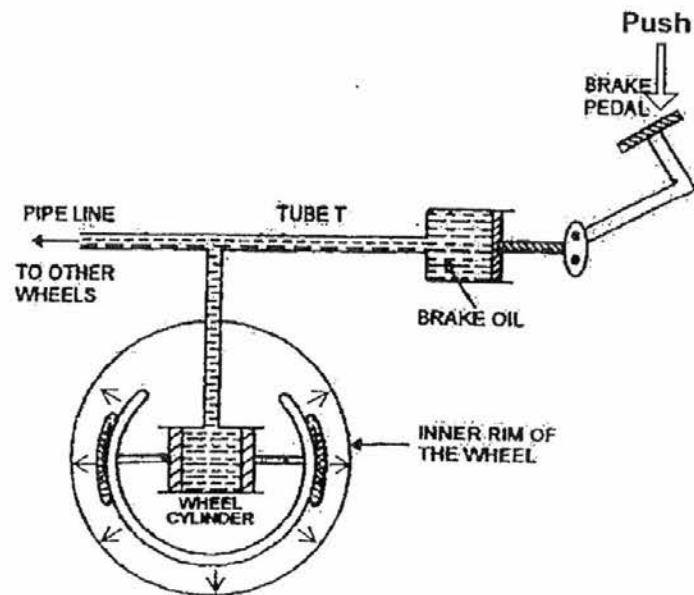
..... [1]

(ii) What is the colour of the precipitate?

..... [1]

OR

- B9 (a) The hydraulic brake system for a car is shown below:



When the pedal is stepped on, the force is transmitted to the piston, which causes the brake oil (fluid) to be displaced. The brake shoes are pushed outwards by the brake fluid and pressed against the inner rim of the car wheel. This results in the car slowing down and coming to a stop.

- (i) What property of a liquid allows this brake system to work?

..... [1]

- (ii) Explain this property in terms of the arrangement of the particles in a liquid.

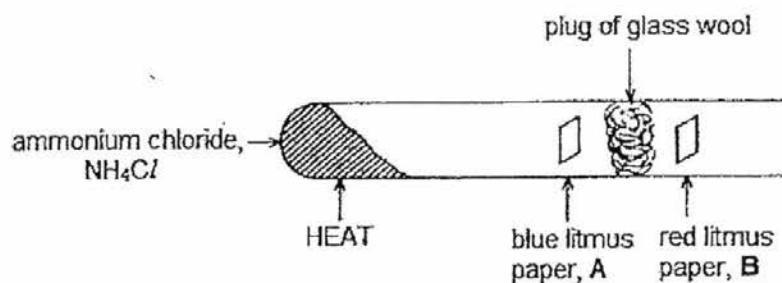
..... [1]

- (iii) "Bleeding" the hydraulic brake system which is removing air bubbles in the brake fluid, is done time to time.

Explain, in terms of the arrangement of particles in air, why this is necessary.

..... [2]

- (b) Ammonium chloride was heated in the apparatus shown below.



It was noticed that litmus paper **B** started to turn blue first and then litmus paper **A** became red; a white solid was seen to form near the cool, open end of the test-tube.

- (i) Explain why the litmus paper **B** turned blue first then litmus paper **A** turned red.

.....

 [2]

- (ii) Identify the white solid seen near the cool, open end of the test-tube.

..... [1]

- (iii) Name a substance, used to reduce acidity of soil - which will react with ammonium chloride to form ammonia gas. Support your answer with a balanced chemical equation, with state symbols.

.....

 [2]

- (iv) Ammonium chloride and sodium chloride are both soluble salts. Suggest a physical separation technique to separate both chlorides from each other.

..... [1]

End of Section B

END OF PAPER

**3E CHEMISTRY WITH SPA
END-OF-YEAR 2016**

ANSWERS

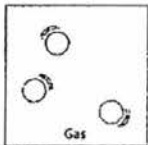
QUESTION NO	ANSWERS	QUESTION NO	ANSWERS	QUESTION NO	ANSWERS	QUESTION NO	ANSWERS
1	C	11	A	21	B	31	D
2	D	12	C	22	D	32	B
3	A	13	D	23	D	33	B
4	B	14	D	24	C	34	C
5	D	15	A	25	C	35	C
6	D	16	C	26	C	36	B
7	A	17	D	27	B	37	B
8	C	18	C	28	D	38	A
9	C	19	D	29	A	39	C
10	B	20	A	30	A	40	C

Paper 2, Section A

A1	a) Graphite b) Aluminium c) Helium d) Oxygen e) Magnesium oxide / graphite f) Sulfur dioxide g) Ammonia h) Potassium hydroxide / ammonia	1; 1; 1; 1; 1; 1; 1; 1;
		8

A2	a) They are different element in different groups with different number of protons b) Both elements are placed in the same Period VII with 6 electron shells/same number of shells. Hence, they should both have similar atomic radius. c) - Caesium is a soft Group I metal that can be cut easily unlike barium. - Caesium is silvery and shiny while barium is dull. - Caesium will float on water due to its low density unlike barium which has a high density (Any one of the points above) d) <u>Smaller.</u> A barium ion would <u>lose two of its valence electrons</u> and the <u>electron shell will reduce by one</u> making the ion smaller than the atom itself.	1; 1; 1; 1; 1; 1;
		5

A3	a) Across the period, the melting point increases to a highest of 2800°C from Na₂O to MgO. Thereafter, the melting point <u>decreases steadily</u> to reach a minimum of -73°C as sulfur dioxide. b) The charge of magnesium in MgO is bigger than the charge of sodium in Na₂O, which results in a stronger electrostatic attraction with the oxides, This cause MgO to have a higher MP than Na₂O. c) SiO₂ exist as a <u>giant covalent</u> compound with <u>strong covalent bonds</u> throughout the structure. These bonds are strong and <u>require a lot of energy</u> to overcome it resulting in its high MP. P₂O₃ exist as a <u>simple covalent molecule</u> with <u>weak intermolecular forces</u> of attraction. Hence very <u>little or no energy is need to overcome these forces resulting in its low MP.</u> - d)	1; 1; 1; 1; 1; 1;
		1; 1;

	$\begin{array}{c} \text{:}\ddot{\text{Cl}}-\ddot{\text{O}}-\ddot{\text{Cl}}\text{:} \\ \text{e) Na}_2\text{O / MgO / Al}_2\text{O}_3 \\ \text{f) J is Al}_2\text{O}_3 \text{ and H is SO}_2 \\ \text{g)} \end{array}$ 	1; 1;1; 1;
		13

A4	a) $\text{ZnCO}_3(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ b) Effervescence / bubbles seen c) No of moles of sulfuric acid = $2(10/1000) = 0.02 \text{ mol}$ No of moles of zinc sulfate = 0.02 mol Mass of zinc sulfate formed = $161 \times 0.02 = 3.22 \text{ g}$ d) – Add excess zinc carbonate to sulfuric acid, stir until no more carbonate can dissolve. – Filter the mixture to remove the excess carbonate. – Heat the zinc sulfate filtrate until saturated. – Remove heat and allow it to crystallize. – Filter the mixture and wash the crystals with cold distilled water – Dry in between filter paper. e) Dissolved the crystals. <u>Add acidified barium nitrate</u> to a sample. If it is zinc sulfate, <u>white precipitate</u> of barium sulfate is observed.	1;1; 1; 1; 1; 6pt: 3 4-5pt: 2 2-3pt: 1 0-1: 0 1; 1;
		10

A5	a) M: copper(II)carbonate O: carbon dioxide P: calcium carbonate Q: copper(II)sulfate R: copper(II)hydroxide S: barium sulfate b) $\text{Cu}^{2+}(\text{aq}) + \text{OH}^{-}(\text{aq}) \rightarrow \text{Cu}(\text{OH})_2$ c) The blue precipitate R will remain Insoluble in the added aqueous sodium hydroxide.	1; 1; 1; 1; 1; 1; 1; 1; 1;
		8

A6	a) It has an electronic configuration 2,8,7 with 7 valence electrons hence it will be in Group VII b) Down the group : 1. Increasing MP/BP 2. Increase in colour intensity 3. Density increases c) AlCl_3 Ionic compound between metals and non metals. It has <u>strong electrostatic forces</u> of attraction between the <u>oppositely charged ions</u> . Ions in a <u>fixed crystal lattice</u> . Hence <u>alot of energy needed</u> to overcome these forces. High MP.	1; 1; 1; 1; 1; 1;
		6

Paper 2, Section B

B7

a) i.

Titration number	1	2	3	4
Final reading of NaOH (aq) / cm ³	22.40	47.10	31.70	30.50
Initial reading of NaOH (aq) / cm ³	0.00	25.30	14.00	8.90
Volume of NaOH (aq) used / cm ³	22.40	21.80	17.70	21.60

1; values recorded to 2 dp
1; correct data processing

ii. Trial 2 & 4:

$$\text{Volume of sodium hydroxide} = (21.8 + 21.6)/2 \\ = 21.70 \text{ cm}^3$$

iii. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

iv. Mole of NaOH = 0.00217 mol

Mole of NaOH : Mole of H₂SO₄

2 : 1

Mole of acid = $0.002155 / 2 = 0.001085$ mol

Conc of acid = $0.0010775 / (20/100) = 0.0539 \text{ mol/dm}^3$

v. $HCl + NaOH \rightarrow NaCl + H_2O$

Mole of NaOH = 0.002155 mol

Mole of NaOH : Mole of HCl

1 : 1

Mole of acid = 0.002155 mol

Hence volume of HCl = $0.002155 / 0.2 = 10.80 \text{ cm}^3$

1;
1;1;
1;

1;

b) Mole of sodium hydroxide = 0.2 mol

Mole of sodium carbonate = 0.1 mol

Actual mass of sodium carbonate = 10.6g

% purity = 70.7%

1;
1;

1;

1;
1;

12

B8

a) Empirical formula = CH_2

	carbon	hydrogen
% mass	85.7	14.3
Ar	12	1
Mole	7.141	14.3
Molar ratio	1	2

1; show workings

$$(\text{CH}_2)_n = 70$$

$$14n = 70$$

$$n = 5$$

Molecular formula = C_5H_{10}

b) i) Nitric acid is the limiting reagent

Mole of Mg : mole of HNO_3

$$1 : 2$$

0.0375 : 0.075 When all nitric acid is completely used up (accepted)

0.05 : 0.1 When all magnesium is completely used up (rejected)

ii) Mole of hydrogen = 0.0375 mol

Mole of H_2 : mole of HNO_3

$$1 : 2$$

Volume of hydrogen = $0.0375 \times 24 = 0.90 \text{ dm}^3$

iii) Insert a lighted splint. Lighted splint will extinguish with pop sound.

1;

1;

1;

1;

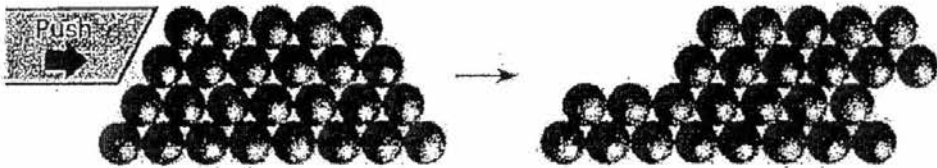
1;

1;

1;

8

EITHER

B9	a) No, Both copper & silver are unreactive.	1; 1;
	b) Filtration	1;
	c) In pure metals, <u>atoms of the same size are packed regularly in layers</u> . Metals are malleable and ductile because <u>the layers of atoms can slide over each other easily</u> when a force is applied.	1; 1;
		1;
	d) % of gold = $(8.77 / 15) \times 100 = 58.46\%$ → 14 carat	1; 1;
	e) $\text{Ag}^+ (\text{aq}) + \text{Cl}^- (\text{aq}) \rightarrow \text{AgCl} (\text{s})$	1;
	f) White precipitate	1;
		10

OR

B9	a) i) Liquids are <u>incompressible</u> and able to take up the shape of a container; it has no definite shape. Hence, when pressure is applied the brake will stop instantaneously.	1;
	ii) The particles are <u>not in a fix position</u> and they are <u>able to slide over</u> each other; not much spaces in between.	1; 1;
	iii) Air particles are <u>randomly arranged and are far apart</u> , with <u>spaces in between</u> allowing it to be compressed. Hence, if there are air bubbles in the liquid brake, when the brake is pressed, the brake will not be effective as it will not brake immediately.	1; 1;
	b) i) When the ammonium chloride is heated, <u>acidic HCl and alkaline NH₃ gases</u> will be produced. The lighter <u>NH₃</u> with a <u>lower Mr</u> will <u>travel faster / diffuse further</u> and causes vicinity B to be alkaline. The heavier <u>HCl</u> with a <u>higher Mr</u> will diffuse slower causing vicinity A to be acidic.	1; 1; 1;
	ii) ammonium chloride	1;
	iii) calcium hydroxide / any other alkali except NH ₃	1;
	$\text{Ca}(\text{OH})_2 (\text{aq}) + 2\text{NH}_4\text{Cl} (\text{aq}) \rightarrow \text{CaCl}_2 (\text{aq}) + 2\text{NH}_3 (\text{g}) + 2\text{H}_2\text{O} (\text{l})$	1;
	iv) Sublimation	1;
		10