

SECTION 1 Planet Earth

Multiple-Choice Questions

CE94\_44

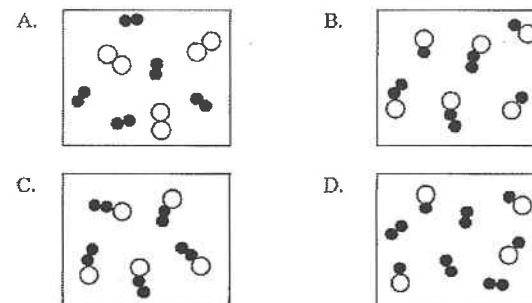
Which of the following methods can be used to distinguish between solid sodium carbonate and solid calcium carbonate?

- (1) Heating the solid and testing the gaseous product with lime water.
  - (2) Testing the solubility of the solid in water.
  - (3) Conducting a flame test on the solid.
- A. (1) and (2) only                      B. (1) and (3) only  
C. (2) and (3) only                      D. (1), (2) and (3)

CE99\_01

Which of the following diagrams can represent a mixture of two compounds?

(In these diagrams, ● and ○ represent a nitrogen atom and an oxygen atom respectively.)



CE99\_45

1<sup>st</sup> statement

Sulphur is classified as a non-metal.

2<sup>nd</sup> statement

Sulphur does not react with dilute acids.

CE04\_11

A white solid is found around the mouth of a reagent bottle containing lime water. The white solid is likely to be

- A. calcium oxide.                      B. calcium sulphate.  
C. calcium carbonate.                D. calcium hydrogencarbonate.

CE04\_29

Refer to the melting points and boiling points of four substances at 1 atm pressure as listed in the table below:

Substance	Melting point/ $^{\circ}\text{C}$	Boiling point/ $^{\circ}\text{C}$
argon	-189	-186
bromine	-7	59
chlorine	-101	-35
sulphur dioxide	-75	-10

Which substance exists as a liquid at  $-90^{\circ}\text{C}$  and 1 atm pressure?

- A. argon  
B. bromine  
C. chlorine  
D. sulphur dioxide

CE05SP\_02

The hazard warning label shown below is found on a compressed gas cylinder.



Which of the following gases may be contained in the cylinder?

- A. hydrogen  
B. oxygen  
C. chlorine  
D. argon

CE05SP\_18

A white solid dissolves in water to give a colourless solution. The solution reacts with dilute hydrochloric acid to give a gas. The solid is probably

- A. calcium oxide.  
B. calcium carbonate.  
C. potassium hydroxide.  
D. potassium carbonate.

CE05\_05

When a flame test is performed on copper(II) chloride, what is the colour of the flame observed?

- A. golden yellow  
B. pale purple  
C. brick-red  
D. bluish-green

CE05\_19

Which of the following correctly describes the sequence of procedures to separate sand, salt and water from a mixture of sand and salt solution?

- A. filtration, evaporation  
B. filtration, distillation  
C. crystallisation, filtration  
D. crystallisation, filtration, distillation

CE06\_25

Which of the following substances contain calcium carbonate as the main chemical constituent?

- (1) limestone  
(2) chalk  
(3) marble  
A. (1) and (2) only  
B. (1) and (3) only  
C. (2) and (3) only  
D. (1), (2) and (3)

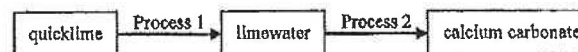
CE08\_08

Nitrogen, instead of air, is used to fill the packets of potato chips. It is because

- A. air supports combustion but nitrogen does not.  
B. the density of air is higher than that of nitrogen.  
C. argon in air contaminates the chips but nitrogen does not.  
D. oxygen in air makes the chips go bad but nitrogen does not.

CE08\_42

Calcium carbonate can be obtained from quicklime through two processes as shown below.



Which of the following combinations is correct?

- |    | Process 1                                  | Process 2                                  |
|----|--|--|
| A. | adding water                               | adding $\text{Na}_2\text{CO}_3(\text{aq})$ |
| B. | adding $\text{Na}_2\text{CO}_3(\text{aq})$ | adding water                               |
| C. | adding water                               | heating                                    |
| D. | heating                                    | adding water                               |

CE11\_28

- | 1 <sup>st</sup> statement                 | 2 <sup>nd</sup> statement  |
|---|--|
| Unpolluted rainwater can erode limestone. | Carbon dioxide in air dissolves in unpolluted rainwater to form carbonic acid. |

CE11\_40

An anhydrous compound Y gives a brick-red flame in flame test. Upon strong heating, Y gives out a gaseous mixture which turns blue cobalt(II) chloride paper pink and lime water milky. Which of the following compounds may Y be?

- A.  $\text{Na}_2\text{CO}_3$   
B.  $\text{NaHCO}_3$   
C.  $\text{CaCO}_3$   
D.  $\text{Ca}(\text{HCO}_3)_2$

DSE11SP\_03

Which of the following correctly describes the sequence of procedures to separate sand, salt and water from a mixture of sand and salt solution?

- A. Filtration, evaporation  
B. Filtration, distillation  
C. Crystallization, filtration  
D. Crystallization, filtration, distillation

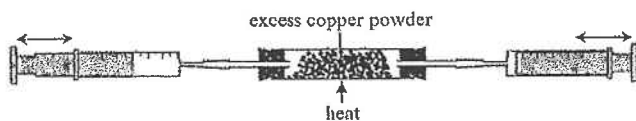
DSE13\_19

Which of the following statements about limestone is/are correct?

- (1) It gives a golden yellow flame in a flame test.  
(2) It gives a colorless gas when heated strongly.  
(3) It dissolves in dilute sulphuric acid to give a clear solution.
- A. (1) only  
B. (2) only  
C. (1) and (3) only  
D. (2) and (3) only

DSE14\_19

The set-up of an experiment is shown below. At room temperature, the system initially contains 40 cm<sup>3</sup> of N<sub>2</sub>(g), 25 cm<sup>3</sup> of O<sub>2</sub>(g) and 10 cm<sup>3</sup> of He(g).

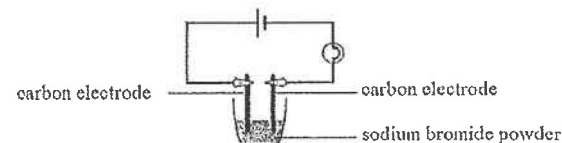


The plungers of the gas syringes are moved to and fro until there is no further change in the system. The system is then allowed to cool to room temperature. Which of the following statements concerning the experiment are correct?

- (1) Some copper powder would change to a black substance.  
(2) The total volume of the gases in the system would decrease by 25 cm<sup>3</sup>.  
(3) The same change in total volume of the gases would be observed if excess copper powder is replaced with excess iron powder.
- A. (1) and (2) only  
B. (1) and (3) only  
C. (2) and (3) only  
D. (1), (2) and (3)

DSE14\_20

The diagram below shows the set-up of an experiment:



Which of the following methods may light up the light bulb?

- (1) heating the sodium bromide powder until molten  
(2) adding deionized water to the sodium bromide powder  
(3) replacing the sodium bromide powder with bromine liquid
- A. (1) and (2) only  
B. (1) and (3) only  
C. (2) and (3) only  
D. (1), (2) and (3)

DSE15\_02

Which of the following processes would NOT give oxygen?

- A. Heating mercury(II) oxide strongly  
B. Electrolysis of dilute sulphuric acid  
C. Fractional distillation of liquefied air  
D. Passing steam over heated magnesium

DSE15\_23

Which of the following can distinguish a sample of limestone powder from a sample of table salt?

- (1) adding water  
(2) performing a flame test  
(3) adding dilute hydrochloric acid
- A. (1) and (2) only  
B. (1) and (3) only  
C. (2) and (3) only  
D. (1), (2) and (3)

DSE16\_01

A flame test conducted for a sample gives a brick-red flame. The sample may contain

- A. chalks.  
B. quartz.  
C. graphite.  
D. rock salts.

DSE17\_14

Which of the following statements concerning oxygen gas is correct?

- A. Oxygen gas relights a glowing splint.  
B. Oxygen gas turns moist pH paper red.  
C. Oxygen gas turns moist pH paper blue.  
D. Oxygen gas gives a 'pop' sound when tested with a burning splint.



CE95\_07a

The label on a bottle of 'Effervescent Calcium' tablets is shown below.

Effervescent Calcium	
Each bottle contains 10 tablets.	
Each tablet contains :	
Calcium carbonate	625 mg
Vitamin C	1000 mg
Citric acid	1350 mg
Dosage : 1 tablet daily	
Administration : Dissolve one tablet in a glass of water.	
Warning : (1) Keep out of reach of children.	
(2) Keep .....	

(i) Effervescence occurs when a tablet of 'Effervescent Calcium' is added to water. Based on the information given on the label, explain why effervescence occurs.

(iii) On the label, some words are missing in the second warning statement. Complete the second warning statement, beginning with the word 'Keep'. Explain your answer.

(4 marks)

CE98\_07a(iii)

Sand (an impure form of quartz) and limestone are raw materials used for making glass.

- (1) Name that main chemical constituent of limestone.
- (2) Suggest ONE reason why glass had been used by mankind for a long time.
- (3) Suggest ONE reason why glass bottles are preferred to plastic bottles for the storage of champagne.

(3 marks)

CE99\_02

(b) For each of the following experiment, state ONE observable change and write a chemical equation for the reaction involved.

A small piece of calcium is placed in a Bunsen flame.

(2 marks)

CE02\_02

(a) For each of the following experiments, state an expected observation and write a chemical equation for the reaction involved.

A magnesium ribbon is placed in a Bunsen flame.

(2 marks)

CE02\_06a

(i) What substance is mainly present in slaked lime?

(1 mark)

CE09\_01

Limestone is an important earth resource.

(a) What is the major chemical constituent in limestone?

(1 mark)

(b) State the expected observation when dilute hydrochloric acid is added to limestone, and write the ionic equation for the reaction involved.

(2 marks)

(c) Limestone can be decomposed under strong heating.

(i) Write a chemical equation for the reaction involved.

(ii) Explain why limestone can be used as fire-proofing additive.

(2 marks)

CE10\_06

In an experiment, carbon dioxide is passed into limewater until excess.

(a) State the expected observations and write the chemical equations for the reactions involved.

(3 marks)

(b) Explain whether the similar observations in (a) would be made if sodium hydroxide solution is used instead of limewater.

(1 mark)

(c) Explain whether the similar observations in (a) would be made if air is used instead of carbon dioxide.

(1 mark)

(d) Carbon dioxide can be obtained from the reaction of solid sodium carbonate with dilute hydrochloric acid. Write an ionic equation for the reaction.

(1 mark)

AL99(I)\_07

Describe how to detect the presence of water of crystallization in an inorganic salt.

(1 mark)

AL00 (II)\_02e

(iii) An aqueous solution of ammonium nitrate(V) was prepared by neutralization of aqueous ammonia with nitric(V) acid. Suggest how you would obtain crystalline ammonium nitrate(V) from the solution.

(2 marks)

ASL01(I)\_06

Suggest tests to show the identities of the cation and anion in  $\text{KCl(s)}$ , and state the expected observation.

(4 marks)

AL02(I)\_08 (modified)

Draw a labeled diagram to show the set up of apparatus used in a simple distillation of mixture of 1-methylcyclopropanol and phosphoric(V) acid.

(2 marks)

AL02(II)\_01

The presence of calcium in the sample can be shown by conducting a flame test. Give the essential steps in a flame test.

(3 marks)

AL04(I)\_02

Consider the noble gases, He, Ne, Ar Kr and Xe. Sketch a graph to show the variation of boiling point of these noble gases and account for the variation.

(2 marks)

AL04(I)\_07

You are provided with three unlabelled bottles each containing one of the white powders listed below:

$\text{KBr(s)}$ ,  $\text{SiO}_2\text{(s)}$  and glucose

(a) Outline the physical tests that you would perform to distinguish unambiguously the three substances from one another.

(2 marks)

(b) Describe how you would carry out a *chemical test* to distinguish  $\text{KBr(s)}$  from glucose.

(2 marks)

AL04(I)\_08

Draw a labeled diagram for the assembly of apparatus used in simple distillation.

(2 marks)

AL06(I)\_08

State a possible consequence from following poor laboratory techniques. "determining the melting point of a compound without completely removing the solvent after recrystallization".

(1 mark)

AL07(I)\_07

In a chemistry laboratory, students are required to wear laboratory coat, plastic gloves and safety spectacles. Which of these safety measures do you consider the most important? Explain.

(2 marks)

AL07(I)\_08 (modified)

The crude product obtained can be purified by recrystallization. Suggest *three criteria* for an appropriate solvent for the recrystallization.

(3 marks)

ASL10(I)\_10

(b) The crude product appears yellow due to the presence of impurities. Outline the experimental procedure for the purification of the crude product by recrystallization from an ethanol-water mixture.

(3 marks)

(c) Suggest a method to verify or not the recrystallized sample of acetanilide is pure.

(1 mark)

AL11(I)\_07

(b) For each of the following pairs of species, suggest a chemical test to distinguish between them and write the chemical equation(s) of the reaction(s) involved.

(ii)  $\text{Cl}^-\text{(aq)}$  and  $\text{Br}^-\text{(aq)}$

(2 marks)

ASL12(I)\_09

Outline how you would separate  $\text{NH}_4\text{Cl(s)}$ ,  $\text{NaCl(s)}$  and  $\text{PbCl}_2\text{(s)}$  from a mixture of the three compounds.

(3 marks)

DSE12PP\_02

(b) One common way of preserving wine in an opened bottle is to inject argon, a gas which is chemically unreactive, into the bottle and then stopper the bottle.

(i) Explain why argon is chemically unreactive.

(1 mark)

(ii) State the principle behind the use of argon in preserving wine.

(1 mark)

(iii) Helium gas is also chemically unreactive. Suggest why helium is NOT used for preserving wine in an opened bottle.

(1 mark)

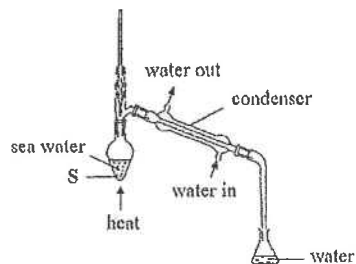
(c) Another way of wine preservation involves pumping air out from an opened bottle of wine and then stoppering the bottle. Suggest ONE possible drawback of preserving wine in this way.

(1 mark)

DSE13\_01

Water is the most abundant compound on the Earth's surface. It is very important to life on Earth.

- (b) Nearly 98% of the water on Earth is sea water, which is not fit for human consumption. The diagram below shows the set-up used in a simple distillation experiment for obtaining water for sea water.



- (i) Outline the underlying principle of this simple distillation experiment. (2 marks)
- (ii) Insoluble solid S was placed into the flask before heating. Why? (1 mark)

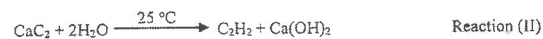
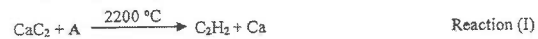
DSE15\_02

For each of the following experiments, state the expected observation, and write the chemical equation(s) for the reaction(s) involved.

- (a) Passing carbon dioxide gas into limewater until in excess. (3 marks)

DSE21\_01(c)

Acetylene ( $C_2H_2$ ) is a fuel. It can be obtained from calcium carbide ( $CaC_2$ ) by two different reactions as represented by the equations shown below :



- (c) Refer to Reaction (I) :
- (i) A is a gas at room conditions. Suggest what A would be.
- (ii) Hence, explain why the reaction is dangerous.

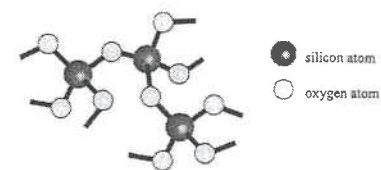
(2 marks)

DSE21\_01(d)

- (d) In Reaction (II),  $Ca(OH)_2$  is formed. State one use of  $Ca(OH)_2$  in daily life.

DSE21\_03(d)

- (d) Part of the structure of a mineral containing silicon and oxygen only is shown in the diagram below :

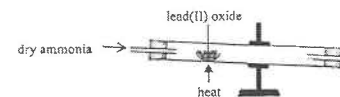


What is this mineral ?

(1 mark)

DSE21\_06(a)

6. Lead can be obtained from lead(II) oxide using the experimental set-up shown below. Besides lead, nitrogen gas and steam are also formed.



- (a) Suggest a reason for each of the following :
- (i) The reaction tube is placed in a downward slanted position.
- (ii) The experiment is performed in a fume cupboard.

(2 marks)

2022

1. Which of the following statements concerning  $\text{CO}_2(\text{g})$  is INCORRECT ?

- A. It can turn limewater milky.
- B. It can be used to make dry ice.
- C. It can be produced by adding marble to water.
- D. It generally has a higher percentage in the air in urban areas than that in rural areas.

2. How many neutrons and electrons are there in a  ${}^{51}_{23}\text{X}^{3+}$  ion ?

	Number of neutrons	Number of electrons
A.	23	20
B.	28	23
C.	28	20
D.	51	23

3. Which of the following substances is an electrolyte ?

- A. sodium chloride
- B. silicon dioxide
- C. methanol
- D. mercury

5. Element X is one of the first twenty elements in the Periodic Table. X forms a stable  $\text{XH}_4^+(\text{aq})$  ion. Which group of the Periodic Table does X most likely belong to ?

- A. Group III
- B. Group IV
- C. Group V
- D. Group VI



Marking Scheme

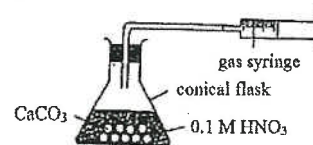
MCQ

CE94_44	D	CE99_01	B	CE99_45	B	CE04_11	C (60%)
CE04_29	C (67%)	CE05SP_02	A	CE05SP_18	D	CE05_05	D (87%)
CE05_19	B (52%)	CE06_25	D (80%)	CE08_08	D (88%)	CE08_42	A (75%)
CE11_28	A (34%)	CE11_40	D (68%)	DSE11SP_03	B	DSE13_19	B (65%)
DSE14_19	D (38%)	DSE14_20	A (63%)	DSE15_02	D (77%)	DSE15_23	D (53%)
DSE16_01	A (81%)	DSE17_14	A (97%)	DSE18_01	B (56%)	DSE18_19	D (68%)

Structural Questions

CE92\_02c

(i)



[2]

CE92\_04b

- (ii) Use a clean platinum (or nichrome) wire to carry out the flame test. [1]  
 Put the wire in concentrated hydrochloric acid and stick some sample solid B on it. [1]  
 Then heat the wire in a blue Bunsen burner flame and watch the flame colour. [1]

CE94\_08b

- (i) The cation is  $K^+$  because  $K^+$  compound burns with a lilac (purple) flame. [1]  
 (ii) Use a clean platinum (or nichrome) wire to carry out the flame test. [1]  
 Put the wire in concentrated hydrochloric acid and stick some sample solid X on it. [1]  
 Then heat the wire in a blue Bunsen burner flame and watch the flame colour. [1]

CE95\_07a

- (i) Citric acid/ vitamin C (ascorbic acid) when dissolved in water gives  $H^+$  (aq) which reacts with calcium carbonate to give gas ( $CO_2$ ) bubbles. [2]  
 (iii) Out of moisture (water) in a dry place. [1]  
 Reason: The amount of active ingredients will decrease/ the tablet will lose function/ the active ingredients of the tablet will react in the presence of water. [1]  
 OR, Out of heat/ in a cool place.  
 Reason: at high temperature, vitamin C deteriorate /  $CaCO_3$  undergoes decomposition / the amount of active ingredients will decrease / the tablet will lose function.  
 OR, Away from sunlight  
 Reason: vitamin C may decompose.  $CaCO_3$  can be decomposed by sunlight.

CE98\_07a(iii)

- (1) Calcium carbonate [1]  
 (2) The materials for making glass are easily available / abundant in the earth crust. [1]  
 OR, Glass can easily be manufactured by heating sand, limestone and sodium hydroxide.  
 (3) Champagne contains a pressurized carbon dioxide solution. Glass can withstand the pressure. [1]  
 OR, The ethanol solution (champagne) can dissolve unpolymerized monomers in plastic.

CE99\_02

- (b) Calcium burns with a brick-red flame / formation of white powder (solid). [1]  
 $2\text{Ca(s)} + \text{O}_2\text{(g)} \longrightarrow 2\text{CaO(s)}$  [1]

CE02\_02

- (a) Magnesium burns with a brilliant (very bright) flame. / A white solid (MgO) solid is formed. [1]  
 $2\text{Mg(s)} + \text{O}_2\text{(g)} \longrightarrow 2\text{MgO(s)}$  (white solid) [1]  
 Note: in some case, a yellow solid (Mg<sub>3</sub>N<sub>2</sub>) may form.  
 $3\text{Mg(s)} + \text{N}_2\text{(g)} \longrightarrow \text{Mg}_3\text{N}_2\text{(s)}$  (yellow solid)

CE02\_06a

- (i) Calcium hydroxide / Ca(OH)<sub>2</sub> [1]

CE09\_01

- (a) Calcium carbonate / CaCO<sub>3</sub> [1]  
 (b) Limestone dissolves. / Gas (bubbles) given out. [1]  
 $\text{CaCO}_3 + 2\text{H}^+ \longrightarrow \text{Ca}^{2+} + \text{H}_2\text{O} + \text{CO}_2$  [1]  
 (c) (i)  $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$  [1]  
 (ii) Decomposition of calcium carbonate is an endothermic process. [1]  
 OR, Carbon dioxide evolved can extinguish fire.

CE10\_06

- (a) Limewater turns milky and then turns clear again. [1]  
 $\text{Ca(OH)}_2 + \text{CO}_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$  [1]  
 $\text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 \longrightarrow \text{Ca(HCO}_3)_2$  [1]  
 (b) No. Sodium carbonate is soluble in water. [1]  
 (c) No. The percentage of carbon dioxide in air is very low and similar observations would not be made in a short period of time. [1]  
 OR, Yes. Air contains a low percentage of carbon dioxide and similar observations would be made in a sufficiently long period of time.  
 (d)  $\text{Na}_2\text{CO}_3 + 2\text{H}^+ \longrightarrow 2\text{Na}^+ + \text{H}_2\text{O} + \text{CO}_2$  [1]

AL99(I)\_07

- Heat the sample. [½]  
 Water vapour will turn anhydrous CuSO<sub>4</sub>(s) from white to blue / anhydrous CoCl<sub>2</sub>(s) from blue to pink. [½]  
 (0 M if heating is not mentioned)

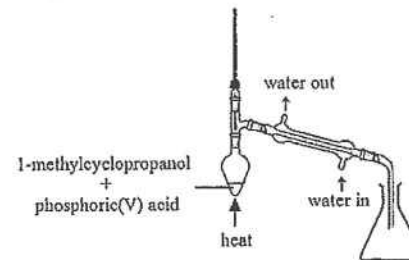
AL00 (II)\_02e

- (iii) Evaporate / heat / warm the solution to obtain a saturated / concentration solution of NH<sub>4</sub>NO<sub>3</sub>. [1]  
 Allow the solution to cool / use an ice bath to obtain NH<sub>4</sub>NO<sub>3</sub>(s). [½]  
 Separate crystal by filtration. [½]

ASL01(I)\_06

- Dissolve the solid sample into water to give solution. [1]  
 Cation: Heat the sample solution over the non-luminous Bunsen flame. Sample can burn with lilac flame. [1]  
 Anion: Add few drops of acidified silver nitrate solution. [1]  
 A white precipitate, AgCl(s), can be formed. [1]

AL02(I)\_08 (modified)

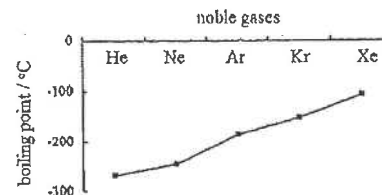


- (1 mark for a workable set-up; 0.5 mark for labeling the reagents and 0.5 mark for the direction of water flow in the condenser.)

AL02(II)\_01

- Clean a Pt wire with concentrated HCl. [1]  
 Stick a sample of the salt onto the Pt wire with concentrated HCl. [1]  
 Heat wire with the sample in a non-luminous (Bunsen flame) [1]

AL04(I)\_02

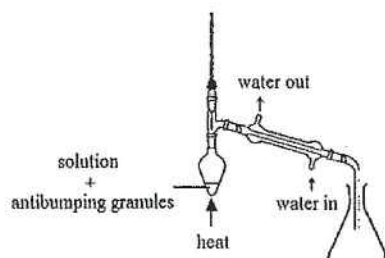


- The intermolecular attraction between noble gas molecules is van der Waals' forces. The strength of van der Waals' forces increases with the number of electrons / atomic size of the noble gas. ∴ The boiling point of noble gas increases as the group is descended. [½]  
 [½]

AL04(I)\_07

- (a) Add water to white powder. Only  $\text{SiO}_2(\text{s})$  is insoluble. ( $\text{SiO}_2$  has giant covalent structure, all structures in giant covalent structure is insoluble in water) [1]  
Test the electrical conductivity of the solution obtained. [1]  
 $\text{KBr}(\text{aq})$  conducts, but glucose solution does not. [1]  
*OR,* Conduct a flame test. Only  $\text{KBr}(\text{aq})$  gives a lilac flame.  
*OR,* Determine the melting points of the solids,  $\text{KBr}(\text{s})$  has a very high melting point.
- (b) Heat the solid strongly. [1]  
Only glucose chars. (burns with unburned carbon) [1]  
*OR,* Add acidified  $\text{AgNO}_3(\text{aq})$ .  $\text{KBr}(\text{aq})$  gives a pale yellow precipitate.

AL04(I)\_08



(1 mark for a workable set-up; 0.5 mark for labeling the reagents and 0.5 mark for the direction of water flow in the condenser.)

AL06(I)\_08

The m.p. determined will be lower than the expected value. [1]

AL07(I)\_07

Safety spectacles [1]  
Eyes are the most delicate organs. Any harm on eyes cannot easily be recovered. [1]

AL07(I)\_08 (modified)

- Any THREE of the following: [3]
- Product should have a high solubility in the solvent while the impurities should not.
  - The solubility of product in the solvent should be high at elevated temperature but low at room temperature.
  - The solvent should be volatile (easily to remove by evaporation / distillation)
  - The solvent should not react with product.

ASL10(I)\_10

- (b) Dissolve the crude product in minimum volume of hot ethanol-water mixture. [1]  
Heat the solution with activated charcoal (to remove the color impurities). [1]  
Filter the hot mixture (using a short-stem funnel). [½]  
Allow the filtrate to cool to room temperature to obtain acetanilide. [½]
- (c) Any ONE of the followings: [1]
1. Determine the melting point of the product and compare the result with literature data.
  2. Use the method of mixed melting point.

AL11(I)\_07

- (b) (ii) Add acidified  $\text{AgNO}_3(\text{aq})$ .  $\text{Cl}^-(\text{aq})$  gives a white precipitate, while  $\text{Br}^-(\text{aq})$  gives a pale yellow precipitate. [1]  
 $\text{Ag}^+ + \text{Cl}^- \rightarrow \text{AgCl}$  [1]  
*OR,* Add  $\text{Cl}_2(\text{aq})$ . Only  $\text{Br}^-(\text{aq})$  gives a brown solution.  
 $\text{Cl}_2 + 2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{Cl}^-$   
*OR,* Treat solution with acidified  $\text{KMnO}_4(\text{aq})$ .  $\text{Cl}^-(\text{aq})$  causes decolorization slowly;  $\text{Br}^-(\text{aq})$  gives an orange solution.  
 $10\text{X}^- + 2\text{MnO}_4^- + 16\text{H}^+ \rightarrow 5\text{X}_2 + 2\text{Mn}^{2+} + 8\text{H}_2\text{O}$

ASL12(I)\_09

- Heat the mixture. Only  $\text{NH}_4\text{Cl}(\text{s})$  will sublime. [1]  
It can be collected on a cold surface. [½]  
Add water to the remaining solid mixture. [½]  
 $\text{PbCl}_2(\text{s})$  is insoluble. It can be collected by filtration. [½]  
 $\text{NaCl}(\text{s})$  can be obtained from its solution by crystallization. [½]  
*OR,* Add water to the mixture to dissolve  $\text{NaCl}(\text{s})$  and  $\text{NH}_4\text{Cl}(\text{s})$ .  
Remove undissolved  $\text{PbCl}_2(\text{s})$  by filtration.  
Separate  $\text{NaCl}(\text{s})$  and  $\text{NH}_4\text{Cl}(\text{s})$  from the solution by fractional crystallization / by (ion-exchange) chromatography.

DSE12PP\_02

- (b) (i) The outermost shell of an argon atom is a stable octet structure. ∴ Ar does not readily form bonds with other atoms [1]  
(ii) Ar is denser than air. It displaces air from the bottle, and thus prevents the wine from contact with air. [1]  
(iii) He is less dense than air. It will not displace air / it will easily diffuse from the bottle. [1]
- (c) The substances with a pleasant odour are volatile organic compounds. Pumping air out from the bottle may also remove these substances. [1]

DSE13\_01

- (b) (i) Water boils at about 100 °C, but the salts in sea water are non-volatile / boiling of water is lower than that of salt. [1]  
The steam (water vapor) formed condenses on the cold surface of the condenser / cool down to give liquid water (the distillate). [1]
- (ii) To prevent bumping / to prevent frothing / splash / overflow due to overheating of water. [1]  
To ensure smooth boiling.

DSE15\_02

- (a) A white precipitate / solid is firstly formed / It turns milky; the precipitate dissolves in the presence of excess CO<sub>2</sub>(g). [1]
- $\text{Ca(OH)}_2(\text{aq}) + \text{CO}_2(\text{g}) \longrightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$  [1]
- $\text{CaCO}_3(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{Ca(HCO}_3)_2(\text{aq})$  [1]