

## SECTION A-46 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

1. (a) Complete the following equations.



(b) The **half-life** of bismuth is **20 minutes**. Determine the **time taken** for Bismuth to decay by **75%**. (02½ marks)

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2. (a) (i) Write the **electronic configuration** of phosphorous. (01 mark)

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(ii) State the **common oxidation states** exhibited by phosphorous in its compounds. (01 mark)

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(b) Draw the **structure** and **name the shape** of phosphorous trichloride molecule. (01 mark)

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(c) The enthalpy of formation of phosphorous trichloride is **-306kJmol<sup>-1</sup>** and enthalpies of atomization of phosphorous and chlorine are **+314kJmol<sup>-1</sup>** and **+242kJmol<sup>-1</sup>** respectively. Calculate the **average bond energy** of the P-Cl bond. (02½ marks)

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3. Complete the following equations and in each case outline the accepted mechanism for the reaction.



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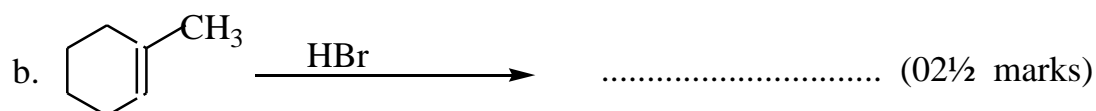
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4. A sample of methylamine was placed at one **end A** of a **0.8metre** glass tube held horizontally. At the other **end B** of the tube was placed a sample of hydrochloric acid and both ends of the tube closed. When the tube was left for some time, a **white ring** was formed inside the tube.

- a) Write **equation** for the reaction leading to the formation of the **white ring**. (01 mark)

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b) Calculate the **distance between end B and the white ring**. (03 marks)

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5. Name **one reagent** that can be used to distinguish between each of the following pairs of ions and in each case, state what would be observed if each member of the pair is treated with the reagent you have named.

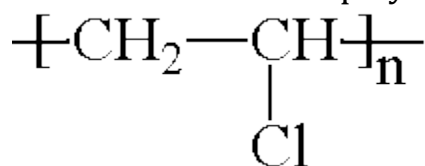
a.  $\text{Cl}^-_{(\text{aq})}$  and  $\text{I}^-_{(\text{aq})}$  (03 marks)

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b.  $\text{SO}_3^{2-}_{(\text{aq})}$  and  $\text{S}_2\text{O}_3^{2-}_{(\text{aq})}$  (02½ marks)

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6. (a) State the conditions for the formation of polyvinyl chloride. (01 mark)



(b) The osmotic pressure of a solution containing **4.00g/dm<sup>3</sup>** of polyvinyl chloride in dioxin is **65pa** at **20°C**. Calculate the number of monomers in polyvinyl chloride. (03 marks)

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(c) State **one** use of polyvinyl chloride (0½ mark)

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7. (a) State what would be observed and write equation for the reaction that would take place if:

- i. Excess hydrogen peroxide was added to acidified solution of potassium manganate (VII). (02 marks)

Observation:

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Equation:

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- ii. 3-phenylpropene was added to a solution of bromine in tetrachloromethane. (01½ marks)

Observation:

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Equation:

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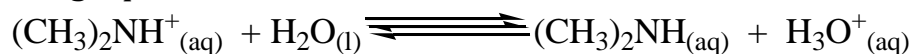
(b) Give a **reason** for your observation in a (i) above. (01 mark)

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8. Dimethyl ammonium chloride undergoes hydrolysis in water according to the following equation:



a) Write the **expression for the hydrolysis constant,  $K_h$**  of dimethyl ammonium chloride. (01 mark)

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b) When **4.0mol/dm<sup>3</sup>** of dimethyl ammonium chloride was hydrolysed **25.0cm<sup>3</sup>** of the resulting solution required **7.5cm<sup>3</sup>** of **0.01mol/dm<sup>3</sup>** of sodium hydroxide for complete neutralization.

i. pH of the solution. (02 marks)

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ii. hydrolysis constant  $K_h$  and any assumptions made. (02½ marks)

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9. Write equation for the reaction (s) between:

a) Lead (IV) oxide and concentrated hydrochloric acid on warming.

(01½ marks)

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b) Aqueous lead (II) nitrate and excess sodium hydroxide solution.

(03 marks)

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c) Tin (II) chloride and water.

(01½ marks)

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### SECTION B-56 MARKS

ATTEMPT ALL QUESTIONS IN THIS SECTION.

10. **Beryllium** is in **Group (II)** of the periodic Table but it shows some similarities with **aluminium** which is in group **(III)** of the Periodic table.

a) Give a reason why aluminium shows some similarities in properties with beryllium.

(01 mark)

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b) Write equation for the reaction between water and:

i. Beryllium carbide.

(01½ marks)

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ii. Calcium carbide.

(01½ marks)

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- c) Thallium and aluminium are both in group (III) of the Periodic Table. State one difference between aluminium oxide and thallium oxide. (01 mark)

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- d) Write equation for the reaction between sodium hydroxide and:
- i. Aluminium. (02 marks)

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- ii. Beryllium. (02 marks)

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11. (a). State the effect on the vapour pressure of water and the total vapour pressure of the system when small amounts of the following substances are separately added to water at **25°C**. (03 marks)

Substance added to H <sub>2</sub> O	Effect on	
	Vapour pressure of H <sub>2</sub> O	Total vapour Pressure of the system
Sodium chloride		
Propanone		
Tetrachloromethane		

- (b). Explain your answer(s) in (a) (ii) and (a) (iii). (04 marks)

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- (c). An organic compound **X** was steam distilled at **95°C** at **760mmHg** pressure. If the distillate contained **0.8g** of water by mass. Calculate the relative molecular mass of **X**. (02 marks)  
(The saturated vapour pressure of water at **95°C** is **732.7mmHg**)

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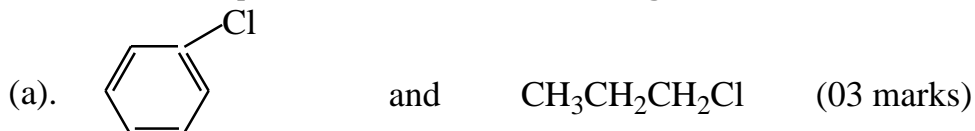
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12. Name **one reagent** that can be used to distinguish between each of the following pairs of compounds. In each case, state what is observed if each member of the pair is treated with the reagent?



Reagent:

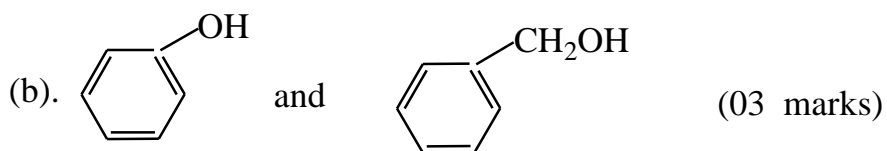
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Observation:

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Reagent:

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Observation:



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(c).  $\text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3$  and  $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$  (03 marks)

Reagent:

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Observation:

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13. Write equations to show how the following compounds can be synthesized. Indicate the condition (s) for the reaction(s).

a) But-2-yne from butan-2-ol. (03½ marks)

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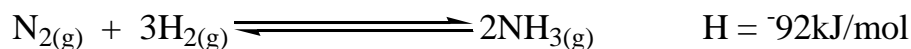
b) Ethylamine from ethanol. (03½ marks)

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c) Propanone from propene. (02 marks)

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14. Nitrogen reacts with hydrogen gas to form ammonia according to the following equation:



- a) State the conditions for the reaction which would give maximum yield of ammonia. (01½ marks)

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- b) Write equations for the reactions that take place during the manufacture of nitric acid from ammonia. (04½ marks)

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- c) Write equations for the reaction between copper and:  
 i. Dilute nitric acid. (01½ marks)

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- ii. Concentrated nitric acid. (01½ marks)

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15. Hydrogen and iodine react to form hydrogen iodide according to the following equation.



- a) (i) Write the expression for the **equilibrium constant, K<sub>c</sub>** for the reaction. (01 mark)

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- (ii) **1 mole** of hydrogen and  $\frac{1}{3}$  **mole** of iodine were heated together at **450°C** until equilibrium was obtained. Calculate the number of moles of hydrogen iodide present in the equilibrium mixture at **450°C**.  
(The equilibrium constant, **K<sub>c</sub>** for the reaction between hydrogen and iodine is **50**) (04 marks)

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- b) Briefly describe how the concentration of iodine in the equilibrium mixture can be determined. (04 marks)

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16. A compound **R** contains **40%** carbon and **6.67%** hydrogen, the rest being oxygen.

a) Calculate the **empirical formula** of **R**. (01½ marks)

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b) A solution containing **28.145g** of **R** in **250g** of water froze at **-3.490°C**.

i. Determine the **molecular formula** of **R**.

(The freezing point constant,  $K_f$  of water **1.86°C/mol/1000g**)

(03 marks)

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ii. Write the structural formula and **I.U.P.A.C names** of all the possible isomers of **R**. (02 marks)

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c) **R** reacted with **sodium carbonate** with **effervescence**.

i. Identify **R**. (01 mark)

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ii. Write equations to show how **R** can be **synthesized** from ethene. (01½ marks)

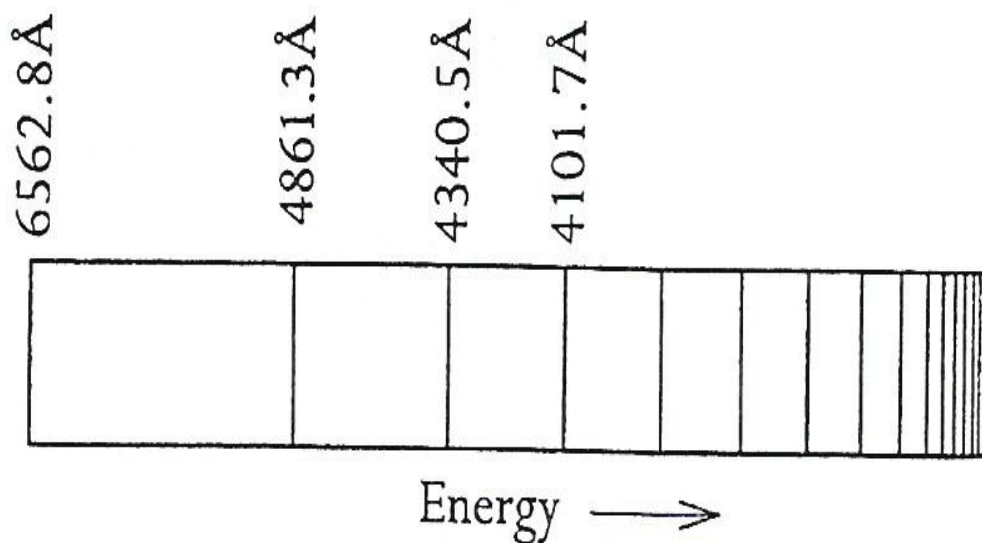
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17. The diagram below shows part of the atomic emission spectrum of hydrogen.



a) State:

i. The information that can be obtained from the separate lines about the electronic structure of the hydrogen atom. (01½ marks)

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ii. How an emission line arises. (01½ marks)

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b) Briefly, explain why the emission lines get closer together. (03½ marks)

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c) State what is meant by term '**principal quantum number**'. (01½ marks)

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♥ ===END===

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