Name … ……**Centre/Index No**……/……

Signature ……

P525/1
CHEMISTRY
Paper 1

INSTRUCTIONS TO CANDIDATES:

Answer **ALL** questions in part **A** and Six questions from part **B**.

All questions are to be answered in the spaces provided.

The Periodic Table with relative atomic masses is provided at the back.

For Examiner's Use Only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

PART A (46 MARKS)

Attempt all questions in this section

1. (a) State three reasons for the anomalous behavior of fluorine in group(VII) of the periodic table. (3 marks)

(b) Write the equation for the reaction between fluorine and
(i) cold dilute potassium hydroxide solution. (1 ½ marks)

(ii) hot concentrated potassium hydroxide solution. (1 ½ marks)

2. A compound P of molecular formula $C_4H_8O_2$, has no effect on litmus solution . P yields ethanol only when treated with lithium tetrahydrido aluminate(III) in the presence of dry ether

(a) Write the structural formula and name of P (1 ½ marks)

(b) Write the equation and suggest a mechanism for the reaction of P and ethylamine. (4 marks)

3. (a) State three properties exhibited chromium as a transition element. (1 ½ marks)

(b) Dilute aqueous sodium hydroxide solution was added to aqueous chromium(III) sulphate solution dropwise until in excess followed by 3 drops of hydrogen peroxide and the mixture warmed.
Explain the reaction(s) and write equations for the reactions that took place. (4 ½ marks)

4. (a) State what is meant by the term buffer solution (1 mark)

(b)(i) 25cm3 of 0.2M sodium benzoate were mixed with 35cm3 of 0.1M benzoic acid calculate the pH of the resultant solution (Ka for benzoic acid is $6.3 \times 10^{-5} moldm^{-3}$) (3 marks)

(ii) State any assumptions made in your calculation in (i). (1 mark)

5. (a) State what would be observed and write equation for the reaction when
(i) Benzene is heated with a mixture of concentrated nitric acid and concentrated sulphuric acid. (1 ½ marks)

(ii) Benzaldedehyde is mixed with 2,4 – dinitrophenyl hydrazine in the presence of dilute sulphuric acid. (1 ½ marks)

(b) Write the mechanism for the reaction in a(i) (2 ½ marks)

6. 6.34cm3 of hydrogen gas were mixed with 7.61cm^3 of chlorine gas at 200K and when equilibrium was establishes, 5.26cm^3 of hydrogen chloride was present.
(a) Write
(i) the equation for the reaction that took place. (1 ½ marks)

(ii) the expression for the equilibrium constant, Kc of the reaction. (1 ½ marks)

(b) Calculate the equilibrium constant Kc for the reaction at 200K. (3 marks)

7. The boiling points of the hydrides of group(VII) elements of the periodic table are given below.

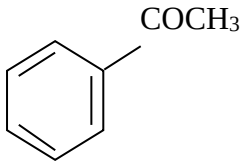
Hydride	HF	HCl	HBr	HI
Bpt(°C)	+19.5	-85	-67	-37

(i) State how the boiling points of the hydrides vary. (1 mark)

(ii) Explain your answer in (i) (3 marks)

8. Write equations to show how the following compounds can be synthesized.

(a) (3 ½ marks)



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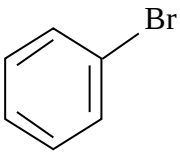
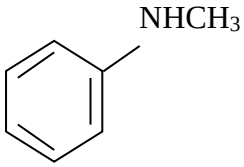


(b) (2 marks)



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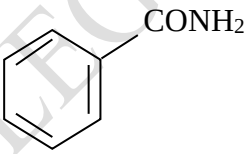


9. (a)(i) State what is meant by the term vegetable oil. (1 mark)

(ii) Name two main sources of vegetable oils. (1 mark)

(b)(i) Write a general equation for the formation of vegetable oil. (1 mark)

(ii) State <u>one</u> use of vegetable oil. (½ mark)

SECTION B: (54 MARKS)

Answer six questions from this section. Additional questions answered will not ne marked.

10. 8.15g of a saturated bromo compound, X, $C_nH_{2-1}B1$contains 49.08% by mass of bromine.

(a)(i) Determine the molecular formula of X (3 marks)

(ii) Write the structural formula and name of X (1 ½ marks)

(b) Phenol was reacted with X;

(i) State the condition(s) for the reaction (1 mark)

(ii) Write equation and mechanism for the reaction that took place. (3 ½ marks)

11. (a)(i) State three factors that can affect bond energy. (1 ½ marks)

(ii) Explain how the factors you have stated in (i) affect bond energy. (3 ½ marks)

(b) The standard enthalpy change of formation of tin(IV) chloride is -508 $KJmol^{-1}$. The standard enthalpy changes of atomization of tin and chlorine are +301 and +121KJMol-1 respectively. Use these values to construct a Born-Haber cycle for the formation of tin(IV) chloride from its elements. (2 marks)

(c) Calculate the average bond energy of the Sn-Cl bond. (2 marks)

12. (a)(i) Write the name and the formula of the principal ore of aluminuim. (1 mark)

(ii) Outline the steps used to concentrate the ore you have named in a(i) (include relevant equations for the reactions that take place) (5 marks)

(b) Write equation(s) for the reaction of aluminuim with;

(i) concentrated sodium hydroxide solution (1 mark)

(ii) heated iron(III) oxide (1 mark)

(iii) concentrated hydrofluoric acid (1 mark)

13. State what is observed and write equations for the reaction(s) that take place when

(a) Lead(IV) oxide was heated with a solution of Manganese(II) chloride and concentrated nitric acid (2 marks)

(b) Dilute sulphuric acid is added to aqueous solution of potassium manganate(VII) (2 ½ marks)

(c) A few frops pf potassium Carbonate solution are added to aqueous solution of Iron(II) Sulphate (2 ½ marks)

(d) Bromine water is added to hydroxybenzene. (2 marks)

14. (a) The oxides of some elements in period 3 of the periodic table are given below. In each case state the chemical nature and structure of the oxide(s) (4 ½ marks)

Oxide	Chemical nature	Structure
Alluminium oxide		

Silicon(IV) oxide		
Phosphorus(V) oxide		

(b) Write equations for the reaction(s) of the oxides with concentrated sodium hydroxide solution.

(i) Aluminium oxide (1 ½ marks)

(ii) silicon(IV) oxide (1 ½ marks)

(iii) Phosphorus(V) oxide (1 ½ marks)

15. State three properties of eutectic mixture (1 ½ marks)

(b) The melting of various mixtures of ethanoic acid and water are given in the table below.

% ethanoic acid	0	20	40	60	80	100
Melting point (°C)	0	-10	-20	-19	-1	18

(i) Draw a well labeled melting point-composition diagram of ethenoic acid-water system. (3 marks)

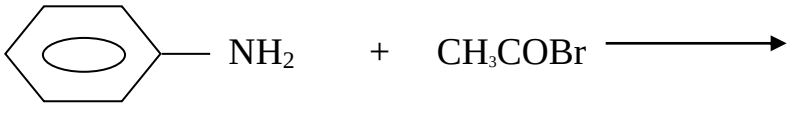
(ii) determine the eutectic temperature and composition of the eutectic mixture. (1 mark)

(ii) Calculate the mass of ice that crystallized out when 135g of a liquid mixture of composition 16% ethanoic acid at 5^{o}C was cooled to -22^{o}C. (1 ½ marks)

(c) Explain what happens when a liquid mixture of composition 20% ethanoic acid at 15^{o}C was cooled to -30^{o}C (2 marks)

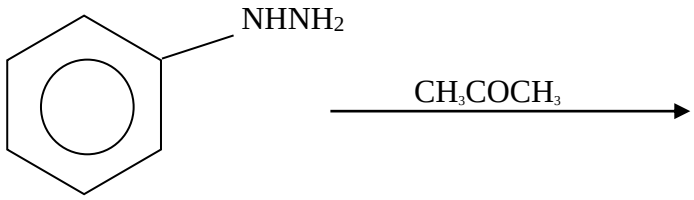
16. Complete the following equation(s) and in each case write the accepted mechanism(s) for the reactions.

(a)



(3 marks)

(b) (3 ½ marks)



(c) (2 ½ marks)

17. (a) State what is meant by the term common ion effect. (1 mark)

(b) Calcium(II) iodate is sparingly soluble in water. Write;-

(i) the equation for solubility of calcium(II) iodate. (1 ½ marks)

(ii) the expression for the solubility product, Ksp of calcium(II) iodate. (½ mark)

(c) Describe how the concentration of iodate ions in a saturated solution of calcium(II) iodate can be determined. (3 marks)

(d) 0.1 moles of calcium nitrate was added to 1 litre of a saturated solution of calcium(II) iodate, and mixture stirred.
Calculate the mass of calcium(II) iodate which was precipitated.
(The solubility product of calcium(II) iodate at 25^{o}C is 1,69 x 10^{-9}mol^{3}dm^{-9})
(3 marks)