CHEMISTRY (Theory)

Time allowed : 3 hours ***Maximum Marks : 70***

General Instructions:

(i) All questions are compulsory.

(ii) Marks for each question are indicated against it.

(iii) Question numbers 1 to 8 are very short-answer questions and carry 1 mark each.

(iv) Question numbers 9 to 18 are short-answer questions and carry 2 marks each.

(v) Question numbers 19 to 27 are also short-answer questions and carry 3 marks each.

(vi) Question numbers 28 to 30 are long-answer questions and carry 5 marks each.

(vii) Use Log Tables, if necessary, Use of calculators is **not** *allowed.*

QUESTION PAPER CODE 56/1/1

1. Write a feature which will distinguish a metallic solid from an ionic solid. 1

2. Define 'order of a reaction'. 1

3. What is an emulsion? 1

4. Why does NO_2 dimerise ? 1

5. Give an example of linkage isomerism. 1

6. A solution of KOH hydrolyses $CH_3CHClCH_2CH_3$ and $CH_3CH_2CH_2CH_2Cl$.
Which one of these is more easily hydrolysed? 1

7. Draw the structural formula of I-phenylpropan-l-one molecule. 1

8. Give the IUPAC name of $H_2N – CH_2 – CH_2 - CH = CH_2$. 1

9. Non-ideal solutions exhibit either positive or negative deviations from Raoult's law. What are these deviations and why are they caused? Explain with one example for each type. 2

10. A reaction is of first order in reactant A and of second order in reactant B. How is the rate of this reaction affected when (i) the concentration of B alone is increased to three times (ii) the concentrations of A as well as B are doubled? 2

11. The rate constant for a reaction of zero order in A is 0.0030 mol L^{-1} s^{-1}. How long will it take for the initial concentration of A to fall from 0.10 M to 0.075 M ? 2

12. Draw the structures of white phosphorus and red phosphorus. Which one of these two types of phosphorus is more reactive and why? 2

13. Explain the following observations:

(i) Generally there is an increase in density of elements from titanium (Z = 22) to copper (Z = 29) in the first series of transition elements.

(ii) Transition elements and their compounds are generally found to be good catalysts in chemical reactions. 2

14. Name the following coordination compounds according to IUPAC system of nomenclature:

(i) $[Co(NH_3)_4(H_2O)Cl]Cl_2$

(ii) $[CrCl_2(en)_2]Cl$, (en = ethane – 1, 2 – diamine) 2

15. Illustrate the following reactions giving a chemical equation for each:

(i) Kolbe's reaction,

(ii) Williamson synthesis. 2

16. How are the following conversions carried out?

(i) Benzyl chloride to benzyl alcohol,

(ii) Methyl magnesium bromide to 2-methylpropan-2-ol. 2

17. Explain the following terms. :

(i) Invert sugar

(ii) Polypeptides

OR

Name the products of hydrolysis of sucrose. Why is sucrose not a reducing sugar? 2

18. What are essential and non-essential amino acids in human food? Give one example of each type. 2

19. The well known mineral fluorite is chemically calcium fluoride. It is known that in one unit cell of this mineral there are 4 Ca^{2+} ions and 8 F^- ions and that Ca^{2+} ions are arranged in a fcc lattice. The F^- ions fill all the tetrahedral holes in the face centred cubic lattice of Ca^{2+} ions. The edge of the unit cell is 5.46×10^{-8} cm in length. The density of the solid is 3.18 g cm^{-3}. Use this information to calculate Avogadro's number (Molar mass of CaF_2 = 78.08 g mol^{-1}) 3

20. A solution prepared by dissolving 1.25 g of oil of winter green (methyl salicylate) in 99.0 g of benzene has a boiling point of 80.31 °C. Determine the molar mass of this compound. (B.P. of pure benzene = 80.10 °C and K_b for benzene = 2.53 °C kg mol^{-1}) 3

21. What is the difference between multi molecular and macromolecular colloids? Give one example of each type. How are associated colloids different from these two types of col1oids ? 3

22. Describe how the following changes are brought about:

(i) Pig iron into steel.

(ii) Zinc oxide into metallic zinc.

(iii) Impure titanium into pure titanium. 3

OR

Describe the role of

(i) NaCN in the extraction of gold from gold are.

(ii) SiO_2 in the extraction of copper from copper matte.

(iii) Iodine in the refining of zirconium.

Write chemical equations for the involved reactions.

23. How would you account for the following?

(i) The atomic radii of the metals of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the second (4d) series.

(ii) The E^o value for the Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} couple or Fe^{3+}/Fe^{2+} couple.

(iii) The highest oxidation state of a metal is exhibited in its oxide or fluoride. 3

24. (i) State one use each of DDT and iodoform.

(ii) Which compound in the following couples will react faster in S_N2 displacement and why?

(a) 1-Bromopentane or 2-bromopentane

(b) 1-Bromo-2-methylbutane or 2-bromo-2-methylbutane. 3

25. In the following cases rearrange the compounds as directed:

(i) In an increasing order of basic strength:

$C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_6NH$ and CH_3NH_2

(ii) In a decreasing order of basic strength:

Aniline, p-nitroaniline and p-toluidine

(iii) In an increasing order of pK_b values:

$C_2H_5NH_2$, C_6H_5 $NHCH_3$, $(C_2H_5)_2NH$ and $C_6H_5NH_2$ 3

26. Give one example each of

(i) addition polymers,

(ii) condensation polymers,

(iii) copolymers. 3

27. What are analgesic medicines? How are they c1assifiedand when are they commonly recommended for use? 3

28. (a) State Kohlrausch law of independent migration of ions. Write an expression for the molar conductivity of acetic acid at infinite dilution according to Kohlrausch law.

(b) Calculate $\wedge^o_m$ for acetic acid.

Given that $\wedge^o_m$ (HC*l*) = 426 S cm^2 mol^{-1}

$\wedge^o_m$ (NaC*l*) = 126 S cm^2 mol^{-1}

$\wedge^o_m$ (CH_3COONa) = 91 S cm^2 mol^{-1} 5

OR

(a) Write the anode and cathode reactions and the overall reaction occurring in a lead storage battery.

(b) A copper-silver cell is set up. The copper ion concentration is 0.10 M. The concentration of silver ion is not known. The cell potential when measured was 0.422 V. Determine the concentration of silver ions in the cell. (Given $E^o_{Ag+/Ag}$ = + 0.80 V, $E^o_{cu^{2+}/cu}$ = + 0.34 V) 5

29. (a) Complete the following chemical equations:

(i) $NaOH_{(aq)} + Cl_{2(g)} \rightarrow$

(Hot and cone.)

(ii) $XeF_6(s) + H_2O(l) \rightarrow$

(b) How would you account for the following?

(i) The value of electron gain enthalpy with negative sign for sulphur is higher than that for oxygen.

(ii) NF_3 is an exothermic compound but NCl_3 is endothermic compound.

(iii) ClF_3 molecule has a T-shaped structure and not a trigonal planar one. 5

OR

(a) Complete the following chemical reaction equations:

(i) $P_4 + SO_2Cl_2 \rightarrow$

(ii) $XeF_4 + H_2O \rightarrow$

(b) Explain the following observations giving appropriate reasons:

(i) The stability of + 5 oxidation state decreases down the group in group 15 of the periodic table.

(ii) Solid phosphorus pentachloride behaves as an ionic compound.

(iii) Halogens are strong oxidizing agents. 5

30. (a) Explain the mechanism of a nucleophilic attack on the carbonyl group of an alciehyde or a ketone.

(b) An organic compound (A) (molecular formula $C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid also produced (B). On dehydration (C) gives but-l-ene. Write the equations for the reactions involved. 5

OR

(a) Give chemical tests to distinguish between the following pairs of compounds:

(i) Ethanal and Propanal

(ii) Phenol and Benzoic acid

(b) How will you bring about the following conversions? 5

(i) Benzoic acid to benzaldehyde

(ii) Ethanal to but-2-enal

(iii) Propanone to propene

Give complete reaction in each case.

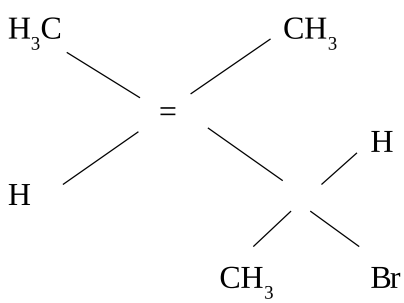
QUESTION PAPER CODE 56/1

1. What type of interactions hold the molecules together in a polar molecular solid? 1

2. What is meant by 'limiting molar conductivity' ? 1

3. Fluorine does not exhibit any positive oxidation state. Why? 1

4. Give the IUPAC name of the following compound: 1



5. Write the structure of the molecule of a compound whose IUPAC name is

I-phenylpropan-2-ol 1

6. What is Tollen's reagent? Write one usefulness of this reagent. 1

7. What is meant by 'reducing sugars' ? 1

8. What does the designation '6,6' mean in the name nylon-6, 6 ? 1

9. Define the terms, 'osmosis' and 'osmotic pressure'. What is the advantage of using osmotic pressure as compared to other colligative properties for the determination of molar masses of solutes in solutions? 2

10. Express the relation among the cell constant, the resistance of the solution in the cell and the conductivity of the solution. How is the conductivity of a solution related to its molar conductivity? 2

11. Given that the standard electrode potentials (E^o) of metals are:

$K^+ / K = – 2.93$ V, $Ag^+ / Ag = 0.80$ V, $Cu^{2+} / Cu = 0.34$ V,

$Mg^{2+} /Mg = - 2.37$ V, $Cr^{3+} / Cr = – 0.74$ V, $Fe^{2+}/Fe = – 0.44$ V.

Arrange these metals in an increasing order of their reducing power. 2

OR

Two half-reactions of an electrochemical cell are given below:

MnO_4^- (aq) + 8 H^+ (aq) + 5 e^- $\rightarrow$ Mn^{2+} (aq) + 4 H_2O (l), E^o = + 1.51 V

Sn^{2+} (aq) $\rightarrow$ Sn^{4+} (aq) + 2 e^-, E^o = + 0.15 V.

Construct the redox reaction equation from the two half-reactions and calculate the cell potential from the standard potentials and predict if the reaction is reactant or product favoured. 2

12. Describe the following: 2

(i) Tyndall effect

(ii) Shape-selective catalysis

13. What is meant by coagulation of a colloidal solution? Name any method by which coagulation of lyophobic sols can be carried out. 2

14. Complete the following, chemical reaction equations: 2

(i) $I_2 + \underset{\text{(cone.)}}{HNO_3} \rightarrow$

(ii) $HgCl_2 + PH_3 \rightarrow$

15. Draw the structural formulae of the following compounds: 2

(i) $H_4P_2O_5$

(ii) XeF_4

16. Give the chemical tests to distinguish between the following pairs of compounds: 2

(i) Ethylamine and Aniline

(ii) Aniline and Benzylamine

17. Identify A and B in each of the following processes : 2

(i) $CH_3CH_2Cl \xrightarrow{NaCN} A \xrightarrow[Ni/H_2]{reduction} B$

(ii) $C_6H_5NH_2 \xrightarrow{NaNO_2/HCl} A \xrightarrow[OH^-]{C_6H_5NH_2} B$

18. Draw the molecular structures of the monomers of 2

(i) PVC

(ii) Teflon

19. The density of copper metal is 8.95 g cm^{-3}. If the radius of copper atom be 127.8 pm, is the copper unit cell simple cubic, body-centred cubic or face-centred cubic? (Given: atomic mass of Cu = 63.54 g mol^{-1} and $N_A = 6.02 \times 10^{23}$ mol^{-1}) 3

20. What mass of NaCl (molar mass = 58.5 g mol^{-1}) must be dissolved in 65 g of water to lower the freezing point by 7.50°C ? The freezing point depression constant, K_f, for water is 1.86 K kg mol^{-1}. Assume van't Hoff factor for NaCl is 1.87. 3

21. Describe the role of the following: 3

(i) NaCN in the extraction of silver from a silver ore

(ii) Iodine in the refining of titanium

(iii) Cryolite in the metallurgy of aluminium

OR

Describe the principle involved in each of the following processes of metallurgy :

(i) Froth floatation method

(ii) Electrolytic refining of metals

(iii) Zone refining of metals

22. Explain the following cases giving appropriate reasons: 3

(i) Nickel does not form low spin octahedral complexes.

(ii) The π-complexes are known for the transition metals only.

(iii) Co^{2+} is easily oxidised to Co^{3+} in the presence of a strong ligand.

23. How would you differentiate between S_N1 and S_N2 mechanisms of substitution reactions? Give one example of each. 3

24. How would you convert the following: 3

(i) Phenol to benzoquinone

(ii) Propanone to 2-methylpropan-2-ol

(iii) Propene to propan-2-ol

25. How would you account for the following: 3

(i) NCl_3 is an endothermic compound while NF_3 is an exothermic one.

(ii) XeF_2 is a linear molecule without a bend.

(iii) The electron gain enthalpy with negative sign for fluorine is less than that for chlorine, still fluorine is a stronger oxidising agent than chlorine.

26. Amino acids may be acidic, alkaline or neutral. How does this happen? What are essential and non-essential amino acids? Name one of each type. 3

27. Explain the following terms with one example in each case: 3

(i) Food preservatives

(ii) Enzymes

(iii) Detergents

28. (a) Explain the following terms:

(i) Rate of a reaction

(ii) Activation energy of a reaction

(b) The decomposition of phosphine, PH_3, proceeds according to the following equation:

$$4\ PH_3\ (g) \rightarrow P_4\ (g) + 6\ H_2\ (g)$$

It is found that tile reaction follows the following rate equation:

$$\text{Rate} = k\ [PH_3].$$

The half-life of PH_3 is 37.9 s at 120° C.

(i) How much time is required for 3/4th of PH_3 to decompose?

(ii) What fraction of the original sample of PH_3 remains behind after 1 minute? 5

OR

(a) Explain the following terms:

(i) Order of a reaction

(ii) Molecularity of a reaction

(b) The rate of a reaction increases four times when the temperature changes from 300 K to 320 K. Calculate the energy of activation of the reaction, assuming that it does not change with temperature. ($R = 8.314\ J\ K^{-1}\ mol^{-1}$)

29. (a) Complete the following chemical equations:

(i) $Cr_2O_7^{2-}$ (aq) + H_2S (g) + H^+ (aq) $\rightarrow$

(ii) Cu^{2+} (aq) + I^- (aq) $\rightarrow$

(b) How would you account for the following:

(i) The oxidising power of oxoanions are in the order $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$.

(ii) The third ionization enthalpy of manganese (Z = 25) is exceptionally high.

(iii) Cr^{2+} is a stronger reducing agent than Fe^{2+}. 5

OR

(a) Complete the following chemical equations:

(i) MnO_4^- (aq) + $S_2O_4^{2-}$ (aq) + H_2O (*l*) $\rightarrow$

(ii) $Cr_2O_4^{2-}$ (aq) + Fe^{2+} (aq) + H^+ (aq) $\rightarrow$

(b) Explain the following observations:

(i) La^{3+} (Z = 57) and Lu^{3+} (Z = 71) do not show any colour in solutions.

(ii) Among the divalent cations in the first series of transition elements, manganese exhibits the maximum paramagnetism.

(iii) Cu^+ ion is not known in aqueous solutions.

30. (a) Illustrate the following name reactions giving a chemical equation in each case:

(i) Clemmensen reaction

(ii) Cannizzaro's reaction

(b) Describe how the following conversions can be brought about:

(i) Cyclohexanol to cyclohexan-l-one

(ii) Ethylbenzene to benzoic acid

(iii) Bromobenzene to benzoic acid 5

OR

(a) Illustrate the following name reactions:

(i) Hell - Volhard - Zelinsky reaction

(ii) Wolff - Kishner reduction reaction

(b) How are the following conversions carried out:

(i) Ethylcyanide to ethanoic acid

(ii) Butan-l-ol to butanoic acid

(iii) Methylbenzene to benzoic acid

Write chemical equations for the involved reactions.

Marking Scheme ó Chemistry

General Instructions

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the same meaning, such answers should be given full weightage.

2. The Marking Scheme carries only suggested value point for the answers. These are only guidelines and do not constitute the complete answers. The students can have their own expression and if the expression is correct the marks, will be awarded accordingly.

3. Some of the questions may relate to higher order thinking ability. These questions have been indicated by the mark* and the students understanding/analytical ability may be judged. These questions are to be evaluated carefully.

4. The Head-Examiners have to go through the first five answer-scripts evaluated by each evaluator to ensure that the evaluation has been carried out as per the instruction given in the marking scheme. The remaining answer scripts meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.

5. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration - Marking Scheme should be strictly adhered to and religiously followed.

6. If a question has parts, please award marks in the right hand side for each part. Marks awarded for different parts of the question should then be totalled up and written in the left hand margin and circled.

7. If a question does not have any parts, marks be awarded in the left-hand margin.

8. If a candidate has attempted an extra question, marks obtained in the question attempted first should be retained and the other answer should be scored out.

9. No Marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.

QUESTION PAPER CODE 56/1/1

EXPECTED ANSWERS/VALUE POINTS

1 Mode of conduction, through electrons in solid metal and through ions in molten state or in solution in ionic solid / Metals are malleable and ductile whereas ionic solids are hard and brittle. 1

2 The sum of powers of the concentration of the reactants in the rate law expression is called the order of that chemical reaction. 1

3 Emulsions are liquid-liquid colloidal systems. 1

4 Because NO_2 contains odd number of valence electrons and on dimerisation it is converted to stable N_2O_4 molecule with even number of electrons. 1

5 $[Co(NH_3)_5(NO_2)]Cl_2$ and $[Co(NH_3)_5(ONO)]Cl_2$ (or any other correct example) 1

6 $CH_3\ CHCl\ CH_2CH_3$ 1

7 $Ph - CO - CH_2\text{-}CH_3$ 1

8 But-3-en-1-amine 1

9 When the vapour pressure of a non-ideal solution is either higher or lower than that predicted by Raoult's law, the solution exhibits deviations. ½

These deviations are caused because of unequal intermolecular attractive forces between solute-solvent molecules and solute-solute or solvent-solvent molecules. ½

Positive deviation eg: mixture of ethanol and acetone, carbon-disulphide and acetone (any one) ½

Negative deviation eg: Chloroform and acetone, nitric acid and water (any one) ½

10 Rate $= k[A][B]^2$

(i) When the concentration of B is increased to 3 times, then rate would be

Rate $= k[A][3B]^2$ ½

$= 9k[A][B]^2$

= 9 times the initial Rate$_1$ i.e. rate is increased 9 times ½

(ii) When the concentration of A as well as B are doubled, then rate would be

Rate $= k[2A][2B]^2$ ½

$= 8k[A][B]^2$

= 8 times the initial Rate i.e. rate is increased 8 times ½

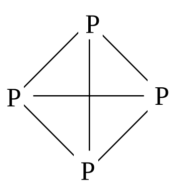
11 $[R]_t = - kt + [R]_0$ ½

$0.075M = - (0.0030 \text{ mol } L^{-1} s^{-1})t + 0.10M$ ½

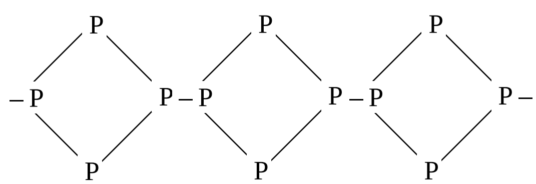
$-0.025M = -(0.0030 \text{ mol } L^{-1} s^{-1})t$

t = 8.3s 1

12



White Phosphorus



Rod Phosphorus

½, ½

White phosphorus is more reactive due to its discrete tetrahedral structure and angular strain 1

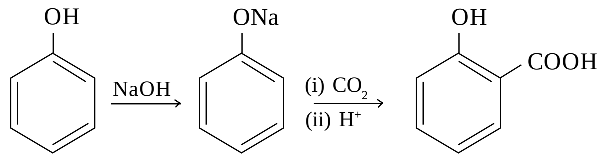
13 (i) Due to decrease in size and increasing mass.

(ii) Because of variable oxidation states exhibited by them. 1+1

14 (i) Tetraammineaquachloridocobalt(III) chloride

(ii) Dichloridobis(ethane-1,2-diamine)chromium(III) chloride 1+1

15 (i) Kolbe's Reaction



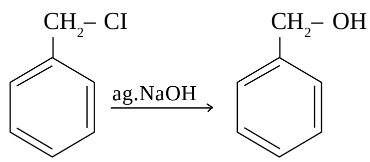
2-Hydroxybenzolc acid
(Salicylio acid) 1

(ii) Williamson Synthesis

RONa + R'Br $\rightarrow$ R – O – R' + NaBr 1

Where R and R' are alkyl groups.

16 (i)



(ii)

$$CH_3MgBr \xrightarrow{CH_3-\overset{\overset{\large O}{||}}{C}-CH_3} CH_3-\underset{\underset{\large CH_3}{|}}{\overset{\overset{\large OMgBr}{|}}{C}}-CH_3 \xrightarrow{H_2O} CH_3-\underset{\underset{\large CH_3}{|}}{\overset{\overset{\large OH}{|}}{C}}-CH_3$$ 1

(or any other suitable method)

17 i) Invert sugar: Hydrolysis of sucrose brings about a change in a sign of rotation from dextro (+) to laevo (-) and the product is named as invert sugar 1

ii) Polypeptides are the polymers of amino acids. 1

OR

Products of hydrolysis of sucrose are : Glucose and Fructose 1

Becuase Carbonyl group of sucrose is not free 1

18 Amino acids which must be supplied in our diet are called Essential Amino Acids eg. Leucine, Isoleucine, Valine (any one) ½ + ½

Amino acids which can be made by our bodies and not required in our diet are called non-essential Amino Acids eg. Glycine, Alanine (any one) ½ + ½

19 $d = \dfrac{z \times M}{a^3 \times N_A}$

For fcc lattice z = 4 1

$$3.18 \text{ g cm}^{-3} = \frac{4 \times 78.08 \text{ g mol}^{-1}}{(5.46 \times 10^{-8} \text{ cm})^3 \times N_A}$$ 1

$$N_A = \frac{4 \times 78.08 \text{ g mol}^{-1}}{(5.46 \times 10^{-8} \text{ cm})^3 \times 3.18 \text{ g cm}^{-3}}$$

$\mathbf{N_A = 6.033 \times 10^{23} \text{ mol}^{-1}}$ 1

20 $\Delta T_b = (80.31 - 80.10)^0C = 0.21^0C$ or 0.21 K

$\Delta T_b = K_b m$ 1

$$0.21\,^\circ C = 2.53\,^\circ C \text{ kg mol}^{-1} \times \frac{1.25g}{M} \times \frac{1000}{99kg}$$ 1

M ò 152 g mol $^{-1}$ 1

Where M is molar mass of the solute

21

Multimolecular colloids	Macromolecular colloids	
They are aggregates of molecules less than 1nm thick.	They themselves are large molecules of colloidal dimensions	½+½
Example :Sulphur Sol	Example :Starch	½+½

Associated colloids – are those which at low concentration behave as normal electolytes & at high concentration act as colloids. 1

22 i) Pig iron is converted into steel by adding carbon and some other elements.

ii) Metallic Zinc is obtained from Zinc oxide by reduction with coke.

Or $ZnO + C \xrightarrow{\text{Ä}} Zn + CO$

iii) Impure titanium is heated with Iodine to form volatile complex TiI_4 which on further heating to higher temperature decomposes to give pure titanium. 1x3 = 3

(or Chemical Equations to represent the above reactions)

OR

(i) Role of NaCN in the extraction of gold is to do the leaching of gold ore in the prescence of air from which the gold is obtained later by replacement. 1

or

$4Au(s) + 8CN^-(aq) + 2H_2O + O_2(g) \longrightarrow 4[Au(CN)_2]^- + 4OH^-$

(ii) SiO_2 is added in copper matte to convert the remaining FeS, FeO to slag. 1

or

$FeO + SiO_2 \longrightarrow FeSiO_3(slag)$

(iii) Iodine is heated with Zirconium to form a volatile compound which on further heating decomposes to give pure zirconium as shown: 1

$Zr(impure) + 2I_2 \xrightarrow{\Delta} ZrI_4$

$ZrI_4 \xrightarrow{\Delta} Zr(pure) + 2I_2$

23 (i) Due to Lanthanoid Contraction / or its meaning

(ii) Due to stable half –filled $3d^5$ configuration of Mn^{2+} / high 3rd ionisation enthalpy of Mn.

(iii) Becuase Oxygen or Fluorine is highly electronegative and small size element. 1x3 = 3

24 (i) DDT is used as an insecticide and Iodoform is used as a mild antiseptic. ½ + ½

(ii) (a) 1-Bromo pentane, as it is a primary alkyl halide. ½ + ½

(b) 1-Bromo-2-methyl butane, as it is a primary alkyl halide. ½ + ½

25 (i) $C_6H_5NH_2 < C_6H_5N(CH_3)_2 < CH_3NH_2 < (C_2H_5)_2NH$

(ii) p-toluidine > Aniline > p-nitroaniline

(iii) $(C_2H_5)_2NH < C_2H_5NH_2 < C_6H_5NHCH_3 < C_6H_5NH_2$ 1x3 = 3

26 (i) Polythene, PVC, (or any other one example)

(ii) Nylon-6,6, Nylon-6, Terylene (or any other one example)

(iii) Buna-S, Buna-N (or any other one example) 1x3 = 3

27 The chemical substances which are used to relieve pain. 1

These are of two types: (i) Non narcotic Drugs

(ii) Narcotic Drugs 1

Non Narcotic Drugs are effective in relieving skeletal pain / preventing heart attack / viral inflammation, etc. ½

Narcotic Drugs are recommended for the relief in postoperative pains / Cardiac pain / terminal cancer. ½

28 (i) The law states that limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the Anion and Cation of the electrolyte. 1

$Ë^{\circ}_{m\,(HAc)} = ë^{\circ}_{H+} + ë^{\circ}_{Ac^-}$ 1

(ii) $\wedge^{o}\ CH_3COOH = \wedge^{o}\ CH_3COONa + \wedge^{o}\ HCI - \wedge^{o}\ NaCI$ 1

$= (91 + 426 - 126)\ S\ cm^2\ mol^{-1}$ 1

$= \mathbf{391\ S\ cm^{2}\ mol^{-1}}$ 1

OR

(i) ***Anode Reaction : -*** $Pb + SO_4^{2-}$? $PbSO_4(s) + 2e^-$ ½

Cathode Reaction : - $PbO_2 + 4H^+ + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + 2H_2O$ ½

Net reaction:- $Pb + PbO_2 + 2SO_4^{2-} + 4H^+ \rightarrow 2PbSO_4 + 2H_2O$ 1

(ii) The cell reaction : $Cu(s) + 2\,Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2\,Ag(s)$

$E^o_{cell} =$ 0.80 V – 0.34V = 0.46V ½

Nernst equation

$$E_{cell} = E^o_{cell} - \frac{0.059}{2} \log \frac{[Cu^{2+}]}{[Ag^+]^2}$$ 1

$$E_{cell} = 0.46V - \frac{0.059}{2} \log \frac{[Cu^{2+}]}{[Ag^+]^2}$$ ½

$$0.422V = 0.46\,V - \frac{0.059}{2} \log \frac{0.10}{[Ag^+]^2}$$ 1

$$\mathbf{\log \frac{0.10}{[Ag^+]^2} = 1.2881}$$

(Full marks to be awarded upto this stage)

$[Ag^+]^2 = 0.0051$

$[Ag^+] = 7.1 \times 10^{-2}$ M

29 (a) (i) $6NaOH + 3Cl_2 \longrightarrow 5NaCl + NaClO_3 + 3H_2O$ 1

(ii) $XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$

or

$XeF_6 + 2H_2O \longrightarrow XeO_2F_2 + 4HF$

or

$XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$ 1

(b) (i) Becuase of larger size of sulphur atom than oxygen atom.

(ii) Becuase bond energy of F_2 is lower than Cl_2 and N-F bond is smaller & stronger than N-Cl bond.

(iii) Becuase it has sp^3d hybridization. 1x3 = 3

OR

(a) (i) $P_4 + 10SO_2Cl_2 \longrightarrow 4PCl_5 + 10SO_2$

(ii) $6XeF_4 + 12H_2O \longrightarrow 2XeO_3 + 4Xe + 24HF + 3O_2$ 1+1

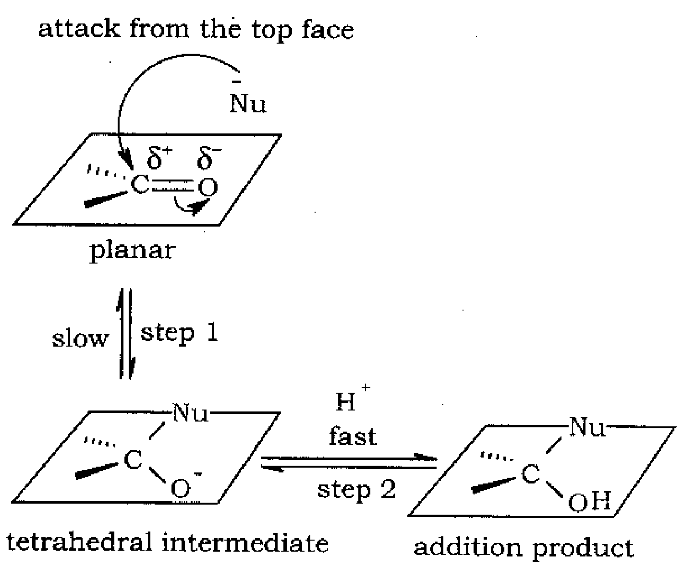
(Note: Assign marks for correct products.)

(b) (i) Becuase down the group, +3 oxidation state becomes more & more stable due to higher energy involved to unpair the s electrons / due to inert pair effect.

(ii) Due to the formation of $[PCl_4]^+ [PCl_6]^-$

(iii) Becuase they readily accept an electron. 1x3 = 3

30 (a)



2

(b)

$$\underset{A}{CH_3CH_2CH_2COOCH_2CH_2CH_2CH_3} \xrightarrow{H_2O/H^+} \underset{B}{CH_3CH_2CH_2COOH} + \underset{C}{CH_3CH_2CH_2CH_2OH}$$

$$CH_3CH_2CH_2CH_2\ OH \xrightarrow{CrO_3} CH_3CH_2CH_2COOH$$

$$CH_3CH_2CH_2\ CH_2OH \xrightarrow{H_2SO_4} CH_3CH_2CH{=}CH_2$$ 1x3 = 3

OR

(a) ***Ethanal and Propanal***

Iodoform test. Warm each compound with iodine and sodium hydroxide on a water bath.

Propanal (CH_3CH_2CHO) No yellow ppt formed

Ethanal (CH_3CHO) Yellow crystals of Iodoform are formed. 1

(Other relevant test can be accepted)

(ii) ***Phenol and Benzoic acid.***

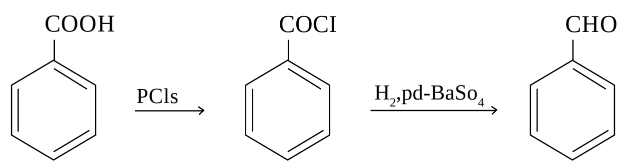
$FeCl_3$ test. Add a few drops of neutral $FeCl_3$ solution. 1

Phenol (C_6H_5OH), violet coloured ppt. is produced.

Benzoic acid (C_6H_5COOH), no ppt. is produced.

(Other relevent test can be accepted)

(b) (i)



(ii) $$2CH_3-CHO \xrightarrow{OH^-} CH_3-\underset{}{\overset{\overset{\displaystyle OH}{|}}{C}H}-CH_2-CHO \xrightarrow[-H_2O]{\Delta} CH_3-CH=CH-CHO$$

(iii) $$CH_3-\underset{\underset{\displaystyle O}{||}}{C}-CH_3 \xrightarrow{LiAlH_4} CH_3-\underset{\underset{\displaystyle OH}{|}}{CH}-CH_3 \xrightarrow{conc\ H_2SO_4} CH_3-CH=CH_2$$ 1x3 = 3

(Or by any other suitable method.)

QUESTION PAPER CODE 56/1

EXPECTED ANSWERS/VALUE POINTS

1	Dipole – Dipole interaction	1
2	It is molar conductivity at infinite dilution or approaching zero concentration	1
3	Because Fluorine is the most electronegative element.	1
4	4-bromo-3-methyl pent-2-ene	1
5	C_6H_5-CH_2-CH(OH)-CH_3	1
6	Ammoniacal solution of silver nitrate is called Tollen's reagent. It is used as an oxidizing reagent / test for –CHO group.	½ + ½
7	Carbohydrates which reduce Tollen's reagent or Fehling solution are called reducing sugars which have free aldehydic group. 1	
8	6,6 means the number of carbon atoms in the monomers of Nylon-6,6	1
9	The flow of solvent from solution of low concentration to higher concentration through semipermeable membrane is called osmosis.	½
	The hydrostatic pressure that has to be applied on the solution to prevent the entry of the solvent into the solution through the semipermeable membrane is called the Osmotic Pressure.	½
	Advantage: Unlike other colligative properties, osmotic pressure is used to determine the Molar mass of macromolecules/polymers like protein / or any other advantage	1
10	k = 1/R (l/A)	1
	Where k is conductivity, R is resistance and l/A is cell constant	
	Ëm = k/C	1
	Where Ëm is molar conductivity and C is concentration of the solution	

11 $Ag^{+} / Ag < Cu^{2+} / Cu < Fe^{2+} / Fe < Cr^{3+} / Cr < Mg^{2+} / Mg < K^{+} / K$ 2

OR

Redox Reaction

$2MnO_4^- + 5Sn^{2+} + 16H^+ \longrightarrow 2Mn^{2+} + 5Sn^{4+} + 8H_2O$ 1

$E^\circ_{cell} = E^\circ_C - E^\circ_A$

$= (+1.51 - 0.15)V = +1.36V$ ½

As E°_{cell} is positive, the reaction is **product favoured** ½

12 Tyndall Effect:- The scattering of light by the colloidal particles present in a colloidal sol is called Tyndall effect 1 + 1

Shape Selective Catalysis:- The catalytic reaction that depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape-selective catalysis.

13 Coagulation is a process of aggregating together the colloidal particles so as to change them into large particles which ultimately settle as a precipitate. 1

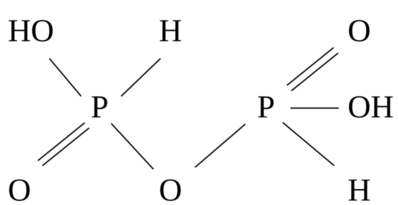
By electrophoresis, coagulation of lyophobic Sols can be carried out / or any other method. 1

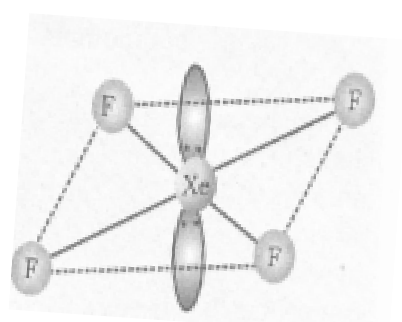
14 (i) $I_2 + 10HNO_3 \longrightarrow 2HIO_3 + 10NO_2 + 4H_2O$ 1+1

(ii) $3HgCl_2 + PH_3 \longrightarrow Hg_3P_2 + 6HCl$

Note: Assign marks for correct products.

15 (i)





1+1

16 Ethylamine and aniline

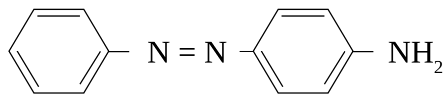
Aniline forms an azo-dye with benzenediazoniumchloride through coupling reaction whereas ethylamine does not form an azo-dye. 1

Aniline and benzylamine

Aniline forms an azo-dye with benzenediazoniumchloride through coupling reaction whereas benzylamine does not form an azo-dye. 1

(or any other suitable test)

17 (i) $A = CH_3 - CH_2 - CN$ $B = CH_3CH_2CH_2NH_2$ ½ + ½

(ii) $A = C_6H_5N_2^+Cl^-$ B = 

½ + ½

18 (i) $CH_2=CH\text{-}Cl$ 1 + 1

(ii) $CF_2=CF_2$

19 $d = \dfrac{z \times M}{a^3 \times N_A}$ 1

Assuming fcc lattice for copper

a = 2v2 r

$a^3 = (2v2\ r)^3 = 8 \times 2v2\ (1.27 \times 10^{-8} cm)^3$

$= 4.723 \times 10^{-23} cm^3$ 1

$d = \dfrac{4 \times 63.54 \text{ g mol}^{-1}}{4.723 \times 10^{-23} \text{ cm}^3 \times 6.02 \times 10^{23} \text{ mol}^{-1}}$

$= \mathbf{8.94\ g\ cm^{-3}}$ 1

Note: If any other lattice is assumed, comparing the density or z-value with the given one, may be accepted as the right procedure.

20 $\Delta T_f = 7.5^0C$

$\Delta T_f = iK_f m$ 1

$$7.5^0C = 1.87 \times 1.86^0C\ kg\ mol^{-1} \times \frac{w}{58.5g\ mol^{-1}} \times \frac{1000}{65\ kg}$$ 1

w = 8.2g 1

21 (i) Role of NaCN in the extraction of silver is to do the leaching of silver ore in the prescence of air from which the silver is obtained later by replacement. 1

or

$$4Ag(s) + 8CN^-(aq) + 2H_2O + O_2(g) \longrightarrow 4[Ag(CN)_2]^- + 4OH^-$$

(ii) Iodine is heated with titanium to form a volatile compound which on further heating decomposes to give pure titanium. 1

or

$$Ti(impure) + 2I_2 \xrightarrow{\Delta} TiI_4$$

$$TiI_4 \xrightarrow{\Delta} Ti(pure) + 2I_2$$

(iii) Cryolite lowers the melting point of mixture of alumina in the extraction of aluminium / increase the conductivity of mixture. 1

OR

(i) Froth Floatation method:- The mineral particles become wet by oils while the gangue particles by water.

(ii) Electrolytic refining: Crude metal is made as anode and pure metal as cathode. When current is passed through electrolyte of same metal ions then pure metal gets deposited at cathode and impurities settle at bottom of anode.

(iii) Zone Refining:- The impurities are more soluble in the melt than in the solid state of the metal. 1x3 = 3

22 (i) Because two inner d-orbitals are not available in Ni. 1x3 = 3

(ii) Because only d-electrons can be involved in ð-complex.

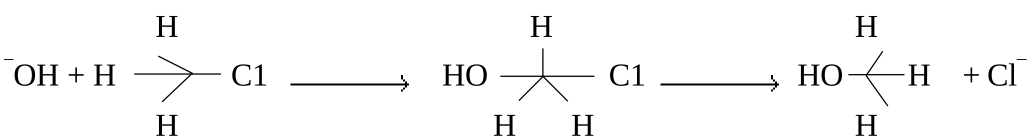
(iii) Because crystal field splitting energy is more than compensated for the third ionisation enthalpy.

23 In S_N1 it occurs in two steps and the reaction is of first order whereas in S_N2 it occurs in one step and the reaction is of second order.

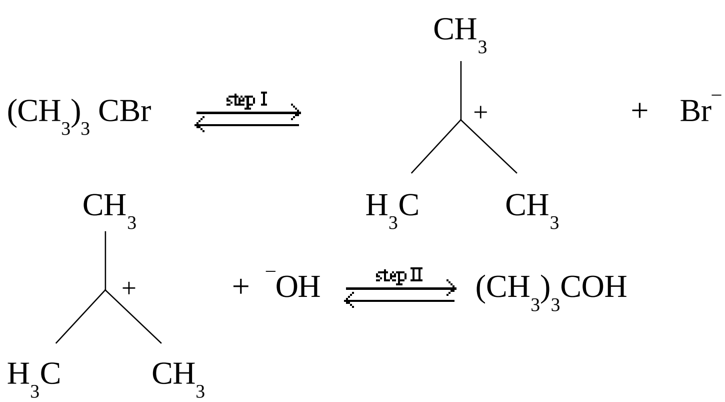
or 1

In S_N1 reaction, retention of configuration takes place whereas in S_N2 inversion of configuration occurs.

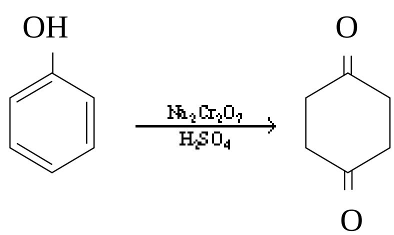
S_N2 example:

 1

S_N1 example:



24 (i)



(ii) $$CH_3-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow[H_2O]{CH_3MgBr} -CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$$

(iii) $$CH_2=CH-CH_3 \xrightarrow{H_2O/H^+} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$$ 1x3 = 3

25 (i) Because (a) bond dissociation enthalpy of F_2 is lower than that of Cl_2 and
(b) small size F atom forms stronger bond with N. 1x3 = 3

(ii) Because it has sp^3d hybridization with 3 lone pairs.

(iii) Because of (a) lower bond dissociation enthalpy of F_2 and
(b) high hydration enthalpy of F

26 Acidic amino acids contain more number of carboxyl groups than amino groups.

Basic amino acids contain more number of amino groups than carboxyl groups.

Neutral amino acids contain equal number of amino acids and carboxyl groups. 1

(or any other suggestive answer)

Those amino acids which must be supplied in our diet are called essential amino acids and those which can be made by our bodies and not required in our diet are called non-essential amino acids. 1

Essential amino acids: Valine, leucine, isoleucine, argenine (any one)

Non Essential amino acids: Glycine, alanine (any one) 1

27 (i) Food preservatives: are the compounds which prevent spoilage of food due to microbial growth. eg: sodium benzoate, vinegar (any one example) ½+½

(ii) Enzymes are the biological catalysts which increase the rate of metabolism. eg: Invertase, Zymase, (or any other one example) ½+½

(iii) Detergents are sodium salts of long chain alkyl sulphonates or benzene sulphonates. eg: Sodium Lauryl sulphate. ½+½

28 (a) (i) Rate of a reaction- Rate of Change of concentration of reactant or product with time is called rate of reaction

(ii) Activation Energy – Minimum energy which the reacting molecules should acquire so that they react to give product is called activation energy. 1+1

or

The energy required by the reactant molecules for the formation of intermediate activated complex

(b) (i) $t_{1/2} = \frac{0.693}{k}$ ½

$k = \frac{0.693}{37.9} s^{-1}$

$k = 0.0183 s^{-1}$

$t = \frac{2.303}{0.183 s^{-1}} \log \frac{[A_0]}{[A]}$ ½

$t = \frac{2.303}{0.183 s^{-1}} \log \frac{1}{1/4}$ 1

$t = 75.84 s$

(ii) $k = \frac{2.303}{60 s} \log \frac{[A_0]}{[A]}$

$\log \frac{[A_0]}{[A]} = \frac{k \times 60}{2.303}$

$= \frac{0.0183 \times 60}{2.303}$

$\log \frac{[A_0]}{[A]} = 0.4762$ 1

(Full credit may be given upto this stage)

$\frac{[A_0]}{[A]} = 2.999$

Therefore, $\frac{[A]}{[A_0]} = 0.33$

OR

(a) (i) The sum of powers of the concentration of the reactants in the rate law expression is called the order of that chemical reaction.

(ii) Molecularity – Number of molecules taking part in rate determining step of a reaction is called molecularity 1+1

(b) $\log \frac{k_2}{k_1} = \frac{Ea}{2.303\ R} \times \frac{T_2 - T_1}{T_1\ T_2}$ 1

$\log 4 = \frac{Ea}{2.303 \times 8.314\ JK^{-1}\ mol^{-1}} \times \frac{320 - 300}{300 \times 320}\ K^{-1}$ 1

$0.6020 = \frac{Ea}{2.303 \times 8.314\ JK^{-1}\ mol^{-1}} \times \frac{20}{96 \times 10^3}\ K^{-1}$

Ea $= 55336.7\ J\ mol^{-1}$

$= 55.33\ kJ\ mol^{-1}$ 1

29 (a) (i) $Cr_2O_7^{2-} + 3H_2S + 8H^+ \longrightarrow 2Cr^{3+} + 7H_2O + 3S$

(ii) $2Cu^{2+} + 4I^- \longrightarrow Cu_2I_2 + I_2$ 1+1

(b) (i) It is due to increasing stability of lower species to which they are reduced.

(ii) Because removing 3^{rd} e^- from extra stable $3d^5$ configuration is difficult in case of Mn

(iii) Because d^3 of Cr^{2+} is more stable than d^5 of Fe^{3+} 1x3 = 3

OR

(i) $8MnO_4^- + 3S_2O_3^{2-} + H_2O \longrightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

(ii) $Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \longrightarrow 2Cr^{3+} + 6Fe^{3+} + 7H_2O$ 1+1

(b) (i) In La^{3+}, there is no f electrons while in Lu^{3+}, there is presence of f^{14} / absence of unpaired electron / due to d-d transition.

(ii) Mn^{2+} has $3d^5$ configuration having 5 unpaired electrons

(i) Cu^+ undergoes disproportionation in aqueous solution. 1x3 = 3

or

$2Cu^+ \longrightarrow Cu^{2+} + Cu$

30 (a) (i) Clemmensen reduction

$$>C=O \xrightarrow[HCl]{Zn-Hg} >CH_2 + H_2O$$

(a) (ii) **<u>Cannizzaro reaction:</u>**

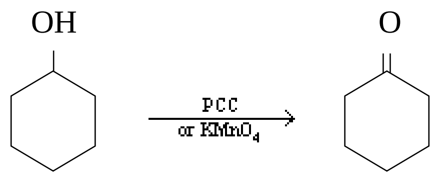
$$\begin{matrix} H \\ H \end{matrix}\!\!>C=O + \begin{matrix} H \\ H \end{matrix}\!\!>C=O + KOH\ (conc.)$$

formaldehyde

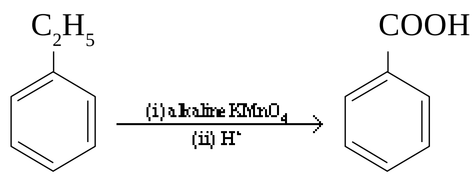
$$\longrightarrow H-\underset{H}{\overset{H}{\underset{|}{\overset{|}{C}}}}-OH + H-C\!\!\begin{matrix} \nearrow\!\!\!\!\!\!= O \\ \searrow OK \end{matrix}$$

Methanol sodium formate

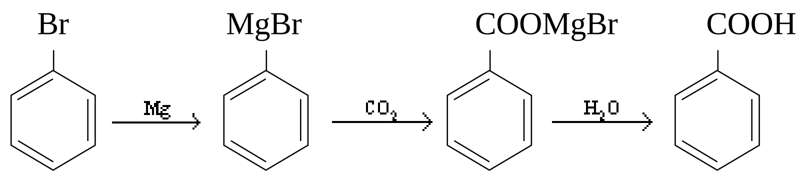
(b) (i)



(i)



(iii)



1x3 = 3

(or by any other suitable method)

OR

(a) (i) **<u>Hell-Volhard-Zelinsky reaction</u>**

$$R\text{-}CH_2\text{–}COOH \xrightarrow[\text{(ii) } H_2O]{\text{(i) } X_2\text{/Red Phosphorus}} R - \underset{\underset{X}{|}}{CH} - COOH$$

1

X = Cl, Br

(ii) **<u>Wolf-kishner reduction</u>**

$$>C = O \xrightarrow[-H_2O]{NH_2NH_2} >C = NNH_2 \xrightarrow[\text{heat}]{\text{KOH/ethylene glycol}} >CH_2 + N_2$$

1

(wolff-Kishner rduction)

(b) (i) $C_2H_5 - CN \xrightarrow[\text{(partial)}]{H_2O/H^+} CH_3 - CH_2 - CONH_2 \xrightarrow{Br_2/KOH} CH_3 - CH_2 - NH_2$

$\xrightarrow{HNO_2} CH_3 - CH_2 - OH \xrightarrow[KMnO_4]{(O)} CH_3COOH$

(ii) $CH_3 - CH_2 - CH_2 - CH_2 - OH \xrightarrow[KMnO_4]{(O)} CH_3 - CH_2 - CH_2 - COOH$ 1x3 = 3

(i)