Sample Question Paper- I
CHEMISTRY
BLUE PRINT
CLASS - XII

Time Allowed : 3 Hrs **Maximum Marks : 70**

S.R.	UNIT	VSA (1)	SAI(2)	SA II(3)	LA (5)	TOTAL
1	Solid State		4(2)			4 (2)
2	Solutions				5 (1)	5 (1)
3	Electrochemistry		2(1)	3(1)		5 (2)
4	Chemical Kinetics	1(1)	4(2)			5 (3)
5	Surface Chemistry	1(1)		3(1)		4 (2)
6	General Principles and processes of isolation of elements			3(1)		3 (1)
7	p-block elements	1(1)	4 (2)	3 (1)		8 (4)
8	d & f- block elements				5 (1)	5 (1)
9	Co-ordination Compounds	1 (1)	2 (1)			3 (2)
10	Haloalkanes and haloarenes	1 (1)		3 (1)		4(2)
11	Alcohols, Phenols & Ethers	1 (1)		3 (1)		4(2)
12	Aldehydes, Ketones & Carboxylic Acids	1 (1)			5 (1)	6 (2)
13	Organic compounds containing Nitrogen		4 (2)			4 (2)
14	Biomolecules	1 (1)		3 (1)		4 (2)
15	Polymers			3 (1)		3 (1)
16	Chemistry in everyday life			3 (1)		3 (1)
	TOTAL:	**8 (8)**	**20(10)**	**27(9)**	**15(3)**	**70(30)**

DESIGN

S No.	Type of Question	Marks for each Question	No. of Questions	Total Marks
1.	Long Answers (LA)	5	3	15
2.	Short Answers-II (SA II)	3	9	27
3.	Short Answers-I (SA-I)	2	10	20
4.	Very Short Answer (VSA)	1	08	08
	Total		**30**	**70**

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General Instructions:

1. All questions are compulsory
2. Question no. 1-8 are very short answer questions and carry 1 mark each.
3. Question no. 9-18 are short answer questions and carry 2 marks each.
4. Question no. 19-27 are also short answer questions and carry 3 marks each.
5. Question no. 28-30 are long answer questions and carry 5 marks each
6. Use log tables if necessary, use of calculators is not allowed.

1. Why $LiC\ell$ acquires pink colour when heated in Li vapours?
2. Write the product obtained at anode on electrolysis of concentrated sulphuric acid using platinum electrodes.
3. For the reaction

   $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

   If $\Delta [NH_3] / \Delta t = 4 \times 10^{-8}$ mol L^{-1} s^{-1}, what is the value of $-\Delta [H_2] / \Delta t$.?
4. Which of the following is most effective electrolyte in the coagulation of $Fe_2O_3.H_2O/Fe^{3+}$ sol?

   $KC\ell$, $AlCl_3$, $MgCl_2$, $K_4[Fe(CN)_6]$
5. Write the overall reaction taking place in the process used for the electrolysis of Alumina by Hall- Heroult process.
6. Which Xenon compound is isostructural with $IC\ell_4^-$?
7. What happens to the colour of coordination compound $[Ti(H_2O)_6]\ Cl_3$ when heated gradually?
8. Write the structure of phenyl isopentylether.
9. (i) For a weak electrolyte molar conductance in dilute solution increases sharply as its concentration in solution is decreased. Give reason.

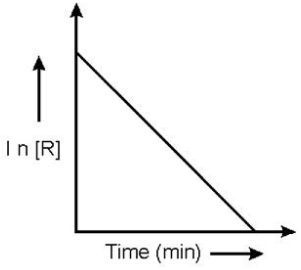
   (ii) Write overall cell reaction for lead storage battery when the battery is being charged.
10. Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law with $t_{1/2}$ = 3hrs. Calculate the fraction of sucrose which remains after 8hrs.

OR

The rate constants of a reaction at 500K and 700K are 0.02 s^{-1} and 0.07 s^{-1} respectively. Calculate value of activation energy for the reaction [Given R=8.314$JK^{-1}Ml^{-1}$].

11. For a chemical reaction variation in concentration,

ln[R] Vs time (min) plot is shown below:



(i) What is the order of the reaction?

(ii) What are units of rate constant, k for the reaction?

(iii) If initial concentration of the reactant is half of the original concentration how will $t_{1/2}$ change?

(iv) Draw the plot of log $[R]_0$ / [R] VS time(s).

12. (i) Draw the structure of phosphinic acid (H_3PO_2)

(ii) Write a chemical reaction for its use as reducing agent.

13. (a) Suggest a quantitative method for estimation of the gas which protects us from U.V. rays of the sun.

(b) Nitrogen oxides emitted from the exhaust system of supersonic jet aeroplanes slowly deplete the concentration of ozone layer in upper atmosphere. Comment.

14. (a) Give the electronic configuration of the d-orbitals of Ti in $[Ti(H_2O)_6]^{3+}$ ion and explain why this complex is coloured? [At.No. of Ti = 22]

(b) Write IUPAC name of $[Cr(NH_3)_3(H_2O)_3]c\ell_3$

15. Show the mechanism of acylation of ethanamine and write the IUPAC name of the product formed.

16. Write a chemical equation each to represent

(a) Gatterman reaction

(b) Carbylamine reaction

17. Sodium crystallizes in a bcc unit cell. Calculate the approximate number of unit cells in 9.2g of sodium? (Atomic Mass of Na =23u)

18. What is a semiconductor? Describe the two main types of semiconductors.

19. a) Calculate the charge in coloumbs required for oxidation of 2 moles of water to oxygen? [Given IF = 96, 500 C mol^{-1}]

b) Zinc/silver oxide cell is used in hearing aids and electric watches. The following reactions occur:

$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$ $\quad E^0Zn^{2+} / Zn = -0.76v$

$Ag_2O + H_2O + 2e^- \rightarrow 2Ag + 2OH^-$ $\quad E^0 Ag^+ / Ag = 0.344v$

Calculate (i) standard potential of the cell

(ii) standard Gibbs energy

20. Give reasons for the following observations:

(a) Peptizing agent is added to convert precipitate into colloidal solution.

(b) Cottrell's smoke precipitator is fitted at the mouth of chimney used in factories.

(c) Colloidal gold is used for intramuscular injection.

21. (a) Extraction of Au by leaching with NaCN involves both oxidation and reduction. Justify by giving equations for the reactions involved.

(b) Why is the froth flotation method selected for the concentration of sulphide ores?

OR

Outline the principle of the method used for refining of

(a) Nickel

(b) Zirconium

(c) Tin

22. Write balanced chemical equations for the following reactions:-

(a) Thermal decomposition of ammonium dichromate.

(b) Reaction of Cl_2 with cold and dilute NaOH.

(c) When Phosphine is passed through mercuric chloride solution.

23. Account for following:

(a) Chloromethane reacts with KCN to form ethanenitrile as main product and with AgCN to form methyl isocyanide as chief product.

(b) Use of DDT was banned in United States in 1973.

(c) Benzylic halides show high reactivity towards SN1 reaction.

24. (a) Give one reaction of D-glucose which can not be explained by its open chain structure.

(b) Give one example each for essential and non-essential amino acids.

(c) Differentiate between keratin and insulin.

25. (a) Identify aliphatic biodegradable polyester which is used in packaging and orthopedic devices.

(i) Write its full form.

(ii) Give the structures of monomers from which it is formed.

(iii) Show the formation of polymer.

b) Write the name and structure of the monomer of nylon-6

26. (a) Justify the following:

(i) Sleeping pills are recommended to patients suffering from sleeplessness but it is not advisable to take them without consulting the doctor.

(ii) Why do we require artificial sweetening agents?

(b) Write the composition of Dettol.

27. (a) Give chemical tests to distinguish between:

(i) Isopropyl alcohol and n-propylalcohol

(ii) Phenol and alcohol

(iii) Methyl ethanoate and Ethyl ethanoate

28. (a) Menthol is a crystalline substance with peppermint taste. A 6.2% solution of menthol in cyclohexane freezes at -1.95°C. Determine the formula mass of menthol. The freezing point and molal depression constant of cyclohexane are 6.5 °C and 20.2 K m^{-1}, respectively.

(b) State Henry's Law and mention its two important applications.

(c) Which of the following has higher boiling point and why?

0.1 M NaCl or 0.1 M Glucose

OR

(a) Define Azeotropes and explain briefly minimum boiling azeotrope by taking suitable example.

(b) The vapour pressures of pure liquids A and B are 450 mm and 700 mm of Hg respectively at 350K. Calculate the composition of liquid mixture if total vapor pressure is 600 mm of Hg. Also find the composition of the mixture in vapour phase.

Q.29: (a) (i) Which is stronger reducing agent Cr^{2}+ or Fe^{2}+ and why?

(ii) Explain why Cu^{+} ion is not stable in aqueous solutions.

(iii) Explain why Ce^{4+} is a strong oxidizing agent.

(b) Describe the oxidizing property of $KMnO_4$ in neutral or faintly alkaline medium for its reaction with iodide ions and thiosulphate ions.

OR

(a) Account for the following:

(i) Oxidizing power in the series $VO^{2+} < Cr_2O_7^{2-} < MnO_4^-$

(ii) Actinoid contraction is greater from element to element than lanthanoid contraction.

(iii) Oxoanions of a metal show higher oxidation state.

(b) What is Misch metal? Give its one use.

30. (a) An organic compound (A) which has characteristic odour, On treatment with NaOH it forms two compounds (B) and (C). Compound (B) has molecular formula C_7H_8O which on oxidation gives back (A). The compound (C) is a sodium salt of an acid. When (C) is treated with soda lime it yields an aromatic hydrocarbon (D). Deduce the structures of (A), (B), (C) and (D). Write the sequence of reactions involved.

(b) Arrange the following in the increasing order of the property: indicated:

(i) Benzoic acid, 4-Nitro benzoic acid, 3,5-dinitrobenzoic acid, 4-Methoxybenzoic acid **(acid strength)**

(ii) Acetaldehyde, Acetone, Di-tertbutylketone, Methyltert-butyl ketone **(Reactivity towards HCN).**

OR

(a) Complete each synthesis by filling the missing starting materials, reagents or products.(X,Y and Z)

(i) $C_6H_5CHO + CH_3CH_2CHO \xrightarrow{NaOH} X$

(ii) $CH_3CH_2CH_2CH_2OH \xrightarrow{Y} CH_3CH_2CH_2COOH$

(iii) $CH_3(CH_2)_9COOC_2H_5 \xrightarrow{Z} CH_3(CH_2)_9CHO$

(b) How will you bring about the following conversions in not more than two steps?

(i) Toulene to Benzaldehyde

(ii) Ethylcyanide to 1-Phenylpropanone.

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MARKING SCHEME
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1. Because on heating electrons are trapped at the anionic sites forming F-centres which absorb energy from visible light and radiate pink colour. 1

2. $S_2O_8^{2-}(aq)$ 1

3. $6 \times 10^{-8}\ mol L^{-1}s^{-1}$ 1

4. $K_4[Fe(CN)_6]$ 1

5. $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$ 1

6. XeF_4 1

7. Its colour becomes lighter on heating. 1

8. $C_6H_5 - O - CH_2 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$ 1

9. (i) Because with dilution, there is increase in degree of dissociation and consequently the number of ions in total volume of solution increases and hence molar conductivity increases sharply.

   (ii) $2PbSO_4(s) + 2H_2O(\ell) \rightarrow Pb(s) + PbO_2(s) + 4H+(aq) + 2SO_4^{2-}(aq)$ 1

10. $k = \dfrac{0.693}{t_{1/2}}$ 1

$$k = \frac{0.693}{3\ hr} = 0.231 hr^{-1}$$

$$0.231 hr^{-1} = \frac{2.303}{8\ hr} \log \frac{[A]_0}{[A]}$$

$$\frac{[A]}{[A]_0} = 0.158$$ 1

OR

(b) $\log \frac{k_2}{k_1} = \frac{Ea}{2.303\,R}\left[\frac{T_2 - T_1}{T_1 - T_2}\right]$ ½

$\log \frac{0.07}{0.02} = \frac{Ea}{2.303 \times 8.314}\left[\frac{700 - 500}{700 \times 500}\ K^{-1}\right]$

$JK^{-1}\ mol^{-1}$

$0.5441 = \frac{Ea}{2.303 \times 8.314}\left[\frac{200}{700 \times 500}\ K^{-1}\right]$ ½

$JK^{-1}\ mol^{-1}$

Ea = 18231 J mol^{-1}

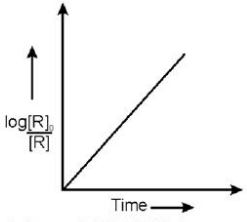
= 18.231 kJ mol-1 1

11. (i) Ist order

(ii) min^{-1}

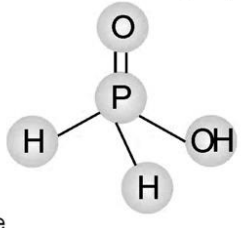
(iii) t½ remain same as it is independent of $[R]_0$

(iv)



½ x4=2

12. Phosphinic acid (H_3PO_2)



1

Evidence

$H_3PO_2 + 4\ AgNO_3 + 2H_2O \rightarrow 4Ag + 4HNO_3 + H_3PO_4$ 1

H_3PO_2 reduces Ag^+ to Ag which shows its reducing nature.

13. (a) $O_3 + 2I^- + H_2O \rightarrow O_2 + I_2 + 2OH^-$ 1

I_2 liberated is then titrated against sodium thiosulphate solution and amount of O_3 can be estimated.

(b) $NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$ 1

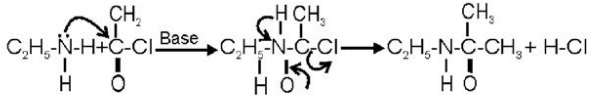
'NO' combines rapidly with O_3 forming oxygen and thus is slowly depleting the concentration of the ozone. 1

14. (a) $Ti^{3+} = 3d^1\ 4s^0$

Due to d-d transition, complex is coloured. 1

(b) Triamminetriaquachromium (III) chloride 1

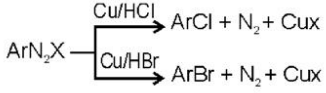
15. Mechanism



1

IUPAC name N-Ethylethanamide 1

16. (a) Gatterman Reaction for introduction of chlorine or bromine in the benzene ring. 1



(b) Carbylamine Reaction to test for presence of primary amines. 1

$$Ar/R\text{-}NH_2 + CHCl_3 + 3\ KOH\ (alc) \rightarrow Ar/R\text{-}NC + 3KCl + 3H_2O$$

Isocyanide (Foul Smelling)

17. (a) no. of atoms per unit cell for bcc(z) = 2

no. of atoms in 9.2 g of Na

$$= \frac{9.2\ g}{23\ gmol^{-1}} \times 6.022 \times 10^{23}\ atoms\ mol^{-1}$$ ½

No. of Na atoms = $2.408\ 8 \times 10^{23}$ 1

No. of unit cells $\frac{2.4088 \times 10^{23} atoms}{2 atoms\ unit\ cell^{-1}} = 1.2044 \times 10^{23}$ ½

18. Semiconductor is a solid with conductivity in the intermediate range form 10^{-6} to 10^4 $Ohm^{-1}\ m^{-1}$. 1

(i) n-type Semiconductor : They have excess of electrons e.g Ge doped with As. ½

(ii) p- type Semiconductor : They have electron vacancy or hole eg Si doped with B. ½

19. (a) $2H_2O \rightarrow 4H^+ + O_2 + 4e^-$ ½

Therefore Q = 4F

$= 4 \times 96500\ C\ mol^{-1}$

$= 386000\ C\ mol^{-1}$ ½

(b) Zn is oxidized and Ag_2O is reduced to Ag

$\overset{\circ}{E}cell = \overset{\circ}{E}Cathode - \overset{\circ}{E}anode = [\,0.344 - (\,-0.76)\,]\ V$

$= 1.104\ V$ 1

$\Delta G^{\circ} = n F \overset{\circ}{E}cell$

$= -2 \times 96500\ C\ mol^{-1} \times 1.104\ V$

$= -2.13 \times 10^5\ J\ mol^{-1}$ 1

20. (a) Addition of peptizing agents to precipitate develops either positive or negative charge by adsorbing ions of the electrolyte; which break up the precipitate into smaller particles of the size of a colloid.

(b) The precipitator containing plates having a charge opposite to that carried by smoke particles which lose their charge and get precipitated and smoke is thus, free form carbon and dust particles after passing through chimney.

(c) Because of larger surface area of colloidal gold and easy assimilation with the blood which is colloidal. 1x3 =3

21. (a) Oxidation of Au

$4Au(s) + 8CN^-(aq) + 2H_2O + O_2(g) \rightarrow 4[Au(CN)_2]^- + 4OH^-$ 1

Reduction of Au^+ tu Au 1

$2[Au(CN)_2]^- + Zn \rightarrow [Zn(CN)_4]2^- + 2Au$

(b) Because sulphide ores are preferentially wetted by oil and impurities by water. 1

OR

(a) Nickel : Mond's Process : Impure nickel on reaction with carbon monoxide forms tetracarbonyl nickel which decomposes to form pure nickel and carbon monoxide.

(b) Zircorium : Vam-Ankel Method : Impure metal Z_r is heated with I_2 to get $Z_r I_4$ which is heated strongly at 2075K to get pure Z_r.

(c) Tin : Liquation: Impure metal is heated at the top of sloping furnace so that tin melts but impurity does not. Molten tin flows down and pure tin so formed is collected. 1 X 3=3

22. (i) $(NH4)_2 Cr_2O_7 \xrightarrow{\Delta} N_2(g) + Cr_2O_3 + 4H_2O$

(ii) $2NaOH + Cl_2 \rightarrow NaCl + NaClO + H_2O$

(cold and dilute)

(iii) $3HgCl_2 + 2PH_3 \rightarrow Hg_3P_2 + 6HCl$ 1x3 = 3

23. (a) Because with KCN, C act as a nucleophile due to ionic nature of K-C bond whereas with AgCN, N act as a nucleophile due to covalent nature of Ag-C bond.

(b) Due to chemical stability of DDT and its fat solubility it is not metabolized very rapidly by animals and hence is banned in US.

(c) Due to high stability of benzyl carbocation through Resonance. 1x3=3

24. (a) Despite having the presence of aldehyde group, glucose does not give 2,4 DNP test/schiff's test/ does not form the hydrogen sulphite additon product with $NaHSO_3$

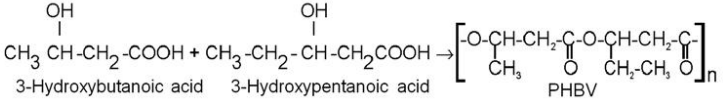
(b) Essential aminoacid-valine; non-essential amino acid = glycine

(c) keratin is a fibrous protein whereas insulin is a globular protein. 1x3=3

25. (a) PHBV

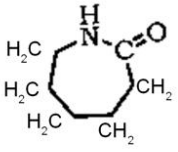
(i) Poly β - Hydroxybutyrate-co - β -Hydroxyvalerate

(ii) CH_3- $CH(OH)CH_2COOH$ and CH_3-CH_2-$CH(OH)CH_2COOH$

(iii) 

½ X4=2

(b) (iii) Nylon-6:Caprolactam


1

26. (a)

(i) Because most of the drugs act as poison in higher doses and may lead to death.

(ii) To control calorie intake and as a substitute of sugar for diabetics.

(b) Chloroxylenol and terpineol 1x3=3

27. (a)

(i) Isopropyl alcohol and n-propyl alcohol

On adding NaOH/I_2 or NaOI and heating, Isopropyl alcohol forms yellow ppt of iodoform(CHI_3) whereas n-propyl alcohol does not. (or any other suitable test)

(ii) Phenol and alcohol

On adding neutral $FeCl_3$ solution, Phenol forms red-violet complex whereas alcohol does not.

(or any other suitable test)

(iii) methyl ethanoate and ethyl ethanoateIodoform test:- On hydrolysis, ethylethanoate gives ethanol which on heating with NaOI gives yellow ppt. of CHI_3 whereas Methyl Ethanoate on hydrolysis gives Methanol which does not form Iodoform with NaOI.

1x3=3

28. (a) $\Delta T_f = K_f m = \frac{W_B}{M_B} X \frac{1000g}{W_A}$ ½

$$8.45\,K = 20.2\,K\,kg\,Mol^{-1} \times \frac{6.2g}{M_B} \times \frac{1000g}{93.8\,kg}$$ ½

$M_B = 158$ g mol-1 1

(b) **Henry's Law :** The Solubility of gas in a liquid is directly proportional to the pressure of the gas. 1

Applications : 1. Solubility of CO_2 is increased at high pressure. ½

2. Mixture of He and O_2 are used by deep sea divers because He is less soluble than nitrogen ½

(c) 0.1 M NaCl, Because it dissociates in solution and furnishes greater number of particles per unit while glucose does not dissociate. 1

OR

(a) Azeotropes : is a liquid mixture which boils at constant temperature without undergoing change in composition .

Ex- A mixture of 95% ethanol and 5% H_2O by mass forms minimum boiling Azeotropes i.e it boils at a temperature lower than expected from ideal behavior, as it shows positive deviation from ideal behaviour. 1+1

(b) $p_B^\circ = 450$ mm Hg $p_B^\circ = 700$ mm Hg

$p = p_A^\circ X_A + p_B^\circ X_B$ 1

$600 = 450\,(X_A) + 700\,(1 - X_A)$

On solving

$X_A = 0.4$ ½ + ½

$X_B = 0.6$

in vapour phase

$p_A = 0.4 \times 450$ mm $= 180$ mm Hg : $p_B = 0.6 \times 700$ mm $= 420$ mm Hg

$$X_A = \frac{180mm}{600mm} = 0.3$$

$$: \quad X_B = \frac{420mm}{600mm} = 0.7$$ 1

29. (a)

(i) Cr^{2+} is stronger reducing agent than Fe^{2+} due to its change from d^4 to stable d^3 configuration incase of Cr^{2+} to Cr^{3+} than d^6 to d^5 in Fe^{2+} to Fe^{3+}Change.

(ii) Because Cu+ in aqueous solution undergoes disproportionation to more stable Cu^{2+} and Cu.

(iii) Because Ce is more stable in +3 oxidation state. 1x3=3

(b) $2MnO_4^- + I^- + H_2O \rightarrow 2MnO_2 + IO_3^- + 2OH^-$

$$8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$$ 1+1

OR

(a) (i) This is due to the increasing stability of the lower species to which they are reduced.

(ii) Due to poor shielding effect of 5f electrons of actinoids than 4f electron of anthanoids.

(iii) Due to high electronegativity and multiple bond formation with metal by oxygen. 1x3=3

(b) Misch metal is an alloy of a Lanthanoids metal and iron and traces of S, Ca, C and Al. It is used in making bullets and lighter flint (any one)

30.

$$\underset{(A)}{C_6H_5CHO} \xrightarrow{NaOH} \underset{(B)}{C_6H_5CH_2OH} + \underset{(C)}{C_6H_5COONa}$$ 1

$$\underset{(C)}{C_6H_5COONa} \xrightarrow{NaOH/CaO} \underset{(D)}{C_6H_6}$$

(A) C_6H_5CHO

(B) $C_6H_5CH_2OH$

(C) C_6H_5COONa

(D) C_6H_6 ½x4=2

(b) (i) 4- methoxybenzoic acid < Benzoic acid < 4-nitrobenzoic acid < 3,5- dinitrobenzoic acid.

(ii) Di tertbutylketone < methyl t-butylketone < Acetone < Acetaldehyde 1+1

OR

(a) (i) $C_6H_5CHO + CH_3CH_2CHO \xrightarrow{NaOH} C_6H_5CH(OH)CH(CH_3)CHO$

(ii) $CH_3CH_2CH_2CH_2OH \xrightarrow{KMnO_4} CH_3CH_2CH_2COOH$

(iii) $CH_3(CH_2)_9\,COOC_2H_5 \xrightarrow{DIBAL\text{-}H\ /H_2O} CH_3(CH_2)_9\,CHO$ 1X3=3

(b) Toluene to Benzaldehyde

$$C_6H_5\text{-}CH_3 \xrightarrow{Cl_2/hv} C_6H_5\text{-}CHCl_2 \xrightarrow[373K]{H_2O} C_6H_5\text{-}CHO$$

(ii) EthylCyanide to 1- PhenylPropanone

$$CH_3CH_2CN \xrightarrow{PhMgBr} PhC{=}(N\,MgBr)CH_2CH_3 \xrightarrow{H_2O} PhCOCH_2CH_3$$ 1+1