SAMPLE PAPER XII 2019-20

CHEMISTRY

Time : 3 hrs. **M. Marks : 70**

General Instructions

- (a) *All questions are compulsory.*
- (b) *Section A: Q.no. 1 to 20 are very short answer questions (objective type) and carry 1 mark each.*
- (c) *Section B: Q.no. 21 to 27 are short answer questions and carry 2 marks each.*
- (d) *Section C: Q.no. 28 to 34 are long answer questions and carry 3 marks each.*
- (e) *Section D: Q.no. 35 to 37 are also long answer questions and carry 5 marks each.*
- (f) *There is no overall choice. However an internal choice has been provided in two questions of two marks, two questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.*
- (g) *Use log tables if necessary, use of calculators is not allowed.*

SECTION - A

Read the given passage and answer the questions 1 to 5that follow:

A Lead storage battery is the most important type of secondary cell having a lead anode and a grid of lead packed with PbO_2 as cathode. A 38% solution of sulphuric acid is used as electrolyte. (Density=1.294 g mL^{-1}) The battery holds 3.5 L of the acid. During the discharge of the battery, the density of H_2SO_4 falls to 1.139 g mL^{-1}. (20% H_2SO_4 by mass)

(1) Write the reaction taking place at the cathode when the battery is in use.
(2) How much electricity in terms of Faraday is required to carry out the reduction of one mole of PbO_2?
(3) What is the molarity of sulphuric acid before discharge?
(4) Lead storage battery is considered a secondary cell. Why?
(5) Write the products of electrolysis when dilute sulphuric acid is electrolysed using Platinum electrodes.

Questions 6 to 10 are one word answers:

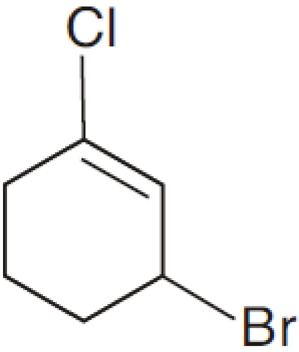
(6) Name the substance used as depressant in the separation of two sulphide ores in Froth floatation method.
(7) Name the unit formed by the attachment of a base to 1′ position of sugar in a nucleoside.
(8) Name the species formed when an aqueous solution of amino acid is dissolved in water?
(9) What type of reaction occurs in the formation of Nylon 6,6 polymer?

(10) Which of the following compoundswould undergo cannizzaro reaction:

Benzaldehyde, Cyclohexanone, 2- Methylpentanal.

Questions 11 to 15 are multiple choice questions:

(11) The IUPAC name of the compound shown below is:



(a) 2-bromo-6-chlorocyclohex-1-ene
(b) 6-bromo-2-chlorocyclohexene
(c) 3-bromo-1-chlorocyclohexene
(d) 1-bromo-3-chlorocyclohexene

(12) When one mole of $CoCl_3.5NH_3$ was treated with excess of silver nitrate solution, 2 mol of AgCl was precipitated. The formula of the compound is:

(a) $[Co(NH_3)_5Cl_2]Cl$

(b) $[Co(NH_3)_5Cl]Cl_2$

(c) $[Co(NH_3)_4Cl_2]\ (NH_3)Cl$

(d) $[Co(NH_3)_3Cl_3]\ (NH_3)_2$

(13) The absorption maxima of several octahedral complex ions are as follows:

S.No	Compound	λ_{max} nm
1	$[Co(NH_3)_6]^{3+}$	475
2	$[Co(CN)_6]^{3-}$	310
3	$[Co(H_2O)_6]^{3+}$	490

The crystal field splitting is maximum for :

(a) $[Co(H_2O)_6]^{3+}$

(b) $[Co(CN)_6]^{3-}$

(c) $[Co(NH_3)_6]^{3+}$

(d) All the complex ions have the same splitting, Δ_o ,

(14) Predict the number of ions produced per formula unit in an aqueous solution of $[Co(en)_3]Cl_3$

(a) 4

(b) 3

(c) 6

(d) 2

(15) The incorrect statement about LDP is:

(a) It is obtained through the free radical addition of ethene.

(b) It consists of linear molecules.

(c) It is obtained by the H-atom abstraction.
(d) Peroxide is used as an initiator.

Questions 16 to 20 :

(A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
(B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

(C) Assertion is correct, but reason is wrong statement.

(D) Assertion is wrong, but reason is correct statement.

16. Assertion: The two strands in double strand helix structure of DNA are complementary to each other

Reason: Disulphide bonds are formed between specific pairs of bases

17. Assertion: Glucose reacts with hydroxylamine to form an oxime and alsoadds a molecule of hydrogen cyanide to give cyanohydrin.

Reason: The carbonyl group is present in the open chain structure of glucose.

18. Assertion: The acidic strength of halogen acids varies in the order HF>HCl>HBr>HI

Reason: The bond dissociation enthalpy of halogen acids decreases in the order HF>HCl>HBr>HI

19. **Assertion**: **C_2H_5OH is a weaker base than phenol but is a stronger nucleophile than phenol. (1)**

Reason: **In phenol the lone pair of electrons on oxygen is withdrawn towards the ring due to resonance.**

20. Assertion: **Aryl halides undergo nucleophilic substitution reactions with ease.**

Reason:**The carbon halogen bond in aryl halides has partial double bonds character.**

SECTION : B

21. Calculate the number of lone pairs on central atom in the following molecule and predict the geometry.

XeF_4

22. The rate of a reaction depends upon the temperature and is quantitatively expressed as

$$k = Ae^{-E_a/RT}$$

i) If a graph is plotted between log k and 1/T, write the expression for the slope of the reaction?

ii) If at under different conditions E_{a1} and E_{a2} are the activation energy of two reactions If E_{a1} = 40 J / mol and E_{a2} = 80 J / mol. Which of the two has a larger value of the rate constant?

23. The experimentally determined molar mass for what type ofsubstances is always lower than the true value when water is used as solvent. Explain. Give one example of such a substance and one example of a substance which does not show a large variation from the true value.

24. **Write structure of the products formed:**

(a) $CH_3CH_2COOH \xrightarrow[\Delta]{c\ell_2, red\ P_4}$

(b) $C_6H_5COC\ell \xrightarrow[\Delta]{H_2, Pd-BaSO_4}$

25. Draw one of the geometrical isomers of the complex $[Pt(en)_2Cl_2]^{2+}$ which is optically inactive. Also write the name of this entity according to the IUPAC nomenclature.

OR

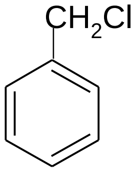
Discuss the bonding in the coordination entity $[CO(NH_3)_6]^{3+}$ on the basis of valence bond theory. Also, comment on the geometry and spin of the given entity. (Atomic no. of Co= 27)

26. What is meant by Vapour phase refining? Write any one example of the process which illustrates this technique, giving the chemical equations involved.

OR

Write and explain the reactions involved in the extraction of gold.

27. Which one of the following compounds will undergo hydrolysis at a faster rate by S_N1 mechanism? Justify.



or $CH_3CH_2CH_2Cl$

SECTION: C

28. Calculate the freezing point of a solution containing 0.5 g KCl (Molar mass = 74.5 g/mol) dissolved in 100 g water, assuming KCl to be 92% ionized.

K_f of water = 1.86 K kg / mol.

29. For the reaction A + B →products, the following initial rates were obtained at various given initial concentrations

S.No.	[A] mol / L	[B] mol / L	Initial rate M/s
1.	0.1	0.1	0.05
2.	0.2	0.1	0.10
3.	0.1	0.2	0.05

Determine the half-life period.

OR

A first order reaction is 50 % complete in 50 minutes at 300 K and the same reaction is again 50 % complete in 25 minutes at 350 K. Calculate activation energy of the reaction.

30. Answer the following questions:

(a) Which of the following electrolytes is most effective for the coagulation of AgI/Ag^+ sol?

  a. $MgCl_2$, K_2SO_4, $K_4[Fe(CN)_6]$

(b) What happens when a freshly precipitated $Fe(OH)_3$ is shaken with a little amount of dilute solution of $FeCl_3$.

(c) Out of sulphur sol and proteins, which one forms macromolecular colloids?

31. Account for the following:

a) Moist SO_2 decolourises $KMnO_4$ solution.

b) In general interhalogen compounds are more reactive than halogens (except fluorine).

c) Ozone acts as a powerful oxidizing agent

32. Identify the product formed when propan-1-ol is treated with Conc. H_2SO_4 at 413 K . Write the mechanism involved for the above reaction.

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

(i) Ethanal and Propanone.
(ii) Pentan-2-one and Pentan-3-one.

(b) Arrange the following compounds in increasing order of their acid strength: Benzoic acid, 4- Nitrobenzoic acid, 3,4-Dinitrobenzoic acid,

4- Methoxybenzoic acid.

OR

Compare the reactivity of benzaldehyde and ethanal towards nucleophilic addition reactions. Write the cross aldol condensation product between benzaldehyde and ethanal.

34. Define and write an example for the following :

(a) Broad spectrum antibiotics.

(b) Analgesics

SECTION: D

35. (a) The e.m.f. of the following cell at 298 K is 0.1745 V

Fe (s) / Fe^{2+} (0.1 M) // H^+ (x M)/ H_2 (g) (1 bar)/ Pt (s)

Given : $E^0_{Fe^{2+}/Fe} = -0.44V$

Calculate the H^+ ions concentration of the solution at the electrode where hydrogen is being produced.

(b) Aqueous solution of copper sulphate and silver nitrate are electrolysed by 1 ampere current for 10 minutes in separate electrolytic cells. Will the mass of copper and silver deposited on the cathode be same or different? Explain your answer.

OR

(a) Calculate the degree of dissociation of 0.0024 M acetic acid if conductivity of this solution is 8.0×10^{-5} S cm^{-1}.

Given $\lambda^{o}_{H^{+}} = 349.6\, S\, cm^{2}\, mol^{-1}$; $\lambda^{o}_{CH_3COO^{-}} = 40.9\, S\, cm^{2}\, mol^{-1}$

(b) Solutions of two electrolytes ‘A’ and ‘B’ are diluted. The limiting molar conductivity of ‘B’ increases to a smaller extent while that of ‘A’ increases to a much larger extent comparatively. Which of the two is a strong electrolyte? Justify your answer.

36. An organic compound A’ with molecular formula C_7H_7NO reacts with Br_2/aqKOH to give compound B’, which upon reaction with $NaNO_2$& HCl at O°C gives C’. Compound C’ on heating with CH_3CH_2OH gives a hydrocarbon D’. Compound B’ on further reaction with Br_2 water gives white precipitate of compound E’. Identify the compound A, B, C, D&E; also justify your answer by giving relevant chemical equations.

OR

(a) How will you convert:

(i) Aniline into Fluorobenzene.
(ii) Benzamide into Benzylamine.

(iii) Ethanamine to N,N-Diethylethanamine.

(b) Write the structures of A and B in the following:

i)

$$CH_3CH_2CN \xrightarrow[\text{Partial hydrolysis}]{OH^{-}} A \xrightarrow{NaOH + Br_2} B$$

ii)

$$CH_3CH_2Br \xrightarrow[\text{ii) } LiAlH_4]{\text{i) } KCN} A \xrightarrow[O^{0}C]{HNO_2} B$$

37. (a) When a chromite ore (A) is fused with an aqueous solution of sodium carbonate in free excess of air, a yellow solution of compound (B) is obtained. This solution is filtered and acidified with sulphuric acid to form compound (C). Compound (C) on treatment with solution of KCl gives orange crystals of compound (D). Write the chemical formulae of compounds A to D.

(b) Describe the cause of the following variations with respect to lanthanoids and actinoids:

(i) Greater range of oxidation states of actinoids as compared to lanthanoids.

(ii) Greater actinoid contraction as compared to lanthanoid contraction.

(iii) Lower ionisation enthalpy of early actinoids as compared to the early lanthanoids.

OR

(a) What happens when

(i) Manganate ions (MnO_4^{2-}) undergoes disproportionation reaction in acidic medium?

(ii) Lanthanum is heated with Sulphur?

(b) Explain the following trends in the properties of the members of the First series of transition elements:

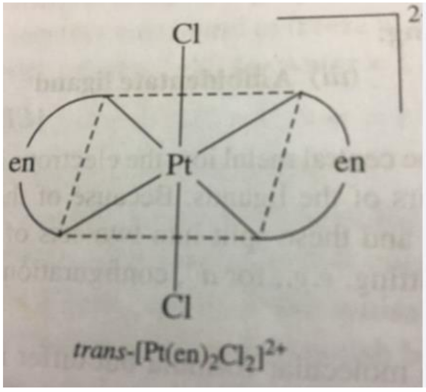
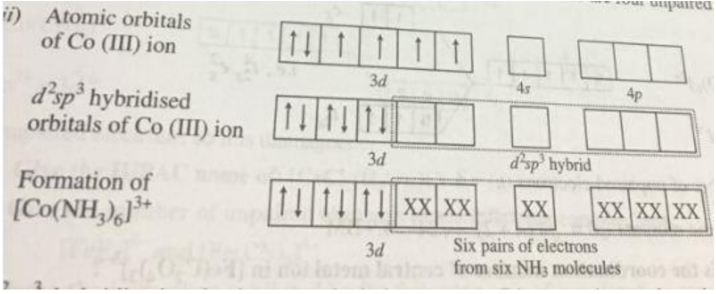
(i) $E^o(M^{2+}/M)$ value for copper is positive(+0.34 V) in contrast to the other members of the series.

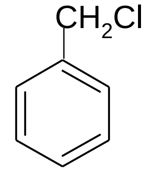
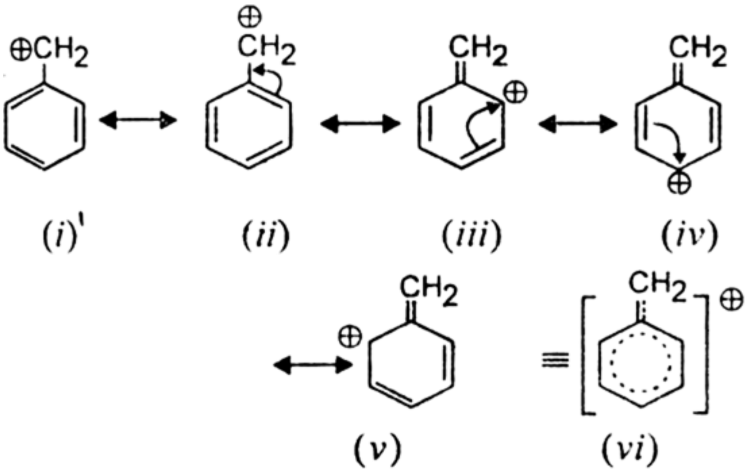
(ii) Cr^{2+} is reducing while Mn^{3+} is oxidising, though both have d^4 configuration.

(iii) The oxidising power in the series increases in the order $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$.

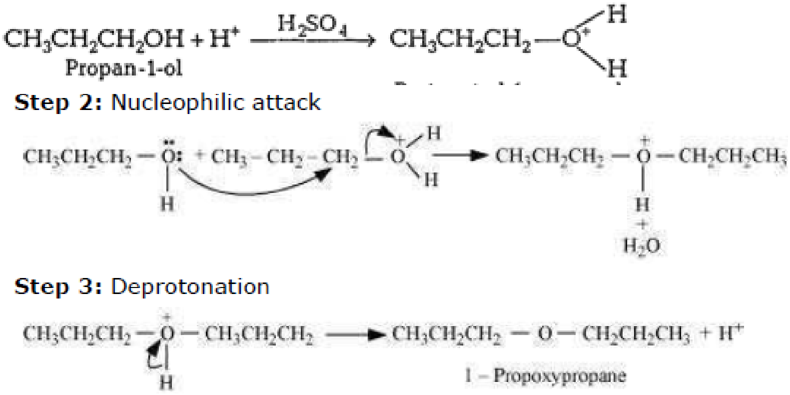
MS CLASS XII CHEMISTRY 2019-20

Q.No.	Value points	Marks
	SECTION:A	
1.	Reaction taking place at cathode when the battery is in use: $PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$	1
2.	2 F	1
3.	$Molarity = \frac{38 \times 1.294 \times 1000}{98 \times 100} = 5.02M$	1
4.	It can be recharged after use.	1
5.	At anode: O_2 (g) At cathode: H_2 (g)	½ ½
6.	Sodium cyanide.	1
7.	Nucleotide	1
8.	Zwitterion / dipolar ion	1
9.	Condensation	1
10.	Benzaldehyde	1
11.	(c)	1
12.	(b)	1
13.	(b)	1
14.	(a)	1
15.	(b)	1
16.	(c)	1
17.	(a)	1
18.	(d)	1
19.	(d)	1
20.	(d)	1
	SECTION:B	
21.	Lone pairs : 2 Geometry : Square planar	1 1
22. (i) (ii)	$Slope = -\frac{E_a}{2.303R}$ $k_1 > k_2$	1 1
23.	When there is dissociation of solute into ions, in dilute solutions (ignoring interionic attractions) the number of particles increases. As the value of colligative properties depends on the number of particles of the solute , the experimentally observed value of colligative property will be higher than the true value, therefore the experimentally determined (observed) molar mass is always lower than the true value. For KCl(electrolyte) the experimentally determined molar mass is always	1 ½

	lower than the true value when water is used as solvent. Glucose (non-electrolyte) does not show a large variation from the true value.	½
24. (a)	CH_3-CH(Cl)-COOH	1
(b)	C_6H_5CHO	1
25.	 trans-$[Pt(en)_2Cl_2]^{2+}$	1
	IUPAC Name of the entity: Dichloridobis(ethane-1,2-diamine)platinum(IV) ion	1
	OR	
	Bonding in $[CO(NH_3)_6]^{3+}$ d^2sp^3 hybridisation	½
		½
	Geometry: Octahedral	½
	Diamagnetic	½
26.	**Vapour phase refining:** It is a refining method in which the metal is converted into its volatile compound and collected elsewhere. It is then decomposed to give pure metal.	1
	Example: Mond's Process for refining of Nickel / van Arkel method for refining of Zirconium	1

	Equations involved: $Ni + 4CO \xrightarrow{330-350K} Ni(CO)_4$ $Ni(CO)_4 \xrightarrow{450-470K} Ni + 4CO$ OR Extraction of gold involves leaching the metal with CN^- Oxidation reaction: $4\,Au\,(s) + 8\,CN\text{-}\,(aq.) + 2H_2O\,(aq.) + O_2\,(g) \rightarrow 4[Au(CN)_2]^-(aq.) + 4\,OH^-\,(aq.)$ The metal is recovered by displacement method: $2[Au(CN)_2]\text{-}\,(aq.) + Zn\,(s) \rightarrow 2\,Au\,(s) + [Zn(CN)_4]^{2-}\,(aq.)$ Zinc acts as a reducing agent.	½ ½ ½ ½ ½ ½
27.	The following compound will undergo S_N1 faster:  Greater the stability of the carbocation, greater will be its ease of formation from the corresponding halide and faster will be the rate of reaction. The benzylic carbocation formed gets stabilised through resonance.  $CH_3CH_2CH_2Cl$ forms a 1^0 carbocation, which is less stable than benzylic carbocation.	½ ½ ½ ½
	SECTION :C	
28.	$KCl \rightarrow K^+ + Cl^-$ n =2 $i = 1 - \alpha + n\alpha$ $i = 1 + \alpha$	½ ½ ½

	$\Delta T_f = iK_f m$ $=(1+0.92)\,\mathbf{x}\,1.86\,\mathbf{x}\,\frac{0.5\,\mathbf{x}\,1000}{74.5\,\mathbf{x}\,100}$ $\Delta T_f = 0.24$ $\Delta T_f = T_f^0 - T_f^{'}$ $T_f^{'} = -\,0.24\ {}^0C$	½ ½ ½
29.	$rate = k\ [A]^x\,[B]^y$ $0.05 = k[0.1]^x[0.1]^y \quad ......(i)$ $0.10 = k[0.2]^x[0.1]^y \quad ....(ii)$ $0.05 = k[0.1]^x[0.2]^y \quad ......(iii)$ $(ii) \div (i)$ $\frac{0.10}{0.05} = (2)^x$ $x = 1$ $(iii) \div (i)$ $\frac{0.05}{0.05} = (2)^y$ $y = 0$ $rate = k[A]^1[B]^0$ It is a first order reaction. $k = \frac{rate}{[A]} = o.5\,s^{-1}$ $t_{1/2} = \frac{0.693}{k} = \frac{0.693}{0.5}$ $t_{1/2} = 1.386\ s$ OR $t_{1/2} = \frac{0.693}{k}$ $k_2 = \frac{0.693}{25} \qquad 350K$ $k_1 = \frac{0.693}{50} \qquad 300K$ $\frac{k_2}{k_1} = 2$	½ ½ ½ ½ ½ ½ ½ ½

	$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$	½
	$\log 2 = \frac{E_a}{2.303 \mathbf{x} 8.314}\left[\frac{350-300}{350 \mathbf{x} 300}\right]$	½
	Ea = 12.104 kJ / mol.	(1/2 +1/2)
30.		
(a)	$K_4[Fe(CN)_6]$	1
(b)	$Fe(OH)_3$ is converted into colloidal state by preferential adsorption of Fe^{3+} ions.	1
(c)	Proteins	1
31.		
(a)	Moist sulphur dioxide behaves as a reducing agent, reduces MnO_4^- to Mn^{2+}.	1
(b)	X –X' bond in interhalogens is weaker than X-X bond in halogensexcept F-F bond.	1
(c)	Due to the ease with which it liberates atoms of nascent oxygen.	1
32.	1-Propoxypropane is formed.	1
	Mechanism involved: Step 1 :Formation of protonated alcohol	½
		1 ½
33. (a) (i)		

(ii)

Experiment	Ethanal	Propanone
1.**Tollens Test:** Warm the organic compound with freshly prepared ammonical silver nitrate solution(Tollen's reagent).	A bright silver mirror is produced	No silver mirror is formed.
2.**Fehlings Test:** Heat the organic compound with Fehling's reagent.	A reddish bown precipitate is obtained.	No precipitate is obtained
Any one test		

1

(b)

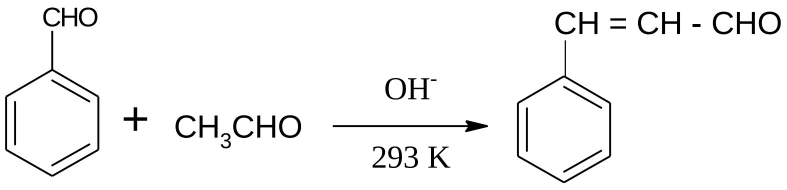
Experiment	Pentan-2-one	Pentan-3-one
IodoformTest: The organic compound is heated with iodine in presence of sodium hydroxide solution.	A yellow precipitate is obtained.	No yellow precipitate is obtained.

Or any other suitable test. 1

4- Methoxybenzoic acid<Benzoic acid<4- Nitrobenzoic acid< 3,4-Dinitrobenzoic acid

OR

The carbon atom of the carbonyl group of benzaldehyde is less electrophilic than carbon atom of the carbonyl group present in ethanal. The polarity of the carbonyl group is reduced in benzaldehyde due to resonance hence less reactive than ethanal. 1



1

1

1

34.

(a) Broad spectrum antibiotics: 1

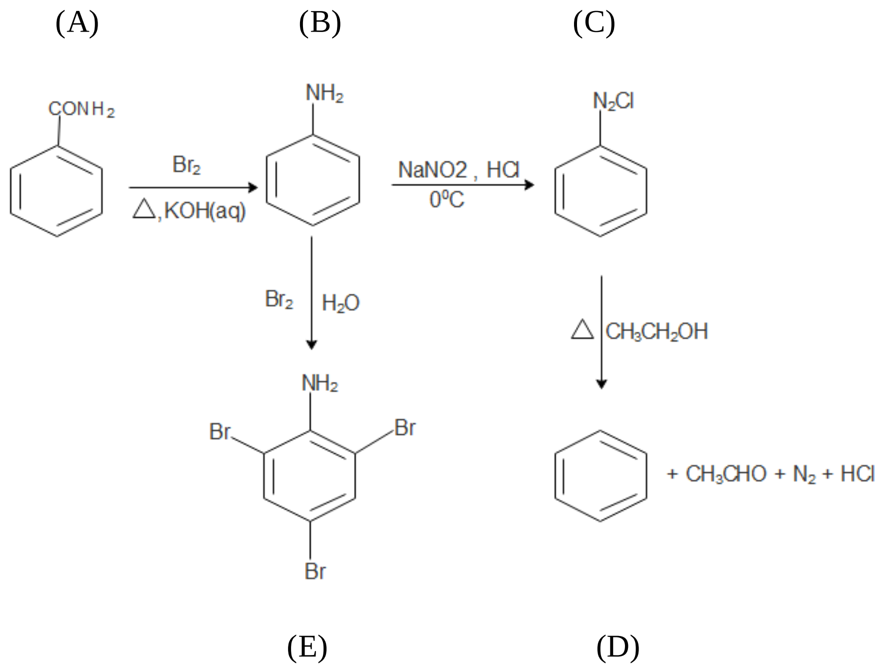
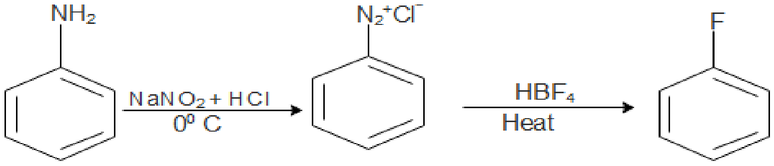
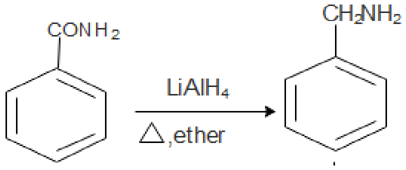
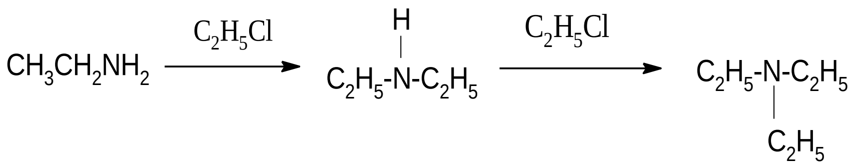
Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria.

e.g. Chloramphenicol. ½

any other suitable example.

(b) Analgesics:

	Reduce or abolish pain without causing impairement of consciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous system. e.g. Aspirin / paracetamol etc. any other suitable example.	1 ½
	SECTION:D	
35. (a)	$Fe + 2H^{+} \rightarrow H_2 + Fe^{2+}$	
	$E_{cell} = E^{0}_{cell} - \frac{2.303RT}{nF}\log\frac{Fe^{2+}}{[H^{+}]^{2}}$	1
	$E^{0}_{cell} = E^{0}_{H^{+}/H_2} - E^{0}_{Fe^{2+}/Fe}$ $= 0-(-0.44) = 0.44V$	½
	$0.1745 = 0.44 - \frac{0.0591}{2}\log\frac{[0.1]}{[x]^{2}}$	½
	Log x = -5 Log[H^{+}] = -5 [H^{+}] = 10^{-5}	½
(b)	The mass of copper and silver deposited at the cathode will be different.	1
	The amount of different substances deposited by the same quantity of electricity passing through the electrolytic solution are directly proportional to their chemical equivalents.	1
	OR	
(a)	$\Lambda^{o}(CH_3COOH) = \lambda^{o}_{H^{+}} + \lambda^{o}_{CH_3COO^{-}}$	½
	= 349.6 + 40.9 = 390.5 S cm^{2} mol^{-1}	½
	$\Lambda_m = \frac{\kappa \times 1000}{c}$	½
	$\Lambda_m = \frac{8.0\times10^{-5}\,S\,cm^{-1}\times1000\,cm^{3}L^{-1}}{0.0024\,mol\,L^{-1}} = 33.33\,S\,cm^{2}\,mol^{-1}$	½
	$\alpha = \frac{\Lambda_m}{\Lambda^{o}_m}$	½
	$\alpha = \frac{33.33\ S\,cm^{2}\ mol^{-1}}{390.5\ \ S\,cm^{2}\ mol^{-1}} = 0.085$	½
(b)	Electrolyte B is a strong electrolyte.	1
	Limiting molar conductivity increases only to a smaller extent for a strong electrolyte, as on dilution the interionic interactions are overcome.	½
	Limiting molar conductivity increases to alarger extent for a weak electrolyte, as on dilution the degree of dissociation increases, therefore the number of ions in total volume of solution increases.	½

36.	 (1/2 x 5 marks for structure and ½ x 5 for writing equations) OR	5
(a) (i)		1
(ii)		1
(iii)	 $CH_3CH_2NH_2 \xrightarrow{C_2H_5Cl} C_2H_5\text{-}\overset{H}{N}\text{-}C_2H_5 \xrightarrow{C_2H_5Cl} C_2H_5\text{-}\underset{C_2H_5}{N}\text{-}C_2H_5$	1
(b) (i)		½ ½
(ii)	A : CH$_3$CH$_2$CONH$_2$ B : CH$_3$CH$_2$NH$_2$	½ ½

	A: $CH_3CH_2CH_2NH_2$ B:$CH_3CH_2CH_2OH$	
37.		
(a)	A = $FeCr_2O_4$ B = Na_2CrO_4 C = $Na_2Cr_2O_7$ D = $K_2Cr_2O_7$	(1/2x 2)
(b)		
(i)	5f, 6d and 7s levels in actinoids are of comparable energies.	1
(ii)	This is due to poorer shielding by 5f electrons in actinoids as compared to shielding by 4f electrons in lanthanoids.	1
(iii)	In actinoids, 5f electrons are more effectively shielded from the nuclear charge than the 4f electrons of the corresponding lanthanoids. Since the outer electrons are less firmly held, they are available for bonding in the actinoids.	1
	OR	
(a)		
(i)	MnO_4^{2-} ions disproportionate in acidic medium to give Permanganate ions and Manganese(IV) oxide.	½
	$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$	½
(ii)	Lanthanum sulphide if formed.	½
	$2La + 3S \xrightarrow{heat} La_2S_3$ (Deduct overall ½ mark if equation not balanced/ statements not written)	½
(b)		
(i)	Copper has high enthalpy of atomisation and low enthalpy of hydration. Since the high energy to transform Cu(s) to Cu^{2+}(aq) is not balanced by hydration enthalpy, therefore $E^o(M^{2+}/M)$ value for copper is positive(+0.34 V).	1
(ii)	Cr^{2+} is reducing as its configuration changes from d^4 to d^3, the latter having more stable half filled t_{2g} level. On the other hand, the change from Mn^{3+} to Mn^{2+} results in extra stable d^5 configuration.	1

(iii)	This is due to the increasing stability of the species of lower oxidation state to which they are reduced.	1