Class: XII
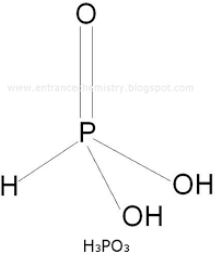**Chemistry**
Marking Scheme 2018-19

Time allowed: 3 Hours   **Maximum Marks: 70**
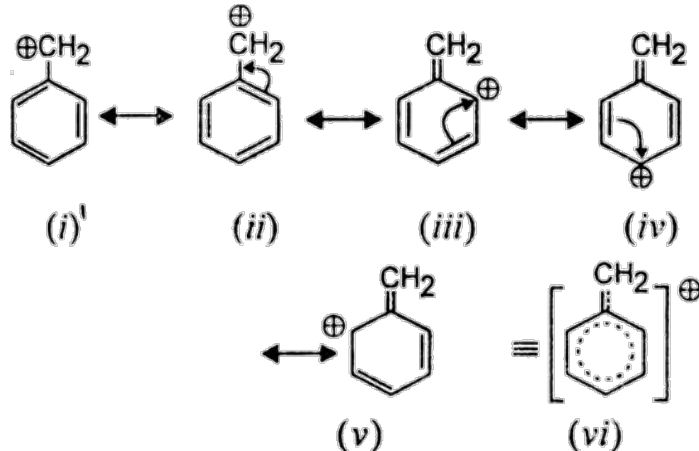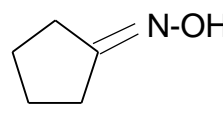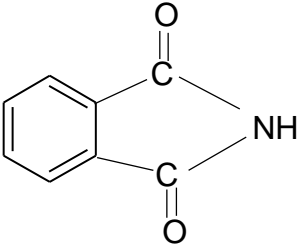
Q No	SECTION A	Marks
1.	On heating ZnO , it loses oxygen and there is excess of Zn^{2+}ions in the crystal.	1
	OR	
	When silicon is doped with phosphorous (group 15 element), the increase in conductivity is due to the delocalised negatively charged electrons.	1
2.	Associated colloids	1
3.	$t_{2g}^3 \, e_g^3$	1
	OR	
	The orbital splitting energies, Δ_t are not sufficiently large for forcing pairing of electrons in the tetrahedral coordination entity formation.	1
4.	B	1
5.	*Poly β-hydroxybutyrate-co-β-hydroxy valerate*	1
	SECTION B	
6.	$HBr \rightarrow H^+ + Br^-$ $i = 1 - \alpha + n\alpha$ $n = 2$ $i = 1 + \alpha$ $\Delta T_f = iK_f m$ $\Delta T_f = (1+\alpha)1.86 \mathbf{x} \dfrac{\mathbf{8.1}}{\mathbf{81}} \mathbf{x} \dfrac{\mathbf{1000}}{\mathbf{100}}$ $\Delta T_f = \mathbf{3.53}$ $T_f^0 = 0^0 C$ $\Delta T_f = T_f^0 - T_f'$ $T_f' = -3.534^0 C$	½ ½ ½ ½ ½ ½
	OR	
	Mole fraction of water, $\chi_{H_2O} = 0.88$ *Mole fraction of ethanol*, $\chi_{C_2H_5OH} = 1 - 0.88$ $\qquad\qquad\qquad\qquad\qquad = 0.12$ $\chi_{C_2H_5OH} = \dfrac{n_2}{n_1 + n_2}$ ....(1)	½

	n_2 = number of moles of ethanol. n_1 = number of moles of water.Molality of ethanol means the number of moles of ethanol present in 1000 g of water. $$n_1 = \frac{1000}{18} = 55.5\,moles$$ Substituting the value of n_1 in equation (1) $$\frac{n_2}{55.5 + n_2} = 0.12$$ $n_2 = 7.57\,moles$ Molality of ethanol (C_2H_5OH) = 7.57 m **Alternatively,** Mole fraction of water = 0.88 Mole fraction of ethanol = 1-0.88 = 0.12 Therefore 0.12 moles of ethanol are present in 0.88 moles of water. Mass of water = 0.88 x 18 =15.84 g of water. Molality = number of moles of solute (ethanol) present in 1000 g of solvent (water) = 12 x 1000 / 15.84 = 7.57 m Molality of ethanol (C_2H_5OH) = 7.57 m	½ ½ ½ ½ ½
7.(a) (b)	Reaction : Hell-Volhard-Zelinsky reaction. IUPAC : 2-Bromopropanoic acid. Reaction : Rosenmund reduction reaction. IUPAC : Benzaldehyde.	½ ½ ½ ½
	OR	
	i) 2-Methylbut-2-enal $$CH_3\text{-}CH=CH\text{-}CHO$$ with CH_3 substituent ii) Pent-2-enal $CH_3\text{-}CH_2\text{-}CH=CH\text{-}CHO$	½ ½ ½ ½
8.(a) (b)	Tert-butyl peroxide acts as a free radical generating initiator(catalyst) $CH_2 = CH\text{-} CH = CH_2$ $C_6H_5 - CH= CH_2$	**1** ½ ½
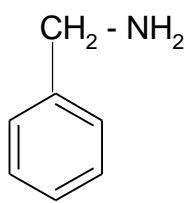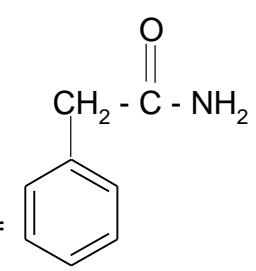
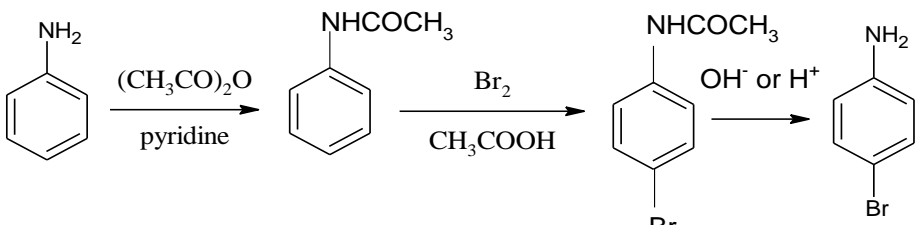|		
9.	Step 1 : Formation of protonated alcohol.	½
	Step 2 : Formation of carbocation.	1
	Step 3: Formation of ethane by elimination of a proton.	
		½
10.	(i) Zero order reaction	½
	(ii) Slope represents –k ; Intercept represents $[R]_o$	½+½
	(iii) $mol\, L^{-1}\, s^{-1}$	½
11.(a)		1
(b)		1
12.(i)	Since Ti^{4+}/Ti^{3+} has lower reduction potential than Fe^{3+}/Fe^{2+}, it cannot be reduced in comparison with Fe^{3+}/Fe^{2+} ions.	1
	Hence Ti^{4+} cannot oxidise Fe^{2+} to Fe^{3+}.	½
(ii)	As the value of reduction potential increases the stability of +2 oxidation increases. Therefore correct order of stability is	1
	$Cr^{3+}/Cr^{2+} < Fe^{3+}/Fe^{2+} < Mn^{3+}/Mn^{2+}$	½

3

	SECTION C	
13.	$r = \dfrac{\sqrt{3}}{4}a$ $143.1 = \dfrac{\sqrt{3}}{4}a$ a = 330.4 pm $\rho = \dfrac{zM}{a^3 N_A}$ $\rho = \dfrac{2 \times 93}{(330.4 \times 10^{-10})^3 \times 6.023 \times 10^{23}}$ $\rho = 8.58 \; g/cm^3$	½ ½ ½ ½ ½ + ½
14.(a)	Molecules of benzoic acid dimerise in benzene, the number of particles are reduced.	1
(b)	The intermolecular interactions between ethanol and acetone are weaker/ the escaping tendency of ethanol and acetone molecules increases on mixing / the vapour pressure increases.	1
(c)	Due to osmosis, a bacterium on fruit loses water, shrivels and dies.	1
15.	$$A: \quad CH_3\text{-}\underset{\overset{\displaystyle |}{CH_3}}{CH}\text{-}CH_2\text{-}OH$$ $$B: \quad CH_3\text{-}\underset{\overset{\displaystyle |}{CH_3}}{CH}\text{-}COOH$$ $$C: \quad CH_3\text{-}\underset{\overset{\displaystyle |}{CH_3}}{CH} = CH_2$$ $$D: \quad CH_3\text{-}\overset{\overset{\displaystyle CH_3}{\displaystyle |}}{\underset{\underset{\displaystyle OH}{\displaystyle |}}{CH}}\text{-}CH_3$$ A and D are position isomers.	1 ½ ½ ½ ½

4

16.	$C_6H_5CH_2Cl$ will undergo S_N1 reaction faster.	½
	The carbocation formed by $C_6H_5CH_2Cl$ gets stabilized through resonance.	½
	Greater the stability of carbocation, greater will be its ease of formation from the respective halide.	1
		1
	OR	
	CH$_3$-CH-CH$_2$Cl (Cl)	½
	CH$_2$Cl-CH$_2$-CH$_2$Cl	½
	CH$_3$-CH$_2$-CHCl$_2$	½
	CH$_3$-C-CH$_3$ (Cl, Cl)	½
		½
		½
	The following isomer will exhibit enantiomerism: CH$_3$-CH-CH$_2$Cl (Cl)	
	IUPAC name: 1,2-Dichloropropane.	
17.(a)		1
(b)	HOOC - CH$_2$ - CH$_2$ - CH$_2$ - CH$_2$ – COOH	1

(c)		1
18.(i) (ii) (iii)	It is unstable at cooking temperature. Excessive hydrogencarbonate can make the stomach alkaline and trigger the production of even more acid. Metal hydroxides being insoluble do not increase the pH above neutrality. Aspirin has anti blood clotting action.	1 1 1
19.(a) (b) (c)	Amylopectin. C- 2 Two peptide linkages.	1 1 1

<div align="center">OR</div>

	(1) Glucose does not give 2,4- DNP test. (2) Glucose does not give Schiff's test. (3) The pentaacetate of glucose does not react with hydroxylamine. (4) Glucose does not form the hydrogensulphite addition product with $NaHSO_3$. (Any three points)	1 1 1

20.	$$2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$$
	At t = 0 0.5 atm 0 atm 0 atm
	At time t $0.5-2x$ atm $2x$ atm x atm
	$p_t = p_{N_2O_5} + p_{N_2O_4} + p_{O_2}$
	     $= = (0.5-2x)+2x+x = = 0.5+x$
	$x = p_t - 0.5$
	$p_{N_2O_5} = 0.5-2x$
	        $= 0.5-2(p_t - 0.5)$
	        $= 1.5 - 2p_t$
	At t = 100 s ; p_t = 0.512 atm
	$p_{N_2O_5} = 1.5 - 2 \times 0.512 = 0.476\, atm$
	$k = \dfrac{2.303}{t} \log \dfrac{p_i}{p_A}$
	$k = \dfrac{2.303}{100s} \log \dfrac{0.5\, atm}{0.476\, atm}$
	$k = \dfrac{2.303}{100s} \times 0.0216 = 4.98 \times 10^{-4}\, s^{-1}$
		½
		
		½
		
		½
		
		½
		
		1

	OR	1
	The Arrhenius equation: $k = Ae^{-Ea/RT}$ Taking log on both sides: $\log k = \log A - \dfrac{E_a}{2.303RT}$	

	For reaction (i) $\log k_1 = \log A - \dfrac{E_a(1)}{2.303RT}$	1
	For reaction (ii) $\log k_2 = \log A - \dfrac{E_a(2)}{2.303RT}$	
	Subtracting (i) from (ii) $\log \dfrac{k_1}{k_2} = \dfrac{E_a(1) - E_a(2)}{2.303RT}$ $\quad = \log \dfrac{k_1}{k_2} = \dfrac{24.9 \times 1000}{2.303 \times 8.3 \times 300} = 4.342$ $\dfrac{k_1}{k_2} = anti\log(4.342) = 2.198 \times 10^4$	1
21. (a)	Negative charge is developed on the sol. Sol is represented as AgI / I^-	½ ½
(b)	Adsorption of reactants on the solid surface of the catalysts increases the rate of reaction.	1
(c)	Na_3PO_4 Hardy-Schulze rule	½ ½
22. (a)	Leached gold complex is treated with Zinc and gold is recovered by displacement method $2Au[(CN)_2]^-(aq) + Zn(s) \rightarrow 2Au(s) + [Zn(CN)_4]^{2-}(aq)$	½ ½
(b)	Zirconium iodide is decomposed on a tungsten filament; electrically heated to 1800 K. Pure Zr metal is deposited on the filament. $ZrI_4 \rightarrow Zr + I_2$	½ ½
(c)	Silica is added to the ore and heated. It helps to slag off iron oxide as iron silicate $FeO + SiO_2 \rightarrow FeSiO_3(slag)$	½ ½
	OR	
(a)	NaCN is used as depressants to separate two sulphide ores (ZnS and PbS) in Froth Floatation Method.	(1)
(b)	Carbon monoxide forms a volatile complex of nickel, nickel tetracarbonyl.	(1)
(c)	Coke is used as a reducing agent to reduce zinc oxide to zinc.	(1)
23. (a)	$Co^{2+} : [Ar]3d^7 \quad Sc^{3+} : [Ar]3d^0 \quad Cr^{3+} : [Ar]3d^3$ Co^{2+} and Cr^{3+} have unpaired electrons. Thus, they are coloured in aqueous solution. Sc^{3+} has no unpaired electron. Thus it is colourless.	1
(b)	Metal copper has high enthalpy of atomisation and enthalpy of ionisation. Therefore the high energy required to convert Cu(s) to Cu^{2+}(aq) is not balanced by its hydration enthalpy.	1

(c)	Due to lanthanoid contraction the size of lanthanoid ion decreases regularly with increase in atomic size. Thus covalent character between lanthanoid ion and OH^- increases from La^{3+} to Lu^{3+}. Thus the basic character of hydroxides decreases from $La(OH)_3$ to $Lu(OH)_3$	1
24. (a)	Isomer A: $[Cr(NH_3)_4 BrCl]Cl$ Isomer B: $[Cr(NH_3)_4 Cl_2]Br$	½ ½
(b)	Hybridisation of Cr in isomer A and B is d^2sp^3.	1
(c)	Number of unpaired electrons in $Cr^{3+}(3d^3)$ is 3 Magnetic moment = $\sqrt{n(n+2)}$ $\qquad\qquad = \sqrt{3(3+2)}$ = 3.87 BM (deduct half mark for wrong unit/unit not written)	1
25.(a)	A = $AgNO_2$	½

B =

CH₂ - NH₂ on benzene ring

C =

CH₂ - C(=O) - NH₂ on benzene ring

D = $CHCl_3$ + KOH , Heat.

½ (B)

½ (C)

½ (D)

(b)
(i)

Experiment	Aniline	Benzylamine
Azo dye test: Dissolve the amine in HCl, cool it and then add cold aqueous solution of $NaNO_2$ and then solution of β - naphthol	A brilliant orange red dye is observed.	No dye is formed.

1

(ii)

Experiment	Methylamine	Dimethylamine
Carbylamine test: To the organic compound add chloroform and ethanolic potassium hydroxide and heat	A foul smelling substance (isocyanide)	No reaction.

(or any other suitable test)

1

(c)	A = CH₃CH₂CH₂NH₂	½
	B = CH₃CH₂CH₂OH	½
OR		
(a)(i)	In strongly acidic medium, aniline is protonated to form the anilium ion which is meta directing.	1
(ii)	Aryl halides do not undergo nucleophilc substitution with the anion formed by phthalimide.	1
(b)(i)	$CH_3\text{-}COOH \xrightarrow{NH_3, \Delta} CH_3\text{-}CO\text{-}NH_2 \xrightarrow{NaOH + Br_2} CH_3NH_2$	1
(ii)		1
(c)	p- Nitroaniline < Aniline < p- Toludine.	1
26.(a)	E_cell decreases.	1
(b)	Anode: Cl₂ ↑	½
	Cathode : H₂ ↑	½
(c)	$Cu^{2+}(aq.) + Ni(s) \rightarrow Ni^{2+}(aq.) + Cu(s)$	½
	$E^0_{cell} = E^0_{cathode} - E^0_{anode}$ $E^0_{cell} = 0.34 - (-0.25)$ $E^0_{cell} = 0.59V$	½
		½
	$E_{cell} = E^0_{cell} - \frac{2.303RT}{nF} \log \frac{[Ni^{2+}]}{[Cu^{2+}]}$	½
	$E_{cell} = 0.59 - \frac{0.059}{2} \log \frac{[0.01\ ]}{[0.1\ ]}$	½
	$E_{cell} = 0.6195V$	½ +½
OR		
(a)	$\Lambda^0_{m(CaCl_2)} = \lambda^0_{Ca^{2+}} + 2\lambda^0_{Cl^-}$	1
(b)	Conductivity of NaCl decreases on dilution as the number of ions per unit volume decreases.	1

	Whereas molar conductivity of NaCl increases on dilution as on dilution the interionic interactions are overcome and ions are free to move.	1
(c)	$G^* = \kappa R$	½
	$\kappa = \dfrac{1.29}{100} = 0.0129 \; S\,cm^{-1}$	½
	$\Lambda_m = \dfrac{1000\,\kappa}{C}$	½
	$\Lambda_m = \dfrac{1000 \; x \; 0.0129}{0.1}$	
	$\Lambda_m = 129 \; S\,cm^2\,mol^{-1}$	½
27. (a)	(i)S atom in SF_4 is not sterically protected as it is surrounded by only four F atoms, so attack of water molecules can take place easily. In contrast, S atom in SF_6 is protected by six F aoms. Thus attack by water molecules cannot take place easily.	1
	(ii) Chlorine water produces nascent oxygen (causes oxidation) which is responsible for bleaching action. $Cl_2 + H_2O \rightarrow 2HCl + [O]$	1
	(iii) Due to inert pair effect Bi(V) can accept a pair of electrons to form more stable Bi (III). (+3 oxidation state of Bi is more stable than its +5 oxidation state).	1
(b)	(i)Phosphorus undergoes disproportionation reaction to form phosphine gas. $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$	1
	(ii)On partial hydrolysis, XeF_6 gives oxyfluoride $XeOF_4$ and HF. $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$	1
OR		
(a)	N.Bartlett first prepared a red compound $O_2^+PtF_6^-$. He then realised that the first ionisation enthalpy of molecular oxygen was almost identical with Xenon. So he carried out reaction between Xe and PtF_6.	1
(b)	(i) $I_2 < F_2 < Br_2 < Cl_2$	1
	(ii) $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$	1
(c)	(i) $2NaOH + Cl_2 \rightarrow NaCl + NaOCl + H_2O$	1
	(ii) $2Fe^{3+} + SO_2 + 2H_2O \rightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$	1

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