PART B – CHEMISTRY

1. The appearance of colour in solid alkali metal halides is generally due to :
(1) Frenkel defect
(2) F-centres
(3) Schottky defect
(4) Interstitial position

Ans. (2)

2. Complete reduction of benzene-diazonium chloride with Zn/HCl gives :
(1) Aniline (2) Phenylhydrazine
(3) Hydrazobenzene (4) Azobenzene

Ans. (2)

3. Which of the following statements about Na_2O_2 is **not** correct ?
(1) Na_2O_2 oxidises Cr^{3+} to CrO_4^{2-} in acid medium
(2) It is diamagnetic in nature
(3) It is the super oxide of sodium
(4) It is a derivative of H_2O_2

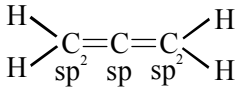
Ans. (3)

Sol. Na_2O_2 is a peroxide O_2^{2-} which is occupied all paired electrons with π^*2px & π^*2py.

4. In allene (C_3H_4), the type(s) of hybridization of the carbon atoms is (are):
(1) only sp^2 (2) sp^2 and sp
(3) sp and sp^3 (4) sp^2 and sp^3

Ans. (2)

Sol.



5. In the reaction of formation of sulphur trioxide by contact process $2SO_2 + O_2 \rightleftharpoons 2SO_3$ the rate of reaction was measured as $\frac{d[O_2]}{dt} = -2.5\times10^{-4}$ mol L^{-1} s^{-1}. The rate of reaction in terms of $[SO_2]$ in mol $L^{-1}s^{-1}$ will be
(1) -2.50×10^{-4} (2) -5.00×10^{-4}
(3) -1.25×10^{-4} (4) -3.75×10^{-4}

Ans. (2)

Sol. $$-\frac{1}{2}\frac{d}{dt}[SO_2] = -\frac{d}{dt}[O_2]$$

$$\Rightarrow \frac{d}{dt}[SO_2] = -2 \times 2.5 \times 10^{-4}$$

$$= -5 \times 10^{-4}$$

6. Based on the equation

$$\Delta E = -2.0\times10^{-18} J\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$$

the wavelength of the light that must be absorbed to excite hydrogen electron from level n = 1 to level n = 2 will be ($h = 6.625 \times 10^{-34}$ Js, $C = 3 \times 10^8$ ms^{-1})
(1) 2.650×10^{-7} m
(2) 1.325×10^{-7} m
(3) 1.325×10^{-10} m
(4) 5.300×10^{-10} m

Ans. (2)

Sol. $$\frac{1}{\lambda} = \frac{2\times10^{-18}}{hc}\left[\frac{1}{(1)^2} - \frac{1}{(2)^2}\right]$$

$$\Rightarrow \frac{1}{\lambda} = \frac{2\times10^{-18}}{6.625\times10^{-34}\times3\times10^8} \times \frac{3}{4}$$

$$\Rightarrow \lambda = \frac{2 \times 6.625 \times 10^{-34} \times 10^8}{10^{-18}}$$

$$= 13.25 \times 10^{-8}$$

$$= 1.325 \times 10^{-7} \text{ m}$$

7. Given :-
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$; $E^\circ = +0.77$ V
$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$; $E^\circ = -1.66$ V
$Br_2(aq) + 2e^- \rightarrow 2Br^-$; $E^\circ = +1.09$ V
Considering the electrode potentials, which of the following represents the correct order of reducing power?
(1) $Al < Fe^{2+} < Br^-$ (2) $Al < Br^- < Fe^{2+}$
(3) $Fe^{2+} < Al < Br^-$ (4) $Br^- < Fe^{2+} < Al$

Ans. (4)

8. Consider the following equilibrium

$$AgCl\downarrow + 2NH_3 \rightleftharpoons [Ag(NH_3)_2]^+ + Cl^-$$

White precipitate of AgCl appears on adding which of the following?
(1) NH_3 (2) Aqueous NaCl
(3) Aqueous NH_4Cl (4) Aqueous HNO_3

Ans. (2)

Sol. $AgCl(\downarrow) + 2NH_3 \rightleftharpoons [Ag(NH_3)_2^{\oplus}] + \overset{\ominus}{Cl}$

$\downarrow HNO_3/H^{\oplus}$ (Acid)

$AgCl\,(\downarrow) + \overset{\oplus}{NH_4} + NO_3^{\ominus}$ (pptd)

9. Tischenko reaction is a modification of

(1) Cannizzaro reaction

(2) Claisen condensation

(3) Pinacol-pinacolon reaction

(4) Aldol condensation

Ans. (1)

10. Which one of the following does **not** have a pyramidal shape ?

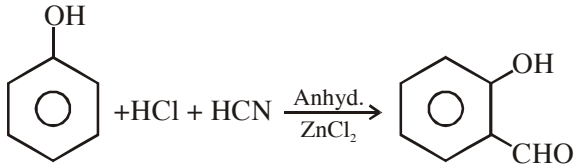
(1) $P(CH_3)_3$ (2) $(SiH_3)_3N$

(3) $(CH_3)_3N$ (4) $P(SiH_3)_3$

Ans. (2)

Sol. In $N(SiH_3)_3$ ℓp present on nitrogen atom of 2nd shall has greater donating tendency to vacant 3d-orbital of 'Si' but not this donating tendency to vacant 3d-orbital of 'Si' but not this donating tendency with P, due to 3rd pd element.

11. The following reaction



is known as

(1) Perkin reaction

(2) Kolbe's reaction

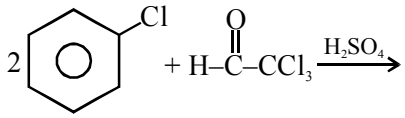
(3) Gattermann reaction

(4) Gattermann-Koch Formylation

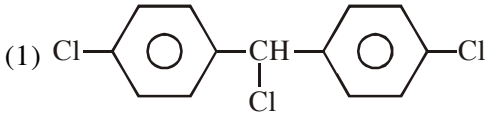
Ans. (4)

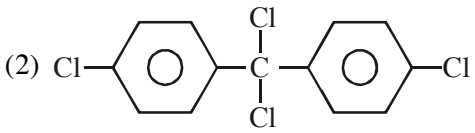
Sol. In (SiH_3) N has strong back bonding tendency than other gsap.

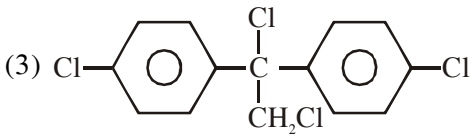
12. Chlorobenzne reacts with trichloro acetaldehyde in the presence of H_2SO_4

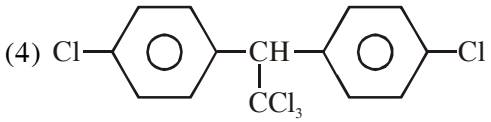


The major product formed is

(1) 

(2) 

(3) 

(4) 

Ans. (4)

13. Shapes of certain interhalogen compounds are stated below. Which one of them is not correctly stated?

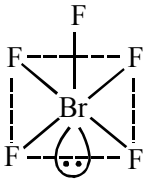
(1) IF_7 : Pentagonal bipyramid

(2) BrF_5 : Trigonal bipyramid

(3) ICl_3 : Planar dimeric

(4) BrF_3 : Planar T-shaped

Ans. (2)

Sol. 

BrF_5 has square pyramidal shape (sp^3d^2) with one lone pair at below the basal plane.

14. Which one of the following statements is not correct?

(1) Alcohols are weaker acids than water

(2) The bond angle  in methanol is 108.9°

(3) Acid strength of alcohols decreases in the following order

$RCH_2OH > R_2CHOH > R_3COH$

(4) Carbon-oxygen bond length in methanol, CH_3OH is shorter than that of C–O bond length in phenol

Ans. (4)

15. Which of the following series correctly represents relations between the elements from X to Y?

$X \rightarrow Y$

(1) $_{18}Ar \rightarrow {}_{54}Xe$ Noble character increases

(2) $_{3}Li \rightarrow {}_{19}K$ Ionization enthalpy increases

(3) $_{6}C \rightarrow {}_{32}Ge$ Atomic radii increases

(4) $_{9}F \rightarrow {}_{35}Br$ Electron gain enthalpy with negative sign increases

Ans. (3)

Sol. e^{ℓ} on moving down the gsaap shell number increases so its radii also increase from "C to Ge".

16. Which of the following statements about the depletion of ozone layer is correct?

(1) The problem of ozone depletion is more serious at poles because ice crystals in the clouds over poles act as catalyst for photochemical reactions involving the decomposition of ozone by $Cl^{\bullet}$ and $ClO^{\bullet}$ radicals

(2) The problem of ozone depletion is less serious at poles because NO_2 solidifies and is not available for consuming $ClO^{\bullet}$ radicals

(3) Oxides of nitrogen also do not react with ozone in stratosphere

(4) Freons, chlorofluorocarbons, are inert chemically, they do not react with ozone in stratosphere

Ans. (1)

17. The initial volume of a gas cylinder is 750.0 mL. If the pressure of gas inside the cylinder changes from 840.0 mm Hg to 360.0 mm Hg, the final volume the gas will be

(1) 1.750 L (2) 7.50 L

(3) 3.60 L (4) 4.032 L

Ans. (1)

Sol. $P_1V_1 = P_2V_2$

$\Rightarrow 840 \times 750 = 360 \times V_2$

$\Rightarrow V_2 = \dfrac{840\times750}{360}$

$= 1750$ ml

$= 1.75$ L

18. If λ_0 and λ be the threshold wavelength and wavelength of incident light, the velocity of photoelectron ejected from the metal surface is

(1) $\sqrt{\dfrac{2hc}{m}\left(\dfrac{\lambda_0-\lambda}{\lambda\lambda_0}\right)}$ (2) $\sqrt{\dfrac{2h}{m}\left(\dfrac{1}{\lambda_0}-\dfrac{1}{\lambda}\right)}$

(3) $\sqrt{\dfrac{2h}{m}(\lambda_0-\lambda)}$ (4) $\sqrt{\dfrac{2hc}{m}(\lambda_0-\lambda)}$

Ans. (1)

Sol. $E = W + \dfrac{1}{2}mv^2$

$\Rightarrow \dfrac{hc}{\lambda} = \dfrac{hc}{\lambda_0}+\dfrac{1}{2}mv^2$

$\Rightarrow v^2 = \dfrac{2hc}{m}\left[\dfrac{1}{\lambda}-\dfrac{1}{\lambda_0}\right] \Rightarrow v = \sqrt{\dfrac{2hc}{m}\left[\dfrac{1}{\lambda}-\dfrac{1}{\lambda_0}\right]}$

$\Rightarrow v = \sqrt{\dfrac{2hc}{m}\left[\dfrac{\lambda_0-\lambda}{\lambda\lambda_0}\right]}$

19. Which one of the following is used as Antihistamine?

(1) Diphenhydramine (2) Norethindrone

(3) Omeprazole (4) Chloranphenicol

Ans. (1)

20. The molar heat capacity (C_p) of CD_2O is 10 cals at 1000 K. The change in entropy associated with cooling of 32 g of CD_2O vapour from 1000 K to 100 K at constant pressure will be (D = deuterium, at. mass = 2u)

(1) – 23.03 cal deg^{-1} (2) 2.303 cal deg^{-1}

(3) 23.03 cal deg^{-1} (4) – 2.303 cal deg^{-1}

Ans. (1)

Sol. $\Delta S = nC_p\, \ell n \left(\dfrac{T_2}{T_1}\right)$

$= 2.303 \times n \times C_p \log \left(\dfrac{T_2}{T_1}\right)$

$= 2.303 \times 1 \times 10 \log \dfrac{100}{1000}$

$= -23.03$ cal deg^{-1}

21. The gas liberated by the electrolysis of Dipotassium succinate solution is

(1) Ethyne (2) Ethene

(3) Propene (4) Ethane

Ans. (2)

22. Which of the following name formula combinations is not correct?

	Formula	**Name**
(1)	$K[Cr(NH_3)_2Cl_4]$	Potassium diammine Tetrachlorochromate (III)
(2)	$[CO(NH_3)_4(H_2O)I]SO_4$	Tetraammine aquaiodo cobalt (III) sulphate
(3)	$[Mn(CN)_5]^{2-}$	Pentacyanomagnate (II) ion
(4)	$K_2[Pt(CN)_4]$	Potassium tetracyanoplatinate(II)

Ans. (3)

Sol. Correct Name of $[Mn(CN)_5]^{2-}$ is Pentacyanomagnate (III) ion.

23. For the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$, the rate equation can be expressed in two ways

$$-\frac{d[N_2O_5]}{dt} = k[N_2O_5] \text{ and } +\frac{d[NO_2]}{dt} = k'[N_2O_5]$$

k and k′ are related as

(1) k = k′ (2) k = 4k′

(3) 2k = k′ (4) k = 2k′

Ans. (3)

Sol. $2N_2O_5 \longrightarrow 4NO_2 + O_2$

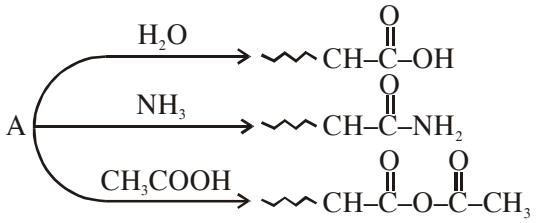
$$-\frac{d}{dt}[N_2O_5] = k[N_2O_5]$$

Now

$$\Rightarrow -\frac{1}{2}\frac{d}{dt}[N_2O_5] = \frac{1}{4} \times K^1 [N_2O_5]$$

$$\Rightarrow 2k = k'$$

24. An organic compound A, C_5H_8O; reacts with H_2O, NH_3 and CH_3COOH as described below:



A is

(1) $CH_3–CH_2–\underset{\displaystyle CH_3}{\underset{|}{C}}=C=O$

(2) $CH_2=CH\underset{\displaystyle CH_3}{\underset{|}{CH}}–CHO$

(3) $CH_3–CH_2–\underset{\displaystyle CH_2H}{\underset{||}{C}} – \underset{\displaystyle }{\underset{|}{C}}=O$

(4) $CH_3CH=\underset{\displaystyle CH_3}{\underset{|}{C}}–CHO$

Ans. (1)

25. A gaseous compound of nitrogen and hydrogen contains 12.5%(by mass) of hydrogen. The density of the compound relative to hydrogen is 16. The molecular formula of the compound is :

(1) NH_2 (2) NH_3 (3) N_3H (4) N_2H_4

Ans. (4)

Sol.

	N	H
Mass %	87.5	12.5
Mol	$\frac{87.5}{14}$	$\frac{12.5}{1}$
	= 6.25	= 12.5
	1	2

Empirical formula = NH_2

Since Vapour density = 16

$\therefore$ mol. wt. = 32

$\because$ Molecular formula = n × Emp. formula

= 2 × NH_2

= N_2H_4

26. Assuming that the degree of hydrolysis is small, the pH of 0.1 M solution of sodium acetate ($K_a = 1.0 \times 10^{-5}$) will be

(1) 5.0 (2) 8.0 (3) 6.0 (4) 9.0

Ans. (4)

Sol. $CH_3COONa \longrightarrow CH_3COO^- + Na^+$

0.1 M – –

– 0.1 M 0.1 M

$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + \overset{\ominus}{O}H$

C – –

C(1–h) ch ch

$$\Rightarrow K_h = \frac{[CH_3COOH]\,[\overset{\ominus}{O}H]}{[CH_3COO^-]} = \frac{K_w}{K_a} = \frac{ch^2}{(1-h)}$$

$$\Rightarrow \frac{10^{-14}}{10^{-5}} = ch^2$$

$\{\because$ h is very small $\therefore 1 - h \approx 1\}$

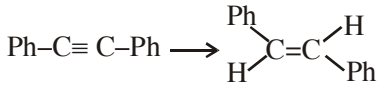
$$\Rightarrow h = \sqrt{\frac{10^{-9}}{0.1}} = 10^{-4}$$

$\therefore [\overset{\ominus}{O}H] = ch = 0.1 \times 10^{-4} = 10^{-5}$

$\Rightarrow [\overset{\oplus}{H}] = 10^{-9}$

$\therefore pH = -\log [\overset{\oplus}{H}] = 9$

27. The reagent needed for converting



is

(1) H_2/Lindlar Cat.

(2) Cat. Hydrogenation

(3) $LiAlH_4$ (4) Li/NH_3

Ans. (4)

28. Consider the coordination compound, $[Co(NH_3)_6]Cl_3$. In the formation of this complex, the species which acts as the Lewis acid is :

(1) $[Co(NH_3)_6]^{3+}$ (2) NH_3

(3) Co^{3+} (4) CI^-

Ans. (3)

Sol. Metalcation i.e. Ca^{3+} act as a lewis acid which accept lone pair from ligands of NH_3.

29. The correct order of bond dissociation energy among N_2, O_2, $O_2^-$is shown in which of the following arrangements?

(1) $N_2 > O_2 > O_2^-$ (2) $O_2 > O_2^- > N_2$

(3) $N_2 > O_2^- > O_2$ (4) $O_2^- > O_2 > N_2$

Ans. (1)

Sol. Bond energy $\propto$ Bond order bondorder :-

N_2 = Nb = 10, Na = 4

$$B.O. = (N_2) = \frac{10-4}{2} = 3$$

O_2 = Nb = 10, Na = 6

$$B.O_{(O_2)} = \frac{10-6}{2} = 2$$

O_2^- = Nb = 10, Na = 7

$$B.O._{(O_2)} = \frac{10-7}{2} = \frac{3}{2} = 1.5$$

Hence the order of B.O.

$N_2 > O_2 > O_2^-$

30. In some solutions, the concentration of H_3O^+ remains constant even when small amounts of strong acid or strong base are added to them. These solutions are known as :-

(1) Colloidal solutions

(2) True solutions

(3) Ideal solutions

(4) Buffer solutions

Ans. (4)