Chemistry JEE Solutions 2022

Chemistry

1. Arrange he following in increasing order of their covalent character

(1) CsCl < RbCl < NaCl < LiCl

(2) LiCl < NaCl < RbCl < CsCl

(3) CsCl < NaCl < LiCl < RbCl

(4) LiCl < RbCl < NaCl < CsCl

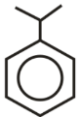
Sol. Answer (1)

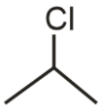
More is the Charge density on the cation more is the polarising power of cation and hence more is the covalent character.

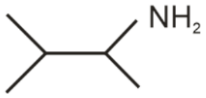
$\therefore$ The increasing order of covalent character

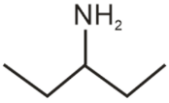
$CsCl < RbCl < NaCl < LiCl$

2. Which of the following has asymmetric carbon.

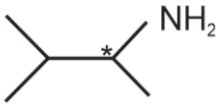
(1) 

(2) 

(3) 

(4) 

Sol. Answer (3)



Carbon atom to which 4 different groups are attached is asymmetric or chiral.

3. Cyanide (CN^-) is not used in extraction of which metal

(1) Zn (From mixture of sulphide ore)

(2) Au

(3) Ag

(4) Cu

Sol. Answer (4)

$ZnS + 4NaCN \rightarrow Na_2[Zn(CN)_4] + Na_2S$

Here, NaCN is used as a depressant

$M + NaCN + O_2 \rightarrow Na[M(CN)_2](aq)$

M = Au, Ag, this is leaching of Ag & Au

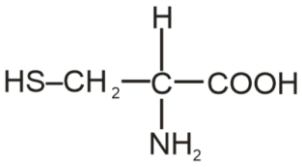
$CN^{\ominus}$ is not used in extraction of Cu metal

4. Which of the following amino acids contains sulphur

(1) Histamine (2) Cimetidine

(3) Cysteine (4) Ranitidine

Sol. Answer (3)



Cysteine is an amino-acid containing sulphur

5. The configuration of element of atomic number 78 is

(1) $[Xe]3f^{14}4d^{10}5s^0$ (2) $[Kr]3f^{14}4d^8 5s^o$

(3) $[Xe]3f^{14}4d^{10}5s^2$ (4) $[Xe]4f^{14}5d^9 6s^1$

Sol. Answer (4)

For platinum, z = 78

Electronic configuration

= $[Xe]\ 4f^{14}\ 5d^9\ 6s^1$

6. Find out the lowest wavelength of incident radiation required for photoelectric effect among the following elements

(1) Li (2) Cs

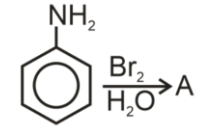
(3) Rb (4) Na

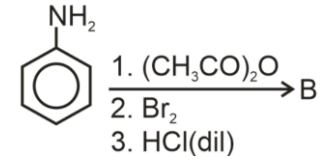
Sol. Answer (1)

$$E = \frac{hc}{\lambda} \Rightarrow E \propto \frac{1}{\lambda}$$

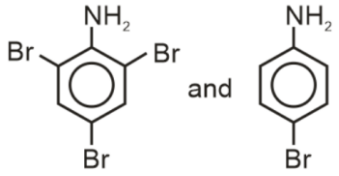
The lowest wavelength is required for Li, as it has the highest ionization energy.

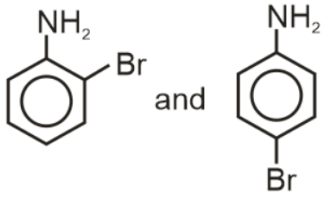
7.

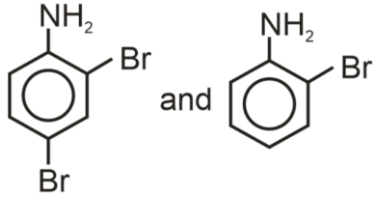


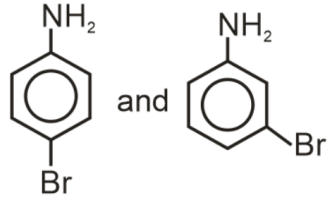


A and B are respectively

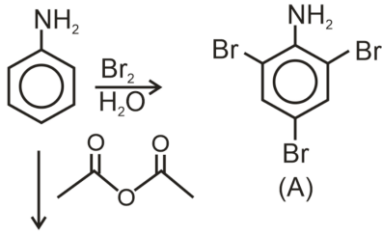
(1) 

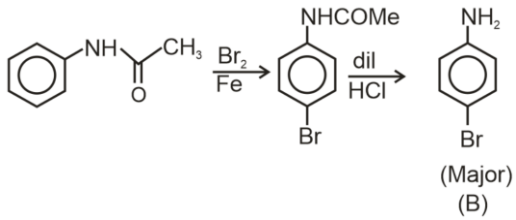
(2) 

(3) 

(4) 

Sol. Answer (1)





(Major)
(B)

8. Which sugar is present in DNA and RNA respectively?

(1) β-D-Ribose, β-D-Ribose

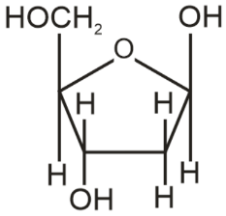
(2) β-D-Ribose, β-D-2-Deoxyribose

(3) β-D-2-Deoxyribose, β-D-Ribose

(4) β-D-Deoxyribose, β-D-2-Deoxyribose

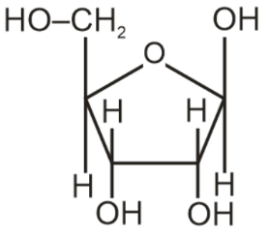
Sol. Answer (3)

The sugar present in DNA is β-D-2-Deoxyribose



β-D-2-deoxyribose

The sugar present in RNA is β-D-ribose



β-D-ribose

9. Statement 1 : Phenol is weaker acid as compared to acetic acid

Statement 2 : Phenol is weaker acid than alcohol and water

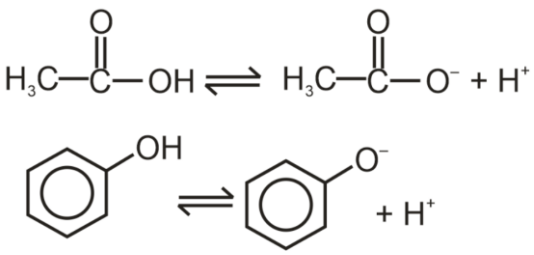
(1) Statement 1 and 2, both are correct

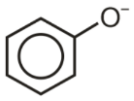
(2) Statement 1 is correct but statement 2 is incorrect

(3) Statement 1 is incorrect and Statement 2 is correct

(4) Statement 1 and 2, both are incorrect

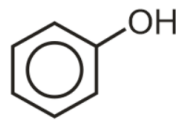
Sol. Answer (2)



$H_3C - COO^-$ is a weaker base than 

So acetic acid is more acidic than phenol

$\therefore$ Statement -1 is correct.



is more acidic than alcohol and water because the phenoxide ion is stabilised by resonance $\therefore$ statement 2 is false

10. Which of the following is present in rain water that affects Taj Mahal and causes damage to the monument

(1) H_2SO_4 (2) H_3PO_4

(3) Phenol (4) Lactic acid

Sol. Answer (1)

Burning of fossil fuels which contains sulphur produces SO_2, which gets oxidized and reacts with water to produce H_2SO_4.

$$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$$

H_2SO_4 present in acid rain reacts with marble ($CaCO_3$) of Taj Mahal and cause it's discolouration.

$$H_2SO_4 + CaCO_3 \rightarrow CaSO_4 + H_2O + CO_2$$

11. Which of the following polymer can regain its shape.

(1) Nylon -6, 6 (2) Buna – S

(3) Terylene (4) Bakelite

Sol. Answer (2)

Buna - S is an Elastomers. Elastomers are the polymers which have rubber like properties and can regain their shape.

12. $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, $\frac{a}{b}$ will be dimensionally equal to

(1) $\frac{P}{V}$ (2) P

(3) PV^3 (4) $\frac{P}{V^2}$

Sol. Answer (2)

For 1 mole, vander waal's equation is:

$\left(P + \frac{a}{V^2}\right)(V - b) = RT$ (Here V = molar volume)

unit of $\frac{a}{V^2}$ = unit of P

$\frac{a}{L^2\,mol} = atm$

a = atm L^2 mol

Also,

Unit of b = unit of V

b = L mol^{-1}

$$\frac{a}{b} = \frac{atm\ L^2\ mol^{-1}}{L\ mol^{-1}}$$

= L atm

So dimensionally $\frac{a}{b}$ is equal to PV.

13. Solubility of AgCl is maximum in

(1) 0.01 M HCl (2) 0.01 M KCl

(3) Deionised water (4) 0.01 M NH_3

Sol. Answer (4)

$$AgCl \rightleftharpoons Ag^{\oplus} + Cl^{\ominus}$$

Since HCl, KCl, will provide common ion, due to common ion effect solubility decreases

$$Ag^{+} + 2NH_3 \rightleftharpoons [Ag(NH_3)_2]^{+}$$

In the presence of NH_3, Ag^+ form complex due to which dissociation of AgCl increases, hence solubility increases.

So option (4) is correct.

14. Statement 1 : Photoelectric emission happens when incident energy is less than work function

Statement 2: Kinetic energy becomes zero when incident energy becomes equal to work function

(1) Statement-1 and 2 both are correct

(2) Statement-1 is correct but statement 2 is incorrect

(3) Statement-1 is incorrect but statement 2 is correct

(4) Statement-1 and 2 both are incorrect

Sol. Answer (3)

When energy of incident photon is less than work function, then no photoelectric emission occurs

$\therefore$ Statement (1) is not correct

$E_{incident}$ = work function + KE

$\therefore$ $KE = E_{incident} - Work\ function$

If $E_{incident}$ = work function than KE = 0

$\therefore$ Statement 2 is correct

$\therefore$ Option (3) is correct answer

15. Match the elements given in Column-1 with their uses given in column-II.

Column-I (Element)		Column-II (Uses)
(i)	Cs	(a) High temperature thermometer
(ii)	Ga	(b) Water proofing
(iii)	B	(c) Photoelectric
(iv)	Si	(d) Bullet-proof vest

(1) (i)–c, (ii)–a, (iii)-d, (iv)-b

(2) (i)–d, (ii)–c, (iii)-a, (iv)-b

(3) (i)–b, (ii)–c, (iii)-d, (iv)-a

(4) (i)–d, (ii)–a, (iii)-b, (iv)-c

Sol. Answer (1)

Cs is used in photoelectric cell. Ga has High Boiling point, hence it is used in High temperature thermometer.

Boron fibers are used in making bullet - proof vest.

Silicon as silicones used for water proofing of fabrics.

16. Manganate ion disproportionates in neutral medium. Find spin only magnetic moment of the species formed by oxidation of manganate ion (in BM)

(1) 0 (2) 1.73

(3) 2.89 (4) 3.8

Sol. Answer (1)

$$\overset{+6}{MnO_4^{2-}} \longrightarrow \boxed{\overset{+7}{MnO_4^-}} + MnO_2$$

Oxidized species

$\overset{x}{Mn}O_4^-$, $x - 8 = -1$

$x = +7$

$Mn \rightarrow [Ar]3d^5 4s^2$

$Mn^{+7} \rightarrow [Ar]3d^0 4s^0$

Since there is no unpaired electron, So spin only magnetic moment is zero.

17. On reaction of white phosphorous with alkali in inert atmosphere, salt of which of the following acid is obtained ?

(1) Phosphoric acid

(2) Phosphonic acid

(3) Hypophosphoric acid

(4) Phosphorous acid

Sol. Answer (2)

$$P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$$

$NaH_2PO_2 \rightarrow$ sodium hypophosphite H_3PO_2 is hypophosphorous acid which is also known as Phosphonic acid.

So option 2 is correct.

18. Consider the following reaction

$$C_6H_{12}O_6 \xrightarrow{\text{Zymase}} A \xrightarrow{NaOI} B + CHI_3$$

The number of carbon atoms in B is

Sol. Answer (1)

$$C_6H_{12}O_6 \xrightarrow{\text{Zymose}} \underset{A}{2C_2H_5OH_{(aq)}} + 2CO_{2(g)}$$

$\downarrow$ NaOI (iodoform reagent)

$$\underset{B}{HCOO^-Na^+} + \underset{\text{iodoform}}{CHI_3}$$

B contain 1 carbon atom

19. Consider the following reaction

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

If 4640 g of Fe_2O_3 is allowed to react with 90 moles of CO. What is the weight (in g) of Fe produced?

Sol. Answer (3248)

No. of moles of $Fe_2O_3 = \dfrac{4640}{160} = 29$

$$\underset{29}{Fe_2O_3} + \underset{90}{3CO} \rightarrow 2Fe + 3CO_2$$

1 moles of Fe_2O_3 reacts with = 3 moles of CO

29 moles of Fe_2O_3 react with = $3 \times 29 = 87$

CO is in Excess, So Fe_2O_3 is Limiting Reagent

1 mole of Fe_2O_3 give = 2 moles of Fe

29 mole of Fe_2O_3 give = 29×2 moles of Fe

$$n_{Fe} = 58 = \frac{W_{Fe}}{M_{Fe}}$$

$$W_{Fe} = 58 \times 56 = 3248\,g$$

20. Given activation energy (E_a) for a chemical reaction is 23566 J. Initial temp is 310 K and final temperature is 300 K. If the rate constant of the reaction in initial and final condition is K_1 and K_2 respectively and the value of $\frac{k_2}{k_1}$ is $x \times 10^{-3}$. Find the value of x

[Given log (0.75) = –0.13]

Sol. Answer (750)

We know that

$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$$

$$\log\frac{k_2}{k_1} = \frac{23566}{2.303\times 8.314}\left(\frac{1}{310}-\frac{1}{300}\right)$$

$$= -\frac{23566}{2.303\times 8.314}\times\left(\frac{10}{300\times 310}\right)$$

$$\log\frac{k_2}{k_1} = -0.13$$

$$\frac{k_2}{k_1} = 0.75$$

$= 750 \times 10^{-3}$

Hence x = 750

21. The minimum value of radius ratio for tetrahedral void is ___

Sol. Answer (0.225)

$$0.225 \le \frac{r^+}{r^-} < 0.414$$

$\therefore$ the minimum value of $\frac{r^+}{r^-}$(radii ratio) for tetrahedral void is 0.225

22. Find the molar mass of an ideal gas at 100 mm Hg pressure of 235°C temperature having density of 0.46 gm/L. Use R = 0.0821 L atm mol^{-1} K^{-1} (Round off to the nearest integer)

Sol. Answer (146)

$$P = 100 \text{ mm Hg} = \frac{100}{760}\text{atm}$$

T = 235°C = 235 + 273 = 508 K

ρ = 0.46 gm/L

R = 0.0821 L atm mol^{-1} K^{-1}

From ideal gas equation (in terms of density)

$$P = \frac{\rho RT}{M}$$

$$M = \frac{\rho RT}{P} = \frac{0.46\times 0.0821\times 508\times 760}{100}$$

$$= 145.8 \approx 146\,\text{gm/mole}$$

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