CHEMISTRY QUESTION PAPER WITH SOLUTION
(CODE – 2ND SHIFT)

1. Cast iron is used for the manufacture of :
   (1) Wrought iron and steel
   (2) Wrought iron and pig iron
   (3) Wrougth iron, pig iron and steel
   (4) Pig iron, scrap iron and steel

Sol. 1
Refer topic metallurgy

2. The shape/structure of $[XeF_5]^-$ and XeO_3F_2, respectively, are :
   (1) Pentagonal planar and trigonal bipyramidal
   (2) Trigonal bipyramidal and trigonal bipyramidal
   (3) Octahedral and square pyramidal
   (4) Trigonal bipyramidal and pentagonal planar

Sol. 1

$[XeF_5]^-$ 5BP + 2LP = 7VSEP sp^3d^3 hybridisation

XeO_3F_2 5BP + 0LP = 5VSEP sp^3d hybridisation

3. Simplified absorption spectra of three complexes ((i), (ii) and (iii)) of M^{n+} ion are provided below; their $_{max}$ values are marked as A, B and C respectively. The correct match between the complexes and their $_{max}$ values is :
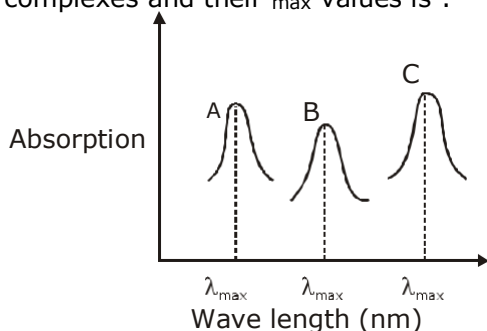
(i) $[M(NCS)_6]^{(-6+n)}$
(ii) $[MF_6]^{(-6+n)}$
(iii) $[M(NH_3)_6]^{n+}$

   (1) A-(i), B-(ii), C-(iii)
   (2) A-(iii), B-(i), C-(ii)
   (3) A-(ii), B-(iii), C-(i)
   (4) A-(ii), B-(i), C-(iii)

Sol. 2

$$= \frac{hc}{absorbedf\ max}$$

A → NH_3 comp (iii)
B → NCS comp (i)
C → F^- comp (ii)
using spectrochemical series of ligand
$F^- < NCS^- < NH_3$ order of ↑e
crystal field spliting energy
So. NH_3 complex → A
F^- complex – C
NCS^- complex → B

4. The correct observation in the following reactions is :

Sucrose $\xrightarrow[\substack{\text{Cleavage}\\\text{(Hydrolysis)}}]{\text{Gly cos idic bond}}$ A B $\xrightarrow{\substack{\text{Seliwanoff 's}\\\text{reagent}}}$?

(1) Formation of red colour (2) Formation of blue colour
(3) Formation of violet colour (4) Gives no colour

Sol. **1**

Sucrose $\xrightarrow[\substack{\text{Cleavage}\\\text{(Hydrolysis)}}]{\text{Gly cosidic bond}}$ Glucos e Fructose $\xrightarrow{\substack{\text{Seliwanoff 's}\\\text{reagent}}}$ Re dColour

5. The results given in the below table were obtained during kinetic studies of the following reaction : 2A+B C+D

Experiment	[A]/ molL^{-1}	[B]/ molL^{-1}	Initial rate/ molL^{-1} min^{-1}
I	0.1	0.1	6.00×10^{-3}
II	0.1	0.2	2.40×10^{-2}
III	0.2	0.1	1.20×10^{-2}
IV	X	0.2	7.20×10^{-2}
V	0.3	Y	2.88×10^{-1}

X and Y in the given table are respectively :
(1) 0.4, 0.4 (2) 0.3, 0.4 (3) 0.4, 0.3 (4) 0.3, 0.3

Sol. **2**

2A+B → C+D

Exp. (I) $6 \times 10^{-3} = K (0.1)^p (0.1)^q$
(II) $2.4 \times 10^{-2} = K (0.1)^p (0.2)^q$
(III) $1.2 \times 10^{-2} = K (0.2)^p (0.1)^q$

$\dfrac{\exp(I)}{\exp(II)}$ $\dfrac{1}{4} = \dfrac{1}{2}^q$ q = 2

$\dfrac{\text{Exp.(I)}}{\text{Exp.(III)}}$ $\dfrac{1}{2} = \dfrac{1}{2}^p$ p = 1

exp. (I) exp (IV)

$\dfrac{0.6 \ 10^{-2}}{7.2 \ 10^{-2}} = \dfrac{0.1}{x}^1 \cdot \dfrac{0.1}{0.2}^2$

$\dfrac{1}{12} \dfrac{0.1}{x} \dfrac{1}{4}$

[x] = 0.3

exp (I) exp(V)

$\dfrac{0.6 \ 10^{-2}}{2.88 \ 10^{-1}} = \dfrac{0.1}{0.3}^1 \dfrac{0.1}{y}^2$

$\dfrac{1}{48} \dfrac{1}{3} \dfrac{10^{-2}}{y^2}$ y^2 0.16

y = 0.4
Ans(2)

6. Match the type of interaction in column A with the distance dependence of their interaction energy in column B :

A		B	
(I)	ion-ion	(a)	$\dfrac{1}{r}$
(II)	dipole-dipole	(b)	$\dfrac{1}{r^2}$
(III)	London dispersion	(c)	$\dfrac{1}{r^3}$
		(d)	$\dfrac{1}{r^6}$

(1) (I)-(a), (II)-(b), (III)-(d)   (2) (I)-(a), (II)-(b), (III)-(c)
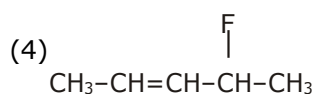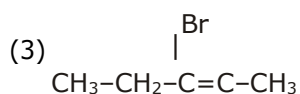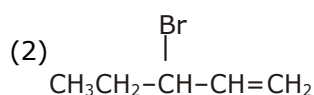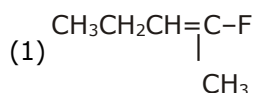(3) (I)-(b), (II)-(d), (III)-(c)   (4) (I)-(a), (II)-(c), (III)-(d)

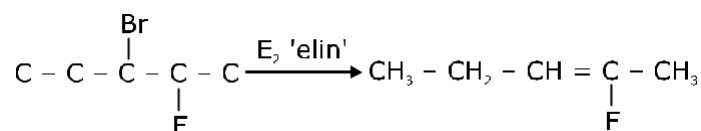**Sol.** **4**

ion - ion $\dfrac{1}{r}$

dipole – dipole $\dfrac{1}{r^3}$

Londong dispersion $\dfrac{1}{r^6}$

7. The major product obtained from E_2– elimination of 3-bromo-2-fluoropentane is :

(1) $CH_3CH_2CH=\underset{\underset{CH_3}{|}}{C}-F$

(2) $\underset{\underset{CH_3CH_2-CH-CH=CH_2}{}}{\overset{\overset{Br}{|}}{}}$

(3) $CH_3-CH_2-\underset{\underset{}{}}{\overset{\overset{Br}{|}}{C}}=C-CH_3$

(4) $CH_3-CH=CH-\underset{}{\overset{\overset{F}{|}}{C}H}-CH_3$

Sol. **1**

$$C-C-\underset{\underset{F}{|}}{\overset{\overset{Br}{|}}{C}}-C-C \xrightarrow{E_2 \text{ 'elin'}} CH_3-CH_2-CH=\underset{\underset{F}{|}}{C}-CH_3$$

8. Consider the reaction sequence given below :

rate = k[t-BuBr]

rate = k[t-BuBr][OH$^\ominus$]
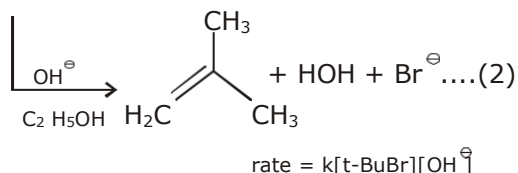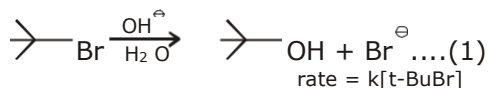
Which of the following statements is true :
(1) Changing the concentration of base will have no effect on reaction (1).
(2) Doubling the concentration of base will double the rate of both the reactions.

(3) Changing the base from OH to OR will have no effect on reaction (2).
(4) Changing the concentration of base will have no effect on reaction (2).

Sol. **1**
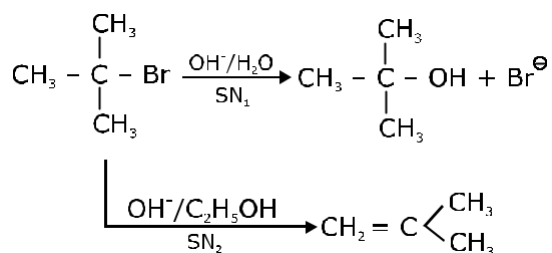
9. The size of a raw mango shrinks to a much smaller size when kept in a concentrated salt solution.

(1) Diffusion   (2) Osmosis
(3) Reverse osmosis   (4) Dialysis

Sol. **2**
Theoritical
Ans. Osmosis
Option (2)

10. If you spill a chemical toiled cleaning liquid on your hand, your first aid would be :
(1) Aqueous NH_3 (2) Aqueous $NaHCO_3$
(3) Aqueous NaOH   (4) Vinegar

Sol. **2**
Fact

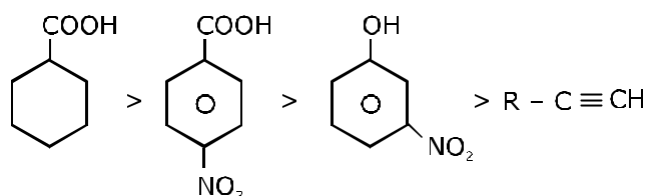**11.** Arrange the followig labelled hydrogens in decreasing order of acidity :
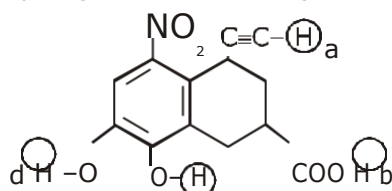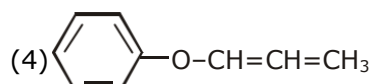

(1) b > a > c > d   (2) b > c > d > a
(3) c > b > d > a   (4) c > b > a > d

Sol. **2**

Order of acidic strength

12. An organic compound 'A' ($C_9H_{10}O$) when treated with conc. HI undergoes cleavage to yield compounds 'B' and 'C'. 'B' gives yellow precipitate with $AgNO_3$ where as 'C' tautomerizes to 'D'. 'D' gives positive iodoform test. 'A' could be :

(1) ⟨benzene⟩–CH_2–O–CH=CH_2 (2) H_3C–⟨benzene⟩–O–CH=CH_2

(3) ⟨benzene⟩–O–CH_2–CH=CH_2 (4) ⟨benzene⟩–O–CH=CH=CH_3
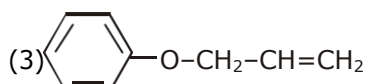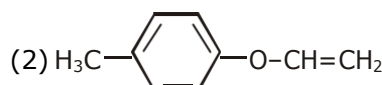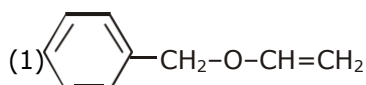
Sol. **1**
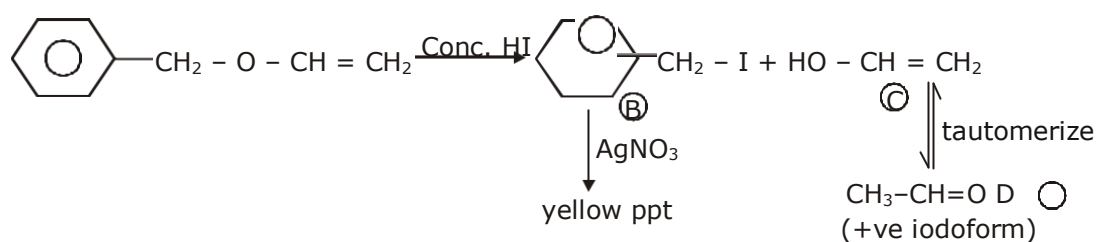
13. Two elements A and B have similar chemical properties. They don't form solid hydrogencarbonates, but react with nitrogen to form nitrides. A and B, respectively, are :
(1) Na and Ca   (2) Cs and Ba
(3) Na and Rb   (4) Li and Mg

Sol. **4**

$LiHCO_3$ & $Mg(HCO_3)_2$ does not exist in solid form but both forms nitrides with nitrogen gas

Radiance®
spreading the fragrance of knowledge

Address - Near Himfed Building, BCS Chowk, New Shimla (HP) - 171009
www.radianceiit.in | Phone: +91 8091157087 | E-mail: er.j.k.tiwari@gmail.com

14. The number of subshells associated with n = 4 and m = −2 quantum numbers is :

(1) 4   (2) 8   (3) 2   (4) 16

Sol. **3**

n = 4

  = 0   m = 0

  = 1   m = − 1, 0, +1

  = 2   m = − 2, + 2, −1, +1, 0

  = 3   m 3, 2, 1,0

Ans.   '2' Subshells

Option (3)

15. The major product of the following reaction is :
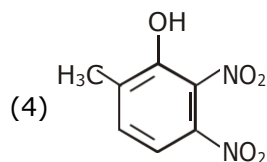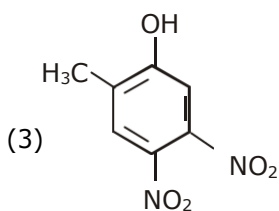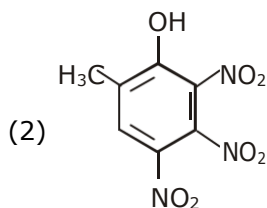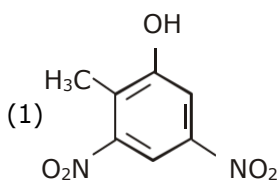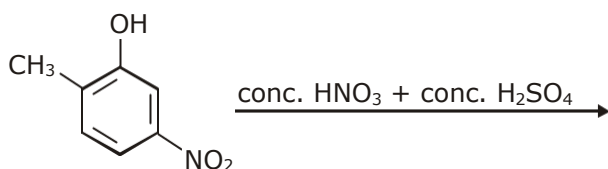
Sol. **3**
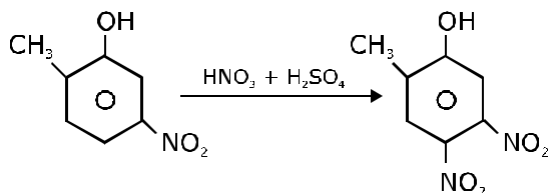
16. Two compounds A and B with same molecular formula (C_3H_6O) undergo Grignard's reaction with methylmagnesium bromide to give products C and D. Products C and D show following chemical tests.

Test	C	D
Ceric ammonium nitrate Test	Positive	Positive
Lucas Test	Turbidity obtained after five minutes	Turbidity obtained immediately
Iodoform Test	Positive	Negative

C and D respectively are :

(1) C=H₃C–CH₂–CH₂–CH₂–OH;

    D=H₃C–CH₂–CH–CH₃
                  |
                OH

               OH
(2) |
    C=H₃C–CH₂–CH–CH₃;

             CH₃
             |
    D=H₃C–C–OH
             |
             CH₃

(3) C=H₃C–CH₂–CH₂–CH₂–OH;

             CH₃
             |
    D=H₃C–C–OH
             |
             CH₃

             CH₃
             |
    C=H₃C–C–OH
(4) |
         CH₃

    D=H₃C–CH₂–CH–CH₃
                  |
                OH

Sol. **2**

17. Three elements X, Y and Z are in the 3rd peroid of the periodic table. The oxides of X, Y and Z, respectively, are basic, amphoteric and acidic, The correct order of the atomic numbers of X, Y and Z is :
    (1)X<Y<Z   (2)Y<X<Z
    (3)Z<Y<X   (4)X<Z<Y

Sol. **1**

x	<	y	<	z
Mg		Al		Si
Basic oxide		amphoteric		acidic oxide

18. The one that is not expected to show isomerism is :
    (1) $[Ni(NH_3)_4(H_2O)_2]_{2+}$ (2) $[Ni(en)_3]_{2+}$
    (3) $[Pt(NH_3)_2Cl_2]$ (4) $[Ni(NH_3)_2Cl_2]$

Sol. **4**

$[Ni(NH_3)_2Cl_2]$ Ni_{2+} is sp_3 hybridised & such tetrahedral complex does not show either of geometrical or optical isomerism

$[Ni(en)_3]^{2+}$ shows only optical isomers while other three shows geometrical isomerism

19. Amongst the following statements regarding adsorption, those that are valid are :
    (a) H becomes less negative as adsorption proceeds.
    (b) On a given adsorbent, ammonia is adsorbed more than nitrogen gas.
    (c) On adsorption, the residual force acting along the surface of the adsorbent increases.
    (d) With increase in temperature, the equilibrium concentration of adsorbate increases.
    (1) (b) and (c)   (2) (c) and (d)
    (3) (a) and (b)   (4) (d) and (a)

Sol. Statement 'a' & 'b'

20. The molecular geometry of SF$_6$ is octahdral. What is the geometry of SF$_4$ (including lone pair(s) of electrons, if any) ?
    (1) Pyramidal   (2) Trigonal bipyramidal
    (3) Tetrahedral   (4) Square planar

Sol. **2**

SF$_4$ is Sp^3d hybridised in which hybrid orbitals have TBP arrangement but its shape is sea-saw

Radiance®
spreading the fragrance of knowledge

Address - Near Himfed Building, BCS Chowk, New Shimla (HP) - 171009
www.radianceiit.in | Phone: +91 8091157087 | E-mail: er.j.k.tiwari@gmail.com

21. The ratio of the mass percentages of 'C & H' and 'C & O' of a saturated acyclic organic compound 'X' are 4 : 1 and 3 : 4 respectively. Then, the moles of oxygen gas required for complete combustion of two moles of organic compound 'X' is _____.

Sol. Mass ratio of C : H is 4 : 1   12 : 3
& C : O is 3 : 4 12 : 16
So,

	mass	mole	mole ratio
C	12	1	1
H	3	3	3
O	16	1	1

Empirical formula CH_3O
as compound is satured a cyclic so, molecular formula is $C_2H_6O_2$.

$$CHO_2 + \frac{5}{2}O_{2(g)} \quad 2CO_{2(g)} \quad +3H_2O_{(g)}$$
2mole   5 mole

So, required moles of O_2 is   5

22. For the disproportionation reaction $2Cu^+(aq) \longrightarrow Cu(s) + Cu^{2+}(aq)$ at K, ln K (where K is the equilibrium constant) is _____ $\times 10^{-1}$.
Given :

$(E^0_{Cu^{2}/Cu} \quad 0.16 \, V$

$E^0_{Cu/Cu} \; 0.52 \, V$

$\frac{RT}{F} \quad 0.025)$

Sol. **144**

$2Cu^+ \quad\quad Cu(s) + Cu^{+2}$

$E^o = 0.52 - 0.16$
$\quad = 0.36$

$E^o = \dfrac{RT}{nF} \ln (k_{eq})$

$\ln(k_{eq}) = \dfrac{0.36}{0.025} \quad \underline{\quad} \quad \dfrac{1}{1} \times$

$= \dfrac{360}{25} = 14.4$

$= 144 \times 10^{-1}$

Ans. 144

23. The work function of sodium metal is 4.41×10^{-19} J. If photons of wavelength 300 nm are incident on the metal, the kinetic energy of the ejected electrons will be (h = 6.63×10^{-34} J s; c = 3×10^8 m/s) _____ $\times 10^{-21}$ J.

Sol. **222**

$= 4.41 \times 10^{-19}$ J

$= 300$ nm

$KE_{max} = \dfrac{hc}{\lambda} -$

$= \dfrac{6.63 \; 10^{-34} \; 3 \; 10^8}{300 \; 10^{-9}} - 4.41 \times 10^{-19}$
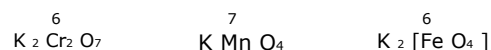
$= 6.63 \times 10^{-19} - 4.41 \times 10^{-19}$

$= 222 \times 10^{-21}$

Ans. 222

24. The oxidation states of transition metal atoms in $K_2Cr_2O_7$, $KMnO_4$ and K_2FeO_4, respectively, are x, y and z. The sum of x, y and z is _____.

Sol. **19**

$\overset{6}{K_2 Cr_2 O_7}$ $\overset{7}{K Mn O_4}$ $\overset{6}{K_2 [Fe O_4]}$

25. The heat of combustion of ethanol into carbon dioxide and water is −327 kcal at constant pressure. The heat evolved (in cal) at constant volume and 27ºC (if all gases behave ideally) is (R = 2 cal mol^{-1} K^{-1}) _____.

Sol. $\Delta H^0_c \, [C_2H_5OH] = -327$ kcal

$C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3(H_2O)(l)$

$\Delta E^0_c = \Delta H^0_c - \Delta n_g RT$

$= -327 \times 1000 - (-1) \times 2 \times 300$

$= -327000 + 600$

$= -326400$

Radiance® spreading the fragrance of knowledge

Address - Near Himfed Building, BCS Chowk, New Shimla (HP) - 171009
www.radianceiit.in | Phone: +91 8091157087 | E-mail: er.j.k.tiwari@gmail.com