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JEE (Main)

PAPER-1 (B.E./B. TECH.)

2023

COMPUTER BASED TEST (CBT)

Memory Based Questions & Solutions

Date: 29 January, 2023 (SHIFT-1) | TIME : (9.00 a.m. to 12.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

1. Select the correct option :

	Li_2O	K_2O	Na_2O_2
(1)	Diamagnetic	Diamagnetic	Diamagnetic
(2)	Paramagnetic	Diamagnetic	Diamagnetic
(3)	Paramagnetic	Paramagnetic	Diamagnetic
(4)	Paramagnetic	Paramagnetic	Paramagnetic

Ans. **(1)**

Sol. O^{-2} & O_2^{-2} are diamagnetic.

2. Give the correct order of bond dissociation energy ?
(1) F – F > Cl – Cl > Br – Br > I – I
(2) F – F < Cl – Cl < Br – Br < I – I
(3) Cl – Cl > Br – Br > F – F > I – I
(4) Cl – Cl > Br – Br > I – I > F – F

Ans. **(3)**

Sol. In F_2 due to small size LP – LP repulsion is high.

Halogens	Bond dissociation energy (KJ/Mol)
F_2	158.8
Cl_2	242.6
Br_2	192.8
I_2	151.1

Order of bond dissociation energy is Cl – Cl > Br – Br > F – F > I – I.

3. Arrange the following in decreasing order of their hydration energy
Mg^{2+} Cs^+ K^+ Ca^{2+} Rb^+
(1) $Mg^{2+} > Ca^{2+} > K^+ > Rb^+ > Cs^+$
(2) $Cs^+ > Rb^+ > K^+ > Ca^{2+} > Mg^{2+}$
(3) $Mg^{2+} > Ca^{2+} > Cs^+ > Rb^+ > K^+$
(4) $K^+ > Rb^+ > Cs^{2+} > Ca^{2+} > Mg^{2+}$

Ans. **(1)**

Sol. $Mg^{2+} > Ca^{2+} > K^+ > Rb^+ > Cs^+$
Decreasing the size, hydration energy increases.

4. Which among the following represent reactions of mond process ?
(1) $Ti + 2I_2 \xrightarrow{50-250^\circ C} TiI_4$
$Ti\,I_4 \xrightarrow[\text{Tungsten filament}]{1400^\circ C} Ti + 2I_2$
(2) $Ni + 4CO \xrightarrow{50^\circ C} [Ni(CO)_4]$
$[Ni(CO)_4] \xrightarrow{200^\circ C} Ni + 4CO$
(3) $4Ag + O_2 + 2H_2O + 8NaCN \longrightarrow 4Na[Ag(CN)_2] + 4NaOH$
$2Na[Ag(CN)_2] + Zn \longrightarrow 2Ag + Na_2[Zn(CN)_4]$
(4) $2AlN + 3H_2O \longrightarrow Al(OH)_3 + 2NH_3$

Ans. **(2)**

Sol. Theory Based.

5. Identify total number of odd electron species form following :
NO_2, NO_2^+, ClO_2, NO, ICl_4^-, BrF_3

Ans. **(3)**

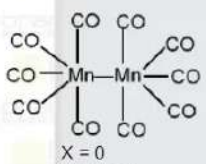
Sol.

Species	Total electron
NO_2	23
ClO_2	33
NO	15

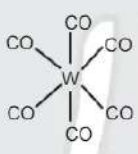
6. X = number of bridging CO present in $Mn_2(CO)_{10}$
Y = number of bridging CO present in $W(CO)_6$
Find out (X + Y)

Ans. **(0)**

Sol.



X = 0



Y = 0

X + Y = 0

7. Oxidation of ammonia in Ostwald process leads to [A], which on further oxidation forms [B]. Hydration of [B] forms oxo acids, one of which again forms [A] on decomposition. [A] & [B] are respectively.

	[A]	[B]
(1)	NO	NO_2
(2)	NO_2	N_2O_3
(3)	N_2O	NO

(3) N_2O NO
(4) N_2O_5 N_2O_4

Ans. **(1)**

Sol. $NH_3 + O_2 \xrightarrow{\Delta} \underset{(A)}{NO} + H_2O$

$NO + O_2 \xrightarrow{\Delta} \underset{(B)}{NO_2}$

$NO_2 + H_2O \longrightarrow HNO_2 + HNO_3$

$HNO_2 \longrightarrow NO + H_2O + HNO_3$

8. Which of the following metal ion will release H_2 gas on reaction with dilute acid solution

Given $E^0_{V^{3+}|V^{2+}} = -0.255$ V

$E^0_{Cr^{3+}|Cr^{2+}} = -0.407$ V

$E^0_{Mn^{3+}|Mn^{2+}} = 1.54$ V

$E^0_{Co^{3+}|Co^{2+}} = 1.81$ V

(1) V^{2+}, Cr^{2+} (2) Mn^{2+}, Co^{2+} (3) V^{2+}, Mn^{2+} (4) Cr^{2+}, Co^{2+}

Ans. **(1)**

Sol. The metal ion for which have less value of reduction potential than ($E^0_{H^+|H_2} = 0$) can release H_2 on reaction with dilute acid.

9. In borax bead test, by heating $CuSO_4$ a green blue bead is obtained in oxidising flame consist of following :

(1) Cu (2) $Cu(BO_2)_2$ (3) Cu_2O (4) CuO

Ans. **(2)**

Sol. $CuSO_4 \xrightarrow{\Delta} CuO + SO_2$

$CuO + B_2O_3 \longrightarrow Cu(BO_2)_2$

10. For a reversible reaction at 27°C

$$A \underset{K_b = 10^2}{\overset{K_f = 10^3}{\rightleftharpoons}} B$$

Value of ΔG° for above reaction is – _____KJ/mole
(Nearest integer)

[Given $R = 8.3 \frac{J}{mole \times k}$, $\ell n\ 10 = 2.3$]

Ans. **(6)**

Sol. $K_{eq} = \frac{K_f}{K_b} = \frac{10^3}{10^2} = 10$

$\Delta G^\circ = -RT\ \ell n\ k_{eq}$

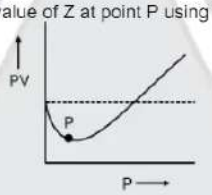
$= -8.3 \times 300\ \ell n\ (10)$

$= -8.3 \times 300 \times 2.3$

$= -5.72 \times 10^3$ J

$= -5.72$ KJ

11. For one mole real gas, the correct value of Z at point P using following graph is



(1) $1 + \frac{b}{V}$ (2) $1 + \frac{a}{VRT}$ (3) $1 - \frac{b}{V}$ (4) $1 - \frac{a}{VRT}$

Ans. **(4)**

Sol. For 1 mole of real gas

$\left(p + \frac{a}{V^2}\right)(V - b) = RT$

In low pressure range

$\left(p + \frac{a}{V^2}\right) V = RT$

$\Rightarrow PV + \frac{a}{V} = RT$

$$\frac{PV}{RT}+\frac{a}{VRT}=1$$

$$Z=1-\frac{a}{VRT}$$

12. The milimole of $Ca(OH)_2$ dissolved to obtained 100 ml of solution of pH = 12 is _____ $\times 10^{-1}$

Ans. **(5)**

Sol. pH = 12 $\Rightarrow$ pOH = 2 so $[OH^-] = 10^{-2}$ M.

Milimole of $[OH^-] = 10^{-2} \times 100 = 1$

$Ca(OH)_2(s) \longrightarrow Ca^{2+}(aq.) + 2\,OH^-(aq.)$

$\frac{1}{2}$ milimole 1 milimole

milimole of $Ca(OH)_2 = \frac{1}{2} = 5 \times 10^{-1}$ milimole.

13. For reaction at P = 1 bar and 2300 K.

$H_2O(g) \longrightarrow H_2(g) + \frac{1}{2}O_2(g)$

$K_p = 2 \times 10^{-3}$, the value of degree of dissociation is.....$\times 10^{-2}$ [Nearest integer]

Ans. **(2)**

Sol. $H_2O(g) \longrightarrow H_2(g) + \frac{1}{2}O_2(g)$

$1-\alpha \quad \alpha \quad \alpha/2$

$$K_p = \frac{\alpha\left(\frac{\alpha}{2}\right)^{\frac{1}{2}}}{1-\alpha} = 2 \times 10^{-3}$$

$$= \frac{(\alpha)^{\frac{3}{2}}}{\sqrt{2}\,(1-\alpha)} = 2 \times 10^{-3}$$

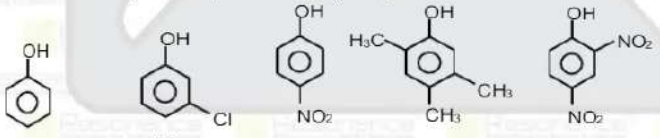
$= (\alpha)^{\frac{3}{2}} = 2\sqrt{2} \times 10^{-3}$ $(\alpha << 1)$

$(\alpha)^{\frac{3}{2}} = \sqrt{8} \times 10^{-3}$

$(\alpha)^3 = (2)^3 \times 10^{-6}$

$\alpha = 2 \times 10^{-2}$

14. Write increasing order of pK_a of following compounds



(a) (b) (c) (d) (e)

(1) a < b < c < d < e (2) a < c < b < d < e

(3) e < c < b < a < d (4) d < a < b < c < e

Ans. **(3)**

Sol. –M and –I group increases the acidity of phenol and +M and +I group decreases the acidity of phenol.

15. Select the correct statement from the given below

(1) Classical smog has high concentration of oxidising agent.

(2) Photochemical smog has high concentration of oxidising agent.

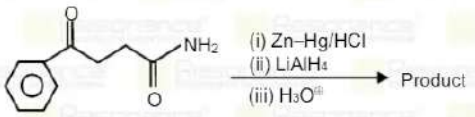
(3) Classical smog contains SO_2 & NO_2.

(4) Classical smog contains NO_2.

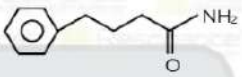
Ans. **(2)**

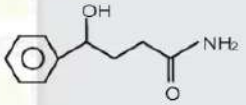
Sol. Photochemical smog has high concentration of oxidising agent like oxides of nitrogen, oxides of sulphur, acrolein & ozone.

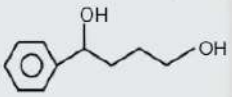
16.



(1) 

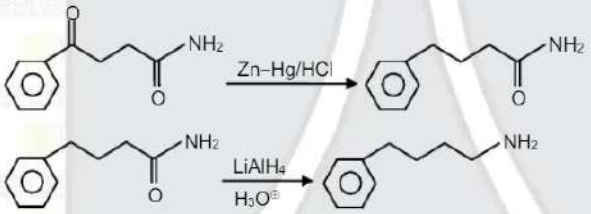
(2) 

(3) 

(4) 

Ans. (1)

Sol.



17. Match the following given reaction (Column-I) and Reagent (Column-II).

	Column-I		Column -II
	Reaction		**Reagent**
(1)	Hoffmann Degradation	**(i)**	$CHCl_3$, NaOH
(2)	Clemmensen reaction	**(ii)**	Con. KOH
(3)	Reimer-Tiemann reaction	**(iii)**	NaOH, Br_2
(4)	Canizzaro reaction	**(iv)**	Zn–Hg, HCl

(1) (1)-(iii), (2)-(iv), (3)-(i), (4)-(ii)
(2) (1)-(iii), (2)-(iv), (3)-(ii), (4)-(i)
(3) (1)-(iv), (2)-(iii), (3)-(i), (4)-(ii)
(4) (1)-(ii), (2)-(iii), (3)-(iv), (4)-(ii)

Ans. (1)
Sol. Based on Facts.

18. Which of the following compounds give positive Lassaigne test for both nitrogen and halogen.
(1) NH_4Cl (2) $NH_4OH.HCl$
(3) $NH_4OH.2HCl$ (4) $CH_3NH_2.2HCl$

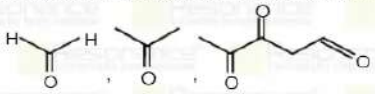
Ans. (4)
Sol. Lassaigne test for both Nitrogen & Halogen is given by the compound which have C, N as well as X atom in the compound.

19. How many cyclic tripeptides are formed by two amino acids (A) & (B).
(1) 5 (2) 4 (3) 3 (4) 2

Ans. (2)

Sol. With two amino acids (A) & (B) only two combination of tripeptides is possible. AAB and ABB. Further in cyclic tripeptides AAB & ABB has only one possible cyclic arrangements hence the answer is 2.

20. 17 mg of $C_{10}H_{16}$ requires 8.4 mL of H_2 at STP. A on Ozonolysis gives



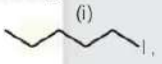
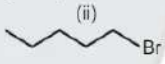
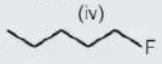
Find number of double bonds in the compound

Find number of double bonds in the compound.

Ans. **(3)**

Sol. Number of carbon in compound is 10.
Degree of unsaturation in (A) is 3.
Number of products formed on Ozonolysis is 4. Two moles of HCHO, one moles of CH_3COCH_3 and one mole of CHO–CO–CO–CH_2–CHO.
Over all (4) fragments on Ozonolysis hence number of π-bond = 3.

21. Arrange the following compound in the increasing order of their boiling point.

(i)  (ii)  (iii)  (iv) 

(1) (i) > (ii) > (iii) > (iv)
(2) (i) > (iii) > (ii) > (iv)
(3) (iv) > (ii) > (iii) > (i)
(4) (iii) > (ii) > (i) > (iv)

Ans. **(1)**

Sol. Boiling point for Alkyl halide $\propto$ Vander wall's forces.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