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

2022

COMPUTER BASED TEST (CBT)

Memory Based Questions & Solutions

Date: 25 July, 2022 (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. Find total number of diamagnetic species from the following

$N_2,\ N_2^-, N_2^{\oplus}, N_2^{2-}, O_2, O_2^+, O_2^-, O_2^{2-}$

Ans. **(2)**

Sol.

Species	N_2	N_2^-	$N_2^{\oplus}$	N_2^{2-}	O_2	O_2^+	O_2^-	O_2^{2-}
Bondorder	3	2.5	2.5	2	2	2.5	1.5	1
No.of unpaired electrons	0	1	1	2	2	1	1	0

$N_2 : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\sigma 2p_z)^2$

$N_2^- : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\sigma 2p_z)^2\ ,\ (\pi^*2px)^1$

$N_2^+ : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\sigma 2p_z)^1$

$N_2^{2-} : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\sigma 2p_z)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\pi^*2p_x^1 = \pi^*2p^1_y)$

$O_2 : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\sigma 2p_z)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\pi^*2p_x^1 = \pi^*2p^1_y)$

$O_2^+ : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\sigma 2p_z)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\pi^*2p_x^1 = \pi^*2p^0_y)$

$O_2^- : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\sigma 2p_z)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\pi^*2p_x^2 = \pi^*2p^1_y)$

$O_2^{2-} : (\sigma 1s)^2\ (\sigma^*1s)^2\ (\sigma 2s)^2\ (\sigma^*2s)^2\ (\sigma 2p_z)^2\ (\pi 2p^2_x = \pi 2p^2_y)\ (\pi^*2p_x^2 = \pi^*2p^2_y)$

2 H_2O_2 on reaction with $KMNO_4$ in acidic medium gives

(1) Mn^{2+} (2) Mn^{3+} (3) Mn^{4+} (4) Mn^{+6}

Ans. **(1)**

Sol. $$2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$$

3 For cell reaction Zn (s) | Zn^{2+} (aq) || Sn^{x+} (aq) | Sn (s)

Ecell = 0.801 V , Then how many electrons are involved in this cell reaction if reaction quotient is 10^{-2}.

Given $E^0_{Zn|Zn^{2+}} = 0.763V$, $E^0_{Sn^{x+}|Sn} = 0.008V$

Ans. **(4)**

Sol. Anode : [Zn (s) $\rightarrow$ Zn^{2+} (aq) + $2e^-$] X

Cathode : [Sn^{x+} + xe^- $\rightarrow$ Sn (s)]2

$$x\ Zn\ (s) + 2Sn^{x+} \xrightarrow{2x} x\ Zn^{2+}\ (aq) + Sn\ (s)$$

$E^O_{Cell} = 0.008 - (-0.763)$

$= 0.771\ V$

$$Ecell = E^O_{Cell} - \frac{0.059}{2x}\log\left(\frac{[Zn^{2+}]^x}{[Sn^{x+}]^2}\right)$$

$$0.801 = 0.771 - \frac{0.059}{2x}\log 10^{-2}$$

$$0.03 = +\frac{0.059}{x}$$

$x = 2$

Total number of electrons involved = 2x = 4

4 Identity correct density order of alkali metals

(1) Li < K < Na < Rb < Cs

(2) Li < Na < K < Rb < Cs

(2) Li < Na < K < Rb < Cs

(3) Li > Na > K > Rb > Cs

(4) Li > K > Na > Rb > Cs

Ans. **(1)**

Sol.

Property	Lithium Li	Sodium Na	Potassium K	Rubidium Rb	Caesium Cs
Density / g cm^{-3}	0.53	0.97	0.86	1.53	1.90

Correct density order is : Li < K < Na < Rb < Cs

5 In the following reaction sequence

$BF_3 + NaH \rightarrow A + NaF$

$A + N(Me)_3 \rightarrow B$

The structure of product B, with respect to Born is

(1) Trigonal planer (2) Tetrahedral (3) Square planar (4) Pyramidal

Ans. **(2)**

Sol. $2BF_3 + 6NaH \xrightarrow{450K} B_2H_6 + 6NaF$

$B_2H_6 + 2\ NMe_3 \rightarrow 2BH_3 \cdot NMe_3$

6 Which set of quantum numbers are not possible?

(1) n = 3 , ℓ = 1, m = 0, s = $+\frac{1}{2}$ (2) n = 3 , ℓ = 2, m = 2, s = $-\frac{1}{2}$

(3) n = 3 , ℓ = 3, m = 1, s = $+\frac{1}{2}$ (4) n = 3 , ℓ = 0, m = 0, s = $-\frac{1}{2}$

Ans. **(3)**

Sol. The value of n & ℓ can not be equal.

For any value of n, possible values of ℓ are 0 to n –1

7 For a reaction at 500 torr half life is 240 sec while at 250 torr half life is 4 min.

Then the order of reaction is:

Ans. **(1)**

Sol. $\frac{(T_{1/2})_I}{(T_{1/2})_{II}} = \left(\frac{P_1}{P_2}\right)^{1-n}$

$\Rightarrow \left(\frac{240}{4\times 60}\right) = \left(\frac{500}{250}\right)^{1-n}$

$\Rightarrow 1 = (2)^{1-n}$

$\Rightarrow (2)^0 = (2)^{1-n}$

n =1

8 Which set of oxide does not used in slag formation during extraction of Copper.

(a) FeO (b) Al_2O_3 (c) ZnO (d) NiO

(e) CaO

(1) a, b (2) b, c, d (3) a, e (4) a, c

Ans. **(2)**

Sol. During extraction of Cu following slag formation reaction takes place.

$FeO + SiO_2 \rightarrow FeSiO_3$

Flux Slag

9. SO_2Cl_2 hydrolyse as

$SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$

For complete neutralization of product 16 mole of NaOH are required then how many mole of SO_2Cl_2 are taken initially

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

Ans. **(3)**

Sol. $SO_2Cl_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$

a mole a mole 2a mole

(i) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

a mole 2a mole

(ii) $HCl + NaOH \rightarrow NaCl + H_2O$

2a mole 2a mole

Total mole of NaOH required = 4a = 16

a = 4

10. 40 ml, 0.05 M HCl titrated with 20 ml, 0.1M NH_4OH then closest pH of final solution is :

[Given K_b (NH_4OH) = 10^{-5}]

(1) 3.2 (2) 4.2 (3) 5.2 (4) 6.2

Ans. **(3)**

Sol.

	HCl	+	NH_4OH	$\rightarrow$	NH_4Cl	+	H_2O
Milimole	2		2		–		–
	0		0		2		

$[NH_4Cl] = \frac{2}{60} = \frac{1}{30}$ M

$\mathbf{pH} = 7 - \frac{1}{2}p^{K_b} - \frac{1}{2}\log C$

$= 7 - \frac{5}{2} - \frac{1}{2}\log\left(\frac{1}{30}\right)$

$= 7 - 2.5 + \frac{1}{2}\log(30)$

$= 7 - 2.5 + \frac{1}{2}[1 + 0.48]$

$= 7 - 2.5 + 0.74$

$= 5.24$

11. Find the enthalpy of formation of propane in (kJ / mole) using enthalpy of combustion of propane, graphite and dihydrogen – 2220KJ / mole – 393.5 KJ / Mole – 285.8 KJ / Mole

and dihydrogen – 2220KJ / mole, – 393.5 KJ / mole, – 285.8 KJ / mole

(Report your answer to the nearest integer)

Ans. **(104)**

Sol. **3 C (Graphite) + 4 H_2 (g) → C_3H_8 (g)**

$\Delta H_r^0 = 3\Delta H_c^0$ (C, graphite) + 4 ΔH_c^0 (H_2,g) – ΔH_c^0 (C_3H_8,g)

= 3 (–393.5) + 4 (–285.8) – (–2220)

= –1180.5 –1143.2 + 2220

= –2323.7 + 2220

= – 103.7 kJ / mole ≈ 104 kJ / mole

12. Concentration of HCOOH aqueous. Solution is 0.5 ml / L density of HCOOH solution is 1.05 g / ml. If depression in freezing point is 0.0405°C then vant Hoff factor is -

(1) 1.2 (2) 1.9 (3) 2.2 (4) 0.7

Ans. **(2)**

Sol. Let us take 1 lit solution, so it contain 0.5 ml HCOOH

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Mass of Solution = d × V

= 1.05 × 0.5

= 0.525 gram

Mass of solution = 1 kg

Mass of solvent = 1000– 0.525

= 999.475 gram

$\Delta T_F = i\ kf\ x\ m$

$$0.0405 = i \times 1.86 \left[\frac{0.525 \times 1000}{46 \times 999.475}\right]$$

0.0405 = i × 0.02124

i = 1.9

13. In the following reaction $Br_2 + F_2$ (excess) → 'A'

On hydrolysis of A obtained anion is

(1) Hypohalite (2) Halite (3) Halate (4) Per halate

Ans. **(3)**

Sol. $Br_2 + 5F_2$ (excess) → $2BrF_5$

$\overset{+5}{BrF_5} + 3H_2O \rightarrow HBrO_3 + 5HF$

Bromic acid

14.

List I **(Reaction)**	List II **(catalyst used)**
(I) $N_2 + 3H_2 \rightarrow 2NH_3$	(a) Ni
(II) $CO + 3H_2 \rightarrow CH_4 + H_2O$	(b) Cu / ZnO – Cr_2O_3
(III) $CO + 2H_2 \rightarrow CH_3OH$	(c) K_2O, / Al_2O_3 – Fe
(IV) $CO + H_2 \rightarrow HCHO$	(d) Cu

Correct match is

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

Ans. **(1)**

Sol. (i) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron in Haber's process.

$$N_2(g) + 3H_2(g) \xrightarrow{Fe(s)} 2NH_3(g)$$

(ii) The selectivity of a catalyst is its ability to direct a reaction to yield a particular product. For example, starting with H_2 and CO, and using different catalysts, we get different products

$$CO(g) + 3H_2(g) \xrightarrow{Ni} CH_4(g) + H_2O(g)$$

(iii) $$CO(g) + 2H_2(g) \xrightarrow{Cu/ZnO\text{-}Cr_2O_3} CH_3OH(g)$$

(iv) $$CO(g) + H_2(g) \xrightarrow{Cu} HCHO(g)$$

15. One of the following complex absorb minimum wave length of light.

(a) $[Co(NH_3)_6]^{3+}$ (b) $[Co(NH_3)_5(H_2O)]^{3+}$

(c) $[Co(CN)_6]^{3-}$ (d) $[CoF_6]^{3-}$

The magnetic moment (spin only) of that complex is _____ BM.

Ans. **(0)**

Sol. As complex absorb minimum wave length of light so complex has maximum splitting.

Order of splitting of complex : $[CoF_6]^{3-} < [Co(NH_3)_5(H_2O)]^{3+} < [Co(NH_3)_6]^{3+} < [Co(CN)_6]^{3-}$

So complex is $[Co(CN)_6]^{3-}$

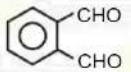
$_{27}Co^{3+} = 3d^6 4s^0 \Rightarrow t_{2g}^{2.2.2}, e_g^{0,0}$

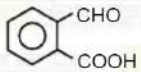
Number of unpaired electrons = 0

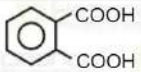
So $\mu = 0$

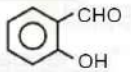
16. Compound X on heating with NH_3 gives B and on strong heating gives (C) $C_6H_5NO_2$.

(C) reacts with ethanolic KOH/Alkyl halide and then followed by alkaline hydroxide to give primary amine find X.

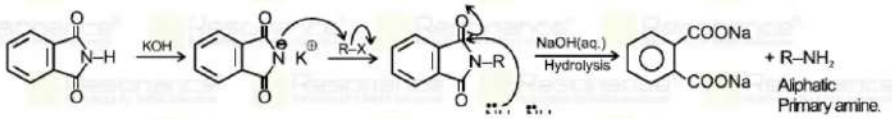
(1) 

(2) 

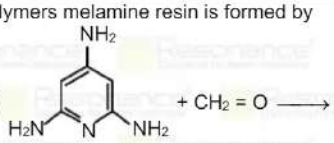
(3) 

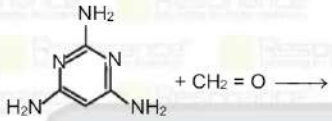
(4) 

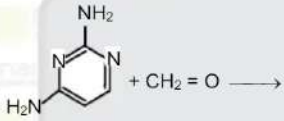
Ans. **(3)**

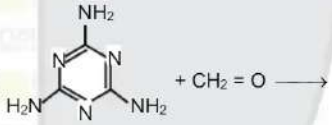
Sol. 

17. Polymers melamine resin is formed by

(1)  + $CH_2 = O \longrightarrow$

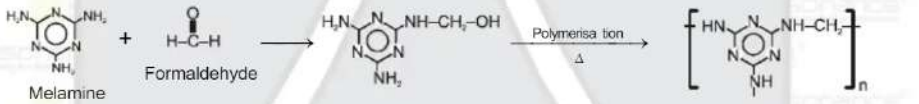
(2)  + $CH_2 = O \longrightarrow$

(3)  + $CH_2 = O \longrightarrow$

(4)  + $CH_2 = O \longrightarrow$

Ans. **(4)**

Sol. Melamine formaldehyde Resin :



Melamine Formaldehyde polymer (Melmac)

Melamine formaldehyde resin is used in the manufacture of unbreakable crockery.

18. Denaturation does not effects which structure of Protein

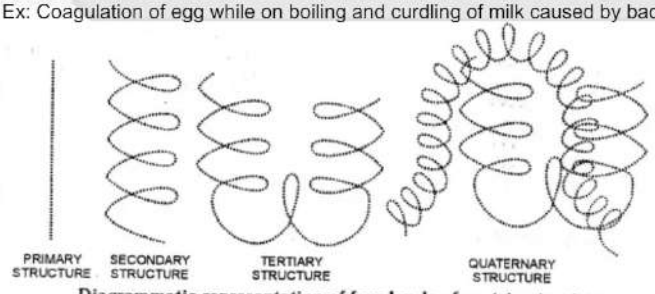
(1) Primary (2) Secondary (3) Tertiary (4) Quaternary

Ans. **(1)**

Sol. **Denaturation of proteins :**

When protein in native form is subjected to a physical change like temperature or pH, the H –bonds are disturbed. As a result globules get unfold and helices get uncoiled therefore proteins loses its activity. During denaturation 2° and 3° structures get destroyed but 1° structure remain the same.

Ex: Coagulation of egg while on boiling and curdling of milk caused by bacteria present in milk.



Diagrammatic representation of four levels of protein structure (two subunits of two types in quaternary structure).

19. Which is absent in photochemical smog :

(1) NO (2) NO_2 (3) SO_2 (4) HCHO

Ans. **(3)**

Sol. Like NO_2, O_3 is a toxic gas and both NO_2 and O_3 are strong oxidising agents : They can react with the unburnt hydrocarbons in the polluted air to produce compounds like formaldehyde, acrolein and peroxyacetyl nitrate (PAN).

$3CH_4 + 2O_3 \longrightarrow 3CH_2=O + 3H_2O$

$CH_2=CHCH=O$ (acrolein)

$CH_3\overset{\overset{O}{\|}}{C}OONO_2$ (peroxyacetyl nitrate, PAN)

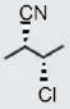
Classical Smog : It is also known as **sulphurous smog** or **London smog** (as first occured in London). It occurs in cool and humid climate. It is a mixture of smoke, fog and sulphur dioxide. Chemically because of the presence of SO_2 and carbon (soot) particles it is a reducing mixture and so it is also called as reducing smog.

20. 

(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

21. Which drug binds to the receptor site and inhibit its natural function and block messages when required?

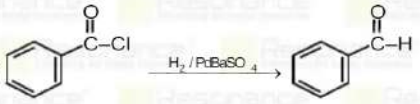
(1) Antagonist (2) Agonist (3) Anti histamine (4) Antacid

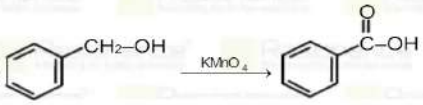
Ans. **(1)**

22. Wrong Reaction is :

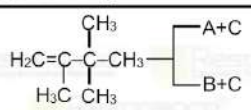
(1) 

(2) 

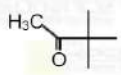
(3) 

(4) 

Ans. (1)

23. 

When A is oxidised it forms a compounds found in red ants. A on oxidation forms B, C is



the correct set of reagents in above reaction :

(1) $KMnO_4/H^+$ and O_3/Zn, H_2O

(2) O_3/Zn, H_2O and $KMnO_4/H^+$

(3) $KMnO_4$ and $K_2Cr_2O_7$

(4) $K_2Cr_2O_7$ and $KMnO_4$

Ans. **(2)**

24. How many sp^3 carbon are present in C_4H_5N for acyclic structure ?

Ans. ()

25. **Statement I :** $KHSO_4$ dehydrates Glycerol to form acrolein

Statement II : Acrolein has fruity smell and reaction is used for test of Glycerol

Choose the **most appropriate** option :

(1) Both **Statement I** and **Statement II** are correct.

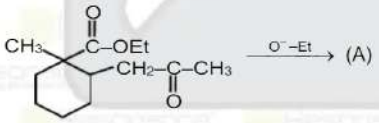
(2) Both **Statement I** and **Statement II** are incorrect.

(3) **Statement I** is correct but **Statement II** is incorrect.

(4) **Statement I** is incorrect but **Statement II** is correct.

Ans. **(3)**

26.



Chiral carbon in product

Ans. (2)