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JEE (Main)

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

2022

COMPUTER BASED TEST (CBT)

Memory Based Questions & Solutions

Date: 29 June, 2022 (SHIFT-2) | TIME : (3.00 a.m. to 6.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

1. Assertion : Ionisation energy of nitrogen is more than oxygen.
Reason : In 2p orbital electron feel more repulsion in oxygen in comparision to nitrogen.
(1) Assertion and reason both are correct and reason is correct explanation of assertion.
(2) Assertion and reason both are correct statements but reason is not correct explanation of assertion.
(3) Assertion is correct but reason is wrong statement.

(4) Assertion is wrong but reason is correct statement.

Ans. (2)

Sol. Due to half filled orbital configuration nitrogen has more ionisation energy than oxygen.

2.

Column-I	**Column-II**
(i) Siderite	(a) KCl. $MgCl_2.6H_2O$
(ii) Malachite	(b) $CuCO_3.Cu(OH)_2$
(iii) Carnalite	(c) $ZnCO_3$
(iv) Calamine	(d) $FeCO_3$

Correct match is :

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

Ans. (1)

Sol. Siderite $\Rightarrow FeCO_3$

Malachite $\Rightarrow CuCO_3.Cu(OH)_2$

Carnalite $\Rightarrow KCl.MgCl_2.6H_2O$

Calamine $\Rightarrow ZnCO_3$

3. Which of the following is correct option regarding CH_4, NH_4^+ and BH_4^-

(1) All are isoelectronic & tetrahedral.

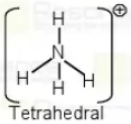
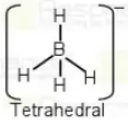
(2) All are not isoelectronic but tetrahedral.

(3) All are isoelectronic but only two are tetrahedral.

(4) All are isoelectronic but all are not tetrahedral.

Ans. (1)

Sol.

Species	CH_4	NH_4^+	BH_4^-
No. of electron	10	10	10
Structure	 Tetrahedral	 Tetrahedral	 Tetrahedral

4. Which set of compounds contain carbonate ion ?

(1) Baking soda, Washing soda (2) Baking soda, Caustic soda

(3) Washing soda, Caustic soda (4) Only Washing soda

Ans. (1)

Sol.

Compound	**Formula**
(1) Baking soda	$NaHCO_3$
(2) Washing soda	$Na_2CO_3.10H_2O$
(3) Caustic soda	NaOH

5. 1 Mole of $CoCl_3.xNH_3$ on reaction with excess of $AgNO_3$ give 2 moles of AgCl then value of X is :

Ans. (5)

Sol. $CoCl_3.xNH_3 + AgNO_3$ (excess) $\longrightarrow$ AgCl

1 mole **2 moles**

It means 2 Cl are outside the co-ordinations sphere & co-ordination number of Co is 6

So possible complex is $[Co(NH_3)_5Cl]Cl_2$

so x = 5

6. The magnetic moment (spin only) of complex $[MnBr_6]^{4-}$ is ..... BM

[Report your answer to nearest integer]

Ans. (6)

Sol. $[MnBr_6]^{4-}$

$_{25}Mn^{2+} = 3d^5 4s^0 \Rightarrow t_{2g}^{1,1,1}, eg^{1,1}$

number of unpaired electrons = 5

μ(spin only) = $\sqrt{n(n+2)}\,BM = \sqrt{5(5+2)}\,BM = \sqrt{35}\,BM$ = 5.916 BM ≈ 6 BM

7. For a first order reaction $K = 6.3 \times 10^{-18}\, e^{-2600/T}$. Then the value of activation energy in KJ is :

[given R = 8.314 J/mole × K]

[Report your answer to nearest integer]

Ans. (216)

Sol. $K = Ae^{-\left(\frac{E_a}{R}\right)/T}$

$K = 6.3 \times 10^{-18}\, e^{-2600/T}$

$\frac{E_a}{R} = 26000 = 26 \times 10^3$

$Ea = 26 \times 10^3 \times 8.314 = 216.164 \times 10^3$ J = 216.164 KJ

8. In 100 L vessel at 610 K, 4 mole of Ar and 5 mole of PCl_5 are taken. At equilibrium total pressure of gases is 6 atm, then value of K_P is :

[$R = 0.082\ \frac{atm \times L}{mole \times K}$]

[Report your answer to nearest integer]

Ans. (2)

Sol. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

5 mole	0	0
(5 – x)	x	x

Total moles at equilibrium = (5 + x) + n_{Ar} = (5 + x) + 4 = (9 + x)

$n_{total} = \frac{PV}{RT} = \frac{6 \times 100}{0.082 \times 610} = 11.995 = 12$ moles

9 + x = 12 moles

x = 3 moles

Pressure of ($PCl_5 + PCl_3 + Cl_2$) = $\frac{8}{12} \times 6 = 4$ atm

$K_P = \frac{P_{PCl_3} \times P_{Cl_2}}{P_{PCl_5}} = \frac{\left(\frac{3}{8} \times 4\right)\left(\frac{3}{8} \times 4\right)}{\left(\frac{2}{8} \times 4\right)} = \left(\frac{3}{2}\right)\left(\frac{3}{2}\right) = \left(\frac{9}{4}\right) = 2.25$

9. For a solution containg non volatile non electrolyte solute concentration is 1.5 m. The elevation in boiling point (ΔT_b) is 4 K while at concentration of 4.5 m depression in freezing point (ΔT_f) is 4 K then find ratio of $\left(\frac{K_b}{K_f}\right)$.

Ans. (3)

Sol. $\Delta T_b = K_b \times m_1$

$\Delta T_f = K_f \times m_2$

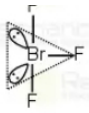
$\Rightarrow \frac{\Delta T_b}{\Delta T_f} = \frac{K_b \times 1.5}{K_f \times 4.5} = \frac{4\,K}{4\,K}$

$\frac{K_b}{K_f} = 3$

10. Shape and number of lone pair electrons in BrF_3 is :

(1) Bent T-shape, 2 (2) Bent T-shape, 1 (3) See-Saw, 2 (4) See-Saw, 1

Ans. (1)

Sol. 

Bent T-shape with Two unpaired electron.

11. 42.14 % (w/v) NaCl solution is used to coagulate 1 L of colloidal solution in 10 hours, then coagulation value for 2 hours is :

(1) 36 mole (2) 36 milimole (3) 1440 mole (4) 1440 milimole

Ans. (4)

Sol. Coagulation value = $\frac{millimoles\ of\ electrolyte}{Volume\ of\ solution\ in\ L}$

Molarity of NaCl = $\frac{\%\,(w/v)\times 10}{GMM} = \left[\frac{42.14\times 10}{58.5}\right] = 7.2\ M$

milimole of NaCl electrolyte = 7.2 mole = 72000 milimole

Coagulation value for 10 hours = $\frac{millimoles\ of\ electrolyte}{Volume\ of\ solution\ in\ L} = 72000$

For 2 hours Coagulation value = $\left(\frac{72000\times 2}{10}\right)$ = 1440 milimole

12. For the following cell: Pt(s) | $H_2(g)$ | $H^+(aq.)$ || $Cu^{2+}(aq)$ | Cu at pH = 3, E_{cell} = 0.31 V and $[Cu^{2+}] = 10^{-x}$, then value of x is ..... [Given $E^{\circ}_{Cu^{2+}/Cu}$ = 0.34 V]

Ans. (7)

Sol. **Anode :** $H_2(g) \longrightarrow 2H^+ + 2e^-$

Cathode : $Cu^{2+} + 2e^- \longrightarrow Cu(s)$

Overall : $H_2(g) + Cu^{2+}(aq) \longrightarrow 2H^+(aq) + Cu(s)$

$E_{cell} = E^{\circ}_{cell} - \frac{0.059}{2}\log\frac{[H^+]^2}{[Cu^{2+}]}$

$0.31 = 0.34 - \frac{0.06}{2}\log\left(\frac{[H^+]^2}{[Cu^{2+}]}\right)$

$0.31 = 0.34 + 0.03\,[-\log[H^+]^2 + \log[Cu^{2+}]$

$0.31 = 0.34 + 0.03\,[2pH + \log[Cu^{2+}]$

$-0.03 = 0.03\,[2pH + \log[Cu^{2+}]$

$-1 = 6 + \log[Cu^{2+}]$

$-7 = \log[Cu^{2+}]$

$\log[Cu^{2+}] = \log 10^{-7}$

$[Cu^{2+}] = 10^{-7}$

x = 7

13. **Statement-I :** $CuSO_4.5H_2O$ contain Cu–O Bond.

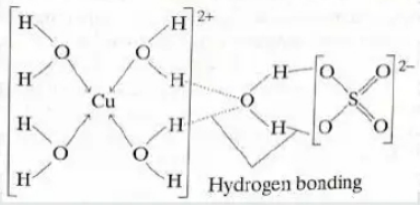
Statement-II : Sulphur and oxygen donate it's electron pair and act as ligand.

(1) Both S_1 & S_2 are true (2) Both S_1 & S_2 are false

(3) S_1 is true & S_2 is false (4) S_1 is false & S_2 is true

Ans. (3)

Sol. $CuSO_4.5H_2O \Rightarrow [Cu(H_2O)_4]SO_4.H_2O$



14. An inorganic Compound on reaction with $BaCl_2$ give white ppt which on reaction with dilute HCl which on reaction with dilute HCl give characteristics smell. Which anion is present in inorganic compound

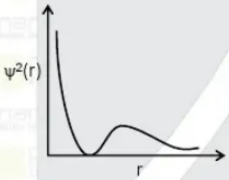
(1) I^- (2) S^{2-} (3) SO_3^{2-} (4) SO_4^{2-}

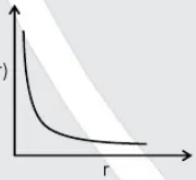
Ans. (3)

Sol. $SO_3^{2-} + Ba^{2+} \longrightarrow BaSO_3\downarrow$ (White ppt) $\xrightarrow{dil\ HCl} SO_2(g)\uparrow$ (Burning sulphur like smell)

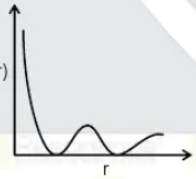
$S^{2-} + Ba^{2+} \longrightarrow$ No PPT

15. Identify the correct graph for 2s-orbital for $\psi^2(r)$ vs r.

(1) 

(2) 

(3) 

(4) 

Ans. (1)

16. A container contain 128 gram O_2 (g) and 16 gram H_2, then volume of gaseous mixture at STP is (Report your answer to nearest integer)

Ans. (269)

Sol. $n_{O_2} = \frac{128}{32} = 4$ mole

$n_{H_2} = \frac{16}{2} = 8$ mole

$n_{Total} = 12$

Volume at STP = $12 \times 22.4 = 268.8\ L \approx 269\ L$

17. What is the value of x in :

0.00285×0.112 ...

$\frac{}{0.5702} = x$

(1) 0.00056 (2) 0.000561 (3) 0.000503 (4) 0.0006

Ans. (2)

Sol. $\frac{0.00285\times0.112}{0.5702} = \frac{0.0003200}{0.5702} = 0.000561$

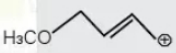
18. A compound decompose according to 1st order reaction, then find time taken (in hours) to reduce concentration from initial value to 6.25 % if its half life is 5 hour.

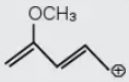
Ans. (20)

Sol. $100 \xrightarrow{t_{1/2}} 50 \xrightarrow{t_{1/2}} 25 \xrightarrow{t_{1/2}} 12.5 \xrightarrow{t_{1/2}} 6.25$

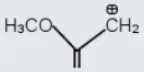
total time = $4T_{1/2}$ = 20 hours

19. Identify most stable carbocation out of following.

(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. Due to extend conjugation most stable carbocation is  .

20. Friedal craft alkylation of aniline gives

(1) Secondary amine (2) Amide product after attack on aniline

(3) ortho/para alkyl derivative (4) Meta alkyl derivative

Ans. (1)

Sol. 

2º amine

21. On heating which structure not affected.

(1) Secondary structure of protein (2) Primary structure of protein

(3) Tertiary structure of protein (4) Quaternary structure of protein

Ans. (2)

Sol. During denaturation of protein 2 and 3 structure are destroyed but 1º structure remain intact.

22. **Statement-I :** Dacron is an example of polyester compound.

Statement-II : Dacron is a combination of terphthalic acid & ethylene glycol.

(1) Statement-I and statement-II both are correct and statement-II is correct explanation of statement-I.

(2) Statement-I and statement-II both are correct statements but statement-II is not correct explanation of statement-I.

(3) statement-I is correct but statement-II is wrong statement.

(4) statement-I is wrong but statement-II is correct statement

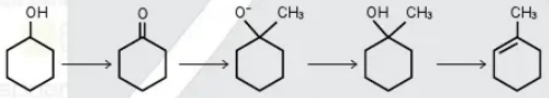
Ans. (1)

Sol. It is fact.

23. 

Find number of sp^2 carbon atoms in final products.

Ans. 2.0

Sol. 

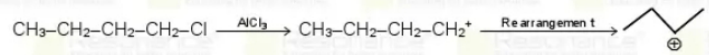
No. of sp^2 carbon are 2 in final product.

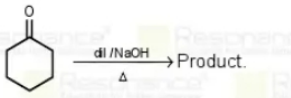
24. 

Most stable carbocation possible in above reaction is :

(1)  (2)  (3)  (4) 

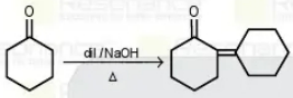
Ans. (1)

Sol. 

25. 

Find out number of π-bonds in product from by above reaction.

Ans. (2)

Sol. 

26. Chloroxylenol and terpineol work as :

(1) Antiseptic (2) Disinfectant (3) Antipyretic (4) Antibiotic

Ans. (1)

Sol. Commonly used antiseptic Dettol is a mixture of chloroxylenol and terpineol.

27. Reaction involve in troposphere during acid rain.

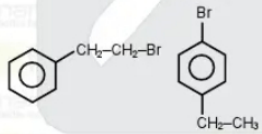
(1) $H_2S + O_2 \longrightarrow S + H_2O$ (2) $S + NaOH \longrightarrow Na_2S + Na_2S_2O_3 + H_2O$

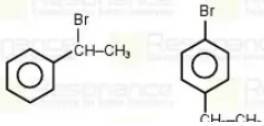
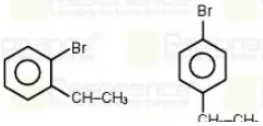
(3) $I_2 + Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + NaI$ (4) $2SO_2 + O_2 + 2H_2O \longrightarrow 2H_2SO_4$

Ans. (4)

Sol. SO_2 and NO_2 after oxidation and reaction with H_2O are major contributors to acid rain.

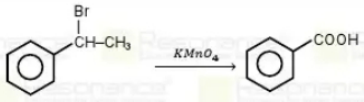
28. 184 g per mole of given compound having C = 52.4%, H = 4.9% and Br = 42.7% and both A and B react with $KMnO_4$ & will give benzoic acid and para-bromo benzoic acid respectively than identify compound A and B. Compound A is optically active.

(1)  (2) 

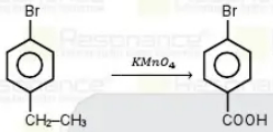
(3)  (4) 

Ans. (3)

Sol.



Optically active (A)

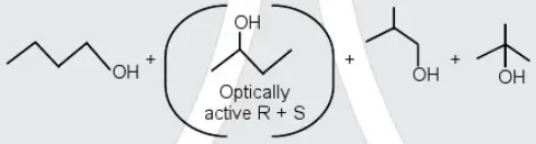


(B)

29. Find out number of chiral alcohol of molecular formula $C_4H_{10}O$.

Ans. (2)

Sol.



Only 2-Butanol is chiral with R or S configuration.