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JEE (Main)

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

2021

COMPUTER BASED TEST (CBT)

Memory Based Questions & Solutions

Date: 27 July, 2021 (SHIFT-2) | TIME : (3.00 p.m. to 6.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

1. If Thomson model is considered to be true then in Rutherford model.

(1) All α particles deflects at 180º (2) They deflect at wide range of angle

(3) All will pass through foil without deflection (4) They will pass but with reduced speed.

Ans. **(1)**

Sol. Theory Based.

2. Identify the correct increasing order of 1st ionisation enthalpy order of

Mg, Al, P, S

(1) Al, Mg, S, P (2) Mg, Al, P, S (3) Al, Mg, P, S (4) Mg, Al, S, P

Ans. **(1)**

Sol. Correct increasing order of 1st ionisation enthalpy is : Al < Mg < S < P.

3.

List-I	**List-II**
(a) Li	(i) used in devising photoelectric cell
(b) Na	(ii) used to make electrochemical cell
(c) K	(iii) used as coolant in nuclear reactor
(d) Cs	(iv) used in absorption of CO_2

Identify the correct match

(1) a – ii, b – iii, c – iv, d – I (2) a – i, b – iii, c – iv, d – ii

(3) a – i, b – ii, c – iii, d – iv (4) a – ii, b – iv, c – iii, d – i

Ans. (1)

Sol. (a) Li $\Rightarrow$ used in electrochemical cell

(b) Na $\Rightarrow$ used as coolant in fast breeder nuclear reactors

(c) K $\Rightarrow$ used as an absorbent of CO_2

(d) Cs $\Rightarrow$ used in devising photoelectric cell.

4. How many number of electron are there in bonding molecular orbital of O_2^{2-}.

Ans. 10

Sol. O_2^{2-} (Total electron = 18)

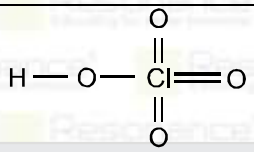
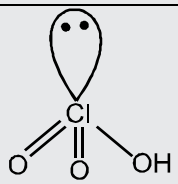
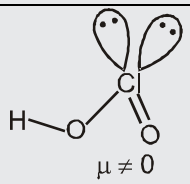
EC = $(\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2p_z)^2(\pi 2p_x^2 = \pi 2p_y^2)(\pi^* 2p_x^2 = \pi^* 2p_y^2)$

Total electron in BMO = 10.

5. How many total Cl=O bonds are there in $HClO_4$, $HClO_3$ and $HClO_2$.

Ans. 6

Sol.

Compounds	Structure	Total C=O bond
$HClO_4$		**3**
$HClO_3$		**2**
$HClO_2$	 $\mu \neq 0$	**1**

6. Identify the incorrect statement from following.

(1) crystalline solids are isotropic

(2) amorphous solids are also called pseudo solid

(3) amorphous solids do not have definite enthalpy of fusion

(4) crystalline solids are lone range order

Ans. (1)

Sol. Crystalline solids are anisotropic in nature.

7. 10 ml 0.05 M $KMnO_4$ is titrated with 10 ml of oxalic acid, find strength of oxalic acid (in g/l).

[Report your answer to nearest integer]

Ans. 11

Sol. $MnO_4^- + C_2O_4^{2-} \xrightarrow{H^+} Mn^{2+} + CO_2$

Valency factor = 5 Valency factor = 2

mili eq. of $C_2O_4^{2-}$ = mili eq. of MnO_4^-

$2\ [M \times 10] = 5\ [0.05 \times 10]$

$M = 0.125$ mole/lit.

Strength of oxalic acid $= 0.125 \times 90 = 11.25$ g/l.

8. 1 mole of A takes 100 minutes to give 0.2 mole of B in the reaction A $\longrightarrow$ 2B (According to 1st order reaction). The half life of the reaction is :

[Report your answer to nearest integer]

[Given $\ell n2 = 0.693$ & $\ell n10 = 2.303$]

Ans. 752

Sol.

	A	$\longrightarrow$	2B
Initially	1 mole		0
After 100 min	(1 – 0.1)mole		0.2 mole

$$k = \frac{1}{t}\ell n\left(\frac{a}{a-x}\right)$$

$$k = \frac{2.303}{100}\log\left(\frac{1}{0.9}\right)$$

$$\frac{\ln 2}{t_{1/2}} = \frac{2.303}{100}[\log 10 - \log 9]$$

$$\frac{0.693}{t_{1/2}} = \frac{2.303}{100}[1 - 2\times 0.48]$$

$$t_{1/2} = \frac{69.3}{2.303\times 0.04}\ \text{min}$$

$t_{1/2}$ =752.3 min

9. The total number of neutrons and electrons present in radioactive isotope of Hydrogen is :

Ans. (3)

Sol. Radioactive isotope of Hydrogen is tritium (^3_1H)

Number of {P = 1, n = 2, e^- = 1}, so (n + e^-) = 3

10. For reaction $MO(s) \rightleftharpoons M(s) + \frac{1}{2}O_2(g)$

K_p is 4, then partial pressure of $O_2(g)$ in atm is :

Ans. **(16)**

Sol. $K_p = \left(P_{O_2}\right)^{\frac{1}{2}} = 4$

$P_{O_2} = 16$

11. Assertion : SO_2 is highly adsorbed on charcoal than H_2.
Reason : SO_2 has high critical temperature than H_2.
(1) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
(2) Assertion is True, Reason is True; Reason is NOT a correct explanation for Assertion.
(3) Assertion is True, Reason is False.
(4) Assertion is False, Reason is True.

Ans. **(1)**

Sol. SO_2 is adsorb more than H_2 on charcoal as critical temperature of SO_2 is higher than H_2 as higher the critical temperature, easier is liquification of gas and more is adsorption of gas on charcoal.

12. An electrolyte AB is 50% dimerise and rest is ionise in a solvent, then Van't hoff factor (i) for this acid is.
(1) 1 (2) 1.25 (3) 2 (4) 1.5

Ans. **(2)**

Sol. $i = \frac{\text{Total no. of particle after dissociation/association}}{\text{Total number of particle before dissociation/association}}$

dissociation [Let total mole of acid HA = a]

$HA \longrightarrow H^+ + A^-$

0.5a 0.5a 0.5a

association

$2HA \longrightarrow (HA)_2$

0.5a $\left(\frac{0.5a}{2}\right)$

$i = \left(\frac{a + 0.5a}{a}\right) = 1.25$

13. S_1 : $[Mn(CN)_6]^{3-}$, $[Fe(CN)_6]^{3-}$ and $[Co(CN)_6]^{3-}$ have d^2sp^3 hybridisation.
S_2 : $[MnCl_6]^{3-}$ and $[FeCl_6]^{3-}$ are paramagnetic with 4 and 5 unpaired electrons respectively.
(1) Both S_1 & S_2 are true. (2) S_1 is true and S_2 is false
(3) S_1 is false and S_2 is true (4) Both S_1 & S_2 are false.

Ans. **(1)**

Sol. $[Mn(CN)_6]^{3-} \Rightarrow Mn^{3+} \Rightarrow 3d^4 \Rightarrow t_{2g}^{2,1,1}, eg^{0,0}$ d^2sp^3

$[Fe(CN)_6]^{3-} \Rightarrow Fe^{3+} \Rightarrow 3d^5 \Rightarrow t_{2g}^{2,2,1}, eg^{0,0}$ d^2sp^3

$[Co(CN)_6]^{3-} \Rightarrow Co^{3+} \Rightarrow 3d^6 \Rightarrow t_{2g}^{2,2,2}, eg^{0,0}$ d^2sp^3

$[MnCl_6]^{3-} \Rightarrow Mn^{3+} \Rightarrow 3d^4 \Rightarrow t_{2g}^{1,1,1}, eg^{1,0}$ 4 unpaired e^-

$[FeCl_6]^{3-} \Rightarrow Fe^{3+} \Rightarrow 3d^5 \Rightarrow t_{2g}^{1,1,1}, eg^{1,1}$ 5 unpaired e^-

so both S_1 & S_2 are true.

14. What is the reason to add silica during metallurgy of copper ore.

(1) To reduce temperature (2) To convert Cu to copper silicate

(3) To convert CuO to copper silicate (4) To remove impurities of iron as $FeSiO_3$

Ans. **(4)**

Sol. During metallurgy of copper from copper ore

FeO	+	SiO_2	$\longrightarrow$	$FeSiO_3$
Impurities		Flux		Slag

15. How many cations will get precipitated from

$Al^{3+}, Cu^{2+}, Ni^{2+}, Co^{2+}, Fe^{3+}, Ba^{2+}, Zn^{2+}$

When H_2S is passed along with dil. HCl.

Ans. **1**

Sol. H_2S + dil. HCl is 2^{nd} group reagent so Cu^{2+} get precipitate

2^{nd} group cation Cu^{2+}

3^{rd} group cation Al^{3+}, Fe^{3+}

4^{th} group cation $Co^{2+}, Ni^{2+}, Zn^{2+}$

5^{th} group cation Ba^{2+}

16. In a closed container initially SO_2 and O_2 are taken at 750 bar and 250 bar and following reaction takes place.

$2SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$

then what will be the total pressure of gases after completion of reaction (in bar.)

Ans. 750

Sol.

	$2SO_2$ (g)	+	O_2 (g)	$\longrightarrow$	$2SO_3$(g)	
Initially	750 bar		250 bar			(LR is O_2)
	$750 - 2 \times 250$		0		2×250	
	250				500	

$P_{Total} = 250 + 500 = 750$ bar

17. 1 Mole of complex $CoCl_3.6NH_3$ on reaction with $AgNO_3$ gives 3 moles of AgCl precipitate. The secondary valency of complex is-

Ans. 6

Sol. As complex give 3 moles AgCl precipitate so all 3 chloride ions are in ionisation sphere so complex is $[Co(NH_3)_6]\ Cl_3$

secondary valency of complex = 6.

18.

List - I (Metal)	List - II (Colour during flame test)
a) Li	(i) Golden yellow
b) Na	(ii) Crimson red
c) Ca	(iii) Apple green
d) Ba	(iv) Brick Red

Identify the correct matching from List – I with List - II :

(1) a-(ii) b-(i) c-(iv) d-(iii) (2) a-(i) b-(ii) c-(iii) d-(iv)

(3) a-(ii) b-(i) c-(iii) d-(iv) (4) a-(i) b-(ii) c-(iv) d- (iii)

Ans. **(1)**

Sol.

Metal	Flame coloure test
(i) Li	Crimson Red
(ii) Na	Golden Yellow
(iii) Ca	Brick Red
(iv) Ba	Apple green

19. Statement-I : Hyper conjugation is a permanent effect.

Statement-II : In $CH_3 - \overset{\oplus}{C}H_2$ $sp^2_{c-H_1s}$ overlap with the adjacent vacant p-orbital.

(1) Both Statement–I & Statement–II are correct.

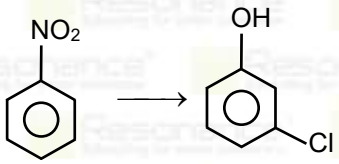
(2) Statement–I is correct and Statement–II is incorrect.

(3) Statement–I is incorrect and Statement–II is correct.

(4) Both Statement–I and Statement–II are incorrect.

Ans. **(2)**

20. For the following conversion



the appropriate sequence of reagent will be.

(1) $NaNO_2/HCl$, $AlCl_3/Fe$, Fe/HCl, H_2O/Δ (2) Fe/HCl, $AlCl_3/Fe$, $NaNO_2/HCl$, H_2O/Δ

(3) $AlCl_3/Fe$, Fe/HCl, $NaNO_2/HCl$, H_2O/Δ (4) Fe/HCl, $AlCl_3/Fe$, H_2O/Δ, $NaNO_2/HCl$

Ans. **(3)**

21. D-Galactose & D-Glucose are formed by the hydrolysis of following disaccharide.

(1) Sucrose (2) Lactose (3) Maltose (4) Amylose

Ans. **(2)**

22. Satement-I : Penicillin is Bacteriostatic.

Satement-II : The correct structure of penicillin is.

(1) Both Statement–I & Statement–II are correct

(2) Statement–I is correct and Statement–II is incorrect

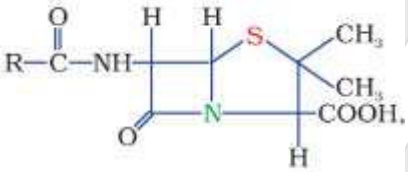
(3) Statement–I is incorrect and Statement–II is correct

(4) Both Statement–I and Statement–II are incorrect

Ans. **(3)**

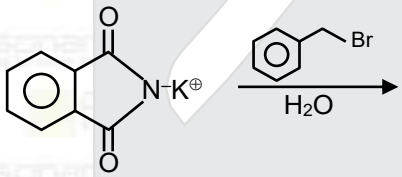
Sol.

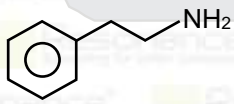
Bactericidal	Bacteriostatic
Penicillin	Erythromycin
Aminoglycosides	Tetracycline
Ofloxacin	Chloramphenicol

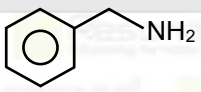


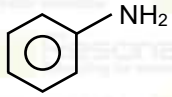
General Sturcture of Pencillin

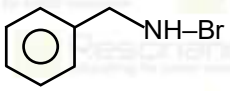
23. In following sequence of reaction final product will be



(1) 

(2) 

(3) 

(4) 

Ans. **(2)**

24. In the following reaction

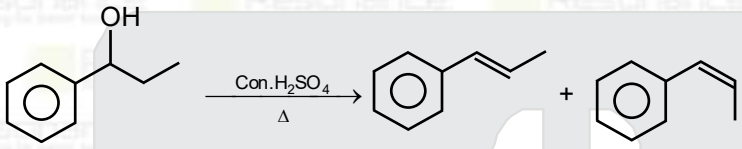
$$R{-}C{\equiv}N \xrightarrow[(2)H_3O^{\oplus}]{(1)DIBAL\ -H} R{-}X$$

–X will be

(1) –CHO (2) –COOH (3) $-CH_2NH_2$ (4) $-CH_2OH$

Ans. **(1)**

25.



(1) The Rx is not possible in acid medium. (2) Compound B will be major product

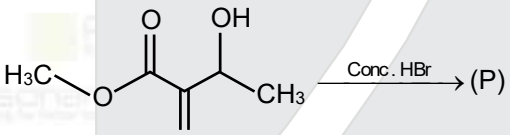
(3) Compound A will be major product (4) Both A and B are equally formed

Ans. (3)

26. Dihedral angle in 1,1,1-trichloro ethane in staggered conformation (in degree) is

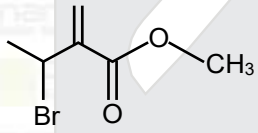
Ans. 60

27. Which of the following product is not possible

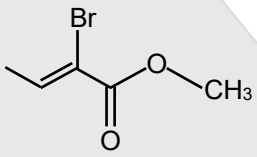


Product (P)

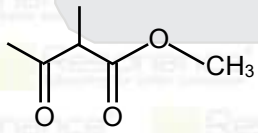
(1)



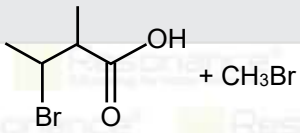
(2)



(3)



(4)



Ans. (4)