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JEE (Main)

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

2022

COMPUTER BASED TEST (CBT)

Memory Based Questions & Solutions

Date: 27 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. Identify correct order of increasing ionic radii.

(1) Mg^{2+}, Na^{+}, F^{-}, O^{2-}, N^{3-} (2) N^{3-}, O^{2-}, F^{-}, Na^{+}, Mg^{2+}

(3) F^{-}, O^{2-}, N^{3-}, Na^{+}, Mg^{2+} (4) Mg^{2+}, F^{-}, Na^{+}, O^{2-}, N^{3-}

Ans. (1)

Sol. Species N^{3-} O^{2-} F^{-} Na^{+} Mg^{2+}

No. of e^-	10	10	10	10	10
Z	7	8	9	11	12

For isoelectronic specie greater is Z smaller is size of ion.

2. Which of the following lanthanide have half-filled and full filled f-orbital respectively.

(1) Eu^{2+}, Tb^{3+} (2) Yb^{3+}, Tb^{2+} (3) Gd^{3+}, Dy^{2+} (4) Sm^{2+}, Dy^{2+}

Ans. (3)

Sol.

Ion	Electronic configuration
Eu^{2+}	$4f^7$
Tb^{2+}	$4f^9$
Tb^{3+}	$4f^8$
Gd^{3+}	$4f^7$
Dy^{2+}	$4f^{10}$
Sm^{2+}	$4f^6$

3. Statement-I : Fluorine form only one oxoacid.

Statement-II : Due to high electronegativity and small size.

(1) Both Statement-I & Statement-II are true (2) Both Statement-I & Statement-II are false

(3) Statement-I is true & Statement-II is false (4) Statement-I is false & Statement-II is true

Ans. (1)

Sol. Due to small size & high electronegativity F can not act as central atom in higher oxidation state so F form only one oxy acid HOF.

4. Which of the following statement is incorrect regarding PCl_5.

(1) In PCl_5 axial bonds are longer than equatorial bonds

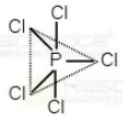
(2) It has trigonal by pyramidal structure

(3) 3Cl atoms are in same plane

(4) Hybridisation of 'P' is sp^3d^2

Ans. (4)

Sol.



Hybridisation = sp^3d

5. Identify correct increasing strength of intermolecular H-bonding.

(1) $HCN < H_2O < NH_3$ (2) $NH_3 < HCN < H_2O$ (3) $CH_4 < HCN < NH_3$ (4) $CH_4 < NH_3 < H_2O$

Ans. (3)

Sol. Correct order of H-bond strength is :

$CH_4 < HCN < NH_3$

6. Identify correct set which represent increasing order of magnetic moment.

(a) $[FeF_6]^{3-}$ (b) $[Fe(CN)_6]^{3-}$

(c) $[Mn(CN)_6]^{2-}$ (d) $[Mn(Cl)_6]^{2-}$ (high spin)

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

Ans. (1)

Sol.

Complex	Electronic configuration	No. of unpaired electron
(a) $[FeF_6]^{3-}$	$Fe^{3+} \Rightarrow 3d^5 \Rightarrow t_{2g}^{1,1,1}, e_g^{1,1}$	5

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

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

(d) $[Mn(Cl)_6]^{2-}$ (high spin) $Mn^{4+} \Rightarrow 3d^5 \Rightarrow t_{2g}^{1,1,1}, e_g^{1,1}$ 4

7. Which of the following have high value of reduction potential ($E^\circ_{M^{2+}|M}$)

(1) Zn (2) Cr (3) Cu (4) Fe

Ans. (3)

Sol. $E^\circ_{Zn^{2+}|Zn} = -0.76$ V

$E^\circ_{Cr^{2+}|Cr} = -0.91$ V

$E^\circ_{Cu^{2+}|Cu} = 0.34$ V

$E^\circ_{Fe^{2+}|Fe} = -0.44$ V

8. Which gas is produced during following reaction :

$NH_4Cl + NaNO_2 \xrightarrow{\Delta}$ Product

(1) NH_3 (2) N_2 (3) Cl_2 (4) N_2O

Ans. (2)

Sol. $NH_4Cl + NaNO_2 \xrightarrow{\Delta} NaCl + NH_4NO_2$

$NH_4NO_2 \xrightarrow{\Delta} N_2(g) + 2H_2O$

9. Match athe acid radicals present in Column I with their characteristic observation in Column II

Column I	Column II
(i) CO_3^{2-}	(P) Brisk effervescence
(ii) NO_3^-	(Q) White PPT
(iii) SO_4^{2-}	(R) Brown Ring
(iv) S^{2-}	(S) Rotten egg smell

(1) (i) – (P) ; (ii) – (R) ; (iii) – (Q) ; (iv) – (S) (2) (i) – (S) ; (ii) – (R) ; (iii) – (Q) ; (iv) – (P)

(3) (i) – (P) ; (ii) – (R) ; (iii) – (S) ; (iv) – (Q) (4) (i) – (P) ; (ii) – (Q) ; (iii) – (R) ; (iv) – (S)

Ans. (1)

Sol. (i) $CO_3^{2-} \xrightarrow{H^+} CO_2\uparrow$

(i) $NO_3^- + FeSO_4 + H_2SO_4 \longrightarrow [Fe(H_2O)_5(NO^+)]SO_4$

Brown ring

(iii) $SO_4^{2-} \xrightarrow{BaCl_2} BaSO_4\downarrow$

White PPT

(iv) $S^{2-} \xrightarrow{H^+} H_2S\uparrow$

Rotten egg smell

10. How many set of quantum numbers are possible.

	n	ℓ	m		n	ℓ	m
(a)	2	2	1	(b)	3	2	–2
(c)	3	2	–1	(d)	2	1	–1

Ans. (3)

Sol. For possible set of quantum number.

$n > \ell$, $m = -\ell$ to $+\ell$ (including zero).

Correct set are b, c, d.

11. Find pH of 0.001 M NaOH solution.

Ans. (11)

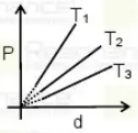
Sol. $NaOH \longrightarrow Na^+ + OH^-$

10^{-3} M $\quad$ 10^{-3} M $\quad$ 10^{-3} M

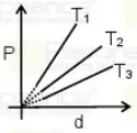
$[OH^-] = 10^{-3}$ $\quad$ pOH = 3

pH = 11

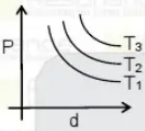
12. Which of the following graph is correct for an ideal gas

(1) 

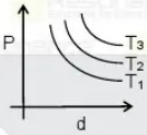
$T_1 > T_2 > T_3$

(2) 

$T_3 > T_2 > T_1$

(3) 

$T_3 > T_2 > T_1$

(4) 

$T_1 > T_2 > T_3$

Ans. (1)

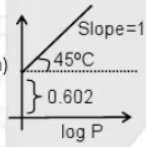
Sol. $PV = nRT$

$P = \left[\frac{w}{V}\right]\frac{RT}{M}$

$P = \frac{dRT}{M}$ so $P \propto d$ $\quad$ Slope = $\frac{RT}{M}$

Greater is slope greater is Temperature.

13. At 1.003 atm pressure value of $\left(\frac{x}{m}\right)$ will be

log(x/m) 

Report your answer to nearest integer.

Ans. (4)

Sol. $\left(\frac{x}{m}\right) = K P^{1/n}$

$\log\left(\frac{x}{m}\right) = \log K + \frac{1}{n}\log P$

Intercept log K = 0.602 = log 4

K = 4

Slope $\Rightarrow \frac{1}{n} = 1$ $\quad$ so $\quad$ n = 1

so $\left(\frac{x}{m}\right) = 4(1.003) = 4.012$

14. 2.5 × 10^{-3} kg of a non-volatile & non electrolyte solute dissolve in 75 × 10^{-3} kg of water. If Boiling point of solution is 373.67 K, then molar mass of solute in gram is :

[Given $(T^0_b)_{H_2O}$ = 373.15 K and $K_b(H_2O)$ = 0.52 K.Kg/mole]

(Report your answer to nearest integer)

Ans. (333)

Sol. Boiling point of solution (T_b) = 373.67 K

Boiling point of solvent (T^o_b) = 373.15 K

$\Delta T_b = (T_b - T^o_b)$

$\Delta T_b = 0.52$

$\Delta T_b = (K_b)m$

$0.52 = 0.52\left[\frac{2.5\times1000}{M_{solute}\times75}\right]$

M_{solute} = 333.33 g/mol

15. 5 mole of an ideal gas change it's volume from 10 L to 20 Lit. reversible isothermally at 300 K then work done by gas is..... ..KCal. [Given R = 2 Cal]

Ans. (2)

Sol. For isothermal reversible process

$W = -2.303\ nRT \log\left(\frac{V_2}{V_1}\right)$

$= -2.303 \times 5 \times 2 \times 300 \log\left(\frac{20}{10}\right)$

$= -2072.7\ Cal = -2.0727 \times 10^3\ Cal = -2\ K\ Cal = |W| = 2\ K\ Cal$

16. 0.25 gram of an organic compound containing chlorine treated with excess of $AgNO_3$, which gives 0.4 gram of AgCl as precipate out in carius method, then % of chlorine in organic compound is ..... .

[Report your answer to nearest integer]

Ans. (40)

Sol. Organic compound $\xrightarrow{AgNO_3}$ AgCl

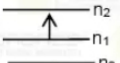
(Containing chlorine) 0.4 gram

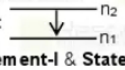
0.25 gram

Mole of AgCl = $\left(\frac{0.4}{143.5}\right)$

$w_{Cl} = \left(\frac{0.4}{143.5}\right) \times 35.5$

% of Cl = $\left[\frac{0.4}{143.5} \times 35.5\right] \times \frac{100}{0.25} = 39.58 \approx 40$

17. **Statement-I :**  $h\nu = (E_2 - E_1)$ absorb photon.

Statement-II :  $h\nu = E_2 - E_1$ = emitted photon.

(1) Both **Statement-I** & **Statement-II** are true (2) Both **Statement-I** & **Statement-II** are false

(3) **Statement-I is true** & **Statement-II** is false (4) **Statement-I** is false & **Statement-II** is true

Ans. (1)

Sol. In this process absorbed & emitted photon have equal energy.

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18. For following cell

$Pt(s)|H_2(g)|H^+(aq)||Ag^+|Ag(s)$ E°_{cell}= 0.302 V

Value of ΔG° is $[-X] \times 10^3$ J then value of X is :

[Report your answer to nearest integer]

Ans. (29)

Sol. Anode $\Rightarrow \frac{1}{2}H_2(g) \longrightarrow H^+(aq) + e^-$

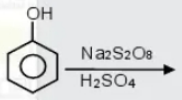
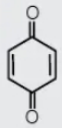
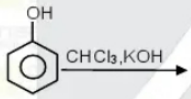
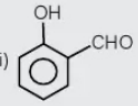
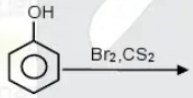
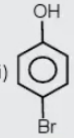
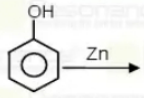
Cathode $\Rightarrow Ag^+ + e^- \longrightarrow Ag(s)$

$\frac{1}{2}H_2(g) + Ag^+(aq) \xrightarrow{n=1} H^+(aq) + Ag(s)$

$\Delta G^\circ = -nFE^\circ_{cell} = -1 \times 96500 \times 0.302$

$= -29143\ J = -29.143 \times 10^3 J$

19. The correct match of the product given in Column-II with the reaction in Column-I is.

Column-I	**Column-II**
(A) 	(i) 
(B) 	(ii) 
(C) 	(iii) 
(D) 	(iv) 

(1) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv)

(2) (A)-(ii), (B)-(i), (C)-(iv), (D)-(iii)

(3) (A)-(iv), (B)-(ii), (C)-(iii), (D)-(i)

(4) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

Ans. (1)

20. Which is most stable.

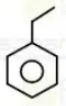
(1) 

(2) 

(3) 

(4) 

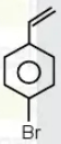
Ans. (4)

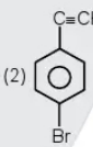
21. 

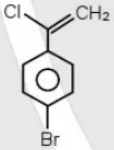
(i) Fe, Br_2
(ii) Cl_2/Δ
(iii) alc.KOH

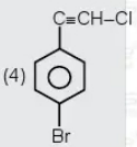
→ major product.

Major product is:

(1) 

(2) 

(3) 

(4) 

Ans. (1)

22. The correct match of the effects given in Column-II with the drug type given in Column-I.

Column-I	**Column-II**
(A) Tranquiliser	(1) Pan reliever
(B) Antipyretic	(2) Reduce acidity
(C) Analgesic	(3) Reduce stress
(D) Antacid	(4) Reduce fever

(1) (A)-(3), (B)-(4), (C)-(1), (D)-(2) (2) (A)-(2), (B)-(3), (C)-(4), (D)-(1)

(3) (A)-(3), (B)-(1), (C)-(1), (D)-(1) (4) (A)-(1), (B)-(3), (C)-(2), (D)-(4)

Ans. (1)

23. Which of the following is incorrect about Buna-N?

(1) N stands for acrylonitrile (2) Buna-N is formed by butadiene & styrene

(3) Buna-N is a addition polymer (4) Buna-N is a copolymer

Ans. (1)

24. **Statement-I :** Maltose is formed by C_1–C_4 glycosidic linkage between two αD(+) glucose units that are reducing sugar.

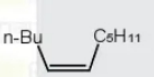
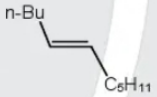
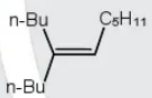
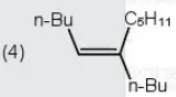
Statement-II : Maltose is formed by C_1–C_6 glycosidic linkage between two αD(+) glucose & βD(+) glucose.

(1) Statement-I is true & Statement-II is false (2) Statement-I & Statement-II both are true

(3) Statement-I & II both are false (4) Statement-I is false & Statement is true

Ans. (1)

25. $nBu-C\equiv CH \xrightarrow[2.\ nC_5H_{11}Cl]{1.\ nBuLi} \xrightarrow[3.\ H_2-Pd,\ BaSO_4]{}$ Major product

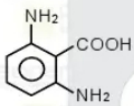
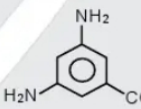
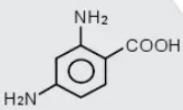
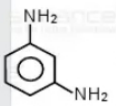
(1)  (2)  (3)  (4) 

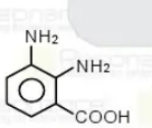
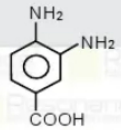
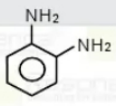
Ans. (1)

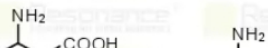
26. A compound has molecular formula $C_6H_3(NH_2)_2COOH$ has six structural isomers, on decarboxylation out of six, three compounds give same product (A), another two isomers give same product (B) & remaining isomer give one product (C). Find melting point of (C).

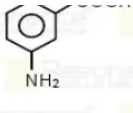
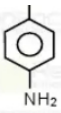
(1) 143°C (2) 104°C (3) 73°C (4) 47°C

Ans. (1)

Sol.  ,  &  give (A)  on decarboxylation.

 &  give (B)  .



&  give (C) 

(C) has highest melting point.