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JEE (Main)

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

2021

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COMPUTER BASED TEST (CBT) Memory Based Questions & Solutions

Date: 26 August, 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. After hydrolysis of PCl_5 , how many non-ionisable hydrogen ions are present.

(1) 2 (2) 0 (3) 1 (4) 3

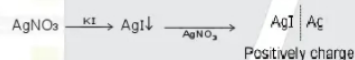
Ans. (2)

Sol. $\text{PCl}_5 \xrightarrow{\text{H}_2\text{O}} \text{POCl}_3 \xrightarrow{\text{H}_2\text{O}} \text{H}_3\text{PO}_4$

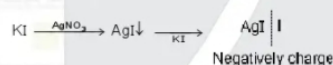
2. In which case negatively charged colloidal solution is obtained.

(1) KI added to AgNO_3
(2) AgNO_3 added to KI
(3) FeCl_3 is added to freshly precipitated $\text{Fe}(\text{OH})_3$

Sol. (a) When KI is added to AgNO_3



(b) When AgNO_3 is added to KI



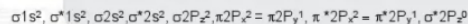
3. Bond order and magnetic nature of O_2^- is :

(1) 1.5, paramagnetic (2) 2.0, diamagnetic (3) 1.5, diamagnetic (4) 2.5, paramagnetic

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Ans. (1)

Sol. O_2^- (Total electron = 17) {Bond order = 1.5, Paramagnetic}



No. of unpaired electron = 1

so it is paramagnetic

$$\text{Bond order} = \frac{n_b - n_a}{2} = \frac{10 - 7}{2} = 1.5$$

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- (1) $[Pt(en)_2Cl_2]$ (2) $[Pt(NH_3)_4Cl_2]$ (3) $[Co(CN)_5H_2O]$ (4) $[Co(NH_3)_5(NO_2)]$

Ans. (3)

Sol. $[Co(CN)_5H_2O]$ do not show geometrical isomerism. Due to presence of plane of symmetry.

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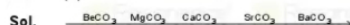


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5. Statement-1 : $BaCO_3$ is highly stable and insoluble in water.

Statement-2 : Stability of carbonates increase with increase in cationic size.

Ans. (3)



(i) Stability \uparrow

(ii) Solubility in water \downarrow

6. Identify the correct order of CFSE (crystal field splitting energy) of following compound

- (i) $[Co(H_2O)_6]^{3+}$ (ii) $[CoF_6]^{3-}$ (iii) $[Co(en)_3]^{3+}$ (iv) $[Co(NH_3)_6]^{3+}$

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

Ans. (1)

Sol. CFSE depends of strength of ligand. Stronger is ligand greater is splitting energy

strength of ligand $\Rightarrow F^- < H_2O < NH_3 < en$

7. 100 ml solution of Na_3PO_4 contains 2.35 gram of Na^+ ion, then molarity of solution is $[x] \times 10^{-2}$, then x is

Ans. (34)

Sol. No. of mole of Na^+ ion = $\frac{2.35}{23}$

$$\text{So no. of mole of } Na_3PO_4 = \frac{2.35}{23 \times 3} = 0.034$$

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$$\text{Molarity} = \frac{\text{mole}}{\text{volume}} = \frac{0.034}{100} \times 1000 = 0.34 = 34 \times 10^{-2}$$

8. **Statement-1** : D_2O is used as a moderator in nuclear reactor and in exchange reactions for the study of reaction mechanisms

Statement-2 : Bond energy of O-H is smaller then bond energy of O-D

- (1) Statement-1 : is true & Statement-2 is false (2) Statement-1 is false & Statement-2 is true
(3) Both Statement-1 & Statement-2 are true (4) Both Statement-1 & Statement-2 are false

Ans. (3)

Sol. **Statement-1** : D_2O is used as a moderator in nuclear reactor and in exchange reactions for the study of reaction mechanisms

Statement-2 : Bond energy of O-H < Bond energy of O-D.

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9. Identify the correct set of chalcogen family member

- (1) S, Se, Te (2) S, Se, Pm (3) O, AS, Bi (4) Se, Te, Pm

Ans. (1)

Sol. Oxygen family also called as chalcogen family So, S, Se, Te, Po are chalcogen family member

10. In London force interaction energy is proportional to r^x [where r is distance between two interacting particles] then x is

- (1) -6 (2) -3 (3) 3 (4) 6

Ans. (1)

Sol. In London force interaction energy is inversely proportional the sixth power of the distance between two interacting particles $\left(\frac{1}{r^6}\right)$

11. What is the cell potential for following cell

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Given $E_{Zn^{2+}/Zn}^0 = -0.76V$ & $E_{Cu^{2+}/Cu}^0 = 0.34V$

[Report your answer to nearest integer]

Sol. Cell reaction



0.02M 0.04M

$$E_{cell}^0 = E_{Cu^{2+}/Cu}^0 - E_{Zn^{2+}/Zn}^0$$

$$= 0.34 - (-0.76) = 1.1V$$

$$E_{cell} = E_{cell}^0 - \frac{0.059}{2} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$$

$$= 1.1 - \frac{0.059}{2} \log \left(\frac{0.04}{0.02} \right)$$

$$= 1.1 - 0.03 \log 2 = 1.1 - 0.03 \times 0.30$$

$$= 1.0915 = 1.09V$$

Ans = 1

12. Statement-1 : Sphalerite is ore of Zn while Galena is ore of Pb.

Statement-2 : Two sulphide ore can be separated by using depressant and froth floatation process.

(1) Statement-1 is true and Statement-2 is false (2) Statement-1 is false and Statement-2 is true

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Ans. (1)

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Sol. Sphalerite ZnS

Galena PbS

It is possible to separate two sulphide ores by adjusting proportion of oil to water or by using 'depressants'. For example, in case of an ore containing ZnS and PbS, the depressant used is NaCN. It selectively prevents ZnS from coming to the froth but allows PbS to come with the froth.

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13. 1 mole of He and 2 mole of CO_2 gas are taken in a container of volume $4 \times 10^{-2} m^3$ at 400 K temperature, then pressure of gaseous mixture (in pascal)

$$[Given R = 8.314 \frac{J}{K \times mole}]$$

- (1) 24.846×10^5 (2) 12.423×10^5 (3) 49.692×10^5 (4) 74.538×10^5

Ans. (1)

Sol. $n_{Total} = n_{He} + n_{CO_2} = 3$

$$P_{Total} \times V_{Total} = n_{Total} \times RT$$

$$P_{Total} = \frac{3 \times 0.082 \times 400}{4}$$

$$= 24.6 \text{ atm}$$

$$= 24.6 \times 1.01 \times 10^5 \text{ pascal}$$

$$= 24.846 \times 10^5 \text{ pascal}$$

14. Which of the following is strong oxidising agent.

- (1) O_3 (2) H_2O_2 (3) SO_2 (4) $KMnO_4$

Ans. (1)

Sol. $E_{O_3/O_2}^0 = 2.07V$

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$$E_{MnO_4^-/Mn^{2+}}^0 = 1.51V$$

15. For reaction $A + B \rightleftharpoons C + D$, $K_c = 100$ if equal concentration of A, B, C & D = 1 M is taken initially,

then concentration of D at equilibrium is:
[Report your answer to nearest integer].

Ans. (2)

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Sol. A + B \rightleftharpoons C + D $K_c = 100$

Initially 1 1 1 1
At eq. (1-x) (1-x) (1+x) (1+x)

$$K_c = \frac{1+x}{1-x} = 100$$

$$= \frac{1+x}{1-x} = 10$$

$$= 1+x = 10-10x$$

$$11x = 9$$

$$x = \left[\frac{9}{11} \right]$$

$$[D] = \left[1 + \frac{9}{11} \right] = \left[\frac{20}{11} \right] = 1.8$$

Ans. 2

16. 83 gram of ethylene glycol is added in 625 gram of water, find ΔT_f of solution (Given $K_f(\text{H}_2\text{O}) = 1.86$

$\frac{\text{K.Kg}}{\text{K.Kg}}$ (Report your answer nearest integer)

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Sol. $\Delta T_f = iK_f \times m$
 $= 1 \times 1.86 \times \frac{83 \times 1000}{62 \times 625}$
 $\Delta T_f = 3.98 \approx 4$

17. Formation constant of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is $K_f = 4 \times 10^{11}$ then dissociation constant of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is $K_{\text{diss}} = [X] \times 10^{-13}$, then value of X is '.....'.

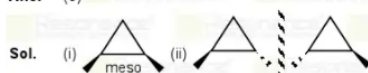
Ans. 25

Sol. $\text{Cu}^{2+} + 4\text{NH}_3 \rightleftharpoons [\text{Cu}(\text{NH}_3)_4]^{2+}$ $K_f = 4 \times 10^{11}$
 $[\text{Cu}(\text{NH}_3)_4]^{2+} \rightleftharpoons \text{Cu}^{2+} + 4\text{NH}_3$ $K_{\text{diss}} = \frac{1}{K_f} = 25 \times 10^{-13}$
 $= 25$

18. Total number of isomers of 1,2-Dimethyl cyclopropane?

(1) 2 (2) 0 (3) 3 (4) 4

Ans. (3)



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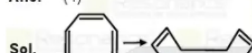


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19. Which of the following is not aromatic?



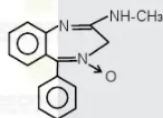
Ans. (4)



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It exists as non-planar tad-shaped so it is non-aromatic.

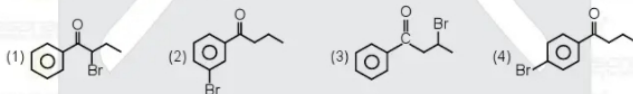
20. Structure of "Chlordiazepoxide" is-



- (1) Analgesic (2) Antibiotic (3) Antacid (4) Tranquilliser

Ans. (4)

Sol.



Ans. (2)

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Sol. Halogenation of by electrophile substitution reaction mechanism in presence of Lewis

acid take place at meta position.

22. Which of the following phenol does not give colour with phthalic anhydride :



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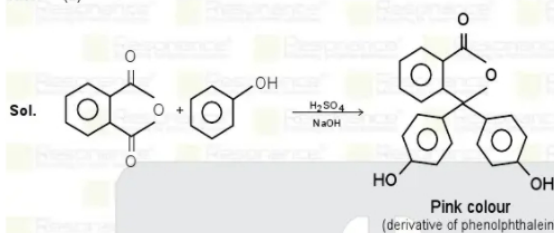
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Ans. (2)



Phenol and its derivatives react at para position with phthalic anhydride. In p-cresol para position is blocked. So reaction not possible.

23. Which statement is incorrect regarding photochemical smog.

- (1) Photochemical smog occur in warm, dry and sunny climate.
(2) The main component of photochemical smog result from action of sunlight on unsaturated hydrocarbon.
(3) It has high concentration of oxidising agent.
(4) It occur by reaction of sunlight on saturated hydrocarbon.

Ans. (4)

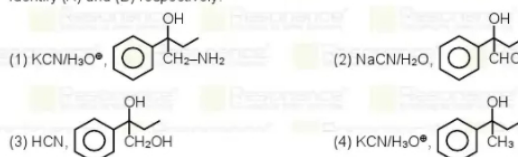
Sol. NCERT Class-VI

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Statement-2: Sucrose is formed by α -D Glucose and α -D Fructose

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is False, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(3) Statement-1 is True, Statement-2 is False.
(4) Statement-1 is False, Statement-2 is False.

Ans. (3)



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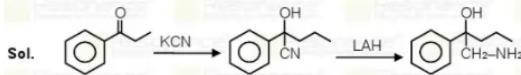
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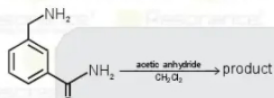
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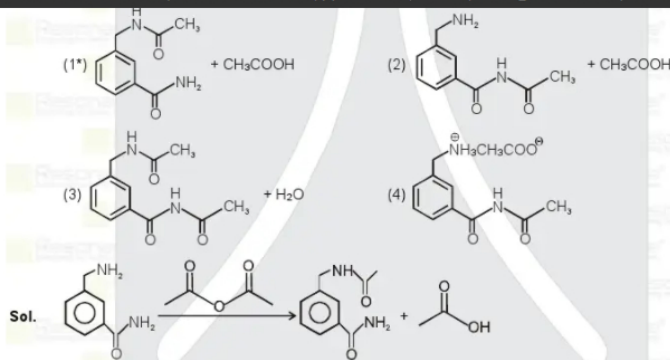
Ans. (1)



26. In the reaction shown below, the major product formed is :



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since -CH₂-NH₂ is more basic.

The resulting amide will fail to react further. Had it been possible, imide formation would have occurred at both the sites.

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