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

2023

COMPUTER BASED TEST (CBT) Memory Based Questions & Solutions

Date: 24 January, 2023 (SHIFT-1) | TIME : (9.00 a.m. to 12.00 p.m.)
Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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1. The magnetic moment of M^{2+} is 3.87 BM. The species is :

- (1) Mn^{2+} (2) V^{2+} (3) Ti^{2+} (4) Cr^{2+}

Ans. (2)
Sol.

Ion	Outer electronic configuration	no. of unpaired electron	Magnetic moment
Mn^{2+}	$3d^5 4s^0$	5	$\sqrt{35}$ BM
V^{2+}	$3d^3 4s^0$	3	$\sqrt{15}$ BM
Ti^{2+}	$3d^2 4s^0$	2	$\sqrt{8}$ BM
Cr^{2+}	$3d^4 4s^0$	4	$\sqrt{24}$ BM

2. In the complex $[Co(NH_3)_5Cl]Cl_2$, The primary & secondary valency of central metal respectively are.
(1) 2 and 8 (2) 3 and 5 (3) 3 and 6 (4) 2 and 6

Ans. (3)

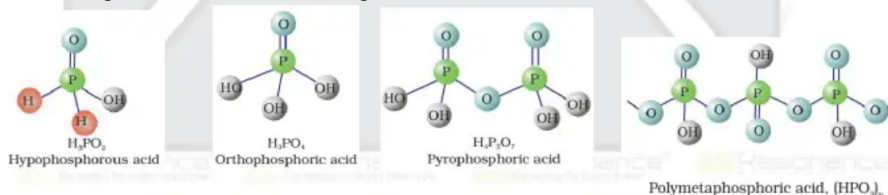
Sol. Primary valency = Oxidation number of central metal.
Secondary valency = Co-ordination number of central metal
In $[Co(NH_3)_5Cl]Cl_2$ Primary valency = 3
Secondary valency = 6

3. Which of the following acid reduce $AgNO_3$ into Ag.

- (1) H_3PO_2 (2) H_3PO_4 (3) $H_4P_2O_7$ (4) $(HPO_3)_n$

Ans. (1)

Sol. The acids which contain P-H bond have strong reducing properties. Thus, hypophosphorous acid is a good reducing agent as it contains two P-H bonds and reduces, for example, $AgNO_3$ to metallic silver
 $H_3PO_2 + 4AgNO_3 + 2H_2O \rightarrow H_3PO_4 + 4Ag + 4HNO_2$



4. $[CoCl_4]$ is a tetrahedral complex. The electronic configuration of central metal ion is $e_2^n t_2^m$ find the value of $n +$ unpaired electrons.

Ans. (07.00)

Sol. $Co^{+2} : 3d^7 4s^0$

According to CFT electronic configuration of Co^{2+} is $e_2^{2,2} t_2^{1,1,1}$

$$\therefore e_2^n t_2^m = e_2^{2,2} t_2^{1,1,1}$$

$$n + \text{unpaired electrons} = 4 + 3 = 7$$

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5. A 25 mL buffer solution is prepared by mixing 0.1 M CH_3COOH and 0.01 M CH_3COONa . If the pK_a of CH_3COOH solution is 4.76. Then calculate pH of the solution.

- (1) 4.76 (2) 3.76 (3) 5.76 (4) 2.76

Ans. (2)

Sol. For acidic buffer solution

$$pH = pK_a + \log \frac{[salt]}{[acid]}$$

$$= 4.76 + \log \frac{[0.01]}{[0.1]}$$

$$= 4.76 + (-1) = 3.76$$

6.

List-I List-II

	List-I		List-II
(A)	Si	(p)	Electrolytic refining
(B)	Al	(q)	Zone refining
(C)	Pig Iron	(r)	Reverberatory furnace
(D)	Cu	(s)	Blast furnace

	A	B	C	D	A	B	C	D	
(1)	q	p	s	r	(2)	p	q	s	r
(3)	q	p	r	s	(4)	p	q	r	s

Ans. (1)

7. The wavelength of first line of Paschen series is 720 nm. The wavelength of 2nd line of this series is :

Ans. (492)

Sol. $\frac{1}{\lambda} = R_H \times \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] \times (Z)^2$

For 1st line of Paschen series : $n_1 = 3$; $n_2 = 4$

$$\frac{1}{720} = \frac{1}{\lambda_1} = R_H \times (Z)^2 \times \left[\frac{1}{(3)^2} - \frac{1}{(4)^2} \right] \quad \dots(1)$$

$$\frac{1}{720} = \frac{5}{9 \times 16} \times R_H \times (Z)^2$$

For 2nd line of Paschen series : $n_1 = 3$; $n_2 = 5$

$$\frac{1}{\lambda_2} = R_H \times (Z)^2 \times \left[\frac{1}{(3)^2} - \frac{1}{(5)^2} \right] \quad \dots(2)$$

(1)/(2)

$$\frac{\lambda_2}{720} = \frac{7}{9 \times 16} \times \frac{9 \times 25}{16}$$

$$\lambda_2 = 492 \text{ nm}$$

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8. On reaction of BeO with HF in presence of NH₃ gives [x].[x] on thermal decomposition gives BeF₂ & NH₄F. [x] is :

- (1) (NH₄)₂BeF₄ (2) (NH₄)₄BeF₆ (3) (NH₄)₃BeF₅ (4) NH₄BeF₃

Ans. (1)

Sol. Thermal decomposition of (NH₄)₂BeF₄ is the best route for preparation of BeF₂

9. Strongest H-bonding is present in following :

- (1) Pure water (2) Rain water (3) Ice (4) Impure water

Ans. (3)

Sol. In ice each H₂O molecule forms four H-bonds & is tetrahedrally structured

10. Among the following which metal cation gives red precipitate with dimethyl glyoxime :

- (1) Li⁺ (2) Ni²⁺ (3) Mg²⁺ (4) Pb²⁺

Ans. (2)

Sol. $\text{Ni}^{2+} + \text{dmg} + \text{NH}_4\text{OH} \rightarrow [\text{Ni}(\text{dmg})_2] \downarrow + \text{NH}_4^+ + \text{H}_2\text{O}$
red ppt

11. Which of the following data are corresponding to non-spontaneous reaction at 300K

	$\Delta H/\text{KJ mol}^{-1}$	$\Delta S/\text{J mol}^{-1}$
(1)	-25	-80
(2)	-22	+20
(3)	+25	-20
(4)	-22	+20

Ans. (3)

Sol. For non-spontaneous reaction $\Delta G > 0$

$$\Delta G = \Delta H - T\Delta S$$

$$(1) \quad -25 \times 1000 - 300 \times (-80) = -25,000 + 24,000 \\ = -1000 \text{ J/mol}$$

$$\Delta G = -ve \text{ (spontaneous)}$$

$$(2) \quad -22 \times 1000 - 300 \times 20 = -22000 - 6000 \\ = -28000 \text{ J/mol}$$

$$\Delta G = -ve \text{ (spontaneous)}$$

$$(3) \quad 25 \times 1000 - 300 \times (-20) = 25000 + 6000 \\ = 31000 \text{ J/mol}$$

$$\Delta G = +ve \text{ (non-spontaneous)}$$

$$(4) \quad -22 \times 1000 - 300 \times 20 = -22000 - 6000 \\ = -28000 \text{ J/mol}$$

$$\Delta G = -ve \text{ (spontaneous)}$$

12. Statement-1 :- The freezing point of a solution decreases with decrease in amount non-volatile solute.
Statement-2 :- Freezing point of the solution is less than that of the solvent.

- (1) Both statement 1 and 2 are correct.
(2) Statement 1 is correct but statement 2 is incorrect.
(3) Statement 1 is incorrect but statement 2 is correct.
(4) Both statement 1 & 2 are incorrect.

Ans. (3)

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Sol. $\Rightarrow |\Delta T_f|$ or $\Delta T_f = i K_f m$
 $m \downarrow |\Delta T_f| \downarrow$ then Freezing Point \uparrow

\Rightarrow Depression in Freezing Point occurs

13. 50g NaOH is dissolved in water to get 450 ml of solution. what volume of the solution is required to prepare 500 ml of 0.1 M NaOH solution ?

Ans. (20)

Sol. Dilution formula

$$M_1 V_1 = M_2 V_2$$

$$\Rightarrow \frac{50}{450} \times V = 0.1 \times 500 \\ \frac{50}{1000}$$

$$\Rightarrow \frac{50 \times 1000}{40 \times 450} \times V = 0.1 \times 500$$

$$\Rightarrow V = 18 \text{ ml}$$

14. Match column-1 with Column-II

Column-I		Column-II	
(A)	Soda ash	(P)	NaF
(B)	Chlorophyll	(Q)	Ca(OH) ₂
(C)	white washing	(R)	Na ₂ CO ₃
(D)	Tooth paste	(S)	Mg ²⁺

- | | | | | |
|-----|---|---|---|---|
| | A | B | C | D |
| (1) | R | S | Q | P |
| (2) | P | Q | R | S |
| (3) | R | Q | S | P |
| (4) | Q | P | R | S |

Ans. (1)

Sol. Theory Based

15. Graph of X-ray frequency (ν)ⁿ v/s atomic number (Z) is linear. Find the value of n :

- (1) 1/2 (2) 1 (3) -1/2 (4) -1

Ans. (1)

Sol. $\nu^n \propto Z$

$$\sqrt{\nu} = a(Z - b)$$

$$\therefore n = \frac{1}{2}$$

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16. Which of the following statements are correct regarding Arrhenius equation ($K = Ae^{-E_a/RT}$) ?

(A) Slope of graph between $\ln K$ v/s $\frac{1}{T}$ is $-\frac{E_a}{R}$

(B) On increasing E_a , rate constant decreases.

(C) On increasing temperature, temperature coefficient decreases.

(D) On increasing activation energy fraction on molecules crossing energy barrier increases.

(1) (A), (B), (C)

(2) (A), (C), (D)

(3) (A) & (D) only

(4) (A), (B), (C) & (D)

Ans. (1)

17. Find correct order of covalent character :

(A) KF < KI

(B) CuCl > NaCl

(C) LiF > KF

(1) A & B only

(2) A & C only

(3) A, B & C

(4) B & C only

Ans. (3)

18. Freons are :

(1) Global warming factor

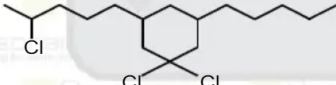
(2) Chlorine radical producing chloro fluoro carbon.

(3) Water pollutant

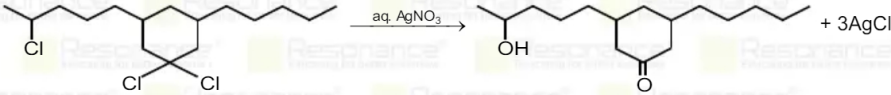
(4) Skin cancer causing carcinogenic factor.

Ans. (2)

Sol. Freons are chlorine radical producing chloro fluoro carbon.

19.  $\xrightarrow{\text{aq. AgNO}_3}$, Find number of moles of AgCl produced

Ans. (3.00 moles)

Sol.  + 3AgCl

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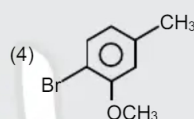
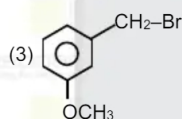
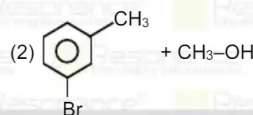
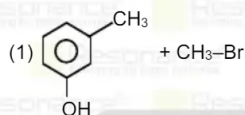
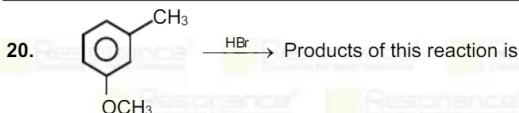
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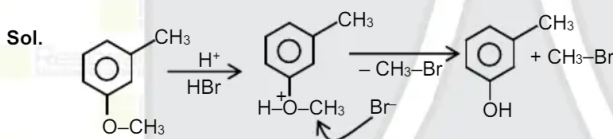
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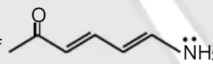


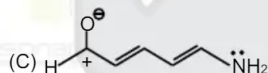
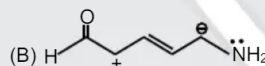
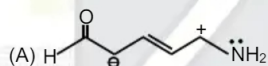
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Ans. (1)



21. Correct stability order of resonating structure of 



(1) A > B > C

(2) B > A > C

(3) C > A > B

(4) B > C > A

Ans. (3)

Sol. (C) is most stable as it has -ve charge on oxygen, (A) is less stable than (C) but more stable than (B) because the -ve charge in (A) is being delocalized on oxygen atom through resonance.

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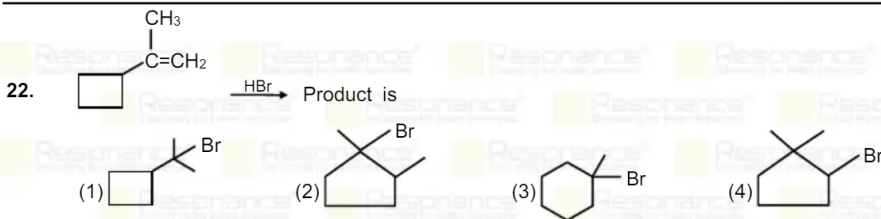
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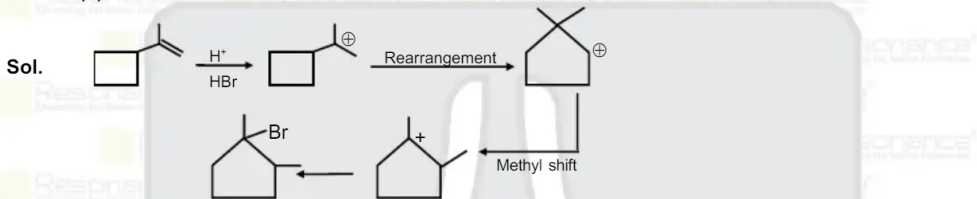
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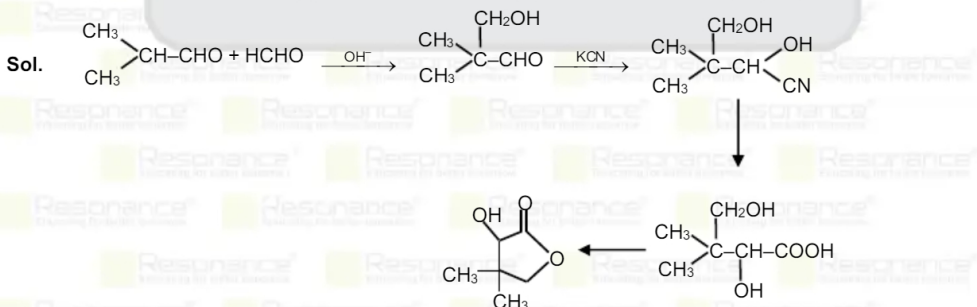
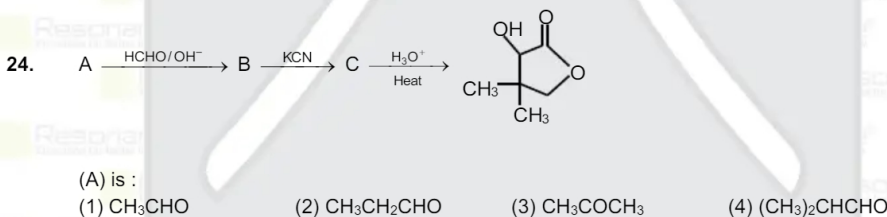
Ans. (2)



23. The phosphodiester bond of RNA is most stable at
- (1) PH = 2 – 3 at 60°C (2) PH = 4 – 5 at 90°C
(3) PH = 9 – 10 at 120°C (4) PH = 7 – 8 at 90°C

Ans. (2)

Sol. At very strong acidic medium or very strong alkaline medium phosphodiester bond hydrolysis that's why the RNA phosphodiester bond is most stable at PH 4-5 at 90°C.



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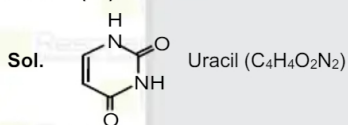
25. Statement-I : Noradrenaline is one of the neurotransmitters in human being.
Statement-II : Noradrenaline is low then the signal-sending activity becomes low and the person suffers from depression.
- (1) Both Statement-I and Statement-II are correct.
(2) Both Statement-I and Statement-II are incorrect.
(3) Statement-I is correct but Statement-II is incorrect.

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

Sol. Fact from NCERT, volume-2, page no. 452.

26. % of N atom in Uracil is :

Ans. (25)







$$\frac{2 \times 14}{4 \times 12 + 4 \times 1 + 2 \times 16 + 2 \times 14} \times 100 = 25\%$$

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