



SHIFT - 1

QUESTIONS & SOLUTIONS

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 24 JANUARY, 2023

 9:00 AM to 12:00 Noon

Duration : 3 Hours

Maximum Marks : 300

SUBJECT - CHEMISTRY

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1. $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ primary and secondary valency will be :

[Coordination compound]

Sol. 3, 6

2. CoCl_4^{2-} electronic configuration $\rightarrow e^m t_2^n$.

Calculate $m + n$. n = number of unpaired electrons

Ans. 7

[Coordination compound]

Sol. $3d^7$ WFL

EC $\rightarrow e^4 t_2^3$

$m = 4$, no. of unpaired electron = 3

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

(1) $\frac{1}{2}$

(2) 1

(3) $-\frac{1}{2}$

(4) -1

Ans. (1)

[Periodic properties]

Sol. $\nu^n \propto Z$

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

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

4. The wavelength of first line of paschen series is 720 nm, then calculate wavelength of second line of paschen series ?

Ans. 492.1875 nm

[Atomic Structure]

Sol. Paschen series first line : $4 \rightarrow 3$

$$\frac{1}{\lambda_1} = R_H Z^2 \left(\frac{1}{9} - \frac{1}{16} \right)$$

$$\frac{1}{720} = R_H Z^2 \left(\frac{7}{16 \times 9} \right) \dots \text{(i)}$$

Paschen series second line : $5 \rightarrow 3$

$$\frac{1}{\lambda_2} = R_H Z^2 \left(\frac{1}{9} - \frac{1}{25} \right)$$

$$\frac{1}{\lambda_2} = R_H Z^2 \left(\frac{16}{9 \times 25} \right) \dots \text{(ii)}$$

eq. (i) / (ii)

$$\frac{\lambda_2}{720} = \left(\frac{7}{16 \times 9} \right) \times \left(\frac{9 \times 25}{16} \right)$$

$\lambda_2 = 492.1875 \text{ nm}$

5. Find correct order of covalent character : [Chemical bonding]

- (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)

6. Freezing point of solution is less than that of pure solvent, which of the following statements are correct ?

- (A) Vapour pressure of solution is less than that of pure solvent
 (B) Vapour pressure of solution is greater than that of pure solvent
 (C) Only solvent molecules will freeze
 (D) Only solute molecules will freeze

(1) A & B only (2) A & C only (3) C & D only (D) A, B & D only

Ans. (2) [Solution & colligative properties]

7. For which of the following aqueous ion, spin only magnetic moment is 3.87 BM ?

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

Ans. (2) [d & f-block]

Sol. $V^{2+} = 3d^3 4s^0$

8. Correct order of strength of H-bond in the following :

- (A) Liquid water (B) Ice (C) Impure water

(1) $A > B > C$ (2) $A < B < C$ (3) $B > A > C$ (4) $A = B > C$

Ans. (3) [Hydrogen]

9. How many reactions are nonspontaneous at 300 K. For independent reaction ΔH & ΔS values are given

- (1) $\Delta H = -25 \text{ kJ/mole}$, $\Delta S = -80 \text{ J/mole}$ (2) $\Delta H = +25 \text{ kJ/mole}$, $\Delta S = -50 \text{ J/mole}$
 (3) $\Delta H = 22 \text{ kJ/mole}$, $\Delta S = +50 \text{ J/mole}$ (4) $\Delta H = -22 \text{ kJ/mole}$, $\Delta S = 80 \text{ J/mole}$

Ans. (2) [Thermodynamics-2 (2nd law & 3rd law)]

- Sol. (1) Spontaneous
 (2) Non-Spontaneous
 (3) Non spontaneous
 (4) Spontaneous

10. Buffer solution of pH = 5 prepared by mixing 25 ml, 0.2M CH₃COONa and 25ml, 0.02M CH₃COOH, if K_a of CH₃COOH = x × 10⁻⁵ find x.

Ans. (10)

[Ionic Equilibrium (Elementary)]

Sol. $\text{pH} = \text{pK}_a + \log \frac{0.1}{0.01}$

$$5 = \text{pK}_a + \log 10$$

$$\text{pK}_a = 4$$

$$\text{K}_a = 10^{-4}$$

$$= 10 \times 10^{-5}$$

$$= 10$$

11. **Column-I** **Column-II**
- (A) Zone refining (P) pig iron
- (B) Electrolysis (Q) Al
- (C) Reverberatory furnace (R) Si
- (D) Blast furnace (S) Cu

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

Ans. (1)

[Metallurgy]

12. How many statements are correct regarding Arrhenius equation ? ($K = Ae^{-E_a/RT}$)

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

(II) On increasing E_a , rate constant decreases

(III) On increasing temperature, temperature coefficient decreases

(IV) On increasing activation energy fraction of molecules crossing energy barrier increases

Ans. (3)

[Chemical Kinetics]

Sol. (I), (II) & (III) are correct.

13. 5g of NaOH is mixed with 450 ml of de-ionized water to form stock solution. What volume of this stock solution is used to prepare 500ml, 0.1M solution.

Ans. 180 ml

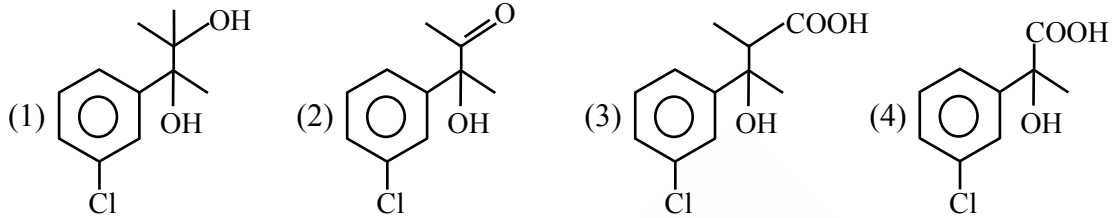
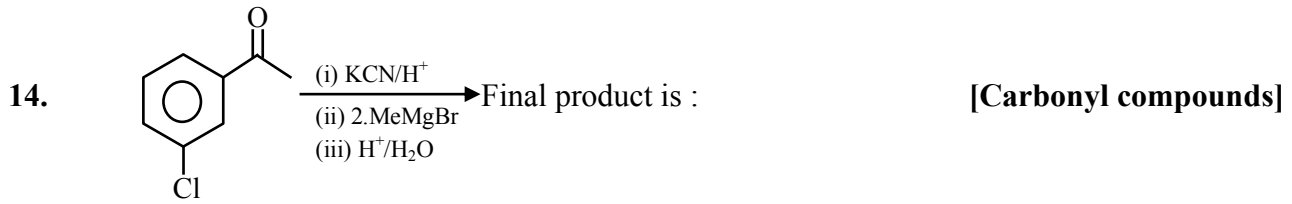
[Mole Concept]

Sol. $M_1V_1 = M_2V_2$

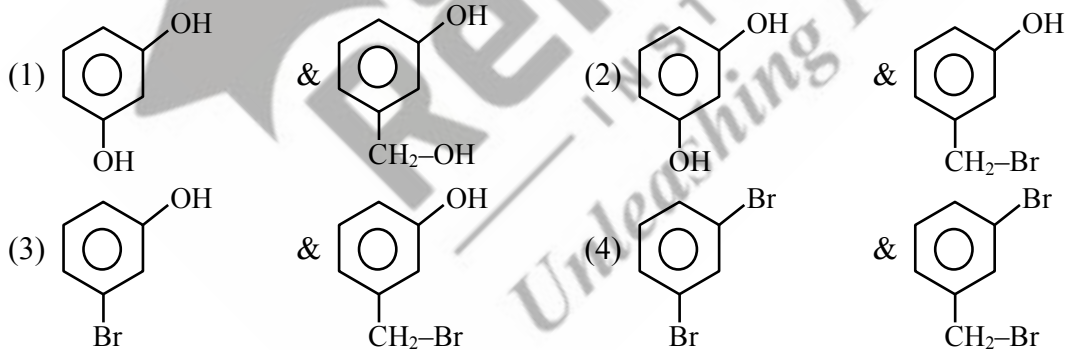
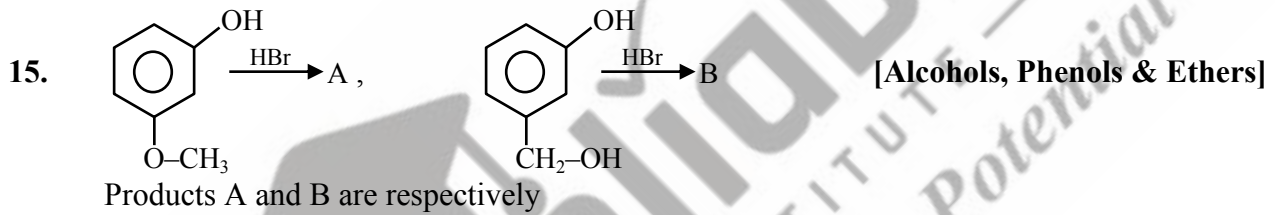
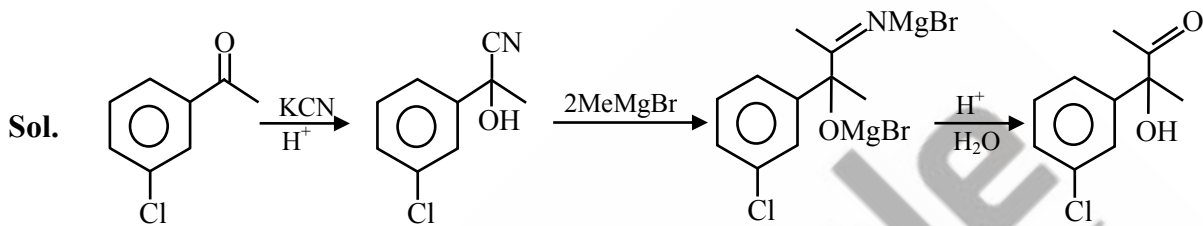
$$\frac{5}{40} \times \frac{1000}{450} \times V = 0.1 \times 500$$

$$V = \frac{0.1 \times 500 \times 40 \times 450}{5 \times 1000}$$

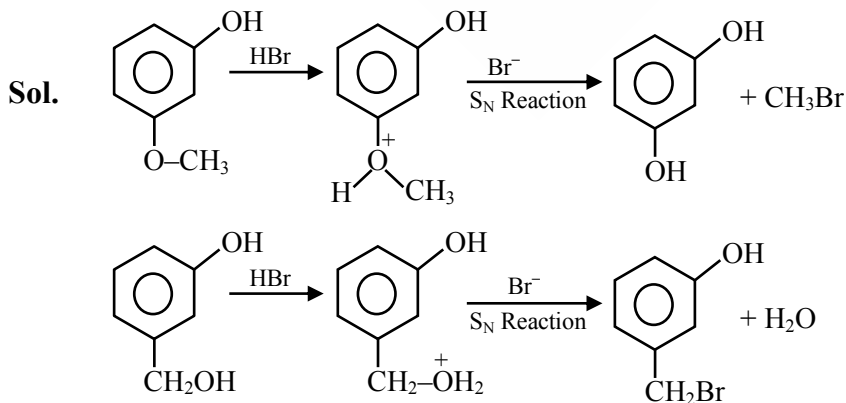
$$V = 180 \text{ ml}$$



Ans. (2)

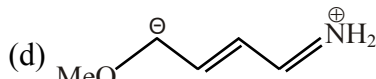
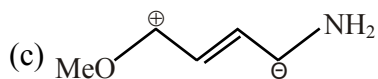
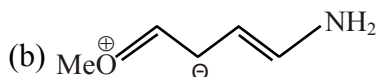
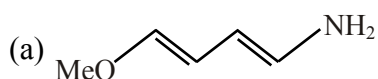


Ans. (2)



16. Which of the following is correct stability order of the given resonance structures?

[GOC-1]



(1) $a > b > c > d$

(2) $b > a > d > c$

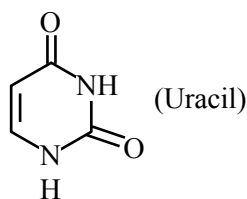
(3) $a > b > d > c$

(4) $a > d > b > c$

Ans. (3)

17. Mass percentage of nitrogen in uracil is

[Biomolecules]



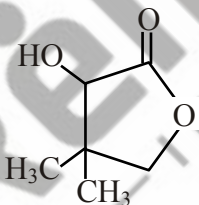
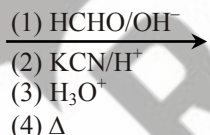
Ans. 25

Sol. Molecular formula of uracil is $C_4H_4N_2O_2$

Molecular mass of uracil is 112

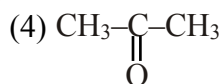
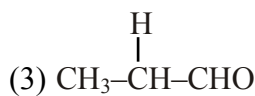
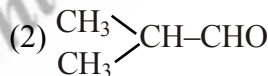
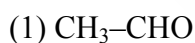
$$\% \text{ of N in uracil} = \frac{28}{112} \times 100 = 25$$

18. Compound (X) $\xrightarrow[\text{(4) } \Delta]{\text{(1) HCHO/OH}^-}$

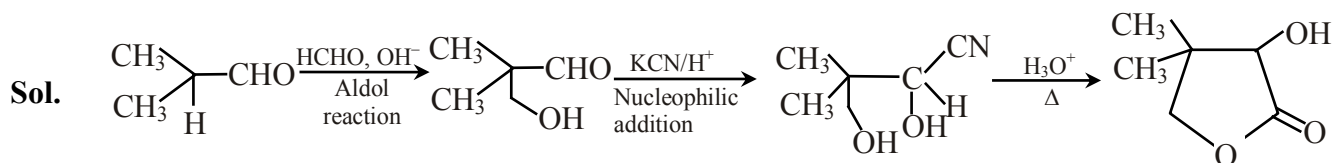


[Carbonyl compounds]

X will be :

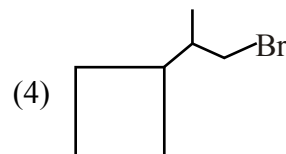
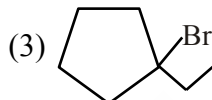
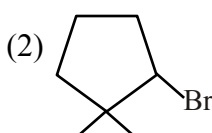
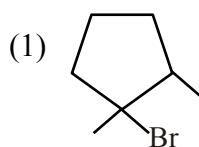
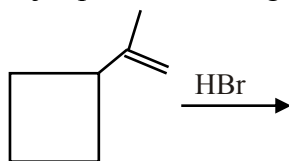


Ans. (2)

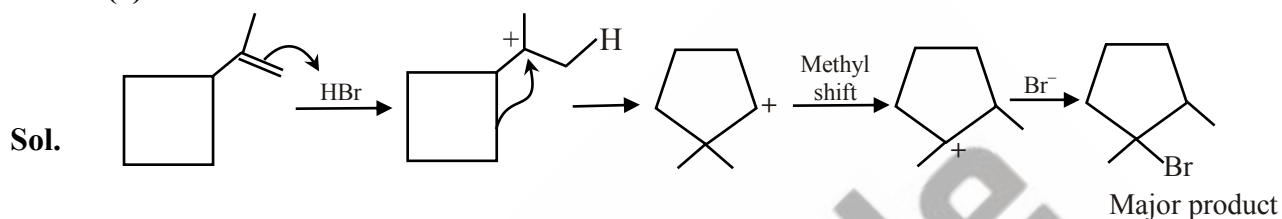


19. Major product of the given reaction will be :

[Hydrocarbons]



Ans. (1)



20. Which of the following statements is correct?

[Haloalkanes & Haloarenes]

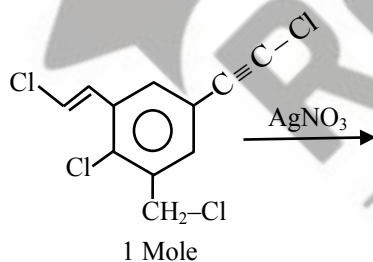
- (1) All radicals are known as freons. (2) Freons cause skin cancer.
(3) Freons are chlorofluoro carbon. (4) Freons are used in sunscreen lotion.

Ans. (3)

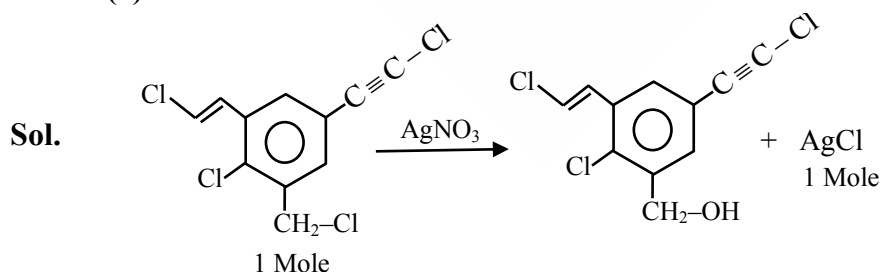
Sol. Freons are chlorofluoro carbon. Other given statements are wrong.

21. How many moles of AgCl are formed in the given reaction?

[Haloalkanes & Haloarenes]



Ans. (1)



Only chlorine atom attached with sp^3 hybrid carbon (haloalkane) in given molecule reacts with AgNO_3 and produces white ppt of AgCl , so only one mole AgCl is formed.

22. Statement-I

[Chemistry in every day life]

Noradrenaline is one of the neurotransmitter.

Statement-II

Low level of noradrenaline is not cause of depression in humans.

- (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.

Ans. (3)



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