

JEE-MAIN EXAM JANUARY, 2024

Date: - 30-01-2024 (SHIFT-2)

CHEMISTRY

SECTION-A

1. Which among the following purification methods is based on the principle of "Solubility" in two different solvents?

- (1) Column Chromatography (2) Sublimation
(3) Distillation (4) Differential Extraction

2. Salicylaldehyde is synthesized from phenol, when reacted with

- (1) $\text{H}-\text{C}(=\text{O})-\text{Cl}, \text{NaOH}$ (2) CO_2, NaOH
(3) $\text{CCl}_4, \text{NaOH}$ (4) $\text{HCCl}_3, \text{NaOH}$

3. Given below are two statements:

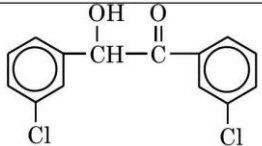
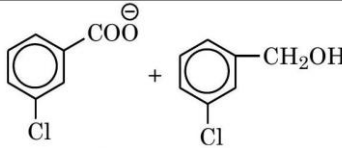
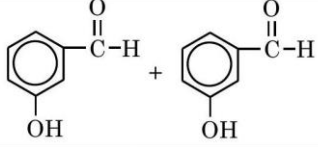
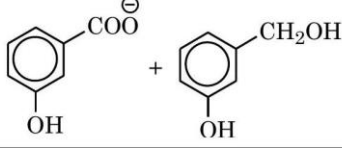
Statement - I: High concentration of strong nucleophilic reagent with secondary alkyl halides which do not have bulky substituents will follow $\text{S}_{\text{N}}2$ mechanism.

Statement - II: A secondary alkyl halide when treated with a large excess of ethanol follows $\text{S}_{\text{N}}1$ mechanism.

In the light of the above statements, choose the most appropriate from the questions given below:

- (1) Statement I is true but Statement II is false. (2) Statement I is false but Statement II is true.
(3) Both statement I and Statement II are false. (4) Both statement I and Statement II are true.

4. m-chlorobenzaldehyde on treatment with 50% KOH solution yields

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

5. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

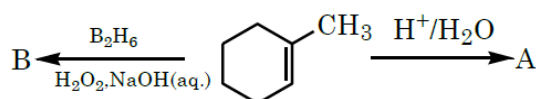
Assertion A : H_2Te is more acidic than H_2S .

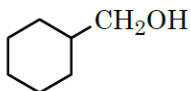
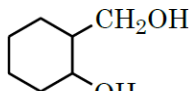
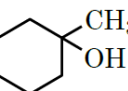
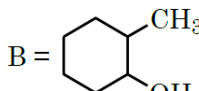
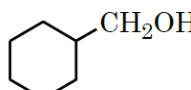
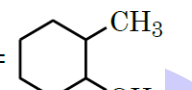
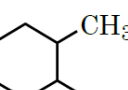
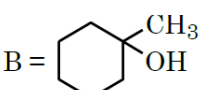
Reason R: Bond dissociation enthalpy of H_2Te is lower than H_2S .

In the light of the above statements. Choose the most appropriate from the options given below.

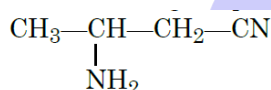
- (1) Both A and R are true but R is NOT the correct explanation of A.
 (2) Both A and R are true and R is the correct explanation of A.
 (3) A is false but R is true.
 (4) A is true but R is false.

6. Product A and B formed in the following set of reactions are:



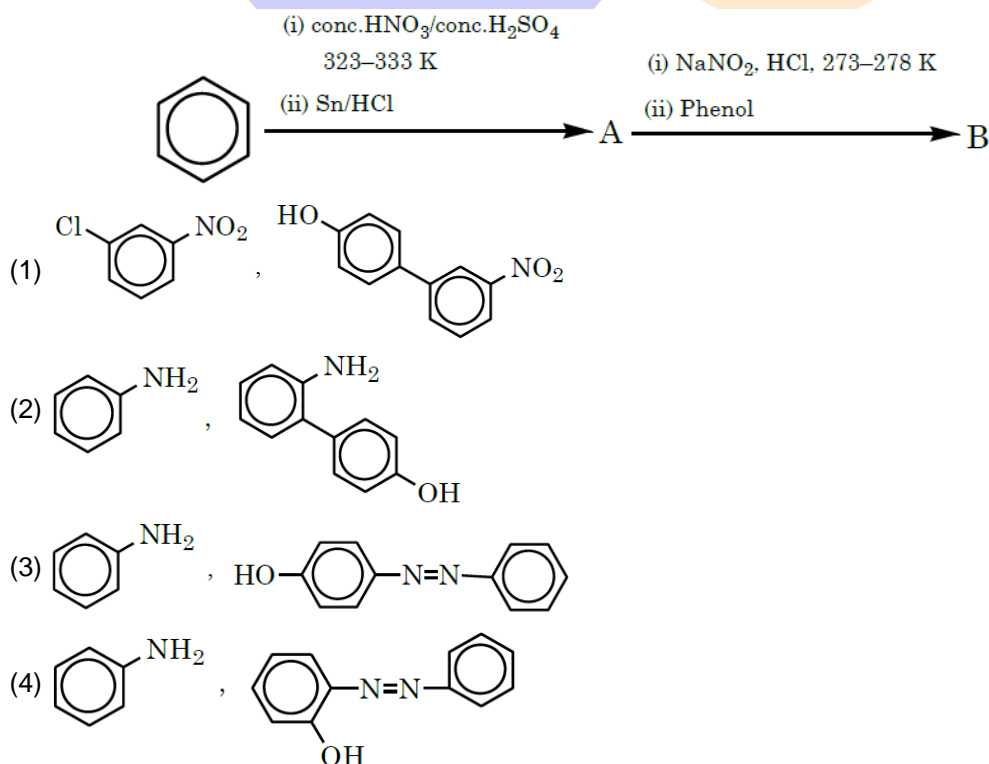
- (1) A =  B =  (2) A =  B = 
 (3) A =  B =  (4) A =  B = 

7. IUPAC name of following compound is



- (1) 2-Aminopentanenitrile (2) 2-Aminobutanenitrile
 (3) 3-Aminobutanenitrile (4) 3-Aminopropanenitrile

8. The products A and B formed in the following reaction scheme are respectively

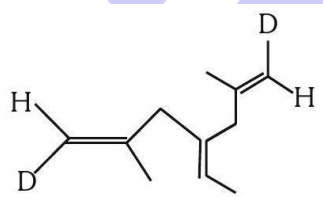


9. The molecule/ion with square pyramidal shape is:
 (1) $[\text{Ni}(\text{CN})_4]^{2-}$ (2) PCl_5 (3) BrF_5 (4) PF_5
10. The orange colour of $\text{K}_2\text{Cr}_2\text{O}_7$ and purple colour of KMnO_4 is due to
 (1) Charge transfer transition in both.
 (2) $d \rightarrow d$ transition in KMnO_4 and charge transfer transitions in $\text{K}_2\text{Cr}_2\text{O}_7$.
 (3) $d \rightarrow d$ transition in $\text{K}_2\text{Cr}_2\text{O}_7$ and charge transfer transitions in KMnO_4 .
 (4) $d \rightarrow d$ transition in both.
11. Alkaline oxidative fusion of MnO_2 gives "A" which on electrolytic oxidation in alkaline solution produces B. A and B respectively are :
 (1) Mn_2O_7 and MnO_4^- (2) MnO_4^{2-} and MnO_4^- (3) Mn_2O_3 and MnO_4^{2-} (4) MnO_4^{2-} and Mn_2O_7
12. If a substance 'A' dissolves in solution of a mixture of 'B' and 'C' with their respective number of moles as n_A , n_B and n_C , mole fraction of C in the solution is:
 (1) $\frac{n_C}{n_A \times n_B \times n_C}$ (2) $\frac{n_C}{n_A + n_B + n_C}$ (3) $\frac{n_C}{n_A - n_B - n_C}$ (4) $\frac{n_B}{n_A + n_B}$
13. Given below are two statements:
Statement - I: Along the period, the chemical reactivity of the element gradually increases from group 1 to group 18.
Statement - II: The nature of oxides formed by group 1 element is basic while that of group 17 elements is acidic.
 In the light above statements, choose the most appropriate from the questions given below:
 (1) Both statement I and Statement II are true.
 (2) Statement I is true but Statement II is False.
 (3) Statement I is false but Statement II is true.
 (4) Both Statement I and Statement II is false.
14. The coordination geometry around the manganese in decacarbonyldimanganese (0)
 (1) Octahedral (2) Trigonal bipyramidal
 (3) Square pyramidal (4) Square planar
15. Given below are two statements:
Statement-I: Since fluorine is more electronegative than nitrogen, the net dipole moment of NF_3 is greater than NH_3 .
Statement-II: In NH_3 , the orbital dipole due to lone pair and the dipole moment of NH bonds are in opposite direction, but in NF_3 the orbital dipole due to lone pair and dipole moments of N-F bonds are in same direction.
 In the light of the above statements. Choose the most appropriate from the options given below.
 (1) Statement I is true but Statement II is false.
 (2) Both Statement I and Statement II are false.
 (3) Both statement I and Statement II is are true.
 (4) Statement I is false but Statement II is are true.

16. The correct stability order of carbocations is
- (1) $(\text{CH}_3)_3\text{C}^+ > \text{CH}_3 - \overset{+}{\text{CH}}_2 > (\text{CH}_3)_2\overset{+}{\text{CH}} > \overset{+}{\text{CH}}_3$
 - (2) $\overset{+}{\text{CH}}_3 > (\text{CH}_3)_2\overset{+}{\text{CH}} > \text{CH}_3 - \overset{+}{\text{CH}}_2 > (\text{CH}_3)_3\text{C}^+$
 - (3) $(\text{CH}_3)_3\text{C}^+ > (\text{CH}_3)_2\overset{+}{\text{CH}} > \text{CH}_3 - \overset{+}{\text{CH}}_2 > \overset{+}{\text{CH}}_3$
 - (4) $\overset{+}{\text{CH}}_3 > \text{CH}_3 - \overset{+}{\text{CH}}_2 > \text{CH}_3 - \underset{\text{CH}_3}{\overset{+}{\text{CH}}} > (\text{CH}_3)_3\text{C}^+$
17. The solution from the following with highest depression in freezing point/lowest freezing point is
- (1) 180 g of acetic acid dissolved in water
 - (2) 180 g of acetic acid dissolved in benzene
 - (3) 180 g of benzoic acid dissolved in benzene
 - (4) 180 g of glucose dissolved in water
18. A and B formed in the following reactions are:
- $$\text{CrO}_2\text{Cl}_2 + 4\text{NaOH} \rightarrow \text{A} + 2\text{NaCl} + 2\text{H}_2\text{O}$$
- $$\text{A} + 2\text{HCl} + 2\text{H}_2\text{O}_2 \rightarrow \text{B} + 3\text{H}_2\text{O}$$
- (1) A = Na_2CrO_4 , B = CrO_5
 - (2) A = $\text{Na}_2\text{Cr}_2\text{O}_4$, B = CrO_4
 - (3) A = $\text{Na}_2\text{Cr}_2\text{O}_7$, B = CrO_3
 - (4) A = $\text{Na}_2\text{Cr}_2\text{O}_7$, B = CrO_5
19. Choose the correct statements about the hydrides of group 15 elements.
- A. The stability of the hydrides decreases in the order $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
 - B. The reducing ability of the hydrides increases in the order $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$
 - C. Among the hydrides, NH_3 is strong reducing agent while BiH_3 is mild reducing agent.
 - D. The basicity of the hydrides increases in the order $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$
- Choose the most appropriate from the option given below:
- (1) B and C only
 - (2) C and D only
 - (3) A and B only
 - (4) A and D only
20. Reduction potential of ions are given below:
- $$\begin{array}{ccc} \text{ClO}_4^- & \text{IO}_4^- & \text{BrO}_4^- \\ E^\circ = 1.19 \text{ V} & E^\circ = 1.65 \text{ V} & E^\circ = 1.74 \text{ V} \end{array}$$
- The correct order of their oxidising power is:
- (1) $\text{ClO}_4^- > \text{IO}_4^- > \text{BrO}_4^-$
 - (2) $\text{BrO}_4^- > \text{IO}_4^- > \text{ClO}_4^-$
 - (3) $\text{BrO}_4^- > \text{ClO}_4^- > \text{IO}_4^-$
 - (4) $\text{IO}_4^- > \text{BrO}_4^- > \text{ClO}_4^-$

SECTION-B

21. Number of complexes which show optical isomerism among the following is ____.
- cis $-\text{[Cr(ox)}_2\text{Cl}_2\text{]}^{3-}$, $[\text{Co(en)}_3]^{3+}$,
 cis $-\text{[Pt(en)}_2\text{Cl}_2\text{]}^{2+}$, cis $-\text{[Co(en)}_2\text{Cl}_2\text{]}^+$,
 trans $-\text{[Pt(en)}_2\text{Cl}_2\text{]}^{2+}$, trans $-\text{[Cr(ox)}_2\text{Cl}_2\text{]}^{3-}$

22. NO_2 required for a reaction is produced by decomposition of N_2O_5 in CCl_4 as by equation $2 \text{N}_2\text{O}_{5(g)} \rightarrow 4\text{NO}_{2(g)} + \text{O}_{2(g)}$
- The initial concentration of N_2O_5 is 3 mol L^{-1} and it is 2.75 mol L^{-1} after 30 minutes.
- The rate of formation of NO_2 is $x \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$, value of x is _____.
23. Two reactions are given below:
- $$2\text{Fe}_{(s)} + \frac{3}{2}\text{O}_{2(g)} \rightarrow \text{Fe}_2\text{O}_{3(s)}, \Delta H^\circ = -822 \text{ kJ/mol}$$
- $$\text{C}_{(s)} + \frac{1}{2}\text{O}_{2(g)} \rightarrow \text{CO}_{(g)}, \Delta H^\circ = -110 \text{ kJ/mol}$$
- Then enthalpy change for following reaction $3\text{C}_{(s)} + \text{Fe}_2\text{O}_{3(s)} \rightarrow 2\text{Fe}_{(s)} + 3\text{CO}_{(g)}$
24. The total number of correct statements, regarding the nucleic acids is _____.
 A. RNA is regarded as the reserve of genetic information.
 B. DNA molecule self-duplicates during cell division
 C. DNA synthesizes proteins in the cell.
 D. The message for the synthesis of particular proteins is present in DNA
 E. Identical DNA strands are transferred to daughter cells.
25. The pH of an aqueous solution containing 1M benzoic acid ($\text{pK}_a = 4.20$) and 1M sodium benzoate is 4.5. The volume of benzoic acid solution in 300 mL of this buffer solution is _____ mL.
26. Number of geometrical isomers possible for the given structure is/are _____.

27. Total number of species from the following which can undergo disproportionation reaction _____.
 $\text{H}_2\text{O}_2, \text{ClO}_3^-, \text{P}_4, \text{Cl}_2, \text{Ag}, \text{Cu}^{+1}, \text{F}_2, \text{NO}_2, \text{K}^+$
28. Number of metal ions characterized by flame test among the following is _____.
 $\text{Sr}^{2+}, \text{Ba}^{2+}, \text{Ca}^{2+}, \text{Cu}^{2+}, \text{Zn}^{2+}, \text{Co}^{2+}, \text{Fe}^{2+}$
29. 2-chlorobutane $+\text{Cl}_2 \rightarrow \text{C}_4\text{H}_8\text{Cl}_2$ (isomers)
 Total number of optically active isomers shown by $\text{C}_4\text{H}_8\text{Cl}_2$, obtained in the above reaction is _____.
30. Number of spectral lines obtained in He^+ spectra, when an electron makes transition from fifth excited state to first excited state will be

NTA ANSWERS

- | | | | | | | | | | | | | | |
|-----|------|-----|-------|-----|-----|-----|-------|-----|-----|-----|-----|-----|-----|
| 1. | (4) | 2. | (4) | 3. | (4) | 4. | (2) | 5. | (2) | 6. | (2) | 7. | (3) |
| 8. | (3) | 9. | (3) | 10. | (1) | 11. | (2) | 12. | (2) | 13. | (3) | 14. | (1) |
| 15. | (2) | 16. | (3) | 17. | (1) | 18. | (1) | 19. | (3) | 20. | (2) | 21. | (4) |
| 22. | (17) | 23. | (492) | 24. | (3) | 25. | (100) | 26. | (4) | 27. | (6) | 28. | (4) |
| 29. | (6) | 30. | (10) | | | | | | | | | | |