JEE-MAIN EXAM JANUARY, 2025

Date: - 23-01-2025 (SHIFT-2)

CHEMISTRY

SECTION-A

1. pH of water is 7 at $25^{\circ}C$. If water is heated to $80^{\circ}C$., it's pH will :

(1) Increase

(2) Decrease

(3) H^+ concentration increases, OH^- concentration decrease

(4) Remains the same

2. Given below are two statements :

Statement (I): For a given shell, the total number of allowed orbitals is given by n^2.

Statement (II): For any subshell, the spatial orientation of the orbitals is given by $-l$ to $+l$ values including zero.

In the light of the above statements, choose the correct answer from the options given below :

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

3. Consider the following reactions

$$K_2Cr_2O_7 \xrightarrow[-H_2O]{KOH} [A] \xrightarrow[-H_2O]{H_2SO_4} [B] + K_2SO_4$$

The products [A] and [B], respectively are :

(1) $K_2Cr(OH)_6$ and Cr_2O_3

(2) K_2CrO_4 and CrO

(3) K_2CrO_4 and Cr_2O_3

(4) K_2CrO_4 and $K_2Cr_2O_7$

4. Match List - I with List - II.

List - I	List - II
(A) Bronze	(I) Cu, Ni
(B) Brass	(II) Fe, Cr, Ni, C
(C) UK silver coin	(III) Cu, Zn
(D) Stainless steel	(IV) Cu, Sn

(1) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

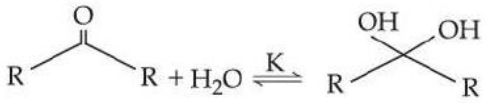
(2) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

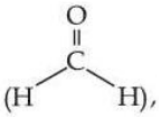
(3) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)

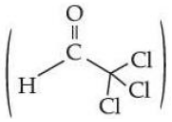
(4) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

5. Given below are two statements :

Consider the following reaction



Statement (I) : In the case of formaldehyde  K is about 2280, due to small substituents, hydration is faster.

Statement (II) : In the case of trichloro acetaldehyde  K is about 2000 due to -I effect of -Cl .

In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is false but Statement II is true (2) Both Statement I and Statement II are true

(3) Statement I is true but Statement II is false (4) Both Statement I and Statement II are false

6. The effect of temperature on spontaneity of reactions are represented as :

	ΔH	**ΔS**	**Temperature**	**Spontaneity**
(A)	+	–	any T	Non spontaneous
(B)	+	+	low T	spontaneous
(C)	–	–	low T	Non spontaneous
(D)	–	+	any T	spontaneous

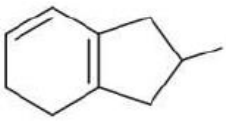
The incorrect combinations are:

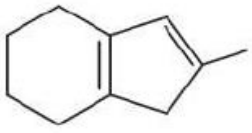
(1) (A) and (D) only (2) (A) and (C) only (3) (B) and (D only (4) (B) and (C) only

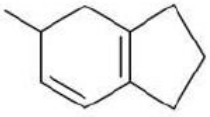
7. Match List-I with List-II

List - I

(Isomers of $C_{10}H_{14}$)

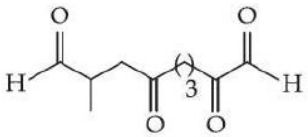
(A) 

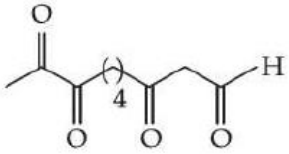
(B) 

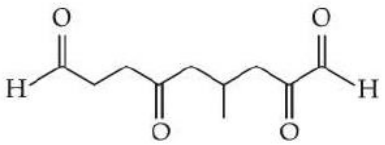
(C) 

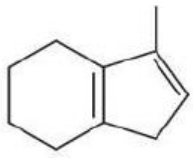
List - II

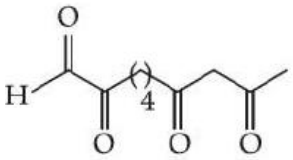
(Ozonolysis product)

(I) 

(II) 

(III) 

(D) 

(IV) 

Choose the correct answer from the options given below :

(1) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

(2) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

(4) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

8. Consider the reaction $X_2Y(g) \rightleftharpoons X_2(g) + \frac{1}{2}Y_2(g)$. The equation representing correct relationship between the degree of dissociation (x) of $X_2Y(g)$ with its equilibrium constant Kp is _____. Assume x to be very very small.

(1) $x = \sqrt[3]{\frac{2Kp}{p}}$ (2) $x = \sqrt[3]{\frac{Kp}{2p}}$ (3) $x = \sqrt[3]{\frac{Kp}{p}}$ (4) $x = \sqrt[3]{\frac{2Kp^2}{p}}$

9 When a non-volatile solute is added to the solvent, the vapour pressure of the solvent decreases by 10 mm of Hg. The mole fraction of the solute in the solution is 0.2. What would be the mole fraction of the solvent if decrease in vapour pressure is 20 mm of Hg ?

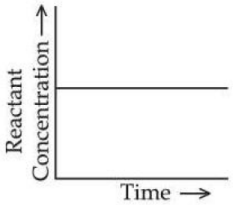
(1) 0.6 (2) 0.8 (3) 0.4 (4) 0.2

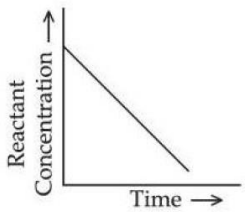
10. Consider a binary solution of two volatile liquid components 1 and 2. x_1 and y_1 are the mole fractions of component 1 in liquid and vapour phase, respectively. The slope and intercept of the linear plot of $\frac{1}{x_1}$ vs $\frac{1}{y_1}$ are given respectively as :

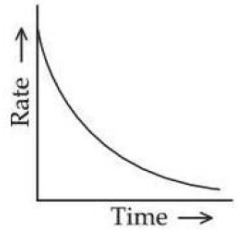
(1) $\frac{P_1^0}{P_2^0}, \frac{P_1^0 - P_2^0}{P_2^0}$ (2) $\frac{P_2^0}{P_1^0}, \frac{P_2^0 - P_1^0}{P_2^0}$

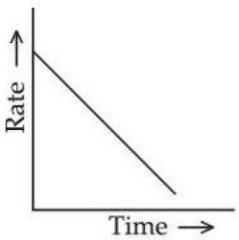
(3) $\frac{P_1^0}{P_2^0}, \frac{P_2^0 - P_1^0}{P_2^0}$ (4) $\frac{P_2^0}{P_1^0}, \frac{P_1^0 - P_2^0}{P_2^0}$

11. Which of the following graphs most appropriately represents a zero order reaction?

(1) 

(2) 

(3) 

(4) 

12. Given below are two statements:

Statement (I): The boiling points of alcohols and phenols increase with increase in the number of C -atoms.

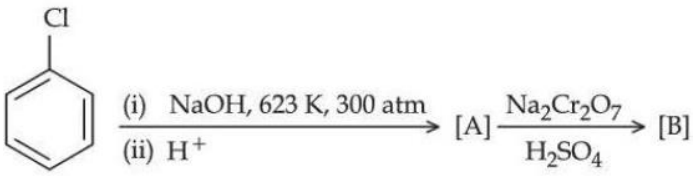
Statement (II): The boiling points of alcohols and phenols are higher in comparison to other class of compounds such as ethers, haloalkanes.

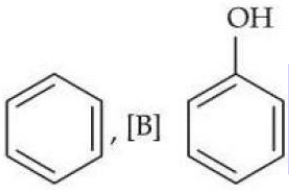
In the light of the above statements, choose the correct answer from the options given below:

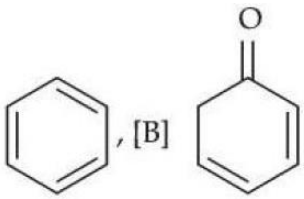
(1) Both Statement I and Statement II are true (2) Both Statement I and Statement II are false

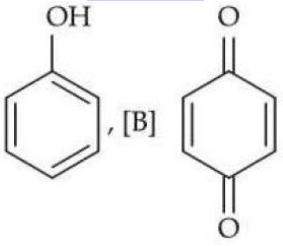
(3) Statement I is false but Statement II is true (4) Statement I is true but Statement II is false

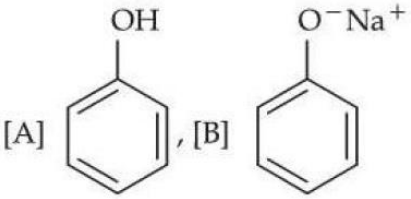
13. Identify the products [A] and [B], respectively in the following reaction:



(1) 

(2) 

(3) 

(4) 

14. Given below are two statements about X -ray spectra of elements :

Statement (I): A plot of $\sqrt{\nu}$ ($\nu =$ frequency of X -rays emitted) vs atomic mass is a straight line.

Statement (II): A plot of $\nu(\nu =$ frequency of X -rays emitted) vs atomic number is a straight line.

In the light of the above statements, choose the correct answer from the options given below :

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are true

15. Given below are the atomic numbers of some group 14 elements. The atomic number of the element with lowest melting point is :

(1) 14 (2) 50 (3) 82 (4) 6

16. The α -Helix and β - Pleated sheet structures of protein are associated with its :

(1) secondary structure (2) primary structure

(3) tertiary structure (4) quaternary structure

17. Identify the coordination complexes in which the central metal ion has d^4 configuration.

(A) $[FeO_4]^{2-}$

(B) $[Mn(CN)_6]^{3-}$

(C) $[Fe(CN)_6]^{3-}$

(D) $Cr_2(O-\overset{\overset{O}{\|}}{C}-Me)_4(H_2O)_2$

(E) $[NiF_6]^{2-}$

Choose the correct answer from the options given below :

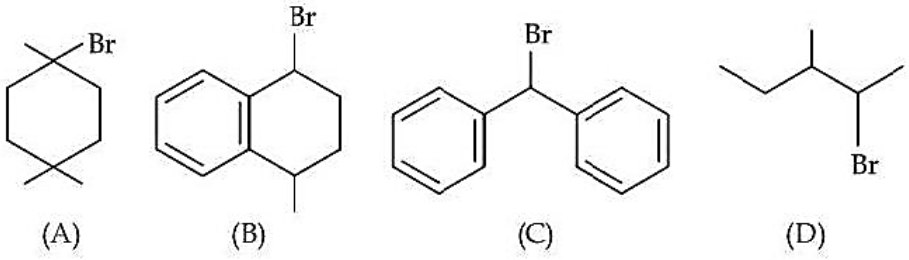
(1) (A), (B) and (E) only

(2) (C) and (E) only

(3) (B) and (D) only

(4) (B), (C) and (D) only

18. The ascending order of relative rate of solvolysis of following compounds is :



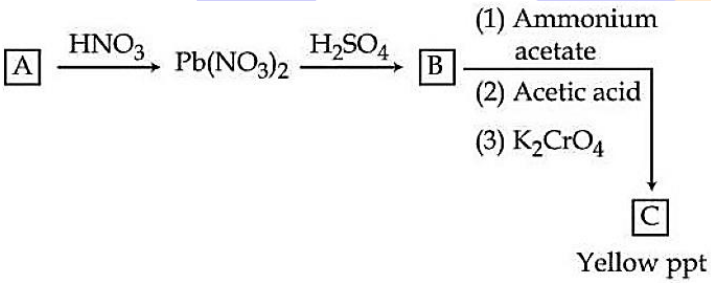
(1) (C) < (D) < (B) < (A)

(2) (C) < (B) < (A) < (D)

(3) (D) < (A) < (B) < (C)

(4) (D) < (B) < (A) < (C)

19. Identify A, B and C in the given below reaction sequence



(1) $PbCl_2, Pb(SO_4)_2, PbCrO_4$

(2) $PbCl_2, PbSO_4, PbCrO_4$

(3) $PbS, PbSO_4, Pb(CH_3COO)_2$

(4) $PbS, PbSO_4, PbCrO_4$

20. Standard electrode potentials for a few half cells are mentioned below :

$E^{\circ}_{Cu^{2+}/Cu} = 0.34\,V, E^{\circ}_{Zn^{2+}/Zn} = -0.76\,V$

$E^{0}_{Ag^{+}/Ag} = 0.80\,V, E^{0}_{Mg^{2+}/Mg} = -2.37\,V$

Which one of the following cells gives the most negative value of ΔG° ?

(1) $Cu\left|Cu^{2+}(1M)\right\| Ag^{+}(1M)\left|Ag\right.$

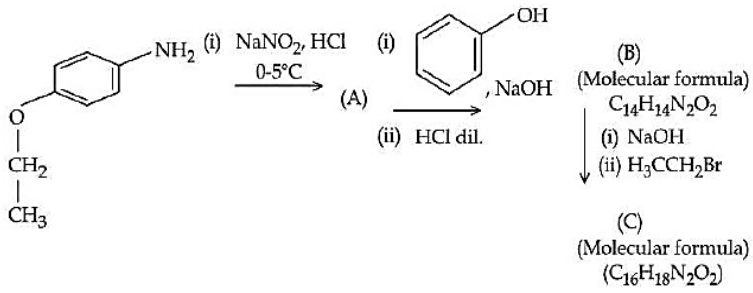
(2) $Zn\left|Zn^{2+}(1M)\right\|\left|Mg^{2+}(1M)\right|Mg$

(3) $Zn\left|Zn^{2+}(1M)\right\| Ag^{+}(1M)\left|Ag\right.$

(4) $Ag\left|Ag^{+}(1M)\right\|\left|Mg^{2+}(1M)\right|Mg$

SECTION-B

21. Consider the following sequence of reactions.



Total number of sp^3 hybridised carbon atoms in the major product C formed is _____.

22. 0.01 mole of an organic compound (X) containing 10% hydrogen, on complete combustion produced $0.9\,g\,H_2O$. Molar mass of (X) is ____ $gmol^{-1}$.

23. When 81.0 g of aluminium is allowed to react with 128.0 g of oxygen gas, the mass of aluminium oxide produced in grams is _____ (Nearest integer)

Given :

Molar mass of Al is $27.0\,g\,mol^{-1}$

Molar mass of O is $16.0\,g\,mol^{-1}$

24. The bond dissociation enthalpy of $X_2\Delta H^{\circ}_{bond}$ calculated from the given data is_____ $kJmol^{-1}$. (Nearest integer)

$$M^+X^-(s) \rightarrow M^+(g) + X^-(g)\Delta H^{\circ}_{lattice} = 800\,kJ\,mol^{-1}$$

$$M(s) \rightarrow M(g)\Delta H^{\circ}_{sub} = 100\,kJ\,mol^{-1}$$

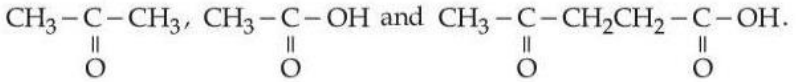
$$M(g) \rightarrow M^+(g) + e^-(g)\Delta H^{\circ}_{i} = 500\,kJ\,mol^{-1}$$

$$X(g) + e^-(g) \rightarrow X^-(g)\Delta H^{\circ}_{eg} = -300\,kJ\,mol^{-1}$$

$$M(s) + \frac{1}{2}X_2(g) \rightarrow M^+X^-(s)\Delta H^{\circ}_{f} = -400\,kJ\,mol^{-1}$$

[Given : M^+X^- is a pure ionic compound and X forms a diatomic molecule X_2 in gaseous state]

25. A compound 'X' absorbs 2 moles of hydrogen and 'X' upon oxidation with $KMnO_4 * H^+$ gives



The total number of σ bonds present in the compound 'X' is ____.

NTA ANSWERS

1.	(2)	2.	(1)	3.	(4)	4.	(4)	5.	(2)	6.	(4)	7.	(3)
8.	(4)	9.	(1)	10.	(3)	11.	(2)	12.	(1)	13.	(3)	14.	(2)
15.	(2)	16.	(1)	17.	(3)	18.	(3)	19.	(4)	20.	(3)	21.	4
22.	100	23.	153	24.	200	25.	27						