

CHEMISTRY

SECTION - A

Multiple Choice Questions: This section contains 20 multiple choice questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer:

1. Highest X-O bond order is

(X is central atom)

- (1) F₂O
- (2) CO
- (3) H₂O
- (4) CO₂

Answer (2)

Sol. :C≡O

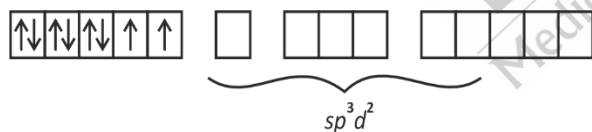
2. The hybridisation states of Ni in the 3 complexes Ni(CO)₄, [Ni(NH₃)₆]²⁺, [Ni(CN)₄]²⁻ are

- (1) dsp², sp³d², sp³
- (2) sp³, sp³d², sp³
- (3) sp³, sp³d², dsp²
- (4) sp³, d²sp³, dsp²

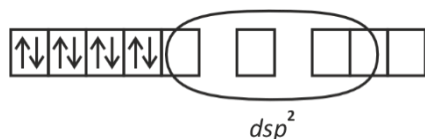
Answer (3)

Sol. [Ni(CO)₄], Ni → 3d⁸4s² ≡ $\underbrace{3d^{10} 4s^0 4p^0}_{sp^3}$

[Ni(NH₃)₆]²⁺, Ni²⁺ → 3d⁸4s⁰



[Ni(CN)₄]²⁻, Ni²⁺ → 3d⁸



3. In a period, ionisation energy of the extreme left and electronegativity of extreme right element is respectively _____. (Don't consider Noble gases).

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

Answer (1)

Sol. I.E. decrease from right to left in period and E.N. increases from left to right in period.

4. Given,

$$k = Ae^{-\frac{2800}{T}}$$

Find activation energy

- (1) 23.28 kJ/mol
- (2) 56 kcal/mol
- (3) 232.8 kJ/mol
- (4) 5600 kcal/mol

Answer (1)

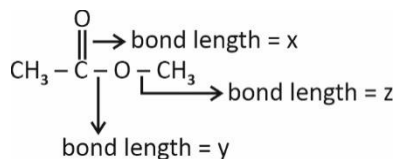
$$\text{Sol. } \frac{-E_a}{RT} = \frac{2800}{T}$$

$$\frac{E_a}{R} = 2800 \text{ K}$$

$$E_a = 2800 \text{ K} \times 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$$

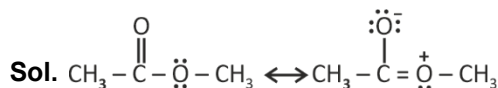
$$E_a = 23279.2 \text{ J mol} = 23.28 \text{ kJ/mol}$$

5. Compare the bond length x, y and z in the following compound



- (1) x = y = z
- (2) x = y < z
- (3) x < y < z
- (4) x < y = z

Answer (3)



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6. Energy of hydrogen like species is given as 54.3 eV. The n and z respectively are

- (1) 1, 2
- (2) 2, 2
- (3) 2, 1
- (4) 1, 1

Answer (1)

Sol. $E = -13.6 \frac{z^2}{n^2}$

$$\frac{z^2}{n^2} = \frac{54.3}{13.6} = 4$$

7. Match : For ideal monoatomic gas,

(A)	Isothermal reversible expansion	(1)	$w = -nRT \ln \frac{V_f}{V_i}$
(B)	Adiabatic reversible expansion	(2)	$w = \frac{nR}{\gamma - 1} (T_f - T_i)$
(C)	Adiabatic irreversible expansion	(3)	$w = nC_v (T'_f - T_i)$ $T'_f > T_f$
(D)	Free expansion	(4)	$w = 0$

- (1) A → 4, B → 2, C → 3, D → 1
- (2) A → 2, B → 1, C → 3, D → 4
- (3) A → 1, B → 2, C → 3, D → 4
- (4) A → 1, B → 3, C → 2, D → 4

Answer (3)

Sol. Isothermal reversible

$$w = -nRT \ln \frac{V_f}{V_i}$$

Adiabatic reversible

$$w = \frac{nR}{\gamma - 1} (T_f - T_i)$$

Adiabatic irreversible

$$w = nC_v (T'_f - T_i)$$

Free expansion

$$w = 0$$

8. Consider the following statements and choose the correct option

Statement I : Out of SF₄, SF₆, H₂S, SO₂ and SO₃ molecules, only 4 molecules do not follow octet rule

Statement II : H₂O, SO₂ and H₂S have only 1 lone pair on central atom

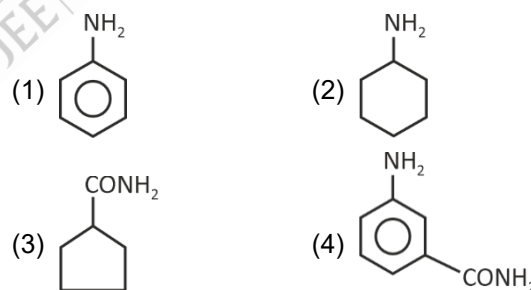
- (1) Statement I is correct, statement II is incorrect
- (2) Statement I is incorrect, statement II is correct
- (3) Both statement I and statement II are correct
- (4) Both statement I and statement II are incorrect

Answer (1)

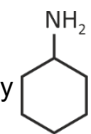
Sol. I. SF₄, SF₆, SO₂ and SO₃ do not follow octet rule

II. H₂O and H₂S have 2 lone pair on central atom

9. Which of the following can be obtained from phthalimide reaction and also give carbylamine reaction.



Answer (2)

Sol. Only  can be prepared by Gabriel phthalimide reaction and gives carbylamine reaction.

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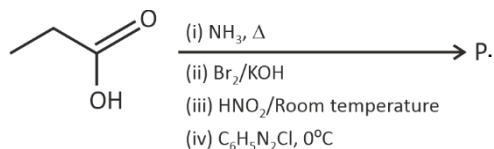
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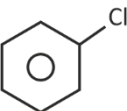
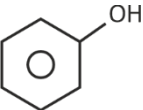

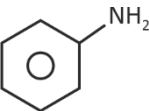
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10. Consider the reaction,

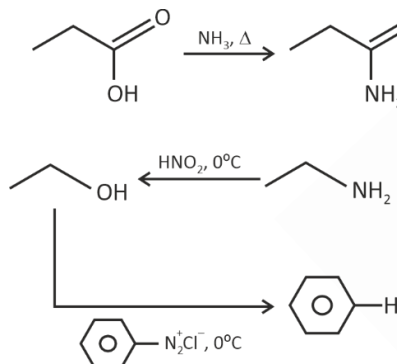


P is

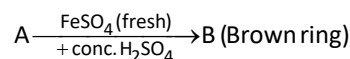
- (1) 
- (2) 
- (3) 
- (4) 

Answer (3)

Sol.



11. Consider the following reaction

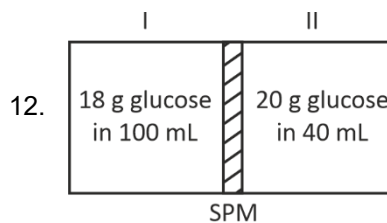


'A' and 'B' can be respectively

- (1) NaNO_2 , $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$
 (2) NaNO_3 , $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 (3) NaNO_2 , $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 (4) NaNO_3 , $[\text{Fe}(\text{H}_2\text{O})_4(\text{NO}_2)_2]^{2+}$

Answer (1)

Sol. $\text{NO}_2^-/\text{NO}_3^- \Rightarrow$ gives brown ring test and complex formed is $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$



Statement I : Glucose solution move from vessel II to vessel I through SPM.

Statement II : The osmotic pressure of vessel II is greater that of vessel I.

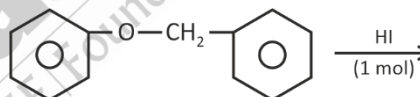
- (1) Statement I and statement II both correct
 (2) Statement I and statement II both incorrect
 (3) Statement I correct and statement II incorrect
 (4) Statement I incorrect and statement II correct

Answer (4)

Sol. Only solvent molecules can pass SPM not solute or solution.

\Rightarrow Concentration of vessel II $>$ I

13. Consider the statements in respect of following reaction and choose the correct option.



Statement I : Cleavage of O – CH₂ bond is taking place.

Statement II : Iodobenzene and benzyl alcohol are product of this reaction.

- (1) Statement I is correct and Statement II is incorrect
 (2) Statement I is incorrect and Statement II is correct
 (3) Both of Statement I and Statement II are correct
 (4) Both of Statement I and Statement II are incorrect

Answer (1)

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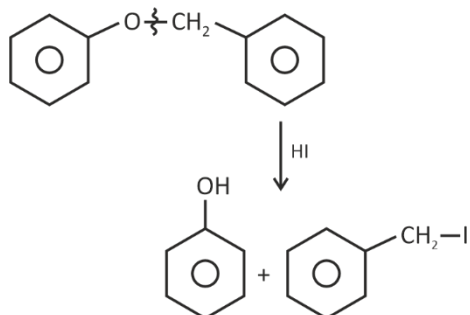
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Sol.

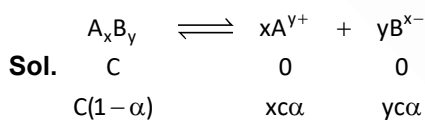


14. The concentration of A_xB_y is CM and its dissociation constant is K. Find the degree of dissociation (α) of A_xB_y .

Consider α to be negligible in comparison to 1

- (1) $\left(\frac{K}{c^{(x+y-1)} \cdot x^x \cdot y^y}\right)^{\frac{1}{(x+y)}}$
 (2) $(Kc^{(x+y-1)} \cdot x^x \cdot y^y)^{(x+y)}$
 (3) $\left(\frac{K}{c^{(x+y-1)} x^x y^y}\right)^{(x+y)}$
 (4) $(Kc^{(x+y-1)} \cdot x^x \cdot y^y)^{\frac{1}{(x+y)}}$

Answer (1)



$$K = \frac{(xc\alpha)^x \times (yc\alpha)^y}{c(1-\alpha)}$$

$$K = \frac{x^x y^y c^{x+y} \alpha^{x+y}}{c}$$

$$K = x^x y^y c^{(x+y-1)} \cdot \alpha^{(x+y)}$$

$$\alpha = \left[\frac{K}{x^x y^y c^{(x+y-1)}}\right]^{\frac{1}{(x+y)}}$$

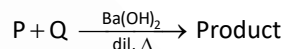
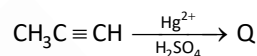
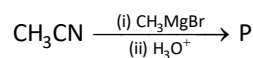
15. Choose the correct option.

- (1) IE_1 of Cr > IE_1 of Mn
 (2) IE_2 of Cr > IE_2 of Mn
 (3) IE_2 of Cr < IE_1 of Mn
 (4) IE_2 of Mn > IE_2 of Cr

Answer (2)

Sol.	Cr	Mn
IE_1 (KJ/mol)	653	717
IE_2 (KJ/mol)	1592	1509

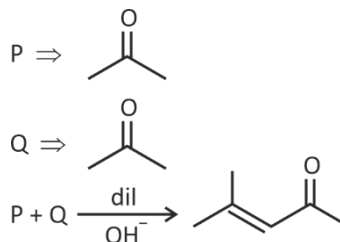
16. Consider the following reaction



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

Answer (2)

Sol.



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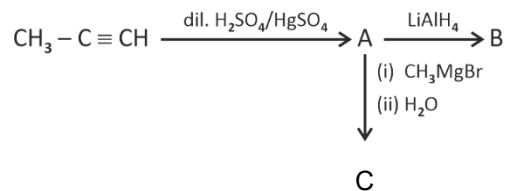
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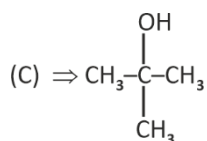
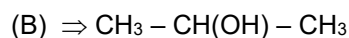
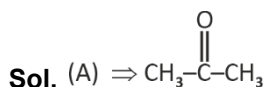
17. Consider the following reaction sequence



Which of the following test can be used to distinguish between B and C

- (1) Lucas test
- (2) Fehling solution
- (3) Benedict's test
- (4) Tollen's test

Answer (1)



B and C can be distinguish by Lucas test

18.

19.

20.

SECTION - B

Numerical Value Type Questions: This section contains 5 Numerical based questions. The answer to each question should be rounded-off to the nearest integer.

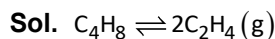
21. For the reaction, $\text{C}_4\text{H}_8(\text{g}) \rightleftharpoons 2\text{C}_2\text{H}_4(\text{g})$ 75% dissociation of C_4H_8 is observed and total equilibrium pressure is 1 atm at 298 K.

Find magnitude of ΔG° in KJ/mol (nearest integer)

$$\left(\log \frac{9}{1.75} = 0.71 \right).$$

$$R = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$$

Answer (4)



$$P \quad 0$$

$$P - 0.75P \quad 0.75P \times 2$$

$$0.25P \quad 1.5P$$

$$0.25P + 1.5P = 1$$

$$1.75P = 1$$

$$P = \frac{1}{1.75}$$

$$K_p = \frac{(1.5P)^2}{0.25P}$$

$$= 9P$$

$$= 9/1.75$$

$$\Delta G^\circ = -RT \ln K_p$$

$$= -8.3 \times 298 \times 2.303 \log (9/1.75)$$

$$= 5696.2 \times 0.71$$

$$= 4.044 \text{ KJ}$$

22.

23.

24.

25.

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