

# Regd. Office: 2nd Floor, Grand Plaza, Fraser Road, Dak Bunglow, Patna - 800001

### JEE Main 2023 (Memory based)

25 January 2023 - Shift 2

Answer & Solutions

# CHEMISTRY

- **1.** If  $H^+$  ion concentration is increased by a factor of 1000 then pH?
  - A. Decreased by 3
  - B. Increased by 3
  - C. There is no change in pH
  - D. Decreased by 1

### Answer (A)

#### Solution:

If  $H^+$ ion concentration is increased by a factor of 1000 then pH will be decreased by 3.

- 2. Which of the following has two chiral centres?
  - A. 2-Bromo-3-deuterobutane
  - B. 1-Bromo-2-deuterobutane
  - C. 1-Bromo-3-deuterobutane
  - D. 1-Bromo-4-deuterobutane

### Answer (A)

#### Solution:



2-Bromo-3-deuterobutane has two chiral centres.

3. Match List – I with List – II

Amine (List – I)	$pK_b$ (aqueous medium) List - II
A. Aniline	1. 9.0
B. Ethanamine	2. 3.29
C. N-Ethylethanamine	3. 3.25
D. N,N-diethylethanamine	4. 3.0

- A. A 1, B 2, C 4, D 3
- B. A 1, B 4, C 3, D 2
- C. A 1, B 2, C 3, D 4
- D. A-2, B-3, C-4, D-1

# Answer (A)

# Solution:

The order of basicity is C > D > B > ATherefore  $pK_b$  order is C < D < B < A

4. Consider the following cell  $Pt/H_2/H^+//M^{3+}/M^+$ (1 bar) (1M) Then value of  $\frac{[M^{3+}]}{[M^+]}$  is  $10^x$ , then find the value of 'X'? (Given:  $E^o_{M^{3+}/M^+} = 2V$  and  $E_{cell} = 1.1V$ )

# Answer (30)

# Solution:

$$\begin{aligned} 1.1 &= 2 - \frac{0.06}{2} \log \frac{[M^{3+}]}{[M^+]} \\ 0.9 &= 0.03 \log \frac{[M^{3+}]}{[M^+]} \\ \frac{[M^{3+}]}{[M^+]} &= 10^{30} \\ X &= 30 \end{aligned}$$

5. Consider the following reaction



The correct product 'P' is







Solution:



6. Consider the following reaction









#### Answer (A)

Solution:



#### 7. Match the following

Ι.	Neoprene	A. Synthetic wool
II.	Acrolein	B. Paint
III.	LDP	C. Flexible pipes
IV.	Glyptal	D. Gaskets

- A. II D, IV B III A, I C
- B. II C, IV D, III A, I C
- C. II A, IV B, III C, I D
- D. II B, IV C, III D, I A

### Answer (C)

### Solution:

Neoprene is a synthetic rubber. It is used for manufacturing of Gaskets.

Acrolein is used for making synthetic wool.

LDP is used for making flexible pipes

Glyptal is used for making paints.

- 8. A hydrocarbon is having molar mass 84 gmol<sup>-1</sup> and 85.8% C by mass. Calculate the number of H-atomS in one molecule?
  - A. 8
  - B. 10
  - C. 12
  - D. 14

# Answer (C)

#### Solution:

С	85.8	85.8	7	1
Ŭ	00.0			•
		12		
Н	14.2	14.2	14	2
	14.2		17	~
		1		

Empirical formula =  $.CH_2$ Molecular formula = n x empirical formula  $n = molar \frac{mass}{empirical formula} = \frac{84}{14} = 6$ Therefore, Molecular formula =  $C_6H_{12}$ 

- 9. Find out mass ratio of ethylene glycol (62g) required to make 500 ml, 0.25 M and 250 ml , 0.25 M solution
  - A. 1:1
  - B. 1:2
  - C. 2:1
  - D. 4:1

# Answer (C)

### Solution:

Milli moles of ethylene glycol in 1<sup>st</sup> case = 500 X 0.25 Milli moles of ethylene glycol in 2<sup>nd</sup> case = 250 X 0.25 Molar ratio =  $\frac{50}{25} = \frac{10}{5} = \frac{2}{1}$ 

- **10.** Assertion [A]: Alkali metals shows characteristic colour in reducing flame Reason [R]: They can be identified by flame test
  - A. [A] is correct, while [R] is incorrect
  - B. [A] is incorrect while [R] is correct
  - C. [A] and [R] both are correct and [R] is the correct explanation of [A]
  - D. [A] and [R] both are correct and [R] is not the correct explanation of [A]

### Answer (B)

#### Solution:

Alkali metal show characteristic color in oxidizing flame.

**11.** How many of the following orbitals is/are considered as axial orbital(s)  $p_x, p_y, p_z, d_{xy}, d_{yz}, d_{zx}, d_{x^2-y^2}, d_{z^2}$ 

# Answer (5)

#### Solution:

 $p_x$ ,  $p_y$ ,  $p_z$ ,  $d_{x^2-y^2}$  and  $d_{z^2}$  orbitals are called axial orbitals.

12. Consider a mixture of CH<sub>4</sub> and C<sub>2</sub>H<sub>4</sub> having volume 16.8 L at 273 K and 1 atm. It undergoes combustion to form CO<sub>2</sub> with total volume 28 L at the same temperature and pressure. If the enthalpy of combustion of CH<sub>4</sub> is -900 KJ/mol and enthalpy of combustion of C<sub>2</sub>H<sub>4</sub> is -1400 KJ/mol then find the magnitude of heat released on combustion of given mixture in KJ

#### Answer (925)

#### Solution:

 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$   $x \qquad x$   $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$   $16.8 - x \qquad 2(16.8 - x)$  x + 2(16.8 - x) = 28 x = 5.6 LHeat released =  $\frac{1}{4} \times 900 + \frac{1}{2} \times 1400 = 2$ 

Heat released = 
$$\frac{1}{4} \times 900 + \frac{1}{2} \times 1400 = 225 + 700$$
  
= 925 KJ

- 13. Arrange the following elements in increasing order of the metallic character: Si, K, Mg and Be
  - A. Si < Mg < Be < K</li>
    B. Be < Mg < Si < K</li>
    C. Si < Be < Mg < K</li>
    D. K < Mg < Si < Be</li>

### Answer (C)

#### Solution:

Based on the electronegativity of the given elements, the correct increasing order of metallic character is Si < Be < Mg < K

- 14. Which of the following elements is the weakest reducing agent in aqueous solution?
  - A. Na
  - B. *K*
  - C. Li
  - D. Rb

# Answer (A)

### Solution:

As per the standard reduction potential values, Na is the weakest reducing agent.

- **15.** Assertion: Carbon forms two oxides CO and  $CO_2$  where CO is neutral while  $CO_2$  is acidic. Reason:  $CO_2$  will combine with water to give carbonic acid and CO is soluble in water
  - A. Assertion and Reason both are correct and Reason is the correct explanation of Assertion.

- B. Assertion and Reason both are correct and Reason is not the correct explanation of Assertion.
- C. Assertion is true while Reason is false.
- D. Assertion is false while Reason is true.

#### Answer (B)

#### Solution:

 $CO_2$  will form carbonic acid with water and it is acidic in nature while CO is neutral but there is no relation of neutrality with solubility.

16. Select the correct match.

- A. Hexane 2 one and Hexane 3 one: Position isomers
- B. Pentane 3 one and Pentane 2 one : Functional isomers
- C. 2 Pentene and 1 Pentene: Metamers
- D. Pentanoic acid and Hexanoic acid: Functional isomers

### Answer (A)

#### Solution:

Hexane - 2 - one and Hexane - 3 - one are position isomers.

- **17.** Chloride salt of M is treated with excess of  $AgNO_3$ . It forms curdly white precipitate 'A'. When 'A' is treated with  $NH_4OH$ , it forms a soluble salt 'B'. The A and B respectively are
  - A. AgCl,  $[Ag(NH_3)_2]^+$
  - B. AgBr,  $[Ag(OH)_2]^-$
  - C. AgCl,  $[Ag(OH)_4]^{2-}$
  - D. AgBr,  $[Ag(OH)_4]^{2-}$

### Answer (A)

#### Solution:

AgCl forms white precipitate which is soluble in  $NH_4OH$ .

**18.** Final oxidation number of Cr when  $K_2Cr_2O_7$  is used in acidic medium during titration will be

- A. +6
- B. +2
- C. +3
- D. +4

### Answer (C)

### Solution:

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Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O
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- **19.** Assertion: BHA is added to butter to increase shelf life. Reason: BHA reacts with oxygen more than butter.
  - A. Assertion and Reason both are correct.
  - B. Assertion is correct but Reason is not correct.
  - C. Assertion is incorrect but Reason is correct.
  - D. Assertion and Reason both are incorrect.

#### Answer (A)

#### Solution:

Butyrated hydroxy anisole (BHA) is an antioxidant. It is added to butter to increase its shelf life from months to years. BHA reacts with oxygen present in air in preference to butter. So, both the assertion and reason are correct.

20. Which of the following options contains the correct match?

List I	List II

(A) Adiabatic	(P) $\Delta T = 0$
(D) leatharmal	(O) Heat avalance is T

- (B) Isothermal(C) Isochoric
- (D) Isobaric

(Q) Heat exchange is zero (R)  $\Delta P = 0$ (S) Work done is zero

- $\mathsf{A}. \quad A \to Q, B \to P, C \to S, D \to R$
- $\mathsf{B}. \quad A \to P, B \to Q, C \to R, D \to S$
- C.  $A \rightarrow S, B \rightarrow R, C \rightarrow Q, D \rightarrow P$
- D.  $A \rightarrow P, B \rightarrow R, C \rightarrow S, D \rightarrow Q$

### Answer (A)

#### Solution:

Adiabatic  $\rightarrow$  Heat exchange is zero Isothermal $\rightarrow \Delta T = 0$ Isobaric  $\rightarrow \Delta P = 0$ Isochoric  $\rightarrow$  Work done is zero

### 21. Which of the following options contains the correct match?

List I (Complex)	List II (λ(absorbed))
(A) $[Co(CN)_6]^{3-}$	(P) 535 nm
(B) $[Co(NH_3)_6]^{3+}$	(Q) 375 nm
(C) $[Co(NH_3)_5Cl]^{2+}$	(R) 600 nm
A. $A \to S, B \to P, C \to Q$	

B.  $A \rightarrow P, B \rightarrow Q, C \rightarrow S$ C.  $A \rightarrow Q, B \rightarrow P, C \rightarrow S$ 

D.  $A \rightarrow S, B \rightarrow O, C \rightarrow P$ 

# Answer (C)

# Solution:

Order of CFSE values for the given complexes are:

 $[Co(CN)_6]^{3-} > [Co(NH_3)_6]^{3+} > [Co(NH_3)_5Cl]^{2+}$ 

Hence,  $\lambda$ (absorbed)) will be in the reverse order.

**22.** For a reaction  $A \rightarrow B$ ,  $k = 2 \times 10^{-3} s^{-1}$  Consider the following statements for the above reaction

- S1: The reaction is complete in 100 s.
- S2: Half-life of the reaction is 500 s.
- S3: Unit of rate constant is same as unit of rate
- S4: Degree of dissociation is  $(1 e^{-kT})$
- S5: It is a zero-order reaction

How many statements are incorrect?

# Answer (4)

### Solution:

Except S4, all statements are incorrect. As,  $[B] = a(1 - e^{-kT})$  $2 = \frac{[B]}{a} = (1 - e^{-kT})$