



# VIDYAPEETH ACADEMY

IIT JEE | NEET | FOUNDATION

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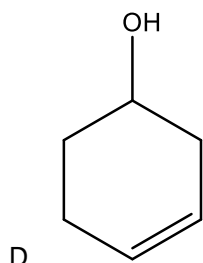
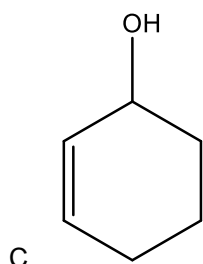
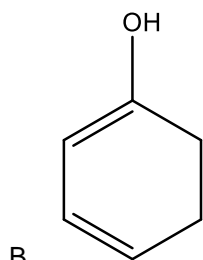
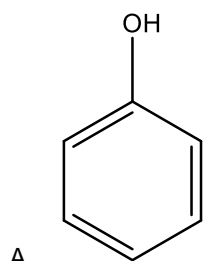
JEE Main 2023 (Memory based)

1<sup>st</sup> February 2023 - Shift 1

Answer & Solutions

## CHEMISTRY

1. Which one of the following compounds shows fastest rate of dehydration?

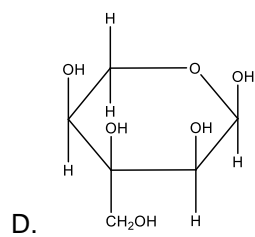
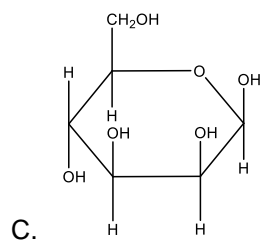
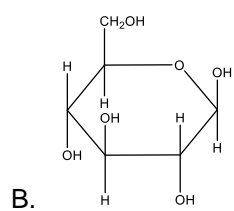
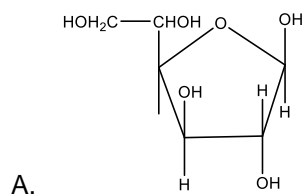
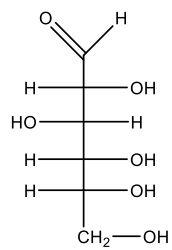


**Answer (C)**

**Solution:**

The alcohol which produces stable carbocation shows faster rate of dehydration.

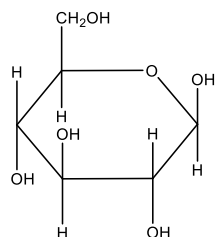
2. Pyranose form of the given compound is



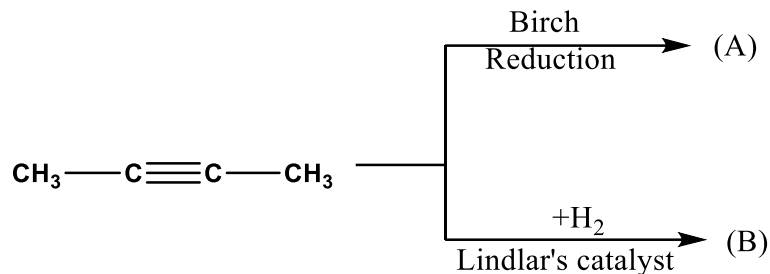
**Answer (B)**

**Solution:**

The correct pyranose form is



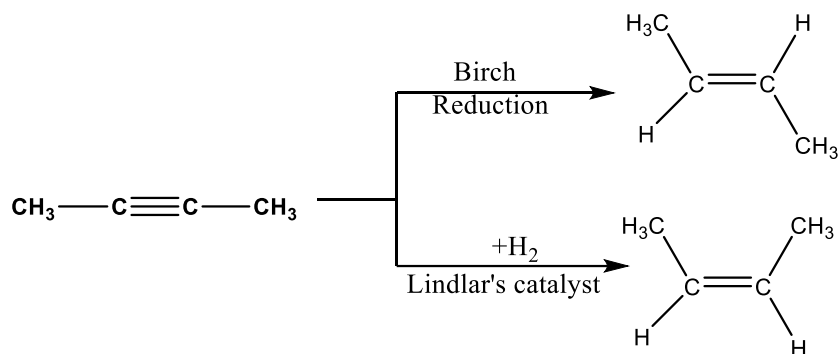
3. Identify the correct statement on physical properties of (A) and (B)



- A. Melting Point: A > B; Boiling Point: A > B
- B. Melting Point: A < B; Boiling Point: A > B
- C. Melting Point: A > B; Boiling Point: A < B
- D. Melting Point: A < B; Boiling Point: A < B

**Answer (C)**

**Solution:**



Compound (A) is non polar, whereas compound (B) is polar. Compound (A) will have lower boiling point than (B) due to dipole – dipole interaction in (B)

Compound (A) is symmetrical with respect to compound (B), thus the packing will be better in (A). Hence, (A) will have higher melting point than B.

4. Choose correct statement.

Consider the following statements.

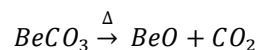
- A: Beryllium oxide is an acidic oxide
- B: Beryllium sulphate is soluble in aqueous medium
- C: Beryllium carbonate is thermally stable
- D: Beryllium shows anomalous behavior in comparison to another Group 2 elements

- A. A&B
- B. B&C
- C. B&D
- D. C&D

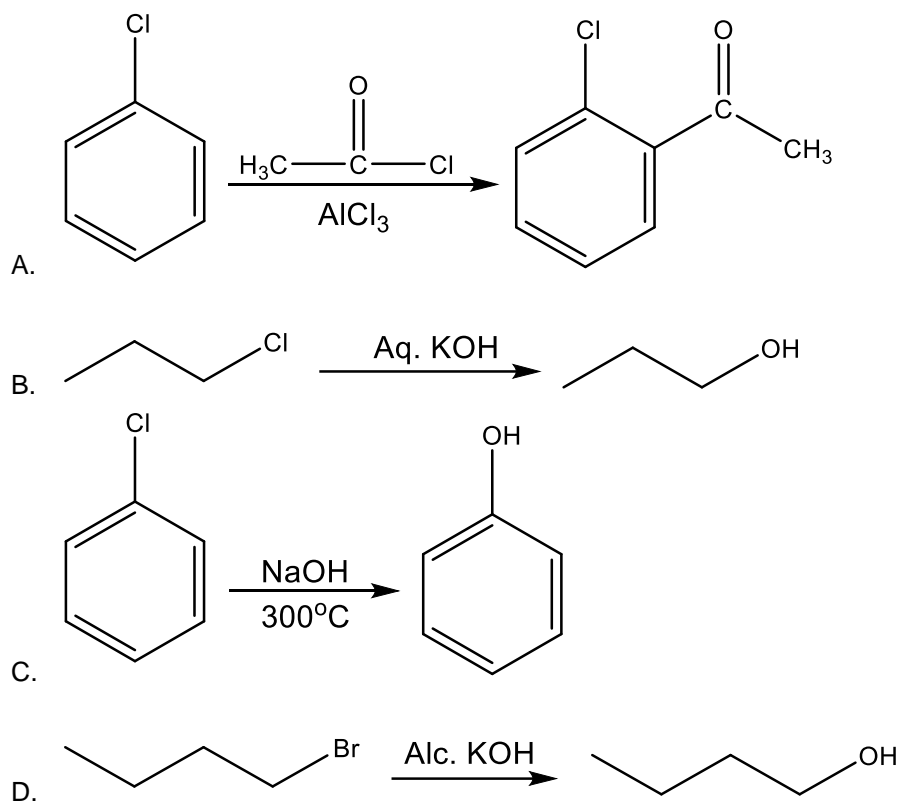
**Answer (C)**

**Solution:**

BeO is amphoteric oxide and  $\text{BeSO}_4$  is soluble in water.  $\text{BeCO}_3$  is thermally unstable.

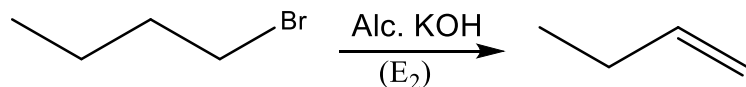


5. In which of the following option the reaction does not matches with their correct product?



Answer (D)

Solution:



With alc. KOH alkyl halides shows elimination reaction

6. Statement 1: Chlorine easily forms oxides and the compounds are explosive.  
Statement 2: The higher oxidation states of chlorine, bromine and iodine are released when halogens form oxides and fluorides.

- A. Statement 1 is correct Statement 2 is incorrect
- B. Statement 1 is incorrect Statement 2 is correct
- C. Statement 1 is correct Statement 2 is correct
- D. Statement 1 is incorrect Statement 2 is incorrect

Answer (C)

Solution:

The oxides of chlorine are easily formed, and the compounds are explosive. The higher oxidation states of chlorine, bromine and iodine are stable in their oxides and fluorides. Therefore, both the statement are correct.

7. For given reaction in acidic medium,  
 $5e^- + 8H^+ + MnO_4^- \rightarrow Mn^{2+} + 4H_2O$   
 $0.001 M \quad 0.1 M ?$   
 Given:  $E_{cell}^o = 1.54 V, E_{cell} = 1.2832 V$   
 Find out  $p^H$  of the solution

- A. 2.46  
 B. 3.52  
 C. 6.38  
 D. 1.02

**Answer (A)**

**Solution:**

$$1.2832 = 1.54 - \frac{0.0591}{5} \log \frac{10^{-1}}{(10^{-3})(H^+)^8}$$

$$-0.2568 = -\frac{0.0591}{5} (\log 10^2 - 8 \log H^+)$$

$$21.72 = 2 + 8 p^H$$

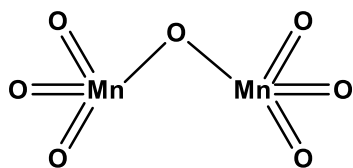
$$19.72 = 8 p^H$$

$$p^H = \frac{19.72}{8} = 2.46$$

8. Consider the structure of  $Mn_2O_7$ .  
 X: No. of Mn-Mn bonds  
 Y: No. of Mn- O- Mn bonds  
 Find out (X+Y)

**Answer (1)**

**Solution:**



$$X = 0 \text{ and } Y = 1$$

$$X + Y = 1$$

9. X: Oxidation number of Br in bromic acid  
 Y: Oxidation number of Br in perbromic acid  
 Find out (X+Y)

**Answer (12)**

**Solution:**

Bromic Acid ( $HBrO_3$ )

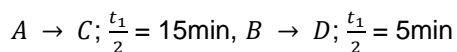
Oxidation number of Br = +5 = X

Perbromic acid ( $HBrO_4$ )

Oxidation number of Br = +7 = Y

X+Y = 12

10. Consider the following first order reaction



The initial concentrations of A and B are 1 molar and 8 molar respectively. The time when the concentration of A and B becomes equal is 'X' minutes. Find 2X (to the nearest integer)

**Answer (45)**

**Solution:**

$$\frac{1}{k_1} \ln \frac{1}{[A]} = \frac{1}{k_2} \ln \frac{8}{[A]}$$

$$A = \frac{1}{\sqrt{8}}$$

$$\frac{t_1}{2} = \frac{15}{0.693} \ln \sqrt{8}$$

$$= 22.5 \text{ min}$$

$$2x = 45$$

11. H- atom in ground state absorbs 12.75 eV of energy. The orbital angular momentum of the electron becomes  $nh/2\pi$ , the value of n is

**Answer (4)**

**Solution:**

$$\Delta E = 13.6 \left( 1 - \frac{1}{n^2} \right) = 12.75$$

$$\Rightarrow -\frac{1}{n^2} = \frac{12.75}{13.60} - 1$$

$$n^2 = 16 \Rightarrow n = 4$$

12. Find out  $\Delta T_f$  of a KCl solution ( $i = 2$ ), if 25 mL of this KCl solution requires 20 mL of 1 M  $AgNO_3$  solution for complete precipitation of KCl solution.

$$K_f = 1.86 \text{ K.kg mol}^{-1}. \text{ Assume molarity = molality (Round off to nearest integer)}$$

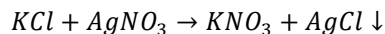
**Answer (3)**

**Solution:**

$$\Delta T_f = i K_f m$$

$$\Delta T_f = 2 \times 1.86 \times m \text{ -- (Eq - 1)}$$

Let's find m



From law of chemical equivalence

millequivalents of KCl reacted = milliequivalents of  $AgNO_3$  reacted

$$(M \times n_f \times V)_{KCl} = (M \times n_f \times V)_{AgNO_3}$$

$$M \times 1 \times 25 = 1 \times 1 \times 20$$

$$M = \frac{20}{25} = \frac{4}{5}$$

Given, molarity = molality

$$\text{Therefore, molality} = \frac{4}{5} m$$

Putting value of molality in (Eq - 1)

$$\Delta T_f = 2 \times 1.86 \times \frac{4}{5} \sim 3$$

13. Which of the following complexes have maximum splitting?

- A.  $[Fe(CN)_6]^{4-}$
- B.  $[Fe(NH_3)_6]^{2+}$
- C.  $[FeCl_6]^{4-}$
- D.  $[Fe(ox)_3]^{4-}$

**Answer (A)**

**Solution:**

All the above complexes show octahedral crystal field splitting

And Octahedral crystal field splitting is dependent on the nature of the ligand

i.e., in case of strong field the splitting will be more when compared to a weak field ligand.

As per the electrochemical series  $CN^-$  is a strong field ligand and stronger than  $NH_3$ ,  $ox^{2-}$  and  $Cl^-$ .

Hence maximum splitting is seen in case of  $[Fe(CN)_6]^{4-}$

14. Average kinetic energy of an ideal gas depends on-

- A. Nature of the gas
- B. Pressure of the gas
- C. Temperature of the gas
- D. Volume of the gas

**Answer (C)**

**Solution:**

Average kinetic energy of an ideal gas per mole is given by

$$\text{Average K.E} = \frac{3}{2}RT$$

Hence, average K.E depends on temperature.

15. Assertion: Hydrogen is an environment/eco-friendly fuel.

Reason: Hydrogen is the lightest element.

- E. Both Assertion and reason are true, and reason is the correct explanation of assertion
- F. Both Assertion and reason are true, but reason is not the correct explanation of assertion
- G. Assertion is true but reason is false
- H. Assertion is false but reason is true

**Answer (B)**

**Solution:**

The correct option is option(B).

16.  $X(g) \rightleftharpoons 2Y(g)$   $K_{P1}$  ----(i)

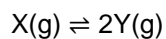
$A(g) \rightleftharpoons B(g) + C(g)$   $K_{P2}$  ----(ii)

If degree of dissociation is same for both the reactions. Find out the ratio of total pressure  $P_1$  &  $P_2$  respectively.

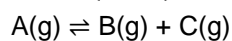
- A.  $\frac{K_{P_1}}{K_{P_2}}$   
 B.  $\frac{4K_{P_1}}{K_{P_2}}$   
 C.  $\frac{K_{P_1}}{4K_{P_2}}$   
 D.  $\frac{K_{P_1}}{2K_{P_2}}$

**Answer (C)**

**Solution:**



$$K_{P_1} = \frac{4\alpha^2}{(1+\alpha)} \times \frac{P_1}{1+\alpha}$$



$$K_{P_2} = \frac{\alpha^2}{(1-\alpha)} \times \frac{P_2}{1-\alpha}$$

$$\frac{K_{P_1}}{K_{P_2}} = \frac{4\alpha^2 \times P_1(1+\alpha)(1-\alpha)}{(1+\alpha)(1-\alpha) \times \alpha^2 \times P_2}$$

$$\frac{P_1}{P_2} = \frac{K_{P_1}}{4K_{P_2}}$$

17. Which of the following is not correctly matched.

List - I	List - II
A. Antibiotic	Penicillin
B. Antiseptic	Chloroxylonol
C. Tranquilizer	Erythromycin
D. Analgesic	Aspirin

- A. A  
 B. B  
 C. C  
 D. D

**Answer (C)**

**Solution:**

Erythromycin is an antibiotic. Hence, the correct answer is option(C).

18. Which of the following option contains the correct match

List - I	List - II
A. Caustic soda	P. $CaSO_4$
B. Washing soda	Q. $Na_2CO_3 \cdot 10H_2O$
C. Dead burnt plaster	R. $Ca(OH)_2$
D. Slaked lime	S. NaOH

- A. A – S, B – Q, C – P, D – R  
 B. A – P, B – Q, C – R, D – S  
 C. A – S, B – P, C – Q, D – R  
 D. A – R, B – S, C – Q, D – P



**Answer (A)****Solution:**

Caustic soda – NaOH

Washing soda –  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

Dead burnt plaster –  $\text{CaSO}_4$

Slaked lime –  $\text{Ca}(\text{OH})_2$

19. How photochemical smog can be controlled in automobiles?

- A. Using catalytic convertors which will increase release of nitrogen oxide
- B. Using catalytic convertors which will decrease the release of nitrogen oxide
- C. By increasing sulphur in fuel content
- D. By decreasing sulphur in fuel content

**Answer (B)****Solution:**

Catalytic convertors will prevent the release of nitrogen oxide and hydrocarbons to the atmosphere.

20. When  $\text{K}_4[\text{Fe}(\text{CN})_6]$  is added to  $\text{FeCl}_3$ , the Prussian blue complex compound formed is:

- A.  $\text{Fe}_3[\text{Fe}(\text{CN})_6]_4$
- B.  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$
- C.  $\text{K}_2\text{Fe}[\text{Fe}(\text{CN})_6]$
- D.  $\text{K}_2\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$

**Answer (B)****Solution:**

Prussian Blue is  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$

21. Match the tests given in column-I with the compounds given in column-II

Column - I	Column - II
A. Schiff's test	1. Carbohydrate
B. Carbylamine test	2. Peptide
C. Molisch test	3. Aldehyde
D. Biuret test	4. $1^\circ$ Amine

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

**Answer (D)****Solution:**

Schiff's test is given by aldehydes. Carbylamine test is given by primary amines only. Molisch test is given by carbohydrates. Biuret test is given by peptide.

22. Electrons are emitted in cathode ray tube with a velocity of 1000 m/s. Select the correct statement among the following.

- A. The de Broglie wavelength of  $e^-$  is 666.67 nm
- B. The cathode rays travel from cathode to anode
- C. The characteristics of  $e^-$  depends on the metal used in cathode
- D. The characteristics of  $e^-$  depends on the gas filled inside the cathode tube

**Answer (B)**

**Solution:**

$$\begin{aligned}\Lambda &= \frac{h}{mv} = \frac{6.6 \times 10^{-34} \text{ J.s}}{9.1 \times 10^{-31} \text{ kg} \times 10^3} \\ &= 725 \times 10^{-9} \text{ m} \\ &= 725 \text{ nm}\end{aligned}$$

Cathode rays travels from cathode to anode. Hence, the correct answer is option (B).

23. The density of a 3M NaCl solution is 1 g/mL. The molality of the solution is 'x'. Then find 2x. (Round off to nearest integer)

**Answer (7)**

**Solution:**

$$m = \frac{M \times 1000}{1000 \times d_{\text{solution}} - M \times MM_{\text{solute}}}$$

m = molality

M = Molarity

d = density

$MM_{\text{solute}}$  = Molar mass of solute

$$\begin{aligned}\text{Molality} = X &= \frac{3}{824.5} \times 1000 \\ &= 3.63 \text{ molal}\end{aligned}$$

Hence,  $2x \approx 7$