

# IIT-JEE 2012

## PAPER - 1

### PART - II : CHEMISTRY

#### SECTION - I : Single Correct Answer Type

This section contains 10 multiple choice questions, Each question has four choices, (A), (B), (C) and (D) out of which ONLY ONE is correct.

21. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen?  
(A)  $\text{HNO}_3$ , NO,  $\text{NH}_4\text{Cl}$ ,  $\text{N}_2$  (B)  $\text{HNO}_3$ , NO,  $\text{N}_2$ ,  $\text{NH}_4\text{Cl}$   
(C)  $\text{HNO}_3$ ,  $\text{NH}_4\text{Cl}$ , NO,  $\text{N}_2$  (D) NO,  $\text{HNO}_3$ ,  $\text{NH}_4\text{Cl}$ ,  $\text{N}_2$

Ans. (B)

Sol.  $\text{HNO}_3 = +5$

NO = +2

$\text{NH}_4\text{Cl} = -3$

$\text{N}_2 = 0$

So correct order will be  $\text{HNO}_3$ , NO,  $\text{N}_2$ ,  $\text{NH}_4\text{Cl}$ .

22. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [ $a_0$  is Bohr radius] :

(A)  $\frac{h^2}{4\pi^2ma_0^2}$

(B)  $\frac{h^2}{16\pi^2ma_0^2}$

(C)  $\frac{h^2}{32\pi^2ma_0^2}$

(D)  $\frac{h^2}{64\pi^2ma_0^2}$

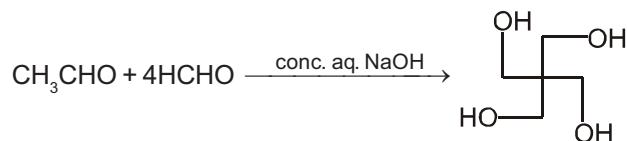
Ans. (C)

Sol.  $mv(4a_0) = \frac{h}{\pi}$

$$\text{so, } v = \frac{h}{4m\pi a_0}$$

$$\text{so } \text{KE} = \frac{1}{2} mv^2 = \frac{1}{2} m \cdot \frac{h^2}{16m^2\pi^2 a_0^2} = \frac{h^2}{32m\pi^2 a_0^2}$$

23. The number of aldol reaction (s) that occurs in the given transformation is :



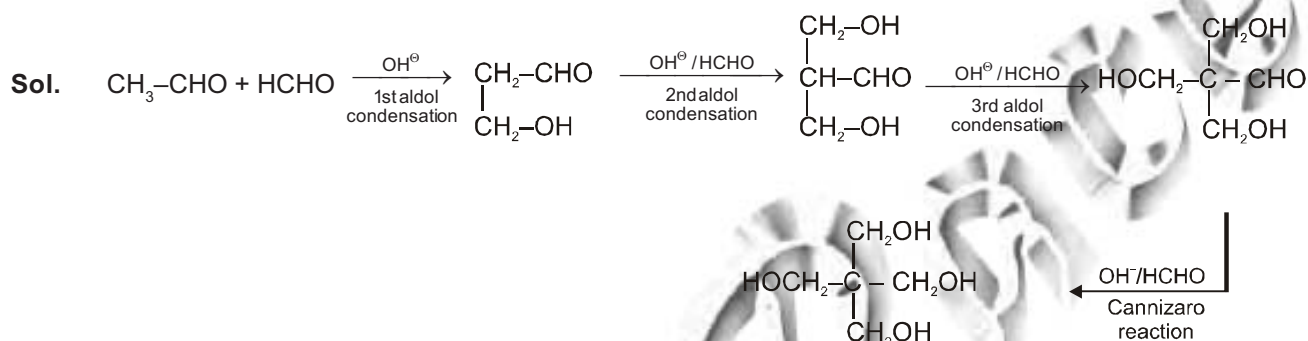
(A) 1

(B) 2

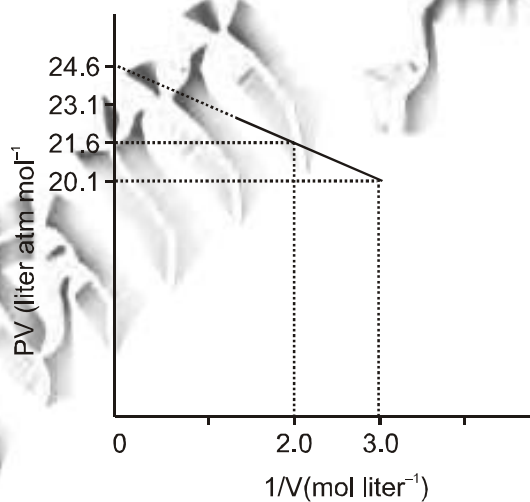
(C) 3

(D) 4

Ans. (C)



24. For one mole of a van der Waals gas when  $b = 0$  and  $T = 300$  K, the  $PV$  vs.  $1/V$  plot is shown below. The value of the van der Waals constant  $a$  ( $\text{atm} \cdot \text{liter}^2 \text{mol}^{-2}$ ) :



(A) 1.0

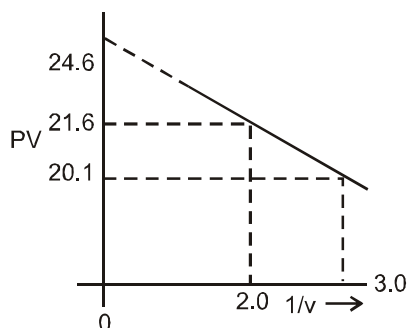
(B) 4.5

(C) 1.5

(D) 3.0

Ans. (C)

Sol.



$$\left(P + \frac{a}{V^2}\right) (V) = RT$$

$$PV + a/V = RT$$

$$PV = RT - a/v$$

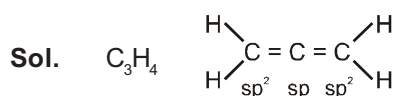
$$y = RT - a( )$$

$$\text{So slope} = a = \frac{21.6 - 20.1}{3 - 2} = \frac{1.5}{1} = 1.5$$

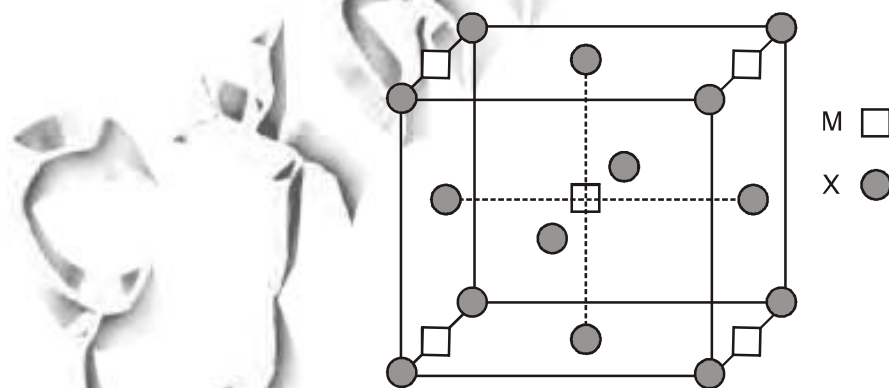
25. In allene ( $C_3H_4$ ), the type(s) of hybridisation of the carbon atoms is (are) :

- (A)  $sp$  and  $sp^3$       (B)  $sp$  and  $sp^2$       (C) only  $sp^3$       (D)  $sp^2$  and  $sp^3$

Ans. (B)



26. A compound  $M_p X_q$  has cubic close packing (ccp) arrangement of X. Its unit cell structure is shown below. The empirical formula of the compound is



- (A)  $MX$       (B)  $MX_2$       (C)  $M_2X$       (D)  $M_5X_{14}$

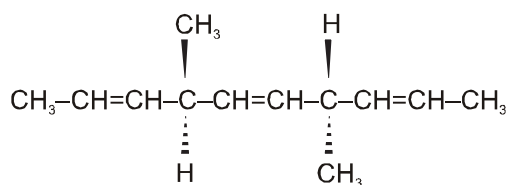
Ans. (B)

Sol. No. of M atoms =  $\frac{1}{4} \times 4 + 1 = 1 + 1 = 2$

$$\text{No. of X atoms} = \frac{1}{2} \times 6 + \frac{1}{8} \times 8 = 3 + 1 = 4$$

$$\text{so formula} = M_2X_4 = MX_2$$

27. The number of optically active products obtained from the **complete** ozonolysis of the given compound is:



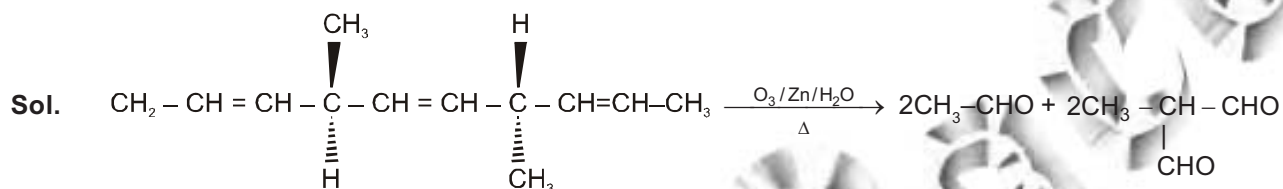
(A) 0

(B) 1

(C) 2

(D) 4

Ans. (A)



All optically inactive products

28. As per IUPAC nomenclature, the name of the complex  $[\text{Co}(\text{H}_2\text{O})_4(\text{NH}_3)_2]\text{Cl}_3$  is :

(A) Tetraaquadiaminecobalt (III) chloride

(B) Tetraaquadiamminecobalt (III) chloride

(C) Diaminetetraaquacoblat (III) chloride

(D) Diamminetetraaquacobalt (III) chloride

Ans. (D)

Sol.  $[\text{Co}(\text{H}_2\text{O})_4(\text{NH}_3)_2]\text{Cl}_3$   
= Diamminetetraaquacobalt (III) chloride.

29. The carboxyl functional group ( $-\text{COOH}$ ) is present i<sup>n</sup>

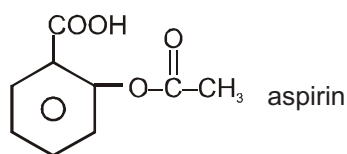
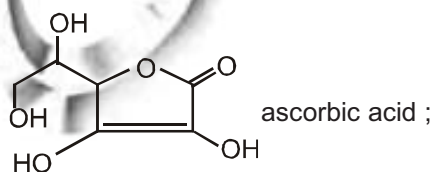
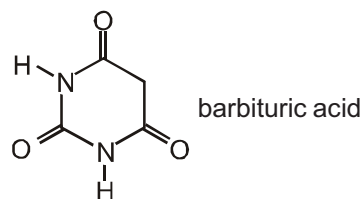
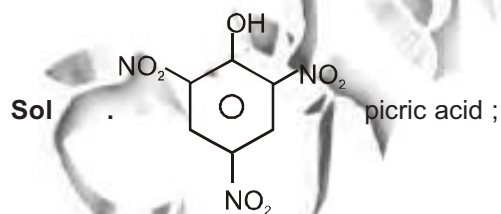
(A) picric acid

(B) barbituric acid

(C) ascorbic acid

(D) aspirin

Ans. (D)



30. The colour of light absorbed by an aqueous solution of  $\text{CuSO}_4$  is :  
 (A) orange-red (B) blue-green  
 (C) yellow (D) violet

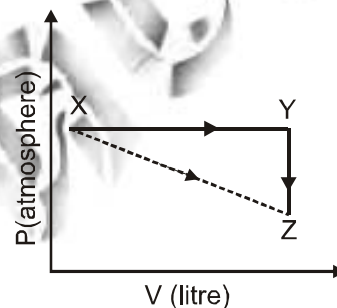
Ans. (A)

Sol.  $\text{CuSO}_4$  will be absorbing orange-red colour & hence will be of blue colour.

**SECTION – II : Multiple Correct Answer(s) Type**

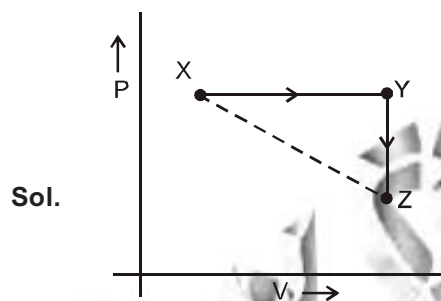
This section contains **5 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.

31. For an ideal gas, consider only P-V work in going from an initial state X to the final state Z. The final state Z can be reached by either of the two paths shown in the figure. Which of the following choice(s) is (are) correct? [take  $\Delta S$  as change in entropy and  $w$  as work done].



- (A)  $\Delta S_{x \rightarrow z} = \Delta S_{x \rightarrow y} + \Delta S_{y \rightarrow z}$   
 (B)  $w_{x \rightarrow z} = w_{x \rightarrow y} + w_{y \rightarrow z}$   
 (C)  $w_{x \rightarrow z} = w_{x \rightarrow y}$   
 (D)  $\Delta S_{x \rightarrow y \rightarrow z} = \Delta S_{x \rightarrow y}$

Ans. (AC)



Sol.

- (A)  $\Delta S_{x \rightarrow z} = \Delta S_{x \rightarrow y} + \Delta S_{y \rightarrow z}$  (Correct)  
 (B)  $w_{x \rightarrow y} = w_{x \rightarrow y} + w_{y \rightarrow z}$  (Incorrect)  
 (C)  $w_{x \rightarrow y \rightarrow z} = w_{x \rightarrow y}$  (Correct)  
 (D)  $\Delta S_{x \rightarrow y \rightarrow z} = \Delta S_{x \rightarrow y}$  (Incorrect)

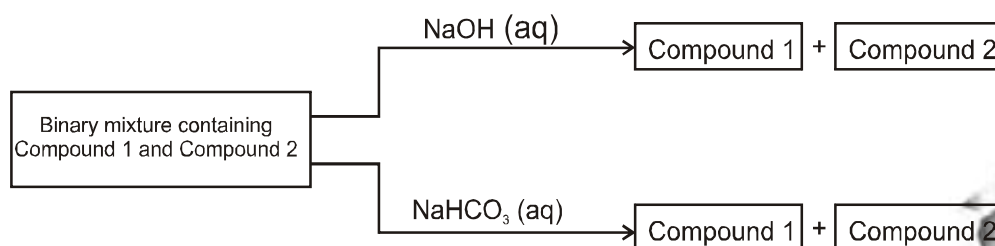
32. Which of the following molecules, in pure form, is (are) **unstable** at room temperature ?



Ans. (B)

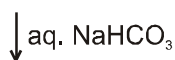
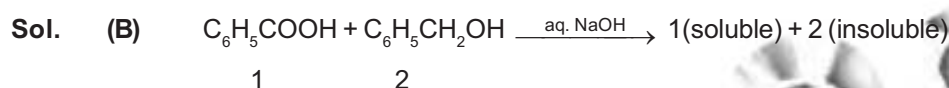
Sol.  is antiaromatic and unstable

33. Identify the binary mixture(s) that can be separated into individual compounds, by differential extraction, as shown in the given scheme.

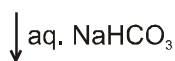
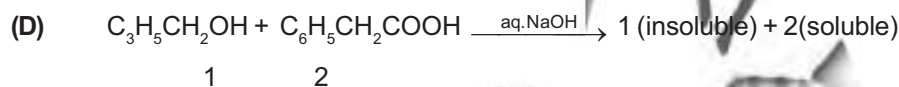


- (A)  $C_6H_5OH$  and  $C_6H_5COOH$  (B)  $C_6H_5COOH$  and  $C_6H_5CH_2OH$   
 (C)  $C_6H_5CH_2OH$  and  $C_6H_5OH$  (D)  $C_6H_5CH_2OH$  and  $C_6H_5CH_2COOH$

Ans. (BD)



1 (soluble) + 2 (insoluble)



(1) (insoluble) + 2 (soluble).

34. Choose the correct reason(s) for the stability of the **lyophobic** colloidal particles.
- (A) Preferential adsorption of ions on their surface from the solution.  
 (B) Preferential adsorption of solvent on their surface from the solution.  
 (C) Attraction between different particles having opposite charges on their surface.  
 (D) Potential difference between the fixed layer and the diffused layer of opposite charges around the colloidal particles.

Ans. (AD)

Sol. (A) due to preferential adsorption of common ions

(B) X

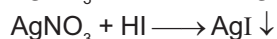
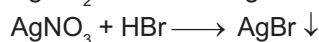
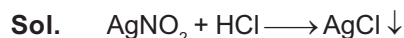
(C) X (due to repulsion not due to attraction)

(D) The layer of oppositely charged particles around any colloidal particles will decrease the potential energy of system as a whole.

35. Which of the following halides react(s) with  $AgNO_3(aq)$  to give a precipitate that dissolves in  $Na_2S_2O_3(aq)$  ?

- (A) HCl (B) HF (C) HBr (D) HI

Ans. (ACD)



All these precipitates will get dissolved in hypo forming complex  $Na_3[Ag(S_2O_3)_2]$

## SECTION - III : Integer Answer Type

This section contains 5 questions. The answer to each question is a single-digit integer, ranging from 0 to 9 (both inclusive).

36. An organic compound undergoes first-order decomposition. The time taken for its decomposition to  $1/8$  and  $1/10$  of its initial concentration are  $t_{1/8}$  and  $t_{1/10}$  respectively. What is the value of  $\frac{[t_{1/8}]}{[t_{1/10}]} \times 10$ ? ( $\log_{10} 2 = 0.3$ )

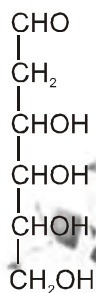
Ans. 9

Sol.  $Kt_{1/8} = \ln \left\{ \frac{C_0}{C_0/8} \right\} = \ln 8$

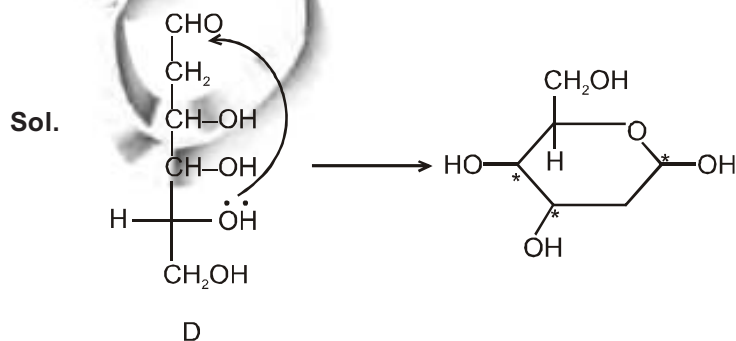
$$Kt_{1/10} = \ln \left\{ \frac{C_0}{C_0/10} \right\} = \ln 10$$

$$\text{then } \frac{t_{1/8}}{t_{1/10}} \times 10 = \frac{\ln 8}{\ln 10} \times 10 = \frac{\log 2}{\log 10} \times 10 = 9$$

37. When the following aldohexose exists in its D-configuration, the total number of stereoisomers in its pyranose form is :

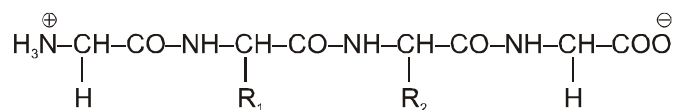


Ans. 8



$$\text{Total stereoisomers} = 2^3 = 8$$

38. The substituents  $R_1$  and  $R_2$  for nine peptides are listed in the table given below. How many of these peptides are positively charged at  $\text{pH} = 7.0$  ?

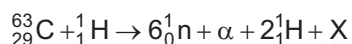


Peptide	$R_1$	$R_2$
I	H	H
II	H	$\text{CH}_3$
III	$\text{CH}_2\text{COOH}$	H
IV	$\text{CH}_2\text{CONH}_2$	$(\text{CH}_2)_4\text{NH}_2$
V	$\text{CH}_2\text{CONH}_2$	$\text{CH}_2\text{CONH}_2$
VI	$(\text{CH}_2)_4\text{NH}_2$	$(\text{CH}_2)_4\text{NH}_2$
VII	$\text{CH}_2\text{COOH}$	$\text{CH}_2\text{CONH}_2$
VIII	$\text{CH}_2\text{OH}$	$(\text{CH}_2)_4\text{NH}_2$
IX	$(\text{CH}_2)_4\text{NH}_2$	$\text{CH}_3$

Ans. 4

Sol. For the polypeptide the isoelectric point will be more than 7. That means the given polypeptide is of basic nature so it must contain two or more amino groups. So (iv), (vi), (viii) and (ix) are the correct options.

39. The periodic table consists of 18 groups. An isotope of copper, on bombardment with protons, undergoes a nuclear reaction yielding element X as shown below. To which group, element X belongs in the periodic table?



Ans. 8

Sol.  ${}_{29}^{63}\text{Cu} + {}_1^1\text{H} \rightarrow {}_0^1\text{n} + {}_2^4\alpha + 2{}_1^1\text{H} + \text{X}$

$$64 = 6 + 4 + 2 + A \Rightarrow A = 52$$

$$29 + 1 = 30 = 0 + 2 + 2 + z \Rightarrow z = 26$$

element X should be iron in group 8.

40. 29.2% (w/w) HCl stock solution has a density of  $1.25 \text{ g mL}^{-1}$ . The molecular weight of HCl is  $36.5 \text{ g mol}^{-1}$ . The volume (mL) of stock solution required to prepare a 200 mL solution of 0.4 M HCl is :

Ans. 8

Sol. 29.2% (w/w) HCl has density =  $1.25 \text{ g/ml}$

Now, mole of HCl required in 0.4 M HCl

$$= 0.4 \times 0.2 \text{ m}^{\sim} \text{e} = 0.08 \text{ m}^{\sim} \text{e}$$

if  $v$  mol of original HCl solution is taken

then mass of solution =  $1.25 v$

$$\text{mass of HCl} = (1.25 v \times 0.292)$$

$$\text{mole of HCl} = \frac{1.25v \times 0.292}{36.5} = 0.08$$

$$\text{so, } v = \frac{36.5 \times 0.08}{0.29 \times 1.25} \text{ mol} = 8 \text{ mL}$$