JEE Main January 2023

Question Paper With Text Solution

25 January | Shift-1

CHEMISTRY

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

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1. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : Acetal/ketal is stable in basic medium.

Reason R : The high leaving tendency of alkoxide ion gives the stability to acetal/ketal in basic medium.

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

(1) Both A and R are true and R is the correct explanation of A

(2) Both A and R are true but R is NOT the correct explanation of A

(3) A is false but R is true

(4) A is true but R is false

नीचे दो कथन दिए गए हैं। एक को **अभिकथन A** तथा दूसरे को **कारण R** चिन्हित किया गया है–

अभिकथन A : ऐसीटैल/कीटेल क्षारीय माध्यम में स्थायी रहते हैं।

कारण R : ऐल्कोक्साइड आयन की निकलने की उच्च प्रवृत्ति ऐसीटैल/कीटेल को क्षारीय माध्यम में स्थायित्व देती है।

उपरोक्त कथनों के लिए निम्नलिखित विकल्पों में से सही उत्तर चुनिए–

(1) A तथा R दोनों सही हैं और R सही व्याख्या है A की।

(2) A तथा R सत्य हैं परन्तु R सही व्याख्या नहीं है A की।

(3) A असत्य है परन्तु R सत्य है।

(4) A सत्य है परन्तु R असत्य है।

Question ID: 3666941215

Ans. Official Answer NTA (4)

Sol. Acetal/Ketal are known to be quite stable under basic conditions but readily hydrolyse to the corresponding carbonyl compound (aldehyde/ketone) and alcohol under acidic condition

2. A cubic solid is made up of two elements X and Y. Atoms of X are present on every alternate corner and one at the centre of cube. Y is at $\frac{1}{3}$ rd of the total faces. The empirical formula of the compound is

(1) $X_{2.5}Y$ (2) $XY_{2.5}$ (3) $X_2Y_{1.5}$ (4) $X_{1.5}Y_2$

एक घनीय ठोस, दो तत्वों X तथ Y से बना है X के परमाणु एकान्तर कोनों पर हैं तथा एक परमाणु घन के केन्द्र पर है। कुल फलकों की एक तिहाई संख्या Y पर है। यौगिक का मूलनिपाती सूत्र है–

(1) $X_{2.5}Y$ (2) $XY_{2.5}$ (3) $X_2Y_{1.5}$ (4) $X_{1.5}Y_2$

Question ID: 3666941201

Ans. Official Answer NTA ()

Sol. $X_{4\times\frac{1}{8}+1\times1}\,y_{6\times\frac{1}{3}\times\frac{1}{2}}$

$\Rightarrow \quad x_{\frac{1}{2}+1}\,y_1$

$\Rightarrow \quad x_{\frac{2}{3}}\,y_1$

$\Rightarrow \quad x_{1.5}\,y_1$

$\Rightarrow \quad x_3\,y_2$

3. Match List-I with List-II

List-I Elements		**List-II Colour imparted to the flame**	
A.	K	I.	Brick Red
B.	Ca	II.	Violet
C.	Sr	III.	Apple Green
D.	Ba	IV.	Crimson Red

Choose the correct answer from the options given below :

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

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

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

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

सूची–I को सूची–II से मिलाएँ।

सूची-I तत्व		**सूची-II ज्योति को रंग प्रदान करने वाले रंग**	
A.	K	I.	गहरा लाल
B.	Ca	II.	बैंगनी
C.	Sr	III.	एप्पल ग्रीन
D.	Ba	IV.	सिंदूरी लाल

नीचे दिये गये विकल्पों में से सही उत्तर का चयन कीजिए।

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

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

Question ID: 3666941209

Ans. Official Answer NTA (3)

Sol.

Metal	K	Ca	Sr	Ba
Colour	Violet	Brick red	Crimson red	Apple green

4. The radius of the 2nd orbit of Li^{2+} is x. The expected radius of the 3rd orbit of Be^{3+} is

(1) $\frac{27}{16}x$ (2) $\frac{4}{9}x$ (3) $\frac{9}{4}x$ (4) $\frac{16}{27}x$

Li^{2+} की द्वितीय कक्षा की त्रिज्या x है। Be^{3+} की तृतीय कक्षा की प्रत्याशित त्रिज्या है–

(1) $\frac{27}{16}x$ (2) $\frac{4}{9}x$ (3) $\frac{9}{4}x$ (4) $\frac{16}{27}x$

Question ID: 3666941202

Ans. Official Answer NTA (1)

Sol. $r_{Li^{2+}} = r_0 \times \frac{2^2}{3} = x \Rightarrow r_0 = \frac{3x}{4}$

$r_{Be^{3+}} = r_0 \times \frac{3^2}{4}$

$r_{Be^{3+}} = \frac{3x}{4} \times \frac{3^2}{4} = \frac{27x}{16}$

5. Which one of the following reactions does not occur during extraction of copper?

(1) $FeO + SiO_2 \rightarrow FeSiO_3$ (2) $2\,Cu_2S + 3\,O_2 \rightarrow 2\,Cu_2O + 2\,SO_2$

(3) $CaO + SiO_2 \rightarrow CaSiO_3$ (4) $2\,FeS + 3\,O_2 \rightarrow 2\,FeO + 2\,SO_2$

निम्नलिखित में से कौनसी एक अभिक्रिया कापर के निष्कर्षण में **नहीं** होती है?

(1) $FeO + SiO_2 \rightarrow FeSiO_3$ (2) $2\,Cu_2S + 3\,O_2 \rightarrow 2\,Cu_2O + 2\,SO_2$

(3) $CaO + SiO_2 \rightarrow CaSiO_3$ (4) $2\,FeS + 3\,O_2 \rightarrow 2\,FeO + 2\,SO_2$

Question ID: 3666941205

Ans. Official Answer NTA (3)

Sol. $CuFeS_2 + O_2 \xrightarrow{\text{Partial roasting}}$

$Cu_2S + FeO + SO_2 + \underset{\text{very small}}{FeS} + \underset{\text{very small}}{Cu_2O}$

$Cu_2S + O_2 \rightarrow Cu_2O + SO_2$
$FeS + O_2 \rightarrow FeO + SO_2$
$FeO + SiO_2 \rightarrow FeSiO_3$

No formation of calcium silicate ($CaSiO_3$) in extraction of Cu.

6. Compound A reacts with NH_4Cl and forms a compound B. Compound B reacts with H_2O and excess of CO_2 to form compound C which on passing through or reaction with saturated NaCl solution forms sodium hydrogen carbonate. Compound A, B and C, are respectively.

(1) $Ca(OH)_2, NH_4^{\oplus}, (NH_4)_2CO_3$ (2) $Ca(OH)_2, NH_3, NH_4HCO_3$

(3) $CaCl_2, NH_3, NH_4HCO_3$ (4) $CaCl_2, NH_4^{\oplus}, (NH_4)_2CO_3$

यौगिक A से NH_4Cl की अभिक्रिया होने पर यौगिक B विरचित होता है। यौगिक B से H_2O तथा CO_2 के आधिक्य की अभिक्रिया यौगिक C उत्पनन करती है जिस को संतुष्ट NaCl के विलयन में प्रवाहित करने पर उससे अभिक्रिया कराने पर/सोडियम हाइड्रोजन कार्बोनेट विरचित होता है। यौगिक A, B तथा C क्रमशः है

(1) $Ca(OH)_2, NH_4^{\oplus}, (NH_4)_2CO_3$ (2) $Ca(OH)_2, NH_3, NH_4HCO_3$

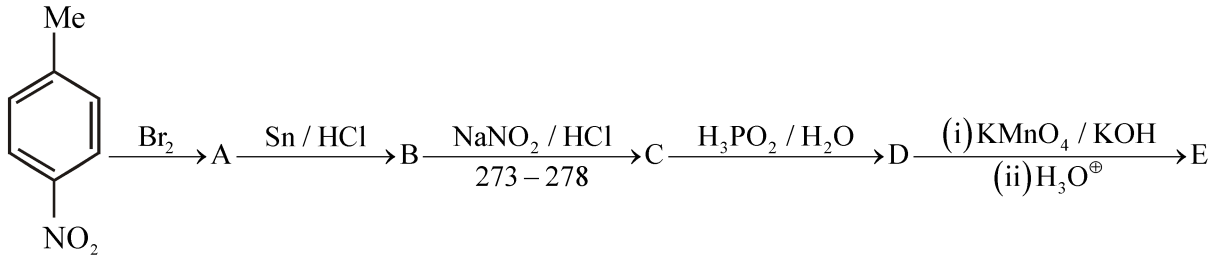
(3) $CaCl_2, NH_3, NH_4HCO_3$ (4) $CaCl_2, NH_4^{\oplus}, (NH_4)_2CO_3$

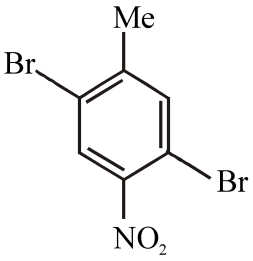
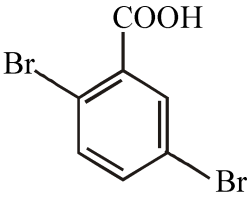
Question ID: 3666941207

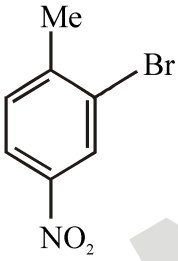
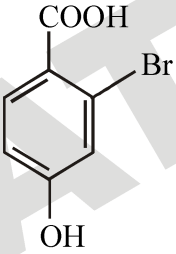
Ans. Official Answer NTA (2)

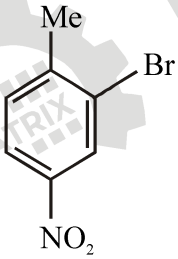
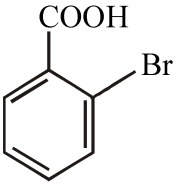
Sol. Reactions related with Solvay process

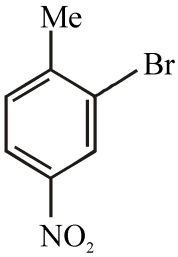
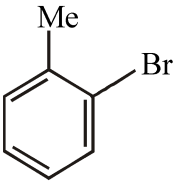
7. Identify the product formed (A and E)



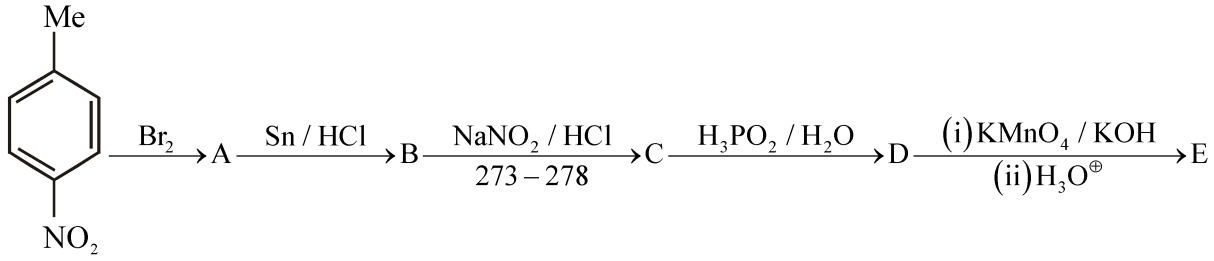
(1) A =  , E = 

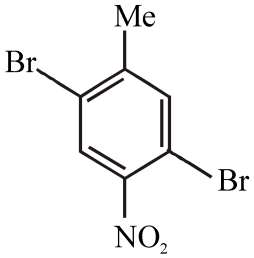
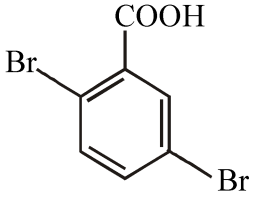
(2) A =  , E = 

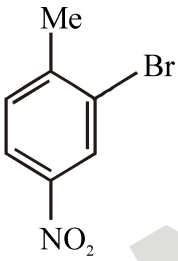
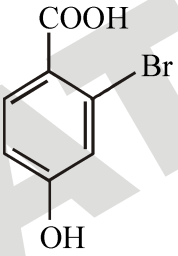
(3) A =  , E = 

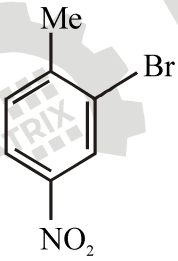
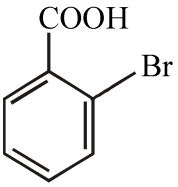
(4) A =  , E = 

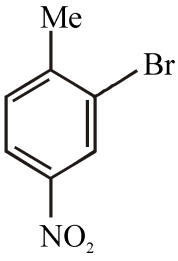
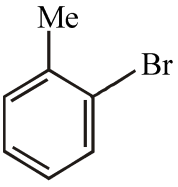
उत्पादों A तथा E को पहचानिए–



(1) A =  , E = 

(2) A =  , E = 

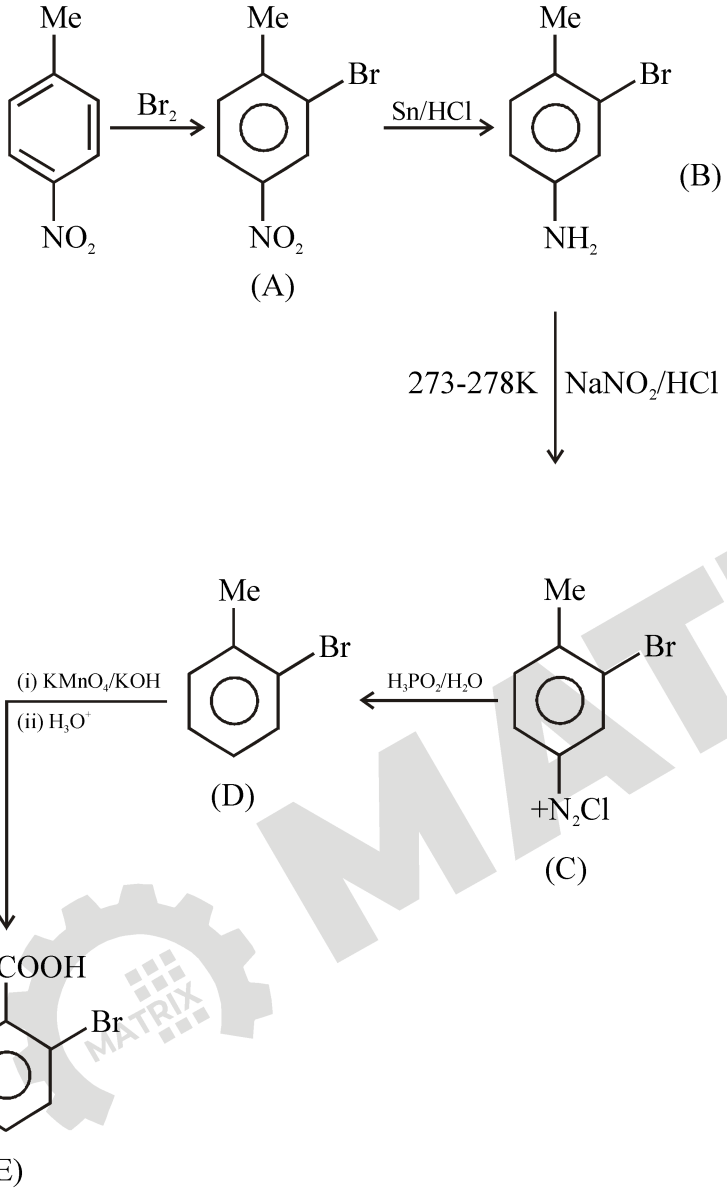
(3) A =  , E = 

(4) A =  , E = 

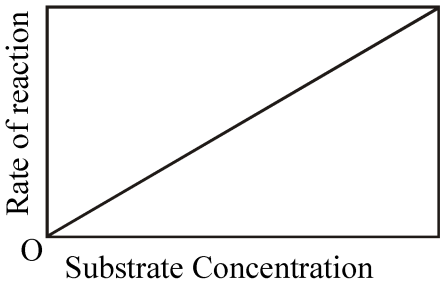
Question ID: 3666941216

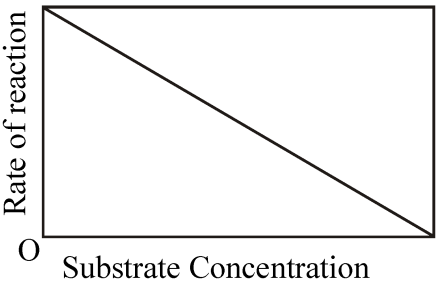
Ans. Official Answer NTA (3)

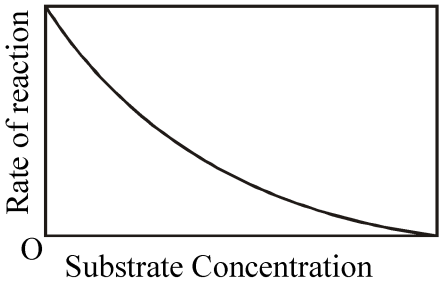
Sol.

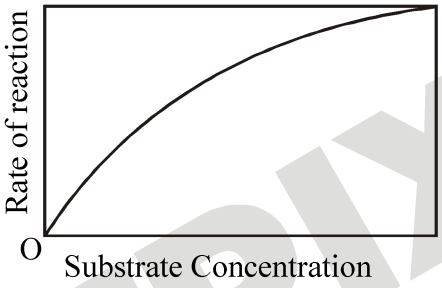


8. The variation of the rate of an enzyme catalyzed reaction with substrate concentration is correctly represented by graph

(A) 

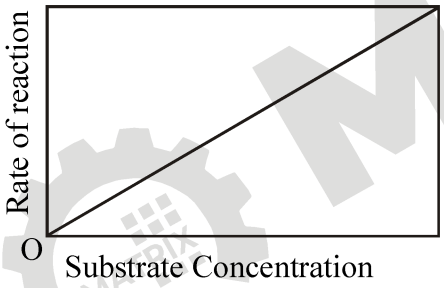
(B) 

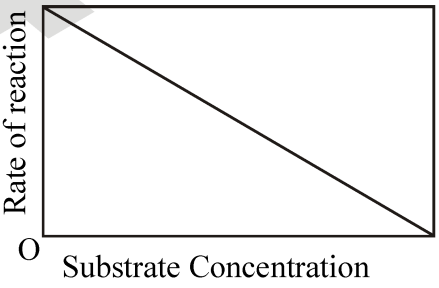
(C) 

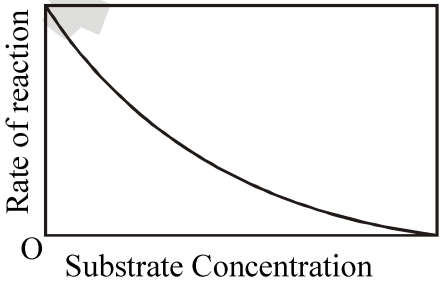
(D) 

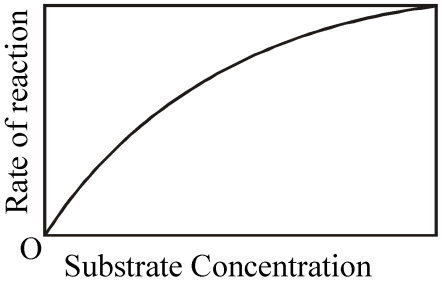
(1) a (2) b (3) c (4) d

एन्जाइम उत्प्रेरित अभिक्रिया के वेग का सबस्ट्रेट की सांद्रता के साथ परिवर्तन जो ग्राफ दर्शाता है, वह है–

(A) 

(B) 

(C) 

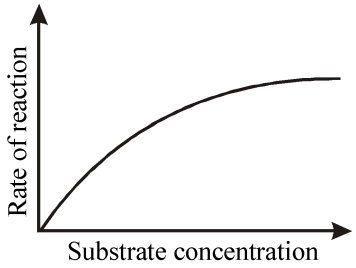
(D) 

(1) a (2) b (3) c (4) d

Question ID: 3666941203

Ans. Official Answer NTA (4)

Sol. The correct plot for enzyme catalysed reaction is



Hence, correct answer is option (4).

9. Some reactions of NO_2 relevant to photochemical smog formation are

$$NO_2 \xrightarrow{\text{sunlight}} X + Y$$
$$\downarrow A$$
$$B$$

Identify A, B, X and Y

(1) $X = N_2O$, $Y = [O]$, $A = O_3$, $B = NO$ (2) $X = [O]$, $Y = NO$, $A = O_2$, $B = O_3$

(3) $X = \frac{1}{2}O_2$, $Y = NO_2$, $A = O_3$, $B = O_2$ (4) $X = NO$, $Y = [O]$, $A = O_2$, $B = N_2O_3$

NO_2 की कुछ अभिक्रियाएँ जो प्रकाश रासायनिक धूम कोहरे से सुसंगत है, इस प्रकार है

$$NO_2 \xrightarrow{\text{sunlight}} X + Y$$
$$\downarrow A$$
$$B$$

A, B, X तथा Y को पहचानिए–

(1) $X = N_2O$, $Y = [O]$, $A = O_3$, $B = NO$ (2) $X = [O]$, $Y = NO$, $A = O_2$, $B = O_3$

(3) $X = \frac{1}{2}O_2$, $Y = NO_2$, $A = O_3$, $B = O_2$ (4) $X = NO$, $Y = [O]$, $A = O_2$, $B = N_2O_3$

Question ID: 3666941210

Ans. Official Answer NTA (2)

Sol. $NO_2 \xrightarrow{h\nu} \underset{(X)}{O} + \underset{(Y)}{NO}$

$\downarrow O_2(A)$

$\underset{(B)}{O_3}$

10.  $\xrightarrow{?}$ $PhCOOH + PhCH_2OH$

P Q R

The correct sequence of reagents for the preparation of Q and R is :

(1) (i) Mo_2O_3, Δ; (ii) CrO_2Cl_2, H_3O^+; (iii) NaOH; (iv) H_3O^+

(2) (i) $KMnO_4$, OH^-; (ii) Mo_2O_3, Δ; (iii) NaOH; (iv) H_3O^+

(3) (i) Cr_2O_3, 770K, 20 atm; (ii) CrO_2Cl_2, H_3O^+; (iii) NaOH; (iv) H_3O^+

(4) (i) CrO_2Cl_2, H_3O^+; (ii) Cr_2O_3, 770K, 20 atm; (iii) NaOH; (iv) H_3O^+

 $\xrightarrow{?}$ $PhCOOH + PhCH_2OH$

P Q R

Q तथा R के विरचन के लिए अभिकर्मकों का सही क्रम है–

(1) (i) Mo_2O_3, Δ; (ii) CrO_2Cl_2, H_3O^+; (iii) NaOH; (iv) H_3O^+

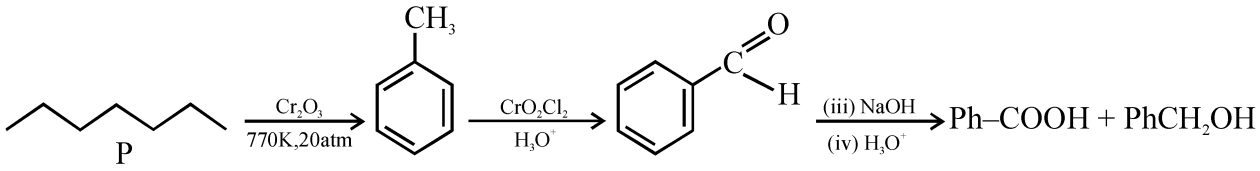
(2) (i) $KMnO_4$, OH^-; (ii) Mo_2O_3, Δ; (iii) NaOH; (iv) H_3O^+

(3) (i) Cr_2O_3, 770K, 20 atm; (ii) CrO_2Cl_2, H_3O^+; (iii) NaOH; (iv) H_3O^+

(4) (i) CrO_2Cl_2, H_3O^+; (ii) Cr_2O_3, 770K, 20 atm; (iii) NaOH; (iv) H_3O^+

Question ID: 3666941212

Ans. Official Answer NTA (3)

Sol. 

Cannizaro reaction

11. Reaction of thionyl chloride with white phosphorus forms a compound [A], which on hydrolysis gives [B], a dibasic acid. [A] and [B] are respectively

(1) PCl_3 and H_3PO_3 (2) P_4O_6 and H_3PO_3 (3) $POCl_3$ and H_3PO_4 (4) PCl5 and H_3PO_4

थायोनिल क्लोराइड की श्वेत फास्फोरस से अभिक्रिया एक यौगिक [A] विरचित करती है। इसका जल अपघटन [B] देता है जो द्विक्षारकी अम्ल है। [A] तथा [B] क्रमशः हैं–

(1) PCl_3 तथा H_3PO_3 (2) P_4O_6 तथा H_3PO_3 (3) $POCl_3$ तथा H_3PO_4 (4) PCl5 तथा H_3PO_4

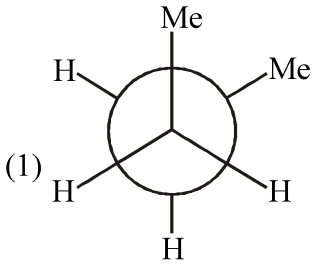
Question ID: 3666941208

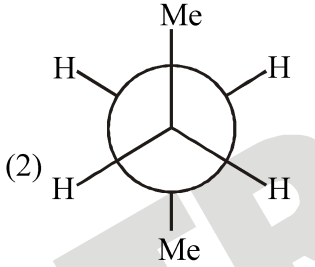
Ans. Official Answer NTA (1)

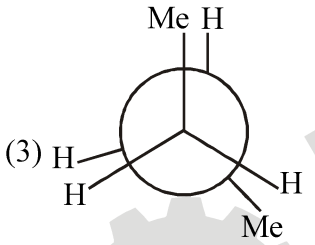
Sol. $P_4 + 8SOCl_2 \longrightarrow 4PCl_3 + 4SO_2 + 2S_2Cl_2$

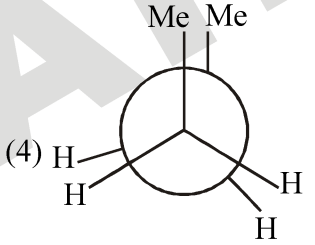
$PCl_3 \xrightarrow{\text{Hydrolysis}} \underset{\substack{\text{(B)}\\\text{Dibasic acid}}}{H_3PO_3}$

12. Which of the following conformations will be the most stable ?

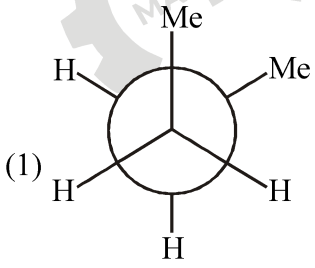
(1) 

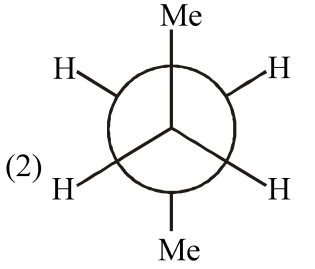
(2) 

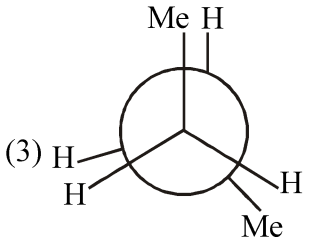
(3) 

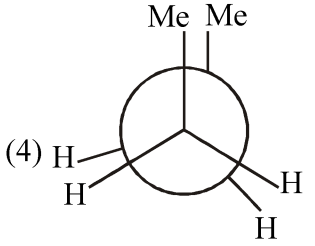
(4) 

निम्नलिखित में कौनसा संरूपण सर्वाधिक स्थायी है?

(1) 

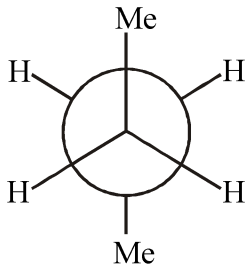
(2) 

(3) 

(4) 

Question ID: 3666941211

Ans. Official Answer NTA (2)

Sol. Conformation  has lowest

vanderwaal and torsional strain. Hence it must be most stable.

13. Which of the following statements is incorrect for antibiotics ?

(1) An antibiotic is a synthetic substance produced as a structural analogue of naturally occurring antibiotic.

(2) An antibiotic must be a product of metabolism.

(3) An antibiotic should promote the growth or survival of microorganisms.

(4) An antibiotic should be effective in low concentrations.

प्रति–जैविक के लिए निम्नलिखित में से कौनसा कथन असत्य है?

(1) प्रतिजैविक एक संश्लेषित पदार्थ है, जिसका उत्पादन प्राकृतिक प्रतिजैविक के संरचना–अनुरूप के रूप में होता है।

(2) प्रतिजैविक उपपाचन का उत्पाद होना चाहिए।

(3) प्रतिजैविक सूक्ष्मजीवों की वृद्धि या जीवन के लिए वर्धक होना चाहिए।

(4) प्रतिजैविक न्यून सान्द्रता में प्रभावी होना चाहिए।

Question ID: 3666941218

Ans. Official Answer NTA (3)

Sol. An antibiotic does not promote the growth or survival of microorganisms.

14. The correct order in aqueous medium of basic strength in case of methyl substituted amines is :

(1) $Me_2NH > Me_3N > MeNH_2 > NH_3$ (2) $NH_3 > Me_3N > MeNH_2 > Me_2NH$

(3) $Me_3N > Me_2NH > MeNH_2 > NH_3$ (4) $Me_2NH > MeNH_2 > Me_3N > NH_3$

मेथिल प्रतिस्थापित ऐमीनो के लिए जलीय विलयन से क्षारीय बल का सही क्रम है–

(1) $Me_2NH > Me_3N > MeNH_2 > NH_3$ (2) $NH_3 > Me_3N > MeNH_2 > Me_2NH$

(3) $Me_3N > Me_2NH > MeNH_2 > NH_3$ (4) $Me_2NH > MeNH_2 > Me_3N > NH_3$

Question ID: 3666941217

Ans. Official Answer NTA (4)

Sol. The observed basic strength order in aq. medium is $Me_2NH > MeNH_2 > Me_3N > NH_3$

15. Match the List-I with List-II :

List-I Cations	List-II Group reagents	
A → Pb^{2+}, Cu^{2+}	I.	H_2S gas in presence of dilute HCl
B → Al^{3+}, Fe^{3+}	II.	$(NH_4)_2CO_3$ in presence of NH_4OH
C → Co^{2+}, Ni^{2+}	III.	NH_4OH in presence of NH_4Cl
D → Ba^{2+}, Ca^{2+}	IV.	H_2S in presence of NH_4OH

Correct match is –

(1) A → iv, B → ii, C → iii, D → i (2) A → iii, B → i, C → iv, D → ii

(3) A → i, B → iii, C → ii, D → iv (4) A → i, B → iii, C → iv, D → ii

सूची–I का सूची–II से मिलान कीजिए।

सूची-I धनायन	सूची-II ग्रुप अभिकर्मक	
A → Pb^{2+}, Cu^{2+}	I.	H_2S गैस, तनु HCl की उपस्थिति में
B → Al^{3+}, Fe^{3+}	II.	NH_4OH की उपस्थिति में $(NH_4)_2CO_3$
C → Co^{2+}, Ni^{2+}	III.	NH_4Cl की उपस्थिति में NH_4OH
D → Ba^{2+}, Ca^{2+}	IV.	NH_4OH–NH_4Cl की उपस्थिति में H_2S

सही मिलान है–

(1) A → iv, B → ii, C → iii, D → i (2) A → iii, B → i, C → iv, D → ii

(3) A → i, B → iii, C → ii, D → iv (4) A → i, B → iii, C → iv, D → ii

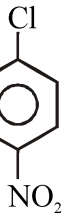
Question ID: 3666941220

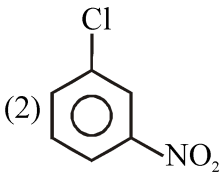
Ans. Official Answer NTA (4)

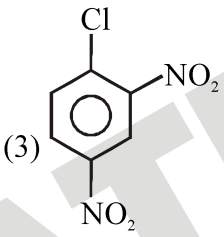
Sol.

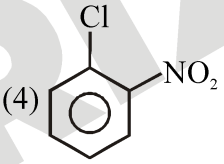
Cations	Group reagents	
A → Pb^{2+}, Cu^{2+}	I.	H_2S gas in presence of dilute HCl
B → Al^{3+}, Fe^{3+}	III.	NH_4OH in presence of NH_4Cl
C → Co^{2+}, Ni^{2+}	IV.	H_2S in presence of NH_4OH
D → Ba^{2+}, Ca^{2+}	II.	$(NH_4)_2CO_3$ in presence of NH_4OH

16. The compound which will have the lowest rate towards nucleophilic aromatic substitution on treatment with OH^- is

(1) 

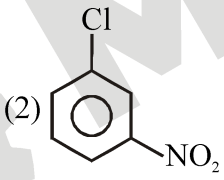
(2) 

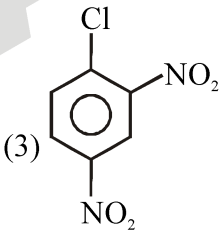
(3) 

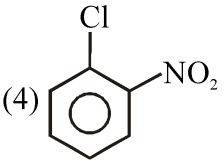
(4) 

OH^- से उपचार करने पर, जिसकी नाभिक स्नेही एरोमैटिक प्रतिस्थापन के लिए न्यूनतम दर होगी, वह यौगिक है–

(1) 

(2) 

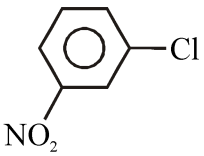
(3) 

(4) 

Question ID: 3666941213

Ans. Official Answer NTA (2)

Sol. Electron withdrawing groups are highly ineffective at meta position in nucleophilic aromatic substitution reactions.

Hence compound 

will have lowest rate in nucleophilic aromatic substitution.

17. Inert gases have positive electron gain enthalpy. Its correct order is

(1) He < Ne < Kr < Xe (2) He < Kr < Xe < Ne

(3) He < Xe < Kr < Ne (4) Xe < Kr < Ne < He

उत्कृष्ट गैसों की इलेक्ट्रॉन लब्धि एन्थैल्पी धनात्मक होती है। इसका सही क्रम है–

(1) He < Ne < Kr < Xe (2) He < Kr < Xe < Ne

(3) He < Xe < Kr < Ne (4) Xe < Kr < Ne < He

Question ID: 3666941204

Ans. Official Answer NTA (3)

Sol.

Noble gas	**He**	**Ne**	**Ar**	**Kr**	**Xe**
Electron gain enthalpy (kJ/mole)	48	116	96	96	77

18. '25 volume' hydrogen peroxide means

(1) 1 L marketed solution contains 75 g of H_2O_2.

(2) 1 L marketed solution contains 25 g of H_2O_2.

(3) 100 mL marketed solution contains 25 g of H_2O_2.

(4) 1 L marketed solution contains 250 g of H_2O_2.

'25 आयतन' हाइड्रोजन परऑक्साइड का तात्पर्य है–

(1) 1 L बेचे गये विलयन में 75 g H_2O_2 है।

(2) 1 L बेचे गये विलयन में 25 g H_2O_2 है।

(3) 100 mL बेचे गये विलयन में 25 g H_2O_2 है।

(4) 1 L बेचे गये विलयन में 250 g H_2O_2 है।

Question ID: 3666941206

Ans. Official Answer NTA (1)

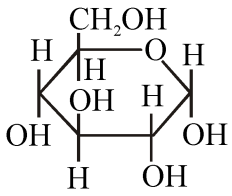
Sol. Molarity of H_2O_2 sol$^n = \frac{\text{volume strength}}{11.2}$

$= \frac{25}{11.2} = 2.23M$

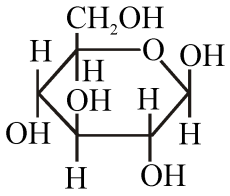
$\therefore$ amount of H_2O_2 in one litre $= 2.23 \times 34 = 75$ gm

19. Match items of Row I with those of Row II.

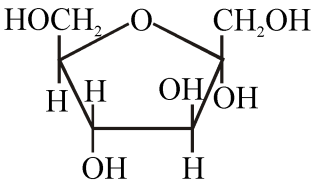
Row I :



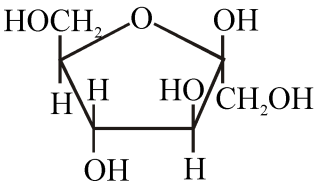
A



B



C



D

Row II :

(i) α–D–(–)–Fructofuranose, (ii) β–D–(–)–Fructofuranose

(iii) α–D–(–)–Glucopyranose, (iv) β–D–(–)–Glucopyranose

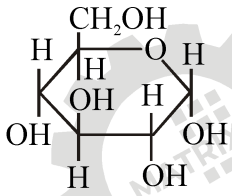
Correct match is

(1) A → i, B → ii, C → iii, D → iv (2) A → iii, B → iv, C → ii, D → i

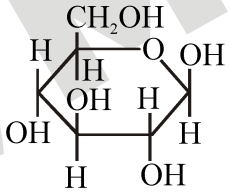
(3) A → iii, B → iv,C → i, D → ii (4) A → iv, B → iii, C → i, D → ii

पंक्ति I की मदों का मिलान पंक्ति II की मदों से कीजिए।

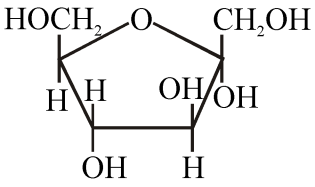
पंक्ति I :



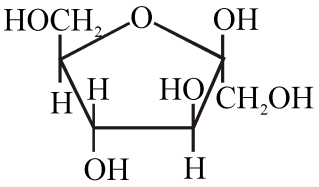
A



B



C



D

पंक्ति II :

(i) α–D–(–)–फ्रक्टोफ्यूरेनोस, (ii) β–D–(–)–फ्रक्टोफ्यूरेनोस

(iii) α–D–(–)–ग्लूकोपाइरैनोस, (iv) β–D–(–)–ग्लूकोपाइरैनोस

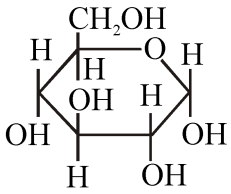
सही मिलान है–

(1) A → i, B → ii, C → iii, D → iv (2) A → iii, B → iv, C → ii, D → i

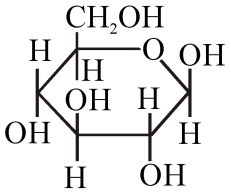
(3) A → iii, B → iv,C → i, D → ii (4) A → iv, B → iii, C → i, D → ii

Question ID: 3666941219

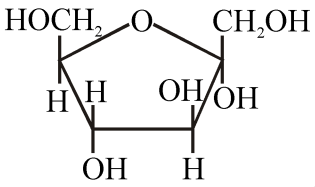
Ans. Official Answer NTA (3)

Sol. Structure  Represents α-D-(+) Glucopyranose

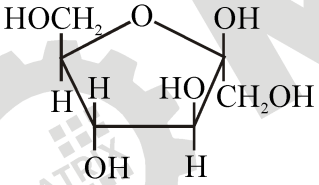
A

Structure  Represents β-D-(+) Glucopyranose

B

Structure  Represents β-D-(–) Fructofuranose

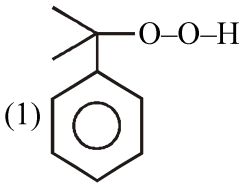
C

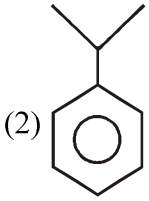
Structure  Represents β-D-(–) Fructofuranose

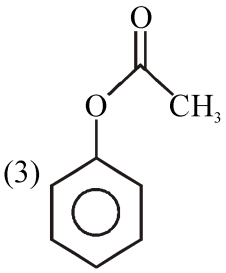
D

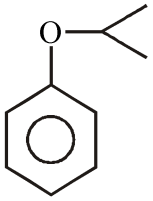
(from the given options best answer is D)

20. In the cumene to phenol preparation in presence of air, the intermediate is

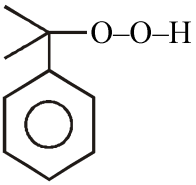
(1) 

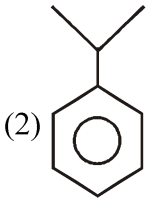
(2) 

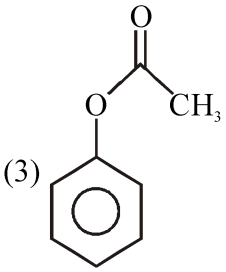
(3) 

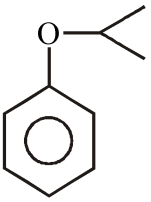
(4) 

वायु की उपस्थिति में, क्यूमीन से फीनाल विरचन में मध्यवर्ती है–

(1) 

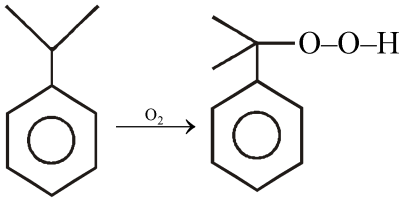
(2) 

(3) 

(4) 

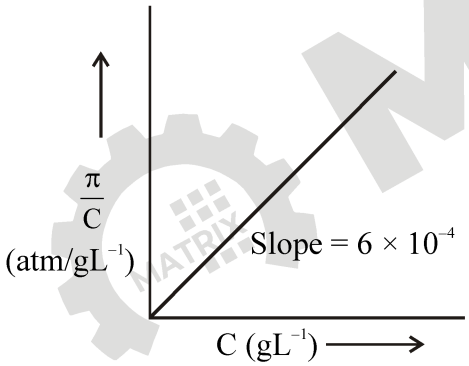
Question ID: 3666941214

Ans. Official Answer NTA (1)

Sol. 

21. The osmotic pressure of solutions of PVC in cyclohexanone at 300 K are plotted on the graph.

The molar mass of PVC is _____ g mol^{-1} (Nearest integer)

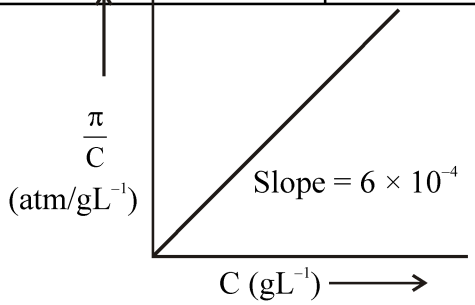


(Given : R = 0.083 L atm K^{-1} mol^{-1})

PVC के साइक्लोहेक्सेन में बने विलयनों के लिए परासरण दाब 300K पर नीचे आरेखित है।

PVC की मोलर द्रव्यमान है _____ g mol^{-1}

(निकटतम पूर्णांक में)

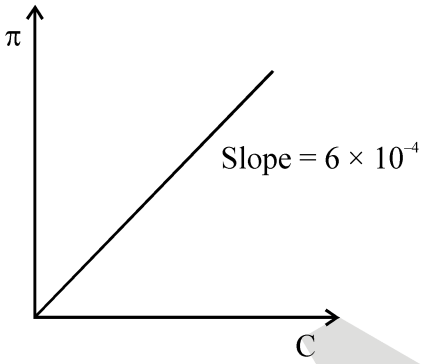


(Given : R = 0.083 L atm K^{-1} mol^{-1})

Question ID: 3666941224

Ans. Official Answer NTA (41500)

Sol.



$\pi = CRT$

$$\pi = \frac{\text{mole}}{\text{volume}} \times RT$$

$$\pi = \frac{\text{mole}}{\text{volume}} \times \frac{mw}{mw} \times RT$$

$$\pi = \frac{\text{mass}}{\text{volume}} \times \frac{RT}{mw}$$

$$\pi(\text{atm}) = \frac{RT}{mw} \times C\left(\text{gm lit}^{-1}\right)$$

$$\text{slope} = \frac{RT}{mw} = 6 \times 10^{-4}$$

$mw = 41500$

22. In sulphur estimation, 0.471 g of an organic compound gave 1.4439 g of barium sulphate.

The percentage of sulphur in the compound is _____ (Nearest Integer)

(Given : Atomic mass Ba : 137 u, S: 32 u, O : 16 u)

0.471 g कार्बनिक यौगिक का सल्फर आकलन 1.4439 g बेरियम सल्फेट देता है यौगिक में सल्फर का प्रतिशत है_____ (5निकटतम पूर्णांक में)

(दिया है : परमाण्विक द्रव्यमान Ba : 137 u, S: 32 u, O : 16 u)

Question ID: 3666941230

Ans. Official Answer NTA (42)

Sol. $\%\text{sulphur} = \frac{32}{233} \times \frac{\text{weight of } BaSO_4 \text{ formed}}{\text{weight of organic compound}} \times 100$

$= \frac{32}{233} \times \frac{1.4439}{0.471} \times 100$

$= 42.10$

Nearest integer 42

23. Consider the cell

$Pt(s)|H_2(g)(1atm)|H^+(aq,[H^+]=1)||Fe^{3+}(aq),Fe^{2+}(aq)|Pt(s)$

Given $E^o_{Fe^{3+}/Fe^{2+}} = 0.771V$ and $E^o_{H^+/\frac{1}{2}H_2} = 0V, T = 298K$

If the potential of the cell is 0.712 V, the ratio of concentration of Fe^{2+} to Fe^{3+} is _____ (Nearest integer)

सेल पर विचार कीजिए–

$Pt(s)|H_2(g)(1atm)|H^+(aq,[H^+]=1)||Fe^{3+}(aq),Fe^{2+}(aq)|Pt(s)$

दिया है $E^o_{Fe^{3+}/Fe^{2+}} = 0.771V$ तथा $E^o_{H^+/\frac{1}{2}H_2} = 0V, T = 298K$

यदि सेल का विभव 0.712 है तो Fe^{+2} तथा Fe^{+3} की सांद्रता का अनुपात है _____ (निकटतम पूर्णांक में)

Question ID: 3666941226

Ans. Official Answer NTA (10)

Sol. $\text{Anode} \Rightarrow \frac{1}{2}H_2(g) \longrightarrow H^+(aq) + e^-$

$\underline{\text{Cathode} \Rightarrow Fe^{3+} + e^- \longrightarrow Fe^{2+}}$

$\text{Overall} \frac{1}{2}H_2 + Fe^{3+} \xrightarrow{n=1} H^+ + Fe^{2+}$

$E_{cell} = E^0_{cell} - \frac{0.059}{1}\log\frac{[Fe^{2+}]}{[Fe^{3+}]} \times \frac{[H^+]}{[P_{H_2}]^{\frac{1}{2}}}$

$0.712 = 0.771 - 0.059 \log \frac{[Fe^{2+}]}{[Fe^{3+}]}$

$$\log\frac{[Fe^{2+}]}{[Fe^{3+}]}=1$$

$$So\frac{[Fe^{2+}]}{[Fe^{3+}]}=10$$

24. An athlete is given 100 g of glucose ($C_6H_{12}O_6$) for energy. This is equivalent to 1800kJ of energy. The 50% of this energy gained is utilized by the athlete for sports activities at the event. In order to avoid storage of energy, the weight of extra water he would need to perspire is _____ g Nearest integer)

Assume that there is no other way of consuming stored energy.

Given : The enthalpy of evaporation of water is 45 kJ mol^{-1}

Molar mass of C, H & O are 12, 1 and 16 g mol^{-1}.

100g ग्लूकोस ($C_6H_{12}O_6$) एक ऐथलीट को ऊर्जा के लिए दिया गया है। यह 1800 J ऊर्जा के तुल्य है। इस प्राप्त ऊर्जा का 50% ऐथलीट द्वारा एक कार्यक्रम में स्पोर्ट गतिविधियों के लिए उपयोग किया जाता है। ऊर्जा के संचयन से बचने के लिए उसे पसीना निकालने के लिए अतिरिक्त जल की कितनी मात्र की आवश्यकता होगी _____ (निकटतम पूर्णांक में)

(दिया है जल की वाष्पन एन्थैल्पी 45 kJ mol^{-1})

परमाण्विक द्रव्यमान : C, H तथा O 12, 1 तथा 16 g mol^{-1}

मान लीजिए संचित ऊर्जा के उपभोग का कोई अतिरिक्त तरीका नहीं है।

Question ID: 3666941223

Ans. Official Answer NTA (360)

Sol. wt of extra water he would need to perspire

$$=\frac{1800}{2}\times\frac{18}{45}$$

$= 20 \times 18 = 360$ gm

25. For the first order reaction A → B, the half life is 30 min. The time taken for 75% completion of the reaction is _____min. (Nearest integer)

Given : log 2 = 0.3010

log 3 = 0.4771

log 5 = 0.6989

प्रथम कोटि की अभिक्रिया A→B के लिए अर्ध आयु 30 min है अभिक्रिया के 75% पूर्ण होने में जो समय लगेगा वह है _____ min. (निकटतम पूर्णांक में)

दिया है : log 2 = 0.3010

log 3 = 0.4771

log 5 = 0.6989

Question ID: 3666941227

Ans. Official Answer NTA (60)

Sol. $t_{1/2} = T_{50} = 30$ min

$T_{75} = 2t_{1/2} = 30 \times 2 = 60$ min

26. The number of paramagnetic species from the following is _____.

$[Ni(CN)_4]^{2-}$, $[Ni(CO)_4]$, $[NiCl_4]^{2-}$,

$[Fe(CN)_6]^{4-}$, $[Cu(NH_3)_4]^{2+}$

$[Fe(CN)_6]^{3-}$ and $[Fe(H_2O)_6]^{2+}$

निम्नलिखित में से अनुचुम्बकीय स्पीशीज की संख्या है _____

$[Ni(CN)_4]^{2-}$, $[Ni(CO)_4]$, $[NiCl_4]^{2-}$,

$[Fe(CN)_6]^{4-}$, $[Cu(NH_3)_4]^{2+}$

$[Fe(CN)_6]^{3-}$ तथा $[Fe(H_2O)_6]^{2+}$

Question ID: 3666941229

Ans. Official Answer NTA (4)

Sol.

S.No.	Species	E.C.	Hybridisation	Magnetic character
(i)	$[Ni(CN)_4]^{2-}$	$Ni^{2+} \Rightarrow 3d^8$	dsp^2	Diamagnetic
(ii)	$[NiCl_4]^{2-}$	$Ni^{2+} \Rightarrow 3d^8$	sp^3	Paramagnetic
(iii)	$[Cu(CN)_4]^{2+}$	$Cu^{2+} \Rightarrow 3d^9$	dsp^2	Paramagnetic
(iv)	$[Cu(CN)_4]^{3-}$	$Cu^{+} \Rightarrow 3d^{10}$	sp^3	Diamagnetic
(v)	$[Fe(CN)_6]^{3-}$	$Fe^{3+} \Rightarrow 3d^5$	d^2sp^3	Paramagnetic
(vi)	$[Fe(CN)_6]^{4-}$	$Fe^{2+} \Rightarrow 3d^6$	d^2sp^3	Diamagnetic
(vii)	$[Fe(H_2O)_6]^{2+}$	$Fe^{2+} \Rightarrow 3d^6$	sp^3d^2	Paramagnetic

27. A litre of buffer solution contains 0.1 mole of each of NH_3 and NH_4Cl. On the addition of 0.02 mole of HCl by dissolving gaseous HCl, the pH of the solution is found to be _____ $\times 10^{-3}$ (Nearest integer)

[Given : $pK_b(NH_3) = 4.745$

log 2 = 0.301

log 3 = 0.477

T = 298 K]

बफर विलयन के एक लीटर में NH_3 तथा NH_4Cl में से प्रत्येक के 0.1 mole हैं। इसमें 0.02 mole HCl गैस को घोल कर संकलन करने पर विलयन की जो pH प्राप्त होगी वह है _____ $\times 10^{-3}$ (निकटतम पूर्णांक में)

[दिया है : $pK_b(NH_3) = 4.745$

log 2 = 0.301

log 3 = 0.477

T = 298 K]

Question ID: 3666941225

Ans. Official Answer NTA (9079)

Sol.

	NH_3	+	HCl	$\rightarrow$	NH_4Cl
At initial	0.1		0		0.1
At time t	0.1 – 0.02				0.1 + 0.02

$$pOH = pK_b + \log\left[\frac{0.1+0.02}{0.1-0.02}\right]$$

$$= 4.745 + \log\left(\frac{3}{2}\right)$$

$= 4.745 + [0.477 - 0.301]$

$= 4.745 + 0.176$

$pOH = 4.921$

$pH = 14 - pOH$

$= 14 - 4.921 = 9.079$

$pH = 9079 \times 10^{-3}$

28. How many of the following metal ions have similar value of spin only magnetic moment in gaseous state ?

_____

(Given : Atomic number : V, 23; Cr, 24; Fe, 26; Ni, 28)

V^{3+}, Cr^{3+}, Fe^{2+}, Ni^{3+}

निम्नलिखित धातु आयनों में से कितनों का गैसीय अवस्था केवल स्पिन चुम्बकीय आघूर्ण समान है _____

(दिया है परमाणु संख्या : V, 23; Cr, 24; Fe, 26; Ni, 28)

V^{3+}, Cr^{3+}, Fe^{2+}, Ni^{3+}

Question ID: 3666941228

Ans. Official Answer NTA (2)

Sol. $\mu_s = \sqrt{n(n+2)}BM$ (n = no. of unpaired electrons)

	n
V^{3+} : [Ar] $3d^2 4s^0$	2
Cr^{3+} : [Ar] $3d^3 4s^0$	3
Fe^{2+} : [Ar] $3d^6 4s^0$	4
Ni^{3+} : [Ar] $3d^7 4s^0$	3

Cr^{3+} & Ni^{3+} have same value of μ_s

29. The density of a monobasic strong acid (Molar mass 24.2 g/mol) is 1.21 kg/L. The volume of its solution required for the complete neutralization of 25 mL of 0.24 M NaOH is _____ $\times 10^{-2}$ mL (Nearest integer)
एक क्षारकी प्रबल अम्ल (मोलर द्रव्यमान 24.2 g/mol.) का घनत्व 1.21 kg/L है। 0.24 M NaOH के 25 mL का पूर्ण उदासीनीकरण करने के लिए इस अम्ल का जो आयतन आवश्यक है, वह है _____ $\times 10^{-2}$ mL. (निकटतम पूर्णांक में)

Question ID: 3666941221

Ans. Official Answer NTA (12)

Sol. Molarity of acid $= \frac{1.2\times10^3}{24.2} = \frac{1000}{20} = 50M$

Neutralization reaction :

$HA + NaOH \longrightarrow NaA + H_2O$

$M_1V_1 = M_2V_2$

$[50] \times V = [0.24 \times 25]$

$V = 00.12$ ml

30. The total number of lone pairs of electrons on oxygen atoms of ozone is _____ .
ओजोन के ऑक्सीजन परमाणुओं पर उपस्थित एकक इलेक्ट्रॉन युग्मों की कुल संख्या है _____ .

Given 2

Question ID: 3666941222

Ans. Official Answer NTA (6)

Sol.