JEE Main August 2021

Question Paper With Text Solution

31 August. | Shift-2

CHEMISTRY

MATRIX

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

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JEE MAIN AUGUST 2021 | 31 AUGUST SHIFT-2

SECTION – A

1. The Eu^{2+} ion is a strong reducing agent is spite of its ground state electronic configuration (outermost):

[Atomic number of Eu = 63]

जिस निम्नतम अवस्था इलेक्ट्रान विन्यास (वाह्यतम) के होते हुए भी Eu^{2+} एक प्रबल अपचायक कर्मक है, वह है :

[परमाणु क्रमांक : Eu = 63]

(1) $4f^7$

(2) $4f^7 6s^2$

(3) $4f^6$

(4) $4f^6 6s^2$

Question ID : 86435121286
Option 1 ID : 86435170445
Option 2 ID : 86435170447
Option 3 ID : 86435170446
Option 4 ID : 86435170448

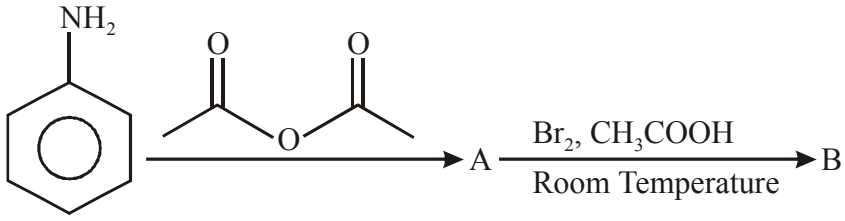
Ans. Official Answer NTA (1)

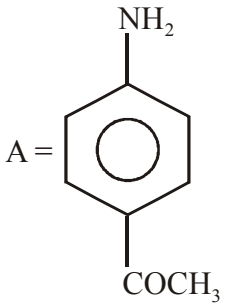
Sol. Eu (Z = 63) = $[_{54}Xe]\ 4f^7\ 6s^2$

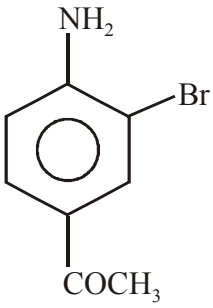
Eu^{+2} (Z = 63) = $[_{54}Xe]\ 4f^7$

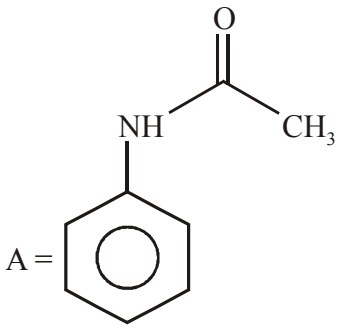
2. The major products A and B formed in the following reaction sequence are :

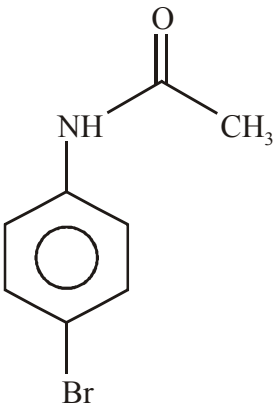
निम्नलिखित अभिक्रिया क्रम में विरचित मुख्य उत्पाद A तथा B हैं :

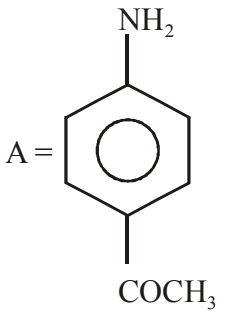


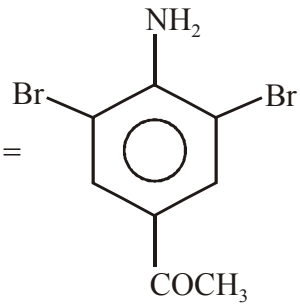
(1) A = 

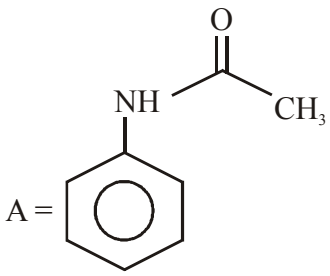
, B = 

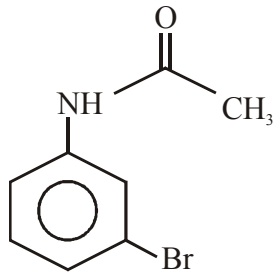
(2) A = 

, B = 

(3) A = 

, B = 

(4) A = 

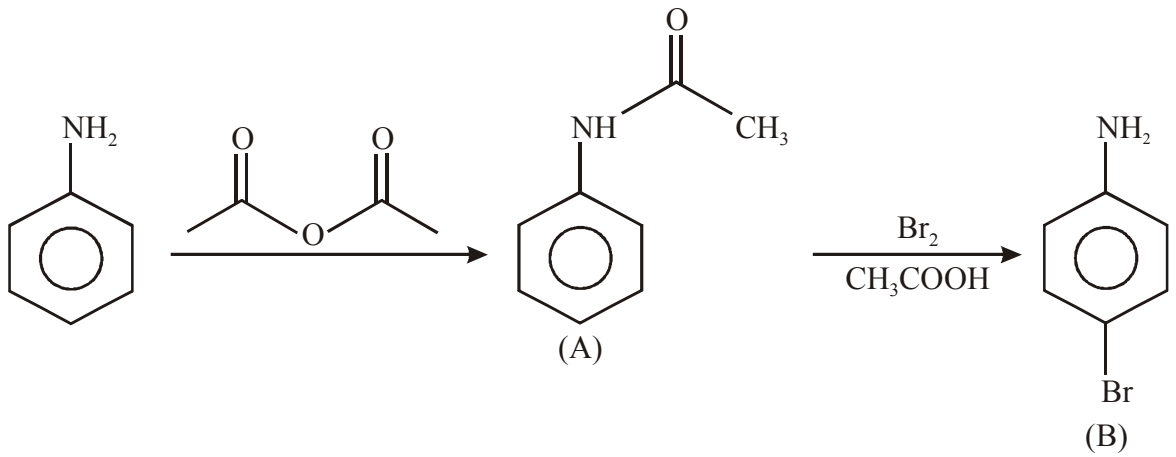
, B = 

Question ID : 86435121296
Option 1 ID : 86435170486
Option 2 ID : 86435170485
Option 3 ID : 86435170488

Option 4 ID : 86435170487

Ans. Official Answer NTA (2)

Sol.



3. Which among the following is not a polyester ?

(1) PHBV (2) Dacron

(3) Glyptal (4) Novolac

निम्नलिखित में से कौन–सा पॉलिएस्टर नहीं है?

(1) पी.एच.बी.वी. (2) डेक्रान

(3) ग्लिप्टल (4) नोवोलेक

Question ID : 86435121297

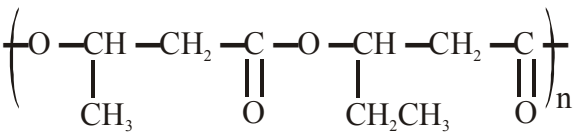
Option 1 ID : 86435170492

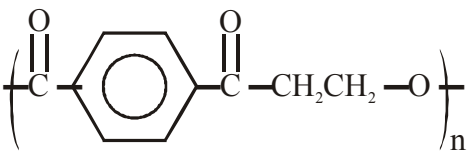
Option 2 ID : 86435170491

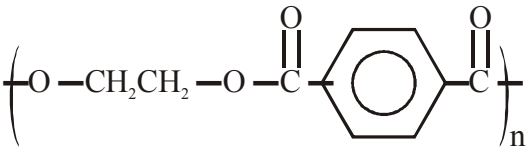
Option 3 ID : 86435170489

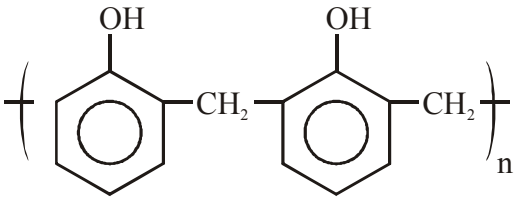
Option 4 ID : 86435170490

Ans. Official Answer NTA (4)

Sol. (1) PHBV =  (Polyester)

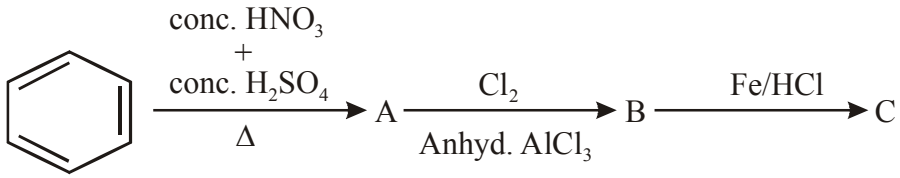
(2) Dacron =  (Polyester)

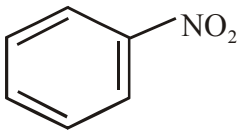
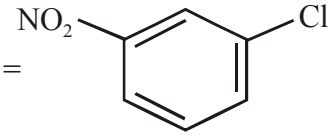
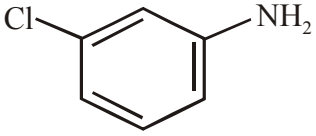
(3) Glyptal =  (Polyester)

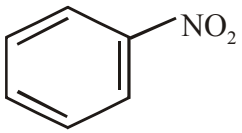
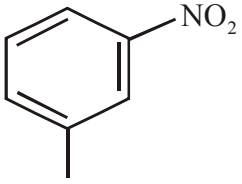
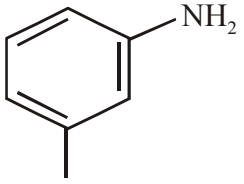
(4) Novolac = 

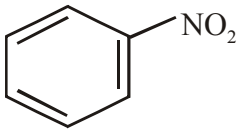
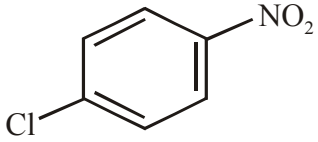
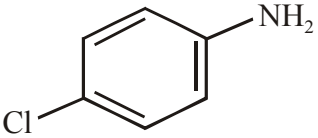
4. Identify correct A, B and C in the reaction sequence given below :

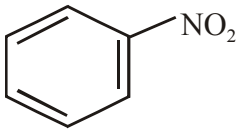
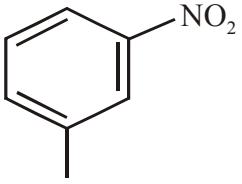
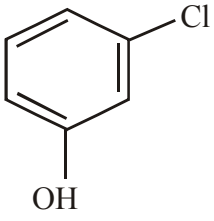
निम्नलिखित अभिक्रिया क्रम में सही A, B तथा C की पहिचान कीजिए।



(1) A =  , B =  , C = 

(2) A =  , B =  , C = 

(3) A =  , B =  , C = 

(4) A =  , B =  , C = 

Question ID : 86435121295

Option 1 ID : 86435170481

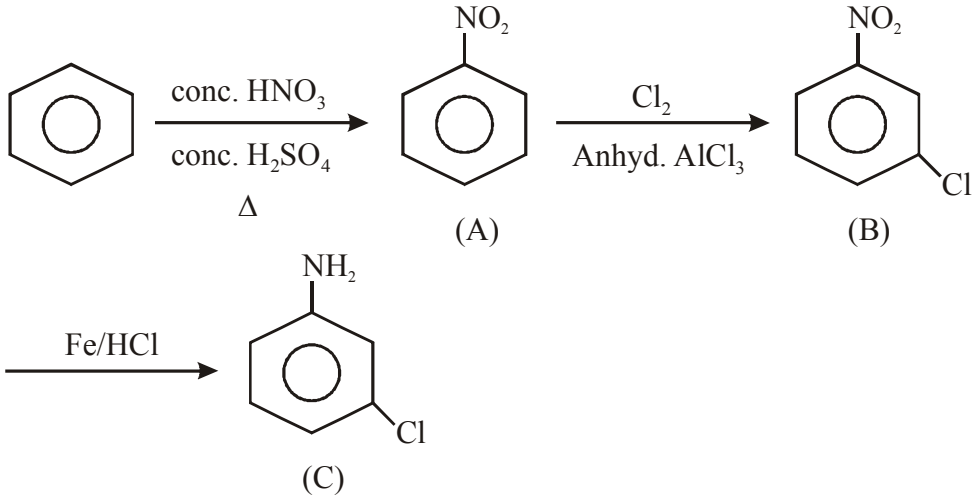
Option 2 ID : 86435170484

Option 3 ID : 86435170482

Option 4 ID : 86435170483

Ans. Official Answer NTA (1)

Sol.



5. The incorrect expression among the following is :

(1) $\frac{\Delta G_{system}}{\Delta S_{Total}} = -T$ (at constant P)

(2) For isothermal process $w_{reversible} = -nRT \ln \frac{V_f}{V_i}$

(3) $K = e^{-\Delta G°/RT}$

(4) $\ln K = \frac{\Delta H° - T\Delta S°}{RT}$

निम्नलिखित में से गलत व्यंजक है।

(1) $\frac{\Delta G_{system}}{\Delta S_{Total}} = -T$ (स्थिर P पर)

(2) समतापीय प्रक्रम $w_{reversible} = -nRT \ln \frac{V_f}{V_i}$ के लिए

(3) $K = e^{-\Delta G°/RT}$

(4) $\ln K = \frac{\Delta H° - T\Delta S°}{RT}$

Question ID : 86435121280
Option 1 ID : 86435170421
Option 2 ID : 86435170422
Option 3 ID : 86435170424
Option 4 ID : 86435170423

Ans. Official Answer NTA (4)

Sol. $\Delta G = \Delta G^\circ + RT\ \ell nQ$ at equilibrium $Q = K_{eq}$ and $\Delta G = 0$

$\Delta G^\circ = -RT\ \ell nK_{eq}$ and $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$

$\Delta H^\circ - T\Delta S^\circ = -RT\ \ell nK_{eq}$

So, $\ell nK_{eq} = -\dfrac{(\Delta H^\circ - T\Delta S^\circ)}{RT} = \left(\dfrac{-\Delta H^\circ + T\Delta S^\circ}{RT}\right)$

6. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as **Reason (R)**.

Assertion (A) : Lithium salts are hydrarted.

Reason (R) : Lithium has higher polarising power than other alkali metal group members.

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

(1) (A) is not correct but (R) is correct

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

(3) Both (A) and (R) are correct and (R) is the correct explanation of (A).

(4) (A) is correct but (R) is not correct.

नीचे दो कथन दिए हैं, एक को अभिकथन (A) नाम दिया है तथा दूसरे को कारण **(R)** दिया है।

अभिकथन (A) : लीथियम के साल्ट जलंयोजित होते हैं।

कारण (R) : अन्य क्षार धातु ग्रुप के सदस्यों की अपेक्षा लीथियम की ध्रुवण क्षमता उच्च होती है।

उपरोक्त कथनों के सम्बन्ध में नीचे दिए गये विकल्पों में से सर्वाधिक उचित उत्तर चुनिए।

(1) (A) सही नहीं है परन्तु (R) सही है

(2) (A) तथा (R) दोनों सही है परन्तु (R) सही व्याख्या नहीं है (A) की

(3) (A) तथा (R) दोनों सही हैं, तथा (R) सही व्याख्या है (A) की

(4) (A) सही है परन्तु (R) सही नहीं है

Question ID : 86435121284
Option 1 ID : 86435170440
Option 2 ID : 86435170438

Option 3 ID : 86435170437

Option 4 ID : 86435170439

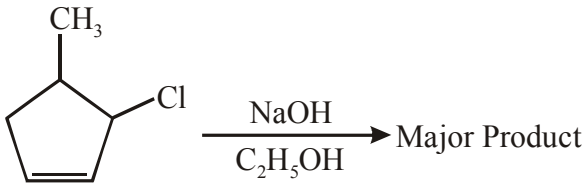
Ans. Official Answer NTA (2)

Sol. Li salts are hydrated Ex: $LiCl.6H_2O$

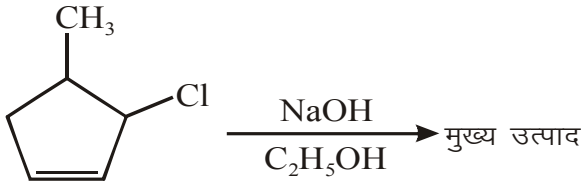
Because Li has maximum positive charge density among alkali metals.

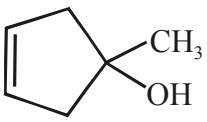
Polarization power $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$

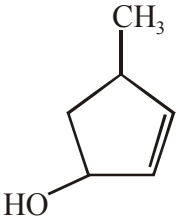
7. The major product of the following reaction is :

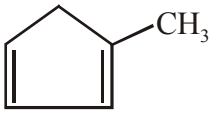


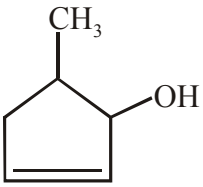
निम्नलिखित अभिक्रिया का मुख्य उत्पाद है :



(1) 

(2) 

(3) 

(4) 

Question ID : 86435121290

Option 1 ID : 86435170461

Option 2 ID : 86435170464

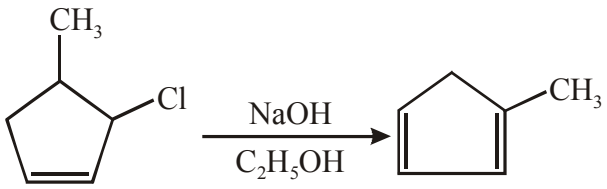
Option 3 ID : 86435170462

Option 4 ID : 86435170463

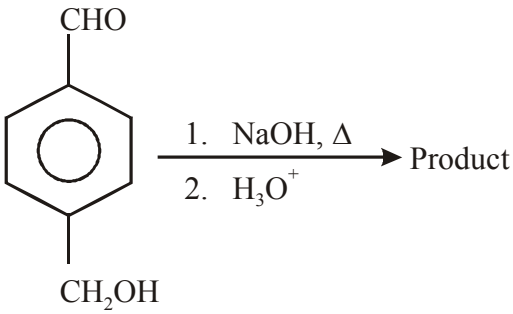
Ans. Official Answer NTA (4)

Answer by Matrix (3)

Sol.



8. For the reaction given below :



The compound which is not formed as a product in the reaction is a :

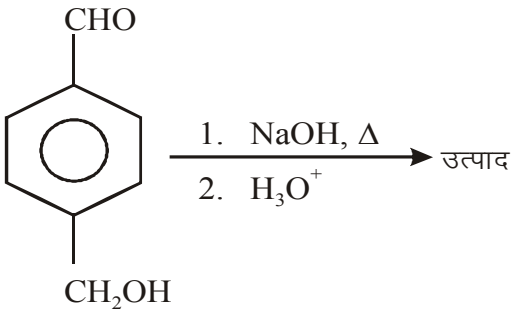
(1) Monocarboxylic acid

(2) Diol

(3) Compound with both alcohol and acid functional groups

(4) Dicarboxylic acid

नीचे दी गयी अभिक्रिया के लिए :



यौगिक जिसका अभिक्रिया में उत्पाद के रूप में विरचन नहीं होता है, वह है :

(1) मोनोकार्बोक्सिलिक अम्ल

(2) डाइऑल

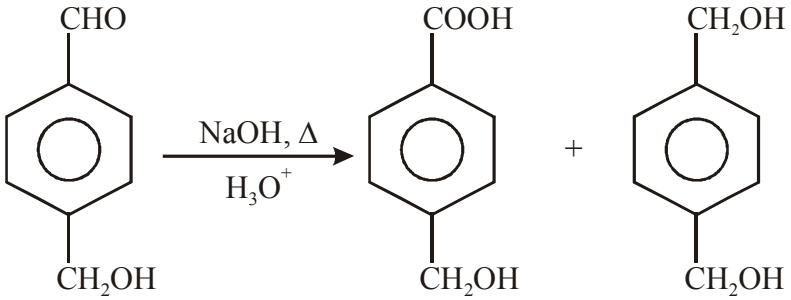
(3) दो, क्रियात्मक ग्रुप ऐल्कोहॉल तथा ऐसिड सहित यौगिक

(4) डाइकार्बोक्सिलिक अम्ल

Question ID : 86435121293
Option 1 ID : 86435170476
Option 2 ID : 86435170473
Option 3 ID : 86435170475
Option 4 ID : 86435170474

Ans. Official Answer NTA (4)

Sol. It is an example of Cannizzaro reaction.



9. In which one of the following sets all species show disproportionation reaction ?

निम्नलिखित सेटों में से किस एक में सभी सदस्य (स्पीशीज) असमानुपातन अभिक्रिया दर्शाते हैं।

(1) MnO_4^-, ClO_2^-, Cl_2 and Mn^{3+}

(2) $Cr_2O_7^{2-}$, MnO_4^-, ClO_2^- and Cl_2

(3) ClO_2^-, F_2, MnO_4^- and $Cr_2O_7^{2-}$

(4) ClO_4^-, MnO_4^-, ClO_2^- and F_2

Question ID : 86435121287
Option 1 ID : 86435170452
Option 2 ID : 86435170450
Option 3 ID : 86435170449
Option 4 ID : 86435170451

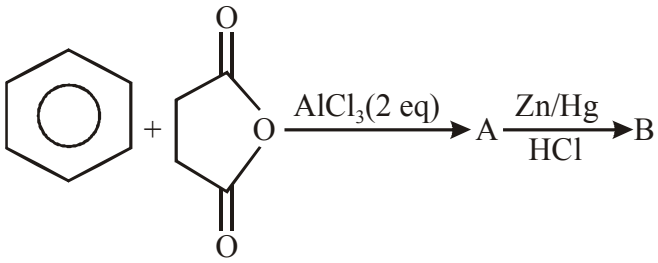
Ans. Official Answer NTA (1)

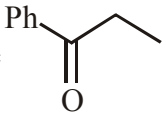
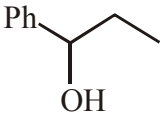
Answer by Matrix (Bonus) Because no option is correct.

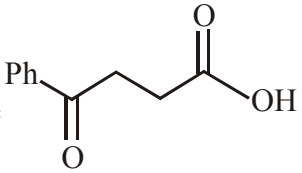
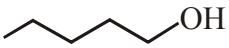
Sol. Disproportionation reactions are a special type of redox reactions. One of the reactants in a disproportionation reaction always contains an element that can exist in at least three oxidation states. The element of reacting species is in intermediate oxidation state and simultaneously gets oxidised and reduced. MnO_4^- do not shows disproportionation reaction.

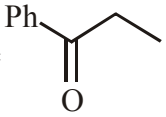
10. The structures of A and B formed in the following reaction are : [Ph = $-C_6H_5$]

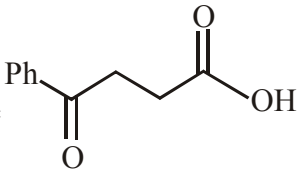
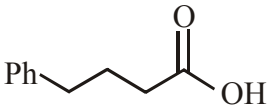
निम्नलिखित अभिक्रिया में उत्पन्न A तथा B की सरंचानायें हैं। [Ph = $-C_6H_5$]



(1) A =  , B = 

(2) A =  , B = Ph 

(3) A =  , B = 

(4) A =  , B = 

Question ID : 86435121294

Option 1 ID : 86435170479

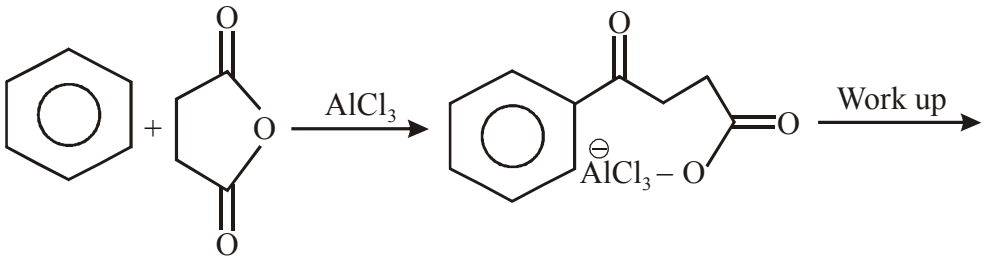
Option 2 ID : 86435170478

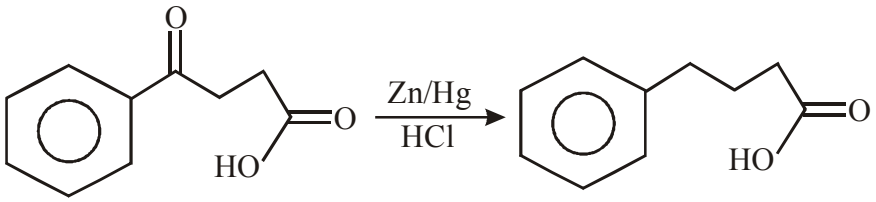
Option 3 ID : 86435170480

Option 4 ID : 86435170477

Ans. Official Answer NTA (4)

Sol.





(A) (B)

11. The deposition of X and Y on ground surfaces is referred as wet and dry depositions, respectively, X and Y are :

(1) X = CO_2 , Y = SO_2

(2) X = Ammonium salts , Y = SO_2

(3) X = SO_2 , Y = Ammonium salts

(4) X = Ammonium salts , Y = CO_2

भूमि सतह पर X तथा Y के निक्षेपण को क्रमशः नम तथा शुष्क निक्षेपण कहते हैं। X तथा Y हैं।

(1) X = CO_2 , Y = SO_2

(2) X = अमोनियम साल्ट , Y = SO_2

(3) X = SO_2 , Y = अमोनियम साल्ट

(4) X = अमोनियम साल्ट , Y = CO_2

Question ID : 86435121289

Option 1 ID : 86435170458

Option 2 ID : 86435170457

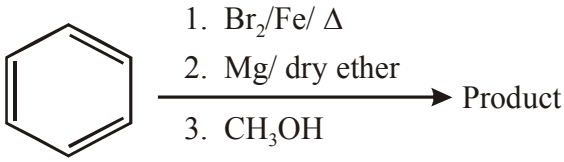
Option 3 ID : 86435170459

Option 4 ID : 86435170460

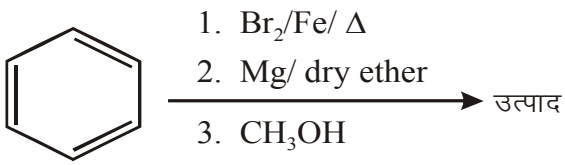
Ans. Official Answer NTA (2)

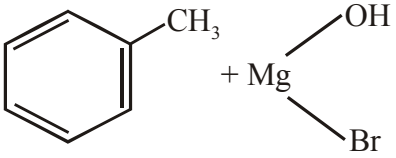
Sol. Ammonium salt in rain drop result in wet deposition. Oxides of Nitrogen and sulphur settle down on ground as dry deposition.

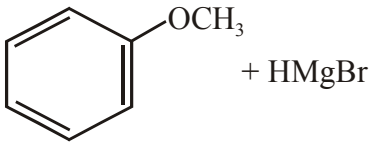
12. For the following sequence of reactions, the correct products are :

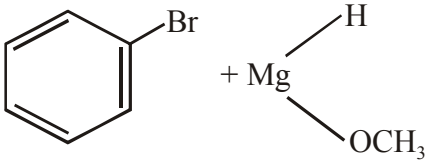


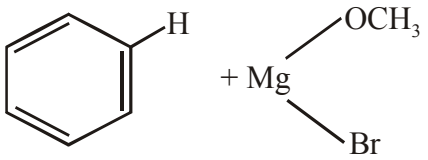
अभिक्रियाओं के निम्नलिखित क्रम के लिए सही उत्पाद है :



(1) 

(2) 

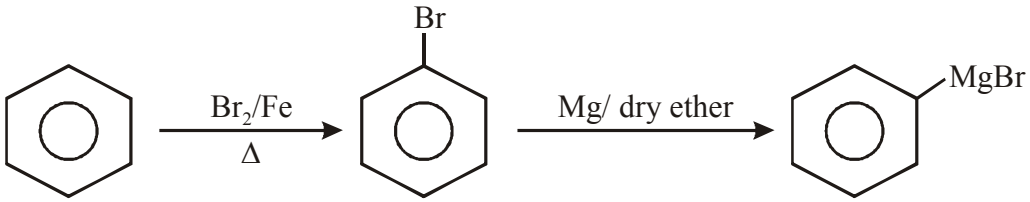
(3) 

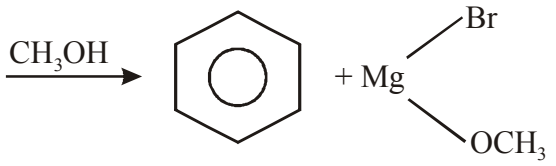
(4) 

Question ID : 86435121292
Option 1 ID : 86435170471
Option 2 ID : 86435170470
Option 3 ID : 86435170472
Option 4 ID : 86435170469

Ans. Official Answer NTA (4)

Sol.





13. Match List - I with List - II :

List - I (Parameter)	List - II (Unit)
(a) Cell constant	(i) $S\ cm^2\ mol^{-1}$
(b) Molar conductivity	(ii) Dimensionless
(c) Conductivity	(iii) m^{-1}
(d) Degree of dissociation of electrolyte	(iv) $\Omega^{-1}\ m^{-1}$

Choose the most appropriate answer from the options given below :

लिस्ट - I का लिस्ट - II से मिलान कीजिए :

लिस्ट - I (पैरामीटर)	लिस्ट - II (इकाई)
(a) सेल स्थिरांक	(i) $S\ cm^2\ mol^{-1}$
(b) मोलर चालकता	(ii) विमाहीन
(c) चालकता	(iii) m^{-1}
(d) वैद्युत अपघट्य की वियोजन डिग्री	(iv) $\Omega^{-1}\ m^{-1}$

नीचे दिये विकल्पों में से सहीं उत्तर चुनिए।

(1) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)

(2) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

(3) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

(4) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

Question ID : 86435121281
Option 1 ID : 86435170427
Option 2 ID : 86435170425
Option 3 ID : 86435170428
Option 4 ID : 86435170426

Ans. Official Answer NTA (4)

Sol. Cell constant $= \frac{\ell}{A} = m^{-1}$

Conductivity $k = \frac{1}{\rho} = \frac{\ell}{RA} = \Omega^{-1}m^{-1}$

Molar Conductivity = $\lambda_m = \frac{k \times 1000}{\text{Molarity}} = cm^2\ mole^{-1}$

Degree of dissociation = Number of mole dissociated out of one mole

31 Aug EveningMCQ 14 Chemical Bonding-1 Inorganic Chemistry 14

14. The number of S = O bonds present in sulphurous acid, peroxodisulphuric acid and pyrosulphuric acid, respectively are :

(1) 1, 4 and 4 (2) 2, 4 and 3

(3) 2, 3 and 4 (4) 1, 4 and 3

सल्फ्यूरस अम्ल, परआक्सोडाइसल्फ्यूरिक अम्ल तथा पाइरोसल्फ्यूरिक अम्ल में उपस्थित S = O आबन्धों की संख्या क्रमशः है:

(1) 1, 4 तथा 4 (2) 2, 4 तथा 3

(3) 2, 3 तथा 4 (4) 1, 4 तथा 3

Question ID : 86435121285

Option 1 ID : 86435170442

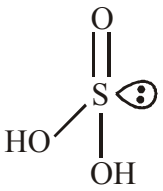
Option 2 ID : 86435170441

Option 3 ID : 86435170444

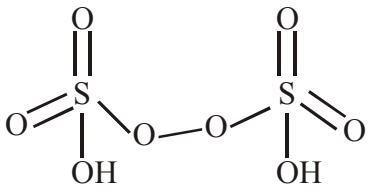
Option 4 ID : 86435170443

Ans. Official Answer NTA (1)

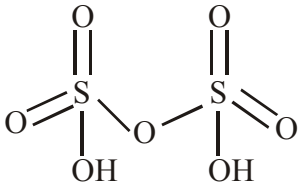
Sol. Sulphurous acid (H_2SO_3)



Peroxodisulphuric acid ($H_2S_2O_8$)



Pyrosulphuric acid ($H_2S_2O_7$)



31 Aug EveningMCQ 15 p-Block Elements Inorganic Chemistry21

15. Which one of the following correctly represents the order of stability of oxides, X_2O; (X = halogen)?
आक्साइडों X_2O; (X = हैलोजन) की स्थिरता का सही क्रम, निम्नलिखित में से कौन–सा एक सही रूप से निरूपित करता है?

(1) Br > I > Cl (2) Br > Cl > I

(3) Cl > I > Br (4) I > Cl > Br

Question ID : 86435121282
Option 1 ID : 86435170432
Option 2 ID : 86435170431
Option 3 ID : 86435170430
Option 4 ID : 86435170429

Ans. Official Answer NTA (4)

Sol. A combination of kinetic and thermodynamic factors lead to the generally decreasing order of stability of oxides formed by halogens, I > Cl > Br. The higher oxide of halogen tend to be more stable than lower one.

16. Spin only magnetic moment in BM of $[Fe(CO)_4(C_2O_4)]^+$ is :
$[Fe(CO)_4(C_2O_4)]^+$ के चुम्बकीय आघूर्ण का केवल स्पिन मान BM में है :

(1) 0 (2) 1

(3) 1.73 (4) 5.92

Question ID : 86435121288
Option 1 ID : 86435170456
Option 2 ID : 86435170453
Option 3 ID : 86435170454
Option 4 ID : 86435170455

Ans. Official Answer NTA (3)

Sol. $[Fe(CO)_4(C_2O_4)]^+$

oxidation state of iron in the given compound is

$X + 0 - 2 = +1$

$x = +3$

$Fe(26) = [Ar]\ 4s^2 3d^6$

$Fe^{3+} = [Ar]3d^5$

It is a low spin complex because of four strong CO ligand. So number of unpaired electron is 1.

$\mu = \sqrt{n(n+2)}$

$= \sqrt{1(1+2)}$

$= \sqrt{3} = 1.73$ B.M.

17. Which one of the following statements is incorrect ?

(1) Bond dissociation enthalpy of H_2 is highest among diatomic gaseous molecules which contain a single bond.

(2) Atomic hydrogen is produced when H_2 molecules at a high temperature are irradiated with UV radiation.

(3) Dihydrogen is produced on reacting zinc with HCl as well as $NaOH_{(aq)}$.

(4) At around 2000 K, the dissociation of dihydrogen into its atoms is nearly 8.1%.

निम्नलिखित कथनों में से कौन–सा एक गलत है?

(1) द्विपरमाणुक गैसीय अणुओं, जिसमें एकल आबन्ध है, में H_2 की आबन्ध वियोजन एन्थैल्पी उच्चतम है।

(2) H_2 के अणुओं का उच्च ताप पर पराबैंगनी विकिरणों से किरणन करने पर परमाण्विक हाइड्रोजन उत्पन्न होती है।

(3) जिन्क पर HCl तथा $NaOH_{(aq)}$ दोनों की अलग–अलग अभिक्रिया से हाइहाइड्रोजन उत्पन्न होता है।

(4) 2000 K के आस–पास डाइहाइड्रोजन का उसके परमाणुओं में वियोजन लगभग 8.1% होता है।

Question ID : 86435121283
Option 1 ID : 86435170433
Option 2 ID : 86435170436
Option 3 ID : 86435170435
Option 4 ID : 86435170434

Ans. Official Answer NTA (4)

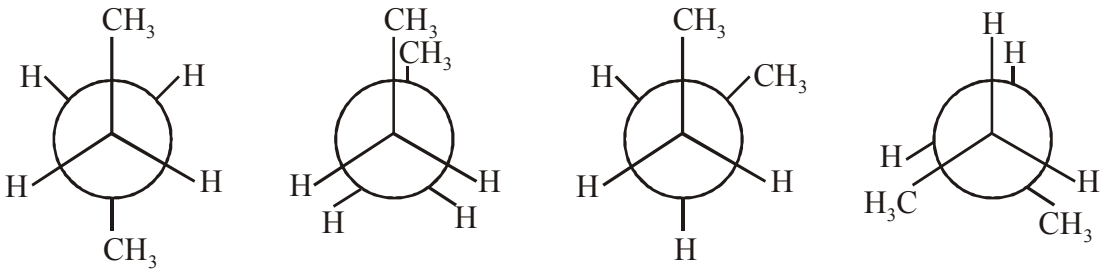
Sol. The H-H bond dissociation enthalpy is the highest for a single bond between two atoms of any element. It is because of this factor that the dissociation of dihydrogen into its atoms is only ~0.081% around 2000 K. The atomic hydrogen is produced at a high temperature in an electric arc or under ultraviolet radiations.

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

18. Arrange the following conformational isomers of n-butane in order of their increasing potential energy:

n-ब्यूटेन के निम्नलिखित संरूपीय समावयवों को जिसमें उनकी बढ़ती स्थितिज ऊर्जा के सही क्रम में व्यवस्थित किया है, वह है :



I II III IV

(1) I < III < IV < II

(2) I < IV < III < II

(3) II < IV < III < I

(4) II < III < IV < I

Question ID : 86435121291

Option 1 ID : 86435170467

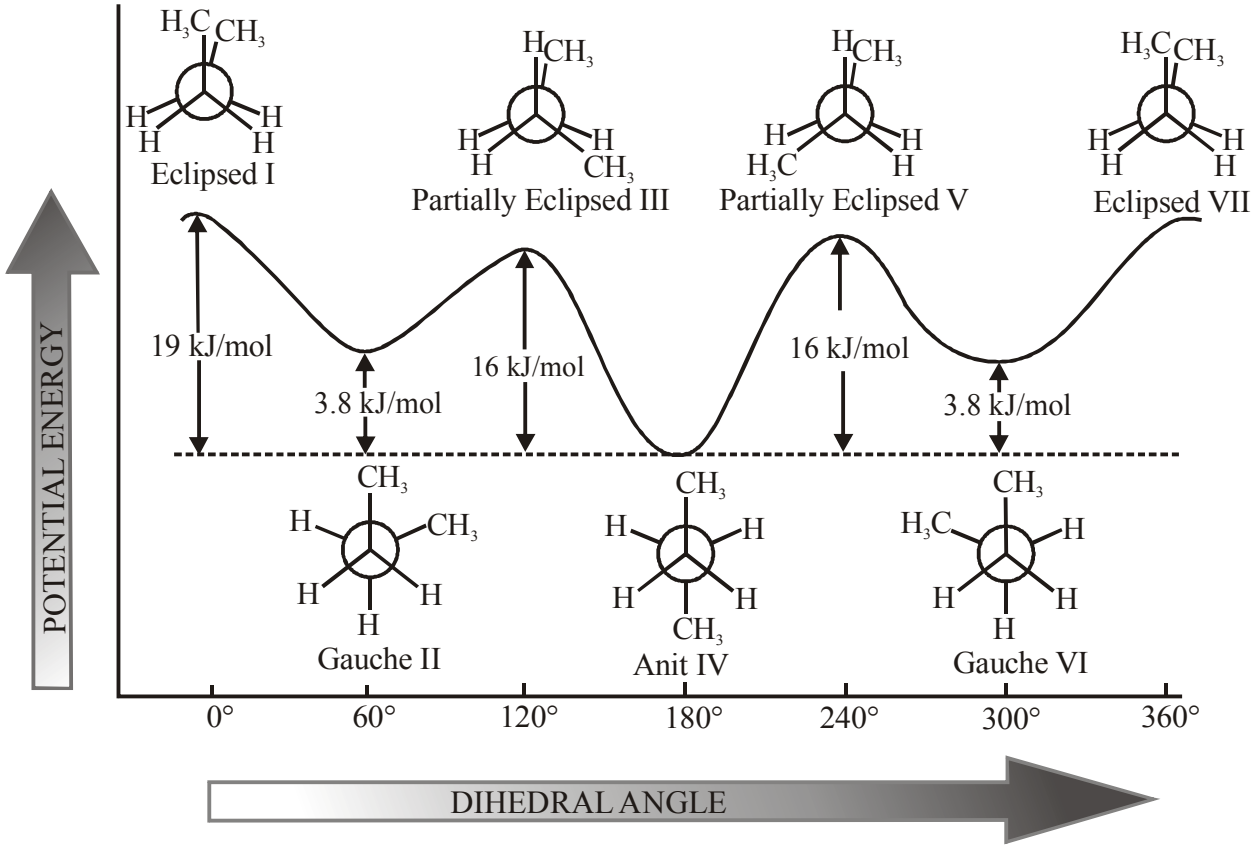
Option 2 ID : 86435170465

Option 3 ID : 86435170468

Option 4 ID : 86435170466

Ans. Official Answer NTA (1)

Sol. **Potential Energy Diagram**



19. Which of the following is NOT an example of fibrous protein ?

(1) Collagen

(2) Albumin

(3) Keratin

(4) Myosin

निम्नलिखित में से कौन–सा रेशेदार प्रोटीन का उदाहरण नहीं है?

(1) कोलैजन

(2) ऐल्बूमिन

(3) किरेटिन

(4) मायोसिन

Question ID : 86435121298

Option 1 ID : 86435170496

Option 2 ID : 86435170494

Option 3 ID : 86435170493

Option 4 ID : 86435170495

Ans. Official Answer NTA (2)

Sol. Albumin is an example of Globular proteins while collagen, keratin and myosin are common examples of Fibrous proteins.

20. Match List - I with List - II :

List - I (Metal Ion)	**List - II (Group in Qualitative analysis)**
(a) Mn^{2+}	(i) Group - III
(b) As^{3+}	(ii) Group - IIA
(c) Cu^{2+}	(iii)Group - IV
(d) Al^{3+}	(iv)Group - IIB

Choose the most appropriate answer from the options given below :

लिस्ट - I का लिस्ट - II से मिलान कीजिए :

लिस्ट - I (धातु आयन)	**लिस्ट - II (गुणात्मक विश्लेषण का ग्रुप)**
(a) Mn^{2+}	(i) ग्रुप - III
(b) As^{3+}	(ii) ग्रुप - IIA
(c) Cu^{2+}	(iii) ग्रुप - IV
(d) Al^{3+}	(iv) ग्रुप - IIB

नीचे दिए गये विकल्पों में से सर्वाधिक सही उत्तर चुनिए :

(1) (a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)

(2) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)

(3) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

(4) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

Question ID : 86435121299
Option 1 ID : 86435170500
Option 2 ID : 86435170499
Option 3 ID : 86435170497
Option 4 ID : 86435170498

Ans. Official Answer NTA (2)

Sol.

Metal ion	Group in qualitative analysis
Mn^{2+}	Group-IV
As^{3+}	Group-IIB
Cu^{2+}	Group-IIA
Al^{3+}	Group-III

SECTION - B

1. The empirical formula for a compound with a cubic close packed arrangement of anions and with cations occupying all the octahedral sites in A_xB. The value of x is _____.

एक यौगिक जिसमें ऋणायन घनीय निविड संकुलित व्यवस्था में है और सभी अष्टफलकीय स्थल धनायन से अध्यासित है, के लिए मूलानुपाती सूत्र A_xB है। x का मान है _____।

Question ID : 86435121301

Ans. Official Answer NTA (1)

Sol. In A_xB
Effective number of B atoms = 4 (in CCP)
Effective number of A atoms = 4 (all O.V.)
So formula of the compound = A_4B_4 = AB
So x = 1

2. In the electrolytic refining of blister copper, the total number of main impurities, from the following removed as anode mud is _____.

Pb, Sb, Se, Te, Ru, Ag, Au and Pt

ब्लिस्टर कापर के वैद्युत अपघटनी शोधन में, निम्नलिखित में से मुख्य अशुद्धियों की कुल संख्या जो एनोड पंक के रूप में पृथक हो जाती है, वह है _____.

Pb, Sb, Se, Te, Ru, Ag, Au and Pt

Question ID : 86435121308

Ans. Official Answer NTA (6)

Sol. Impurities from the blister copper deposit as anode mud which contains **antimony, selenium, tellurium, silver, gold and platinum.**

3. Sodium oxide reacts with water to produce sodium hydroxide. 200 g of sodium oxide is dissolved in 500 mL of water. Neglecting the change in volume, the concentration of the resulting NaOH solution is _____ $\times 10^{-1}$ M.

[Atomic mas : Na = 23.0, O = 16.0, H = 1.0]

सोडियम ऑक्साइड जल से अभिक्रिया करके सोडियम हाइड्रोक्साइड उत्पन्न करता है। 200 g सोडियम ऑक्सांइड को 500 mL जल में घोला गया है। आयतन में परिवर्तन को नगण्य कर, परिणाम स्वरूप प्राप्त NaOH विलयन की सान्द्रता है _____ $\times 10^{-1}$ M।

[परमाण्विक संहति : Na = 23.0, O = 16.0, H = 1.0]

Question ID : 86435121300

Ans. Official Answer NTA (13)

Sol. $Na_2O + H_2O \rightarrow 2NaOH$

According to reaction $\frac{200}{62}$ mole of Na_2O gives $\frac{400}{62}$ mole of NaOH

So molarity of NaOH solution is $= \frac{n_{NaOH}}{V_{ml}} \times 1000 = \frac{400}{62} \times \frac{1000}{500} = \frac{800}{62} = 12.9M \approx 13M$

4. The pH of a solution obtained by mixing 50 mL of 1 M HCl and 30 mL of 1 M NaOH is $x \times 10^{-4}$. The value of x is _____.

[log 2.5 = 0.3979]

1 M HCl के 50 mL को 1 M NaOH के 30 mL के साथ मिश्रित करने पर बने विलयन की pH, $x \times 10^{-4}$ है। x का मान है _____।

[log 2.5 = 0.3979]

Question ID : 86435121305

Ans. Official Answer NTA (6021)

Sol. Milli equivalents of HCl (N_aV_a) = $50 \times 1 = 50$
Milli equivalents of NaOH (N_bV_b) = $30 \times 1 = 30$
Since $N_aV_a > N_bV_b$

$$\left[H^+\right] = \frac{N_aV_a - N_bV_b}{V_a + V_b} = \frac{50-30}{80} = \frac{20}{80} = 0.25 = 2.5 \times 10^{-1}$$

$pH = -\log[H^+] = -\log(2.5 \times 10^{-1}) = 1 - 0.3979 = 0.6021$
$pH \times 10^4 = 0.6021 \times 10^4 = 6021$

5. According to molecular orbital theory, the number of unpaired electron(s) in O_2^{2-} is _____.

आण्विक आर्बिटल सिद्धान्त के अनुसार O_2^{2-} आयन में अयुग्मित इलेक्ट्रानों की संख्या है _____।

Question ID : 86435121303

Ans. Official Answer NTA (0)

Sol. Electronic configuration of O_2^{2-} (according to MOT) is

$$\sigma ls^2, \sigma^* ls^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_x^2, \begin{cases} \pi 2p_y^2, \\ \pi 2p_z^2, \end{cases} \begin{cases} \pi^* 2p_y^2, \\ \pi^* 2p_z^2 \end{cases} \sigma^* 2p_x$$

Total unpaired electron in O_2^{2-} is zero.

6. CH_4 is adsorbed on 1 g charcoal at 0°C following the Freundlich adsorption isotherm. 10.0 mL of CH_4 is adsorbed at 100 mm of Hg, whereas 15.0 mL is adsorbed at 200 mm of Hg. The volume of CH_4 adsorbed at 300 mm of Hg is 10^x mL. The value of x is _____ $\times 10^{-2}$.

[Use $\log_{10}2 = 0.3010$, $\log_{10}3 = 0.4771$]

0°C पर CH_4 का 1 g चारकोल पर अधिशोषण, फ्रायन्डलिक अधिशोषण समतापी का अनुसरण करता है। 100 mm of Hg पर 10.0 mL CH_4 अधिशोषित हो जाती है, जबकि 200 mm Hg पर 15.0 mL अधिशोषित होती है। 300 mm Hg पर CH_4 के अधिशोषित आयतन का मान 10^x mL है। x का मान है _____ $\times 10^{-2}$।

[उपयोग कीजिए : $\log_{10}2 = 0.3010$, $\log_{10}3 = 0.4771$]

Question ID : 86435121307

Ans. Official Answer NTA (128)

Sol. $\frac{x}{m} = Kp^{\frac{1}{n}}$

$\frac{10}{1} = K(100)^{\frac{1}{n}}$ ..... (1)

$\frac{15}{1} = K(200)^{\frac{1}{n}}$ ..... (2)

$\frac{V}{1} = K(300)^{\frac{1}{n}}$ ..... (3)

Divide (2) to (1) = $\frac{15}{10} = 2^{\frac{1}{n}}$

$$\log\left(\frac{3}{2}\right)=\frac{1}{n}\log 2$$

$$\frac{1}{n}=\frac{0.4771-0.3010}{0.3010}=0.585$$

Divide (3) to (1) = $\frac{V}{10}=3^{\frac{1}{n}}$

$$\log\left(\frac{V}{10}\right)=\frac{1}{n}\log 3$$

$$\log\left(\frac{V}{10}\right)=0.585\times 0.4771=0.2791$$

$$\frac{V}{10}=10^{0.2791}$$

$V= 10 \times 10^{0.2791} = 10^{1.2791} = 10^x$

$x = 1.2791 = 127.91 \times 10^{-2} \approx 128 \times 10^{-2}$

7. The value of magnetic quantum number of the outermost electron of Zn^+ ion is _____.

Zn^+ आयन के बाह्यतम इलेक्ट्रॉन के लिए चुम्बकीय क्वान्टम संख्या का मान है _____।

Question ID : 86435121302

Ans. Official Answer NTA (0)

Sol. $Zn(30) = [Ar]4s^2 3d^{10}$

$Zn^+ = [Ar]4s^1 3d^{10}$

Outermost electron is present in 4s

$n = 4 \qquad l = 0 \qquad m_l = 0$

8. The transformation occurring in Duma's method is given below

$$C_2H_7N+\left(2x+\frac{y}{2}\right)CuO\rightarrow x\,CO_2+\frac{y}{2}H_2O+\frac{z}{2}N_2+\left(2x+\frac{y}{2}\right)Cu$$

The value of y is _____.

ड्यूमा विधि में होने वाला रूपांतरण नीचे दिया है :

$$C_2H_7N+\left(2x+\frac{y}{2}\right)CuO\rightarrow x\,CO_2+\frac{y}{2}H_2O+\frac{z}{2}N_2+\left(2x+\frac{y}{2}\right)Cu$$

y का मान है _____।

Question ID : 86435121309

Ans. Official Answer NTA (7)

Sol. The balanced chemical equation

$$C_2H_7N + \frac{15}{2}CuO \longrightarrow 2CO_2 + \frac{7}{2}H_2O + \frac{1}{2}N_2 + \frac{15}{2}Cu$$

$\because x = 2$

and $2x + \frac{y}{2} = \frac{15}{2}$

$4 + \frac{y}{2} = \frac{15}{2}$

$\frac{y}{2} = \frac{15}{2} - 4 = \frac{7}{2}$

$y = 7$

9. For the reaction $A \rightarrow B$, the rate constant k (in s^{-1}) is given by

$$\log_{10} k = 20.35 - \frac{(2.47\times10^3)}{T}$$

The energy of activation in kJ mol^{-1} is _____.

[Given : R = 8.314 J K^{-1} mol^{-1}]

अभिक्रिया $A \rightarrow B$ के लिए वेग स्थिरांक k (s^{-1} में) को

$$\log_{10} k = 20.35 - \frac{(2.47\times10^3)}{T}$$

सक्रियण ऊर्जा kJ mol^{-1} में है _____।

[दिया है : R = 8.314 J K^{-1} mol^{-1}]

Question ID : 86435121306

Ans. Official Answer NTA (47)

Sol. $\log_{10} K = 20.35 - \frac{\left(2.47\times10^3\right)}{T}$ ..... (i)

$\log K = \log A - \frac{E_a}{2.303RT}$ ..... (ii)

Comparing (i) and (ii),

$\frac{E_a}{2.303RT} = \frac{2.47\times10^3}{T}$

$E_a = 2.47 \times 10^3 \times 2.303 \times 8.314$
$= 47293.44 \text{ J mol}^{-1}$
$= 47.29344 \text{ kJ mol}^{-1}$

10. 1.22 g of an organic acid is separately dissolved in 100 g of benzene ($K_b = 2.6 \text{ K kg mol}^{-1}$) and 100 g of acetone ($K_b = 1.7 \text{ K kg mol}^{-1}$). The acid is known to dimerize in benzene but remain as a monomer in acetone. The boiling point of the solution in acetone increases by 0.17°C. The increase in boiling point of solution in benzene in °C is $x \times 10^{-2}$. The value of x is _____.

[Atomic mass : C = 12.0, H = 1.0, O = 16.0]

एक कार्बनिक अम्ल के 1.22 g को 100 g बेन्जीन ($K_b = 2.6 \text{ K kg mol}^{-1}$) तथा 100 g ऐसीटोन ($K_b = 1.7 \text{ K kg mol}^{-1}$). में अलग–अलग घोला गया है। अम्ल का बेन्जीन में द्वितयन ज्ञात है, परन्तु ऐसीटोन में यह एकलक रहता है। ऐसीटोन में बने विलयन का क्वथनांक 0.17°C बढ़ जाता है। बेन्जीन में बने विलयन के क्वथनांक में बढ़त, °C में, $x \times 10^{-2}$ है। x का मान है _____।

[परमाण्विक संहति : C = 12.0, H = 1.0, O = 16.0]

Question ID : 86435121304

Ans. Official Answer NTA (13)

Sol. K_b (benzene) $= 2.6 \text{ K kg mol}^{-1}$
K_b (acetone) $= 1.7 \text{ K kg mol}^{-1}$
In acetone

$$0.17 = \frac{1 \times 1.7 \times 1.22 \times 1000}{M \times 100}$$

M = 122 g/mol
In benzene

$$\Delta T_b = \frac{1}{2} \times \frac{1.22}{122} \times 2.6 \times 10$$
$$= 0.13 \text{ °C}$$
$$= 13 \times 10^{-2} \text{ °C}$$