



**JEE
MAIN
FEB.
2021**

**24th Feb. 2021 | Shift - 1
CHEMISTRY**

JEE | NEET | Foundation

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SELECTIONS SINCE 2007

SECTION - A**Topic- Chemistry in every day life****Subtopic-****Level- M**

1. The gas released during anaerobic degradation of vegetation may lead to:

- (1) Global warming and cancer (2) Acid rain
(3) Corrosion of metals (4) Ozone hole

वनस्पति के अवायवीय अपघटन में निकलने वाली गैस कारण बन सकती है:

- (1) भूमंडलीय ताप वृद्धि तथा कैंसर का (2) अम्ल-वर्षा का
(3) धातुओं के संक्षारण का (4) ओजोन छेद का

Ans. (1)

Sol. Biogas is the mixture of gases produced by the breakdown of organic matter in the absence of oxygen (anaerobically), primarily consisting of methane and carbon dioxide. Biogas can be produced from raw material such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or good waste. Due to release of CH₄ gas during anaerobic vegetative degradation which causes global warming and cancer.

Topic- Biomolecules**Subtopic- Test of protein****Level- M**

2. Out of the following, which type of interaction is responsible for the stabilisation α -helix structure of proteins?

- (1) Ionic bonding (2) Hydrogen bonding
(3) van der Waals forces (4) Covalent bonding

प्रोटीनों की α -हेलिक्स संरचना के स्थायित्व के लिए निम्नलिखित में से किस प्रकार की अनयोन्य क्रिया उत्तरदायी है ?

- (1) आयनिक आबंधन (2) हाइड्रोजन आबंधन
(3) वाडरवाल्स बल (4) ससंयोजक आबंधन

Ans. (2)

Sol. The α -helix is stabilized by hydrogen bond between the NH and CO group of the main chain.

Topic- Chemical bonding**Subtopic- Hybridization****Level- E**

3. Which of the following are isostructural pairs?

- (A) SO₄²⁻ and CrO₄²⁻ (B) SiCl₄ and TiCl₄
(C) NH₃ and NO₃⁻ (D) BCl₃ and BrCl₃

- (1) A and C only (2) A and B only (3) B and C only (4) C and D only

निम्नलिखित में से कौन से समसंरचनात्मक युग्म हैं ?

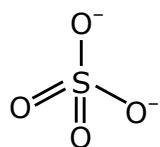
- (A) SO₄²⁻ तथा CrO₄²⁻ (B) SiCl₄ तथा TiCl₄ (C) NH₃ तथा NO₃⁻ (D) BCl₃ तथा BrCl₃
(1) A तथा C केवल (2) A तथा B केवल (3) B तथा C केवल (4) C तथा D केवल

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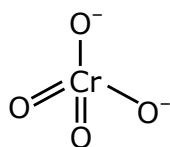
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Ans. (2)

Sol. (1) SO_4^{2-} and CrO_4^{2-} both have tetrahedral structure.

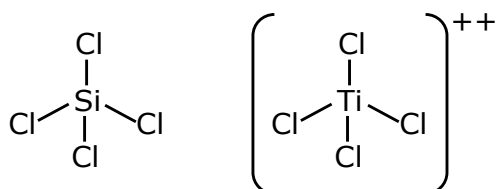


Tetrahedral



Tetrahedral

(2) SiCl_4 and TiCl_4 both have Tetrahedral structure also.



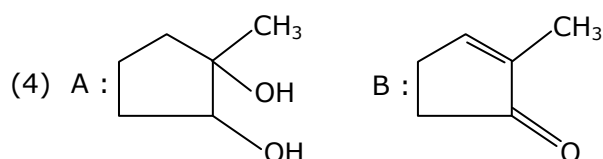
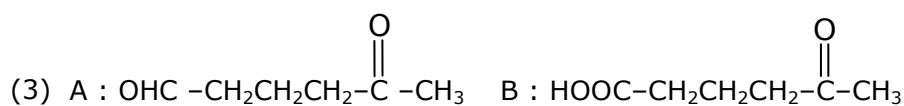
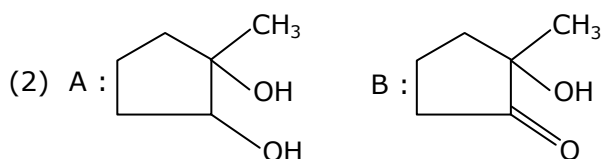
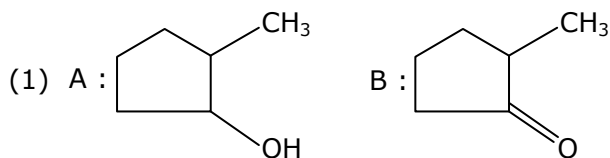
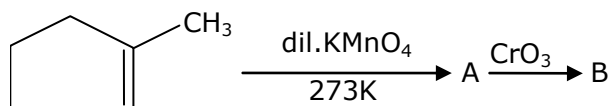
Topic- Carbonyl compound

Subtopic- Chemical reaction of carbonyl compound

Level- M

4. Identify products A and B.

उत्पाद A तथा B को पहिचानिए।

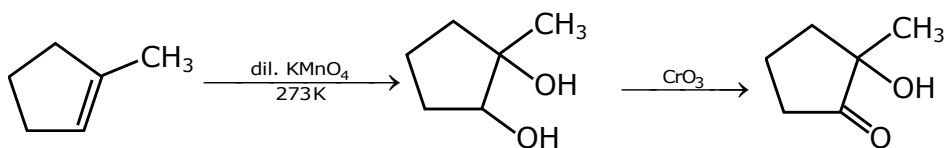


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Ans. (2)

Sol.

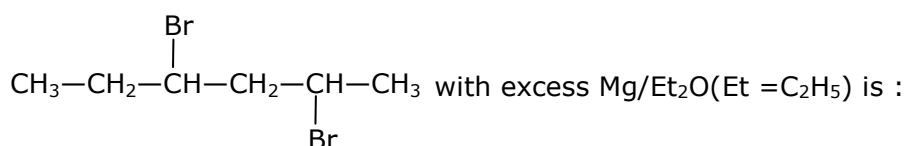


Topic- Alcohol Ether

Subtopic- Chemical reaction of alcohol

Level- M

5. The product formed in the first step of the reaction of



जब $\text{CH}_3-\text{CH}_2-\overset{\text{Br}}{\underset{|}{\text{CH}}}-\text{CH}_2-\overset{\text{Br}}{\underset{|}{\text{CH}}}-\text{CH}_3$, Mg/Et₂O के आधिक्य से अभिक्रिया करता है तब उस के प्रथम अभिक्रिया पद में निर्मित उत्पाद है (Et = C₂H₅):

- | | |
|---|---|
| (1) $\text{CH}_3-\text{CH}_2-\overset{\text{CH}_3}{\underset{ }{\text{CH}}}-\text{CH}_2-\overset{\text{CH}_3}{\underset{ }{\text{CH}}}-\text{CH}_2-\text{CH}_3$ | (2) $\text{CH}_3-\text{CH}_2-\overset{\text{CH}_3}{\underset{ }{\text{CH}}}-\text{CH}_2-\overset{\text{CH}_3}{\underset{ }{\text{CH}}}-\text{CH}_3$ |
| (3) $\text{CH}_3\text{CH}_2-\overset{\text{MgBr}}{\underset{ }{\text{CH}}}-\text{CH}_2-\overset{\text{MgBr}}{\underset{ }{\text{CH}}}-\text{CH}_3$ | (4) $\text{CH}_3-\text{CH} \begin{cases} \text{CH}_2 \\ \\ \text{CH}-\text{CH}_3 \end{cases}$ |

Ans. (3)



Topic- d-block

Subtopic- General propirities

Level-M

6. The electrode potential of M²⁺/M of 3d- series elements shows positive value for:
तत्वों की 3d श्रेणी के लिए M²⁺/M इलेक्ट्रोड विभव का मान जिसके लिए धनात्मक है, वह है :

- (1) Zn (2) Co (3) Fe (4) Cu

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Ans. (4)

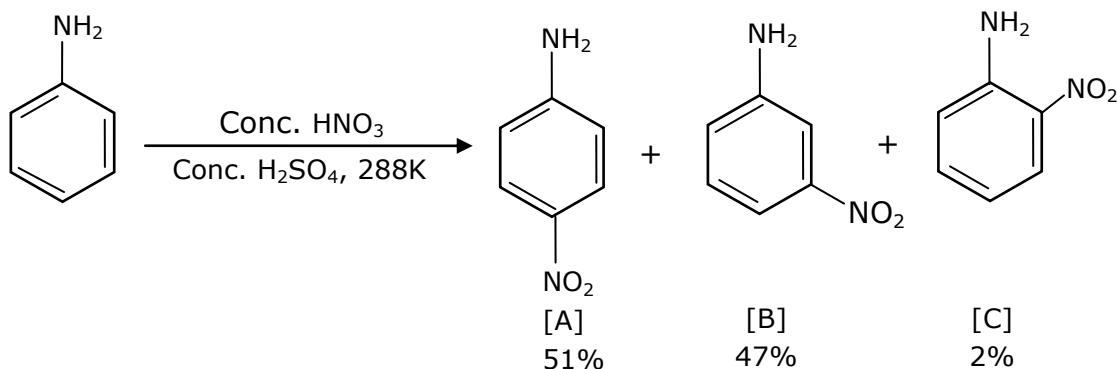
Sol. (A) Zn	-0.76
(B) CO	-0.28
(C) Fe	-0.44
(D) Cu	+0.34

Topic- Amine

Subtopic- Chemical reaction of amine

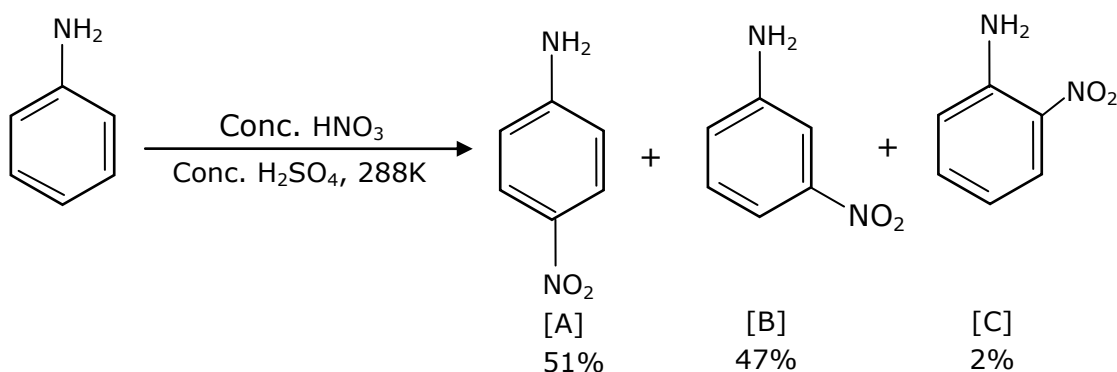
Level-M

7. In the following reaction the reason why meta-nitro product also formed is:



- (1) Formation of anilinium ion
- (2) $-\text{NO}_2$ substitution always takes place at meta-position
- (3) low temperature
- (4) $-\text{NH}_2$ group is highly meta-directive

निम्नलिखित अभिक्रिया में मेटा-नाइट्रो उत्पाद के भी बनने का कारण है :



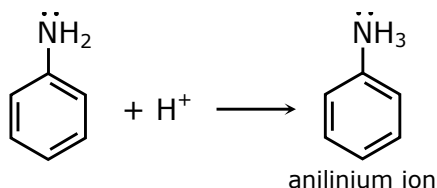
- (1) ऐनिलीनियम आयन का विरचन
- (2) $-\text{NO}_2$ प्रतिस्थापन सदा मेटा-स्थान पर ही होता है
- (3) कम तापमान
- (4) $-\text{NH}_2$ ग्रुप अत्यधिक मेटा-निर्देशक है

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Ans. (1)

Sol.



In acidic medium the $-NH_2$ group in aniline converts into anilinium ion which is meta directing.

Topic- Redox

Subtopic- Basics of easy

Level-M

8. (A) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$
 (B) $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2$

Choose the correct option.

- (1) H_2O_2 act as oxidizing and reducing agent respectively in equations (A) and (B).
 (2) H_2O_2 acts as oxidizing agent in equations (A) and (B).
 (3) H_2O_2 acts as reducing agent in equations (A) and (B).
 (4) H_2O_2 acts as reducing and oxidising agent respectively in equation (A) and (B).

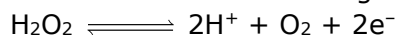
- (A) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$
 (B) $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2$

निम्नलिखित में से सही विकल्प चुनिए:

- (1) H_2O_2 समीकरण (A) तथा (B) में क्रमशः ऑक्सीकारक घटक तथा अपचायक घटक के रूप में कार्य करता है।
 (2) H_2O_2 समीकरण (A) तथा (B) में ऑक्सीकारक घटक के रूप में कार्य करता है।
 (3) H_2O_2 समीकरण (A) तथा (B) में ऑक्सीकारक घटक के रूप में कार्य करता है।
 (4) H_2O_2 समीकरण (A) तथा (B) में क्रमशः अपचायकघटक तथा ऑक्सीकारक घटक के रूप में कार्य करता है।

Ans. (3)

Sol. When H_2O_2 acts a reducing agent it liberates the O_2 .



Topic- Metallurgy

Subtopic- General principles up to purification

Level-M

9. Which of the following ore is concentrated using group 1 cyanide salt ?

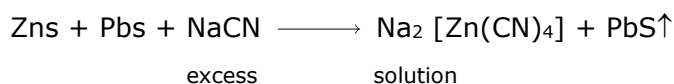
- (1) Sphalerite (2) Siderite
 (3) Malachite (4) Calamine

निम्नलिखित में से कौन सा एक अयस्क का ग्रुप 1 के सायनाइड साल्ट से सान्द्रण करते हैं ?

- (1) स्फ़ेलेराइट (2) सिडेराइट
 (3) मेलाकाइट (4) कैलामाइन

Ans. (1)

Sol. Conc. of sphalerite, first by cyanide salt as a depressant to remove the impurity of galena



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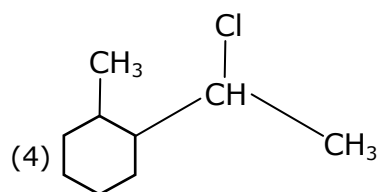
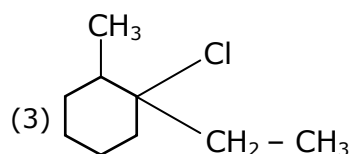
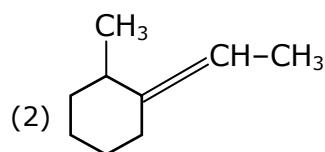
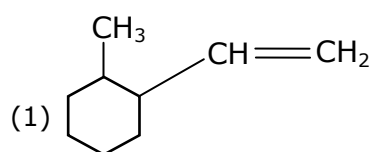
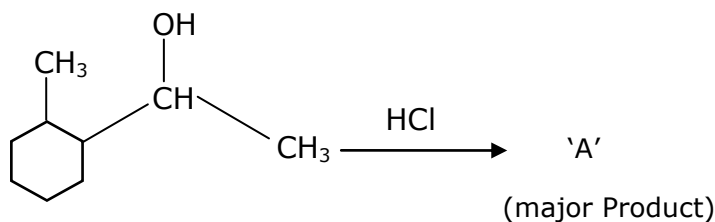
Topic- Alkene

Subtopic- Dehydration of alcohol

Level- M

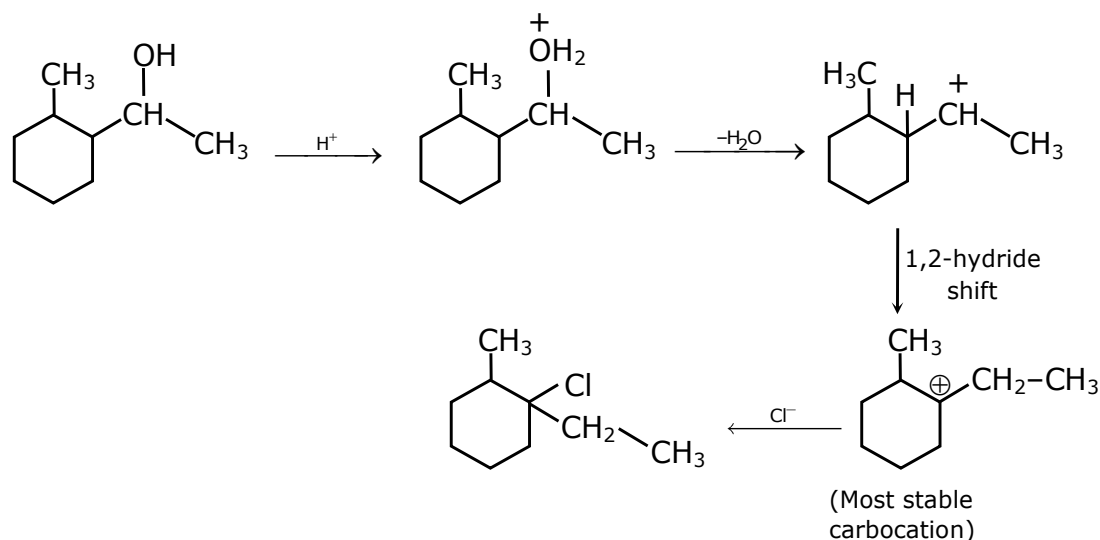
10. Which is the final product (major) 'A' in the given reaction?

दी गयी अभिक्रिया में अंतिम उत्पाद (मुख्य) 'A' क्या है ?



Ans. (3)

Sol.



Topic- Alkane

Subtopic-Addition of hydrogen halide

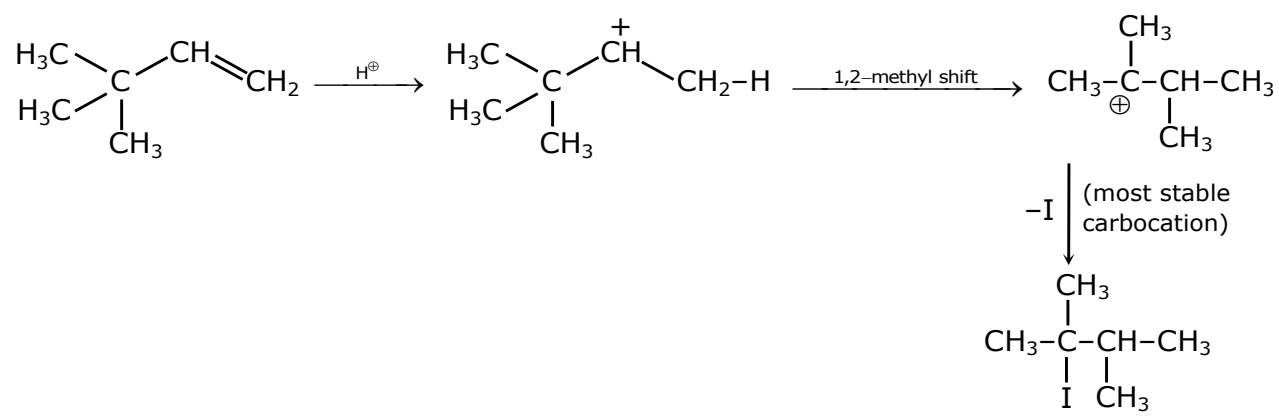
Level-M

11. What is the major product formed by HI on reaction with $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{H}_3\text{C}}{\text{C}}}-\text{CH}=\text{CH}_2$?

HI की $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{H}_3\text{C}}{\text{C}}}-\text{CH}=\text{CH}_2$ से अभिक्रिया का मुख्य उत्पाद क्या है ?

- (1) $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{H}_3\text{C}}{\text{C}}}-\underset{\text{I}}{\text{CH}}-\text{CH}_3$ (2) $\text{CH}_3-\underset{\text{H}_3\text{C}}{\text{CH}}-\underset{\text{I}}{\text{CH}}-\text{CH}_2-\text{CH}_3$
- (3) $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{I}}{\text{C}}}-\underset{\text{CH}_3}{\text{CH}}-\text{CH}_3$ (4) $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{H}_3\text{C}}{\text{C}}}-\underset{\text{H}}{\text{CH}}-\text{CH}_2\text{I}$

Ans. (3)
Sol.



Topic- Carbonyl compound

Subtopic- Oxidation

Level-M

12. Which of the following reagent is used for the following reaction ?
 $\text{CH}_3\text{CH}_2\text{CH}_3 \xrightarrow{?} \text{CH}_3\text{CH}_2\text{CHO}$

(1) Potassium permanganate
 (2) Molybdenum oxide
 (3) Copper at high temperature and pressure
 (4) Manganese acetate

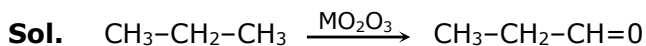
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निम्नलिखित में से कौन सा अभिकर्मक अभिक्रिया $\text{CH}_3\text{CH}_2\text{CH}_3 \xrightarrow{?} \text{CH}_3\text{CH}_2\text{CHO}$ के लिए प्रयोग किया जाता है ?

- (1) पोटैशियम परमैंगनेट
- (2) मॉलिब्डेनम ऑक्साइड
- (3) उच्च ताप व दाब पर कॉपर
- (4) मैंगनीज ऐसीटेट

Ans. (2)

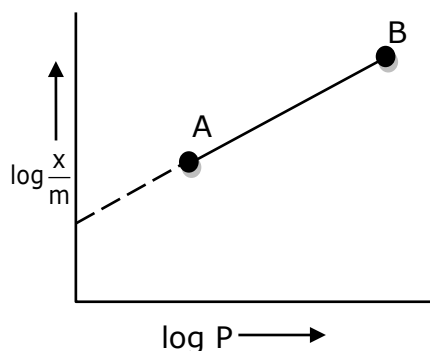


Topic- Surface chemistry

Subtopic- Adsorption (Physical & chemical)

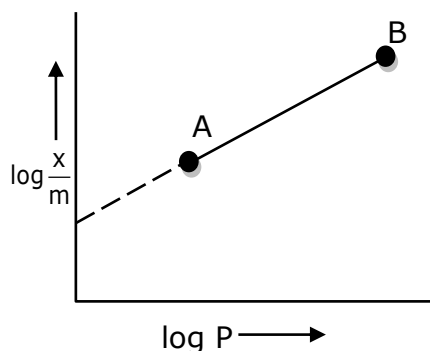
Level-M

13. In Freundlich adsorption isotherm, slope of AB line is :



- | | |
|---|---|
| (1) $\frac{1}{n}$ with $\left(\frac{1}{n} = 0 \text{ to } 1\right)$ | (2) $\log \frac{1}{n}$ with $(n < 1)$ |
| (3) $\log n$ with $(n > 1)$ | (4) n with $(n, 0.1 \text{ to } 0.5)$ |

फ्रेन्डलिक अधिशोषण समतापी में AB रेखा का ढाल है :



- | | |
|---|---|
| (1) $\frac{1}{n}$, जिसमें $\left(\frac{1}{n} = 0 \text{ से } 1\right)$ | (2) $\log \frac{1}{n}$, जिसमें $(n < 1)$ |
| (3) $\log n$, जिसमें $(n > 1)$ | (4) n (मान 0.1 से 0.5) |

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Ans. (1)

Sol. Freundlich adsorption isotherm is :

$$\frac{x}{m} = kp^{1/n}$$

x = mass of adsorbate

m = mass of adsorbent

P = eq. pressure

$$k_1 n = \frac{1}{n} \log p + \log k$$

$$y = mx + c$$

comparing

$$m = \frac{1}{n} = \text{slope} \left[\frac{1}{n} = 0 \text{ to } 1 \right]$$

$$n > 1$$

Topic- Metallurgy

Subtopic- General principles up to purification

Level- E

14. The major components in "Gun Metal" are:

(1) Al, Cu, Mg and Mn

(2) Cu, Sn and Zn

(3) Cu, Zn and Ni

(4) Cu, Ni and Fe

"गन मेटल" के मुख्य घटक हैं :

(1) Al, Cu, Mg तथा Mn

(2) Cu, Sn तथा Zn

(3) Cu, Zn तथा Ni

(4) Cu, Ni तथा Fe

Ans. (2)

Sol. "Gun metal" is alloy of copper with tin and zinc.

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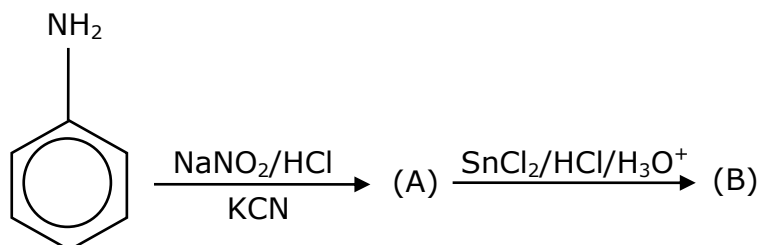
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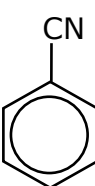
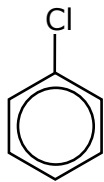
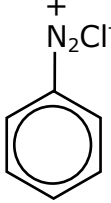
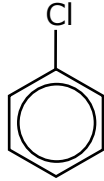
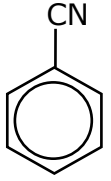
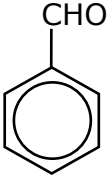
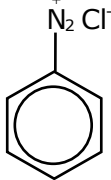
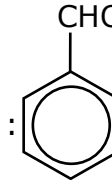
Topic- Aromatic compounds

Subtopic- Diazotisation & reaction of benzene diazonium chlorides Coupling reactions
Level-M

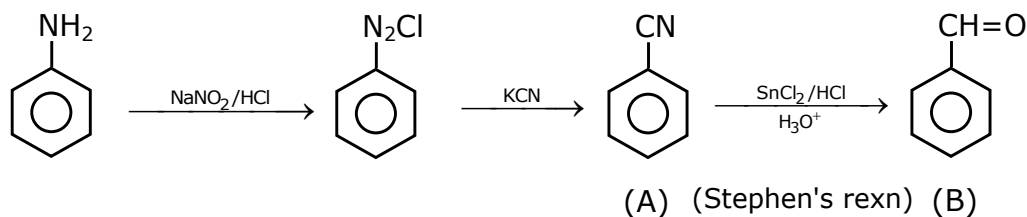
15. 'A' and 'B' in the following reactions are :

निम्नलिखित अभिक्रिया में 'A' तथा 'B' है :



- (1) (A) :  (B) : 
- (2) (A) :  (B) : 
- (3) (A) :  (B) : 
- (4) (A) :  (B) : 

Ans. (3)
Sol.



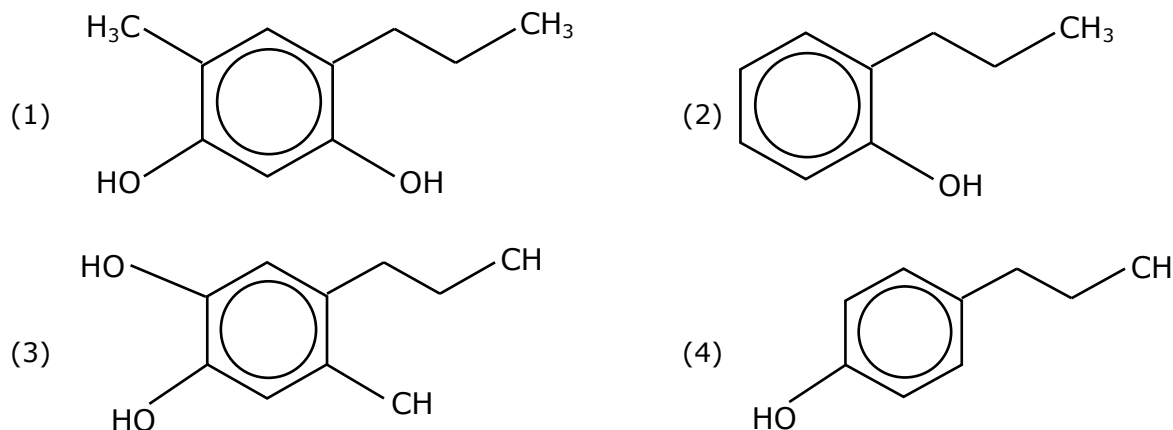
Topic- Carboxylic acid & their derivatives

Subtopic- Chemical reaction of acid derivatives

Level-M

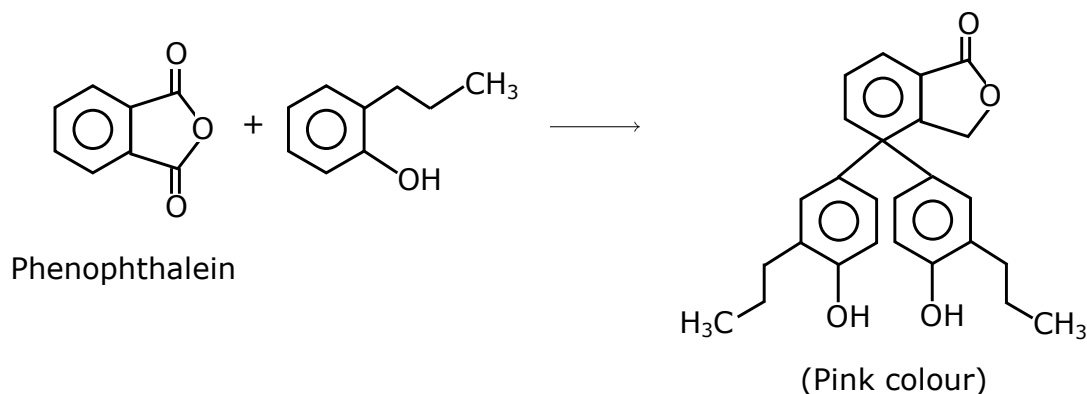
16. Which of the following compound gives pink colour on reaction with phthalic anhydride in conc. H₂SO₄ followed by treatment with NaOH ?

निम्नलिखित में से कौन सा यौगिक सान्द्र H₂SO₄ में थैलिक एनहाइड्राइड से अभिक्रिया के पश्चात NaOH से अभिक्रिया करके गुलाबी रंग देता है :



Ans. (2)

Sol.



Topic- Periodic Properties

Subtopic- Ionic Enthalpy

Level-M

17. Consider the elements Mg, Al, S, P and Si, the correct increasing order of their first ionization enthalpy is:

तत्त्वों Mg, Al, S, P तथा Si पर विचार कीजिए इनकी प्रथम आयनन एन्थैल्पी बढ़ने का सही क्रम है :

- (1) Al < Mg < Si < S < P (2) Al < Mg < S < Si < P
 (3) Mg < Al < Si < S < P (4) Mg < Al < Si < P < S

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Ans. (1)

Sol. Order of IE, in 3rd period is
Na < Mg > Al < Si < P > S < Cl < Ar
Na < Al < Mg < Si < S < P < Cl < Ar

due to stable	due to
full filed 3s-	half filed
orbital and	3p ³ -
more	orbital of
penetrating	phosphor
power	ous

Topic- P-block

Subtopic- Boron family & compound of boron

Level-T

18. Given below are two statements :

Statement I : Colourless cupric metaborate is reduced to cuprous metaborate in a luminous flame.

Statement II : Cuprous metaborate is obtained by heating boric anhydride and copper sulphate in a non-luminous flame.

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

- (1) Statement I is false but statement II is true.
- (2) Statement I is true but Statement II is false.
- (3) Both Statement I and Statement II are true.
- (4) Both Statement I and Statement II are false.

नीचे दो कथन दिए गए हैं :

कथन I : रंगहीन क्यूपरिक मेटाबोरेट दीप्त ज्वाला में क्यूपरस मेटाबोरेट में अपचयित हो जाता है।

कथन II : बोरिक एनहाइड्राइड तथा कॉपर सल्फेट को अ-दीप्त ज्वाला में गर्म करने पर क्यूपरस मेटाबोरेट प्राप्त होता है।

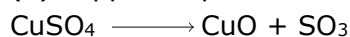
नीचे दिये गये विकल्पों में से उपरोक्त कथनों के लिए सही उत्तर चुनिए :

- (1) कथन I असत्य है परन्तु कथन II सत्य है।
- (2) कथन I सत्य है परन्तु कथन II असत्य है।
- (3) कथन I तथा कथन II दोनों सत्य हैं।
- (4) कथन I तथा कथन II दोनों असत्य हैं।

Ans. (4)

Sol. Both are False

(1) Copper sulphate form copper meta boric with beric an hydride



blue in cold oxidising flame (non luminous flame)

(2) Blue coloured metal borate is reduced to copper in a luminous flame.

Topic- P-block

Subtopic- Boron family & compound of boron

Level-M

19. Al₂O₃ was leached with alkali to get X. The solution of X on passing of gas Y, forms Z. X, Y and Z respectively are :

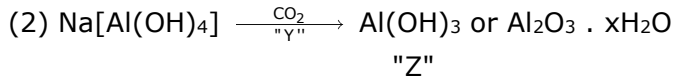
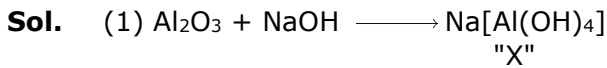
Al₂O₃ का क्षार से निष्कालन करने पर X प्राप्त होता है। X के विलयन में, गैस Y को प्रवाहित करने पर Z प्राप्त होता है। X, Y और Z हैं क्रमशः हैं

- (1) X = Na[Al(OH)₄], Y=CO₂, Z = Al₂O₃.xH₂O
- (2) X=Na[Al(OH)₄], Y=SO₂, Z = Al₂O₃
- (3) X=Al(OH)₃, Y=SO₂, Z = Al₂O₃.xH₂O
- (4) X = Al(OH)₃, Y=CO₂, Z= Al₂O₃

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Ans. (1)



Topic- Polymer

Subtopic-Types of Polymer

Level-M

20. Match List I with List II.

List I

(Monomer Unit)

(a) Caprolactum

(b) 2-Chloro-1,3-butadiene

(c) Isoprene

(d) Acrylonitrile

List II

(Polymer)

(i) Natural rubber

(ii) Buna-N

(iii) Nylon 6

(iv) Neoprene

Choose the correct answer from the options given below :

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

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

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

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

सूची I का सूची II के साथ सुमेलित कीजिए:

सूची I

(एकलक)

(a) कैप्रोलैक्टम

(b) 2-क्लोरो-1,3-ब्यूटाडाइन

(c) आइसोप्रीन

(d) ऐक्रिलोनाइट्राइल

सूची II

(बहुलक)

(i) प्राकृतिक रबर

(ii) ब्यूना-N

(iii) नाइलॉन 6

(iv) निओप्रीन

नीचे दिए गये विकल्पों में से सही उत्तर चुनिए :

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

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

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

(4) (a) → (iv), (b) → (iii), (c) → (ii), (d) → (I)

Ans. (1)

Sol. (1) Polymer of caprolactum is nylon-6

(2) Polymer of 2-chloro-1,3-butadiene is neoprene.

(3) Polymer of isoprene is natureal rubber

(4) Polymer of acrylonitrile and 1,3-butadiene is buna-N

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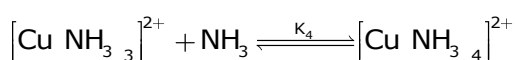
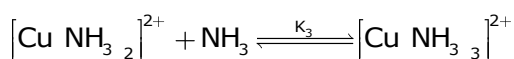
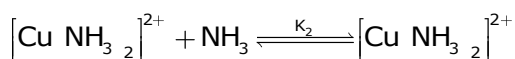
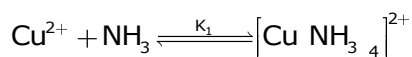
SECTION – B

Topic- Chemical Equilibrium

Subtopic- Simultaneous Equilibrium

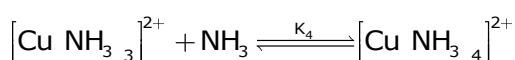
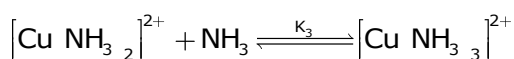
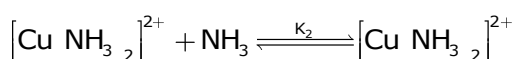
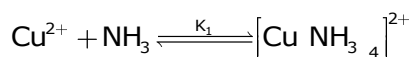
Level-M

1. The stepwise formation of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is given below:



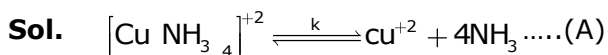
The value of stability constants K_1 , K_2 , K_3 and K_4 are 10^4 , 1.58×10^2 , 5×10^2 and 10^2 respectively. The overall equilibrium constants for dissociation of $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is $x \times 10^{-12}$. The value of x is _____. (Rounded off to the nearest integer)

$[\text{Cu}(\text{NH}_3)_4]^{2+}$ का पदों में विरचन नीचे दिया है:

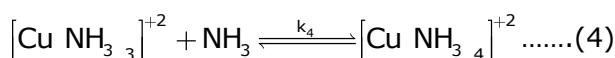
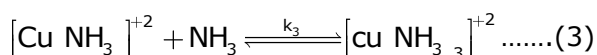
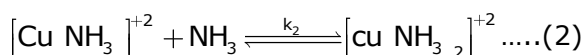
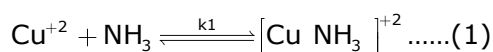


स्थायित्व स्थिरांको K_1 , K_2 , K_3 तथा K_4 के मान क्रमशः 10^4 , 1.58×10^2 , 5×10^2 तथा 10^2 हैं। $[\text{Cu}(\text{NH}_3)_4]^{2+}$ के विघटन के लिए समग्र साम्य स्थिरांक है $x \times 10^{-12}$ । x का मान है _____। (पूर्णांक उत्तर)

Ans. (1)



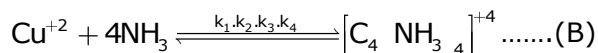
For this :



(1) + (2) + (3) + (4)

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So for (A)

$$K = \frac{1}{k_1 \cdot k_2 \cdot k_3 \cdot k_4}$$

Putting the value of k_1, k_2, k_3 and k_4 .

$$K = \frac{1}{10^{-4} \cdot 1.58 \times 10^3 \cdot 5 \times 10^2 \cdot 10^2} = 1.26 \times 10^{-12}$$

$$x = 1.$$

Topic- Chemical Equilibrium

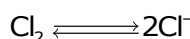
Subtopic- Introduction & Law of Mass Action Level-E

2. At 1990 K and 1 atm pressure, there are equal number of Cl_2 molecules and Cl atoms in the reaction mixture. The value of K_p for the reaction $\text{Cl}_{2(g)} \rightleftharpoons 2\text{Cl}_{(g)}$ under the above conditions is $x \times 10^{-1}$. The value of x is _____. (Rounded off to the nearest integer)

1990 K तथा 1 atm दाब पर अभिक्रिया मिश्रण में Cl_2 अणु तथा Cl परमाणुओं की संख्या समान है। अभिक्रिया $\text{Cl}_{2(g)} \rightleftharpoons 2\text{Cl}_{(g)}$ के लिए उपरोक्त अवस्थाओं में K_p का मान $x \times 10^{-1}$ है। x का मान है _____। (पूर्णांक उत्तर)

Ans. (5)

Sol.



Lets mole of eq. x x

$$\text{P.P. at eq.} \quad \frac{x}{2x} \times 1 \quad \frac{x}{2x} \times 1$$

$$\frac{1}{2} \quad \frac{1}{2}$$

$$K_p = \frac{[\text{P}_{\text{Cl}}]^2}{[\text{P}_{\text{Cl}_2}]} = \frac{\left[\frac{1}{2}\right]^2}{\frac{1}{2}} = \frac{1}{2} = 0.5 = 5 \times 10^{-1}$$

$$x = 5.$$

Topic- Stoichiometry (I)

Subtopic- Interconversion of concentration units Level-E

3. 4.5 g of compound A (MW = 90) was used to make 250 mL of its aqueous solution. The molarity of the solution in M is $x \times 10^{-1}$. The value of x is _____. (Rounded off to the nearest integer)

4.5 g यौगिक A (आण्विक भार = 90) को इसका 250 mL जलीय विलयन बनाने में उपयोग किया गया है। विलयन की मोलरता M में $x \times 10^{-1}$ है। x का मान है _____। (पूर्णांक उत्तर)

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Ans. (2)

Sol. Moles of A = $\frac{\text{Weight}}{\text{M.w}}$

$$= \frac{4.5}{90} = \frac{1}{20} = 0.05$$

$$\text{Volume (Lit)} = \frac{250}{1000} = 0.250 \text{ lit}$$

$$\text{Molarity (M)} = \frac{\text{Mole}}{(\text{Lit})\text{volume}} = \frac{0.05}{0.250} = 0.2$$

$$= 2 \times 10^{-1} \frac{\text{mol}}{\text{Lit}}$$

$$x = 2$$

Topic- Solid State

Subtopic- Types of cubic unit cell SCC, BCC, FCC

Level-E

4. The coordination number of an atom in a body-centered cubic structure is _____.
[Assume that the lattice is made up of atoms]
एक परमाणु की सह-संयोजन संख्या काय केन्द्रित घन जालक में _____ है।
[मान लीजिए कि जालक परमाणुओं से ही बना है]

Ans. (4)

Sol. Fact

Topic- Periodic Properties

Subtopic- nature of oxide

Level-E

5. Number of amphoteric compounds among the following is _____.
निम्नलिखित में से उभयधर्मी यौगिकों की संख्या है _____।
(A) BeO (B) BaO (C) Be(OH)₂ (D) Sr(OH)₂

Ans. (2)

Sol. BeO and Be(OH)₂ are amphoteric in nature

Topic- Liquid solution

Subtopic- Ideal Vs non ideal solution & their distillation and immiscible liquid solution

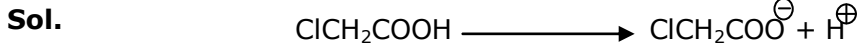
Level-M

6. When 9.45g of ClCH₂COOH is added to 500 mL of water, its freezing point drops by 0.5°C. The dissociation constant of ClCH₂COOH is $x \times 10^{-3}$. The value of x is _____. (Rounded off to the nearest integer)
[K_{f(H₂O}) = 1.86 Kkgmol⁻¹]
500 mL जल में 9.45g ClCH₂COOH मिलाने पर इसका हिमांक 0.5°C गिर जाता है। ClCH₂COOH का वियोजन स्थिरांक $x \times 10^{-3}$ है। x का मान है _____। (पूर्णांक उत्तर)
[K_{f(H₂O}) = 1.86 Kkgmol⁻¹]

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Ans. (35)



Total no. of moles = $c + c\alpha = c(1 + \alpha)$

$$i = \frac{\text{observed}}{\text{calculate}} = \frac{c(1 + \alpha)}{c} = (1 + \alpha)$$

M.W. = 94.5

$$\Delta T_f = i \times k_f \times m$$

$$\Delta T_f = 0.5^\circ\text{C}$$

$$i = 1 + \alpha$$

$$0.5 = (1 + \alpha) \times 1.86 \times \frac{9.45}{\frac{94.5}{\frac{500}{1000}}}$$

$$m = \frac{\text{mole}}{\text{k.g(Solvent)}}$$

$$k_t = 1.86 \text{ k kg/mol}$$

$$(1 + \alpha) = \frac{2.5}{1.86}$$

$$\alpha = \frac{0.64}{1.86} = \frac{32}{93}$$

$$K_a = \frac{C\alpha^2}{1 - \alpha} = \frac{0.2 \times 1024}{93 \times 93 \times \frac{61}{93}}$$

$$K_a = 0.0351 = 35.1 \times 10^{-3}$$

Topic- Atomic

Subtopic- Heisenberg's uncertainty principle & de-Broglie wavelength

Level-M

7. A proton and a Li^{3+} nucleus are accelerated by the same potential. If λ_{Li} and λ_p denote the de Broglie wavelengths of Li^{3+} and proton respectively, then the value of $\frac{\lambda_{\text{Li}}}{\lambda_p}$ is $x \times 10^{-1}$. The value

of x is _____. [Rounded off to the nearest integer]

[Mass of $\text{Li}^{3+} = 8.3$ mass of proton]

एक प्रोटॉन तथा एक Li^{3+} न्यूक्लियस को त्वरण समान विभव से किया गया है। λ_{Li} तथा λ_p क्रमशः Li^{3+} तथा प्रोटॉन की डी ब्राग्ली तरंगदैर्घ्य है तो $\frac{\lambda_{\text{Li}}}{\lambda_p}$ का मान $x \times 10^{-1}$ है। जहाँ x का मान है _____। [पूर्णांक उत्तर]

[Li^{3+} का द्रव्यमान = 8.3 का द्रव्यमान]

Ans. (2)

Sol. De Broglie Wavelength

$$\lambda = \frac{h}{\sqrt{2m \text{ k.E.}}}$$

$$\frac{\lambda_{\text{Li}^{3+}}}{\lambda_p} = \frac{\sqrt{m_p \times (e^-v)_p}}{\sqrt{m_{\text{Li}^{3+}} \times 3e_p v}}$$

$$m_{\text{Li}^{3+}} = 8.3 m_p$$

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$$\frac{\lambda_{L^{13}}}{\lambda_p} = \sqrt{\frac{m_p}{3 \times 8.3m_p}} = \sqrt{\frac{1}{25}} = \frac{1}{5} = 0.2 = 2 \times 10^{-1}$$

$$x = 2.$$

Topic- Chemical Kinetic

Subtopic- 1st order reaction

Level- M

8. Gaseous cyclobutene isomerizes to butadiene in a first order process which has a 'k' value of $3.3 \times 10^{-4} \text{ s}^{-1}$ at 153°C . The time in minutes it takes for the isomerization to proceed 40% to completion at this temperature is _____. (Rounded off to the nearest integer)
गैसीय साइक्लोब्यूटेन का ब्यूटाडाइन में समावयवन प्रथम कोटि का प्रक्रम है जिसके लिए 'k' का 153°C पर मान $3.3 \times 10^{-4} \text{ s}^{-1}$ है। इसी ताप पर समावयवन को 40% से पूर्ण होने में जितना समय मिनटों में लगेगा, वह है _____. (पूर्णांक उत्तर)

Ans. (26)

Sol. For first order Rxn :-

$$t = \frac{2.303}{k} \log \left[\frac{100}{100 - x} \right]$$

$$X = 40, k = 3.3 \times 10^{-4}$$

$$t = \frac{2.303}{3.3 \times 10^{-4}} \log \left[\frac{100}{60} \right]$$

For first order Rxn :-

$$t = \frac{2.303}{k} \log \left[\frac{100}{100 - x} \right]$$

$$X = 40, k = 3.3 \times 10^{-4}$$

$$t = \frac{2.303}{3.3 \times 10^{-4}} \log \left[\frac{100}{60} \right]$$

$$t = \frac{2.303}{3.3 \times 10^{-4}} \times 0.22$$

$$t = 0.1535.3 \times 10^4$$

$$t = 1535 \text{ sec.}$$

$$t = 0.1535.3 \times 10^4$$

$$t = 1535 \text{ sec} = 25.6 \text{ Min.}$$

Topic- Chemical Equilibrium

Subtopic- Thermodynamics of Equilibrium,

Level-M

9. For the reaction $A_{(g)} \rightarrow B_{(g)}$, the value of the equilibrium constant at 300 K and 1 atm is equal to 100.0. The value of $\Delta_r G$ for the reaction at 300 K and 1 atm in J mol^{-1} is $-xR$, where x is _____. (Rounded off to the nearest integer)
[$R = 8.31 \text{ J mol}^{-1}\text{K}^{-1}$ and $\ln 10 = 2.3$]
एक अभिक्रिया $A_{(g)} \rightarrow B_{(g)}$ के लिए साम्य अवस्था स्थिरांक का 300 K तथा 1 atm पर मान 100.0 के बराबर है। 300 K तथा 1 atm पर अभिक्रिया के लिए $\Delta_r G$ का मान, J mol^{-1} , में $-xR$ है। जहाँ x का मान _____. (पूर्णांक उत्तर)
[$R = 8.31 \text{ J mol}^{-1}\text{K}^{-1}$ तथा $\ln 10 = 2.3$]

Ans. (1380)

Sol. $\Delta G^\circ = -RT \ln K_{eq}$.

$$= -R \times 300 \times \ln(10^2) = 300 \times 2 \times 2.3 \times (-R) = -1380R$$

$$x = 1380 \text{ ans.}$$

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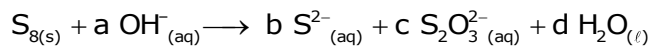
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Topic- Redox

Subtopic- Balancing of redox reaction

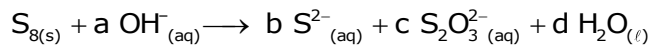
Level-E

10. The reaction of sulphur in alkaline medium is given below:



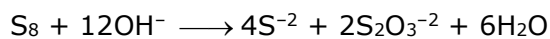
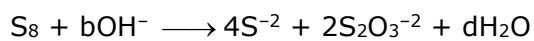
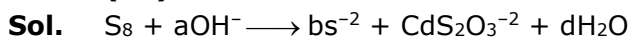
The values of 'a' is _____. (Integer answer)

सल्फर की क्षारीय माध्यम में अभिक्रिया नीचे दी गयी है :



'a' का मान है _____। (पूर्णांक उत्तर)

Ans. (12)



$$a = 12$$

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