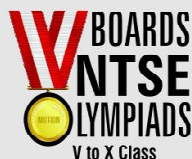


हमारा विश्वास... हर एक विद्यार्थी है स्वास

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QUESTION PAPER WITH SOLUTION

CHEMISTRY _ 3 Sep. _ SHIFT - 2



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6. Complex A has a composition of $H_{12}O_6Cl_3Cr$. If the complex on treatment with conc. H_2SO_4 loses 13.5% of its original mass, the correct molecular formula of A is:

[Given: atomic mass of Cr = 52 amu and Cl = 35 amu]

संकुल A का संघटन $H_{12}O_6Cl_3Cr$ है। यदि संकुल सान्द्र H_2SO_4 के साथ अभिक्रिया कराने पर अपनी मूल संरचना का 13.5% खो देता है, तो A का सही आणविक सूत्र है :

[दिया गया है : परमाणु संरचना Cr = 52 amu तथा Cl = 35 amu]

- (1) $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$ (2) $[Cr(H_2O)_4Cl_2]Cl \cdot 2H_2O$
 (3) $[Cr(H_2O)_3Cl_3] \cdot 3H_2O$ (4) $[Cr(H_2O)_6]Cl_3$

Sol. 2

Let x molecule of water are lost then

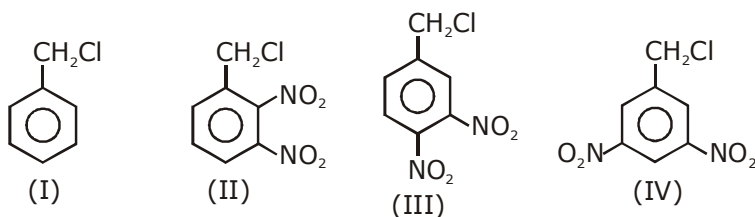
$$13.5 = \left[\frac{x \times 18}{6 \times 18 + 3 \times 35 + 52} \right] \times 100$$

$$x = 1.99 \approx 2$$

so, complex is $[Cr(H_2O)_4Cl_2] \cdot 2H_2O$

7. The decreasing order of reactivity of the following compounds towards nucleophilic substitution (S_N2) is:

निम्नलिखित यौगिकों की नाभिकरागी प्रतिस्थापन (S_N2) के प्रति अभिक्रियाशीलता का घटता क्रम है :



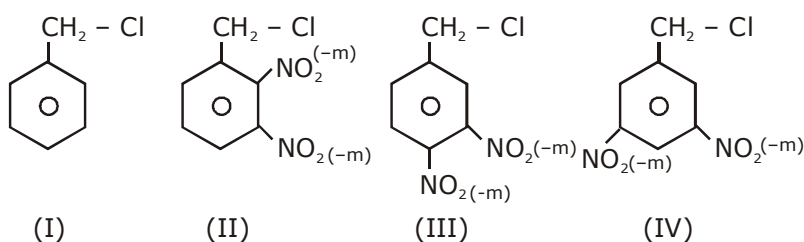
(1) (III) > (II) > (IV) > (I)

(3) (II) > (III) > (IV) > (I)

(2) (IV) > (II) > (III) > (I)

(4) (II) > (III) > (I) > (IV)

Sol. 3



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8. The increasing order of the reactivity of the following compounds in nucleophilic addition reaction is:
Propanal, Benzaldehyde, Propanone, Butanone

- (1) Benzaldehyde < Propanal < Propanone < Butanone
- (2) Propanal < Propanone < Butanone < Benzaldehyde
- (3) Butanone < Propanone < Benzaldehyde < Propanal
- (4) Benzaldehyde < Butanone < Propanone < Propanal

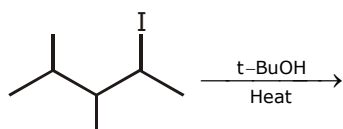
निम्नलिखित यौगिकों की नाभिकरागी योगज अभिक्रियाओं में अभिक्रियाशीलता का बढ़ता क्रम है: प्रोपेनल, बेन्जाल्डिहाइड, प्रोपेनोन, ब्यूटेनोन
प्रोपेनल, बेन्जाल्डिहाइड, प्रोपेनोन, ब्यूटेनोन

- (1) बेन्जाल्डिहाइड < प्रोपेनल < ब्यूटेनोन < ब्यूटेनोन
- (2) प्रोपेनल < ब्यूटेनोन < ब्यूटेनोन < बेन्जाल्डिहाइड
- (3) ब्यूटेनोन < ब्यूटेनोन < बेन्जाल्डिहाइड < प्रोपेनल
- (4) बेन्जाल्डिहाइड < ब्यूटेनोन < ब्यूटेनोन < प्रोपेनल

Sol. 3
Rate of Nucleophilic addition \Rightarrow Aldehyde > Ketone
Aliphatic aldehyde > Aromatic aldehyde

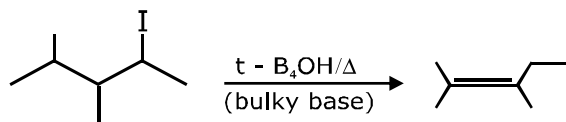
9. The major product in the following reaction is:

निम्नलिखित अभिक्रियाओं में मुख्य उत्पाद है :



- (1)
- (2)
- (3)
- (4)

Sol. 3



10. The incorrect statement(s) among (a) – (d) regarding acid rain is (are):

- (a) It can corrode water pipes.
 - (b) It can damage structures made up of stone.
 - (c) It cannot cause respiratory ailments in animals
 - (d) It is not harmful for trees
- (1) (a), (b) and (d) (2) (a), (c) and (d) (3) (c) and (d) (4) (c) only

अम्लीय वर्षा के संबंध में कथन (a) – (d) में से गलत कथन है/हैं :

- (a) यह जल के पाइपों को संक्षारित करता है।
- (b) यह पत्थर की बनी संरचनाओं को क्षति पहुँचाता है।
- (c) यह मवेशियों में श्वसन की बीमारी का कारण नहीं हो सकता है।
- (d) यह पेड़ों के लिए हानिकारक नहीं है।

- (1) (a), (b) तथा (d) (2) (a), (c) तथा (d) (3) (c) तथा (d) (4) केवल (c)

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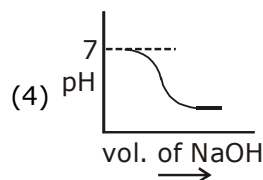
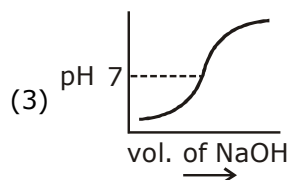
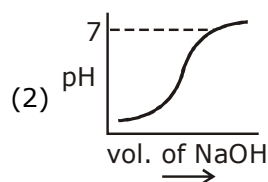
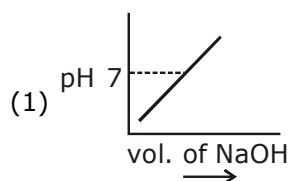
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Sol. 3

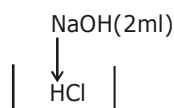
Acid rain can cause respiratory ailments in animals and also harmful for trees and plant.

11. 100 mL of 0.1 M HCl is taken in a beaker and to it 100 mL of 0.1 M NaOH is added in steps of 2 mL and the pH is continuously measured. Which of the following graphs correctly depicts the change in pH?

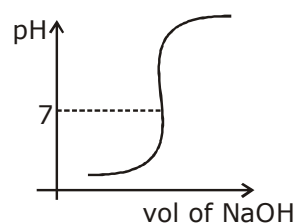
0.1 M HCl के 100 mL को एक बीकर में लिया जाता है तथा इसमें 0.1 M NaOH के 100 mL को 2 mL के पदों में डाला जाता है तथा इसका pH निरन्तर मापा जाता रहा। pH में परिवर्तन के चित्रण के लिए निम्नलिखित आलेखों में से कौन सही हैं ?



Sol. 3



initially pH will be acidic < 7
at eq pH $pH = 7$
& finally pH will be basic > 7



option (3)

12. Consider the hypothetical situation where the azimuthal quantum number, l , takes values 0, 1, 2, $n + 1$, where n is the principal quantum number. Then, the element with atomic number:
- (1) 13 has a half-filled valence subshell (2) 9 is the first alkali metal
(3) 8 is the first noble gas (4) 6 has a 2p-valence subshell

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काल्पनिक स्थिति पर विचार कीजिये जहाँ दिगंशीय क्वाण्टम संख्या l , का मान $0, 1, 2, \dots, n + 1$ होता है, जहाँ n मुख्य क्वाण्टम संख्या है। तब, निम्नलिखित परमाणु क्रमांक वाला तत्व है—

- (1) 13 वाला अर्द्धपूरित संयोजी उपकोश रखता है (2) 9 वाला प्रथम क्षारीय धातु है
 (3) 8 वाला प्रथम आदर्श गैस है (4) 6 वाला 2p-संयोजी उपकोश रखता है

Sol. 1

- (1) ${}_{13}X = 1s^2 1p^6 1d^5$ - half filled
 (2) ${}_{9}X = 1s^2 1p^6 1d^1$ - not alkali metal
 (3) ${}_{8}X = 1s^2 1p^6$ - Second noble gas
 Option (1)

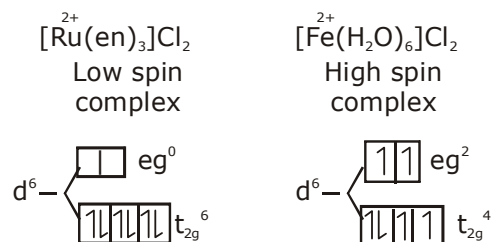
13. The d-electron configuration of $[Ru(en)_3]Cl_2$ and $[Fe(H_2O)_6]Cl_2$, respectively are:

- (1) $t_{2g}^4 e_g^2$ and $t_{2g}^6 e_g^0$ (2) $t_{2g}^6 e_g^0$ and $t_{2g}^6 e_g^0$
 (3) $t_{2g}^4 e_g^2$ and $t_{2g}^4 e_g^2$ (4) $t_{2g}^6 e_g^0$ and $t_{2g}^4 e_g^2$

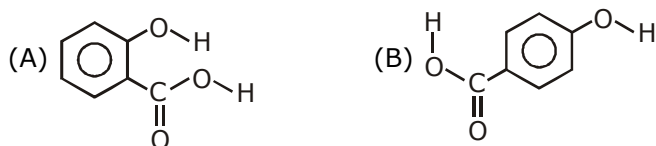
$[Ru(en)_3]Cl_2$ तथा $[Fe(H_2O)_6]Cl_2$ के d-इलेक्ट्रॉन विन्यास क्रमशः हैं :

- (1) $t_{2g}^4 e_g^2$ तथा $t_{2g}^6 e_g^0$ (2) $t_{2g}^6 e_g^0$ तथा $t_{2g}^6 e_g^0$
 (3) $t_{2g}^4 e_g^2$ तथा $t_{2g}^4 e_g^2$ (4) $t_{2g}^6 e_g^0$ तथा $t_{2g}^4 e_g^2$

Sol. 4



14. Consider the following molecules and statements related to them:



- (a) (B) is more likely to be crystalline than (A)
 (b) (B) has higher boiling point than (A)
 (c) (B) dissolves more readily than (A) in water

Identify the correct option from below:

- (1) (a) and (c) are true (2) only (a) is true
 (3) (b) and (c) are true (4) (a) and (b) are true

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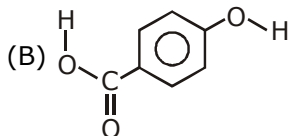
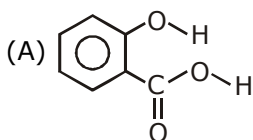
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निम्न अणुओं एवं उनसे सम्बन्धित कथनों पर विचार कीजिए :



(a) (A) की तुलना में (B) के क्रिस्टलित होने की ज्यादा सम्भावना है।

(b) (A) से (B) का क्वथनांक उच्च है।

(c) (A) की तुलना में (B) जल्दी से पानी में घुल जाता है।

निम्न में से सही विकल्प चुनिये :

(1) (a) तथा (c) सत्य है।

(2) मात्रा (a) सत्य है।

(3) (b) तथा (c) सत्य है।

(4) (a) तथा (b) सत्य है।

Sol. Bonus

All answer are correct

15. The strengths of 5.6 volume hydrogen peroxide (of density 1 g/mL) in terms of mass percentage and molarity (M), respectively, are:

(Take molar mass of hydrogen peroxide as 34 g/mol)

(1) 0.85 and 0.5

(2) 0.85 and 0.25

(3) 1.7 and 0.25

(4) 1.7 and 0.5

5.6 आयतन की हाइड्रोजन परॉक्साइड (घनत्व 1 g/mL) की सामर्थ्य, द्रव्यमान प्रतिशतता तथा मोलरता (M) के पदों में क्रमशः है:

(हाइड्रोजन परॉक्साइड का मोलर द्रव्यमान 34 g/mol लीजिये)

(1) 0.85 तथा 0.5

(2) 0.85 तथा 0.25

(3) 1.7 तथा 0.25

(4) 1.7 तथा 0.5

Sol. 4

Volume strength = 5.6V

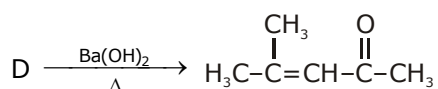
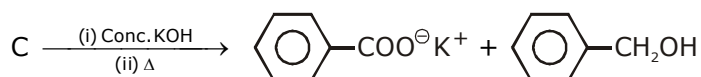
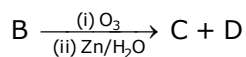
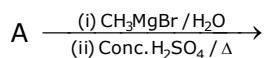
$$\text{molarity} = \frac{5.6}{11.2} = 0.5 \text{ mol/l}$$

$$\text{mass \%} = \left[\frac{0.5 \times 34}{10} \right] \times \frac{1}{1 \text{ g/ml}}$$

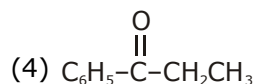
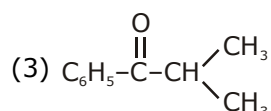
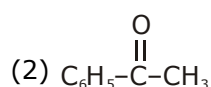
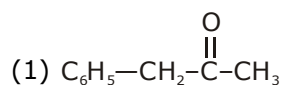
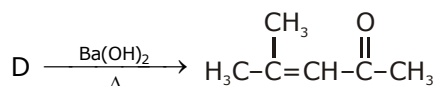
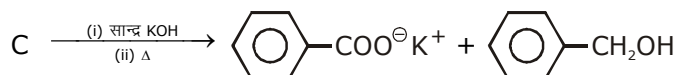
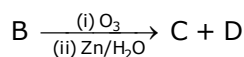
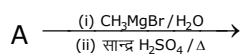
$$= 1.7 \%$$

Ans. 1.7 & 0.5 option (4)

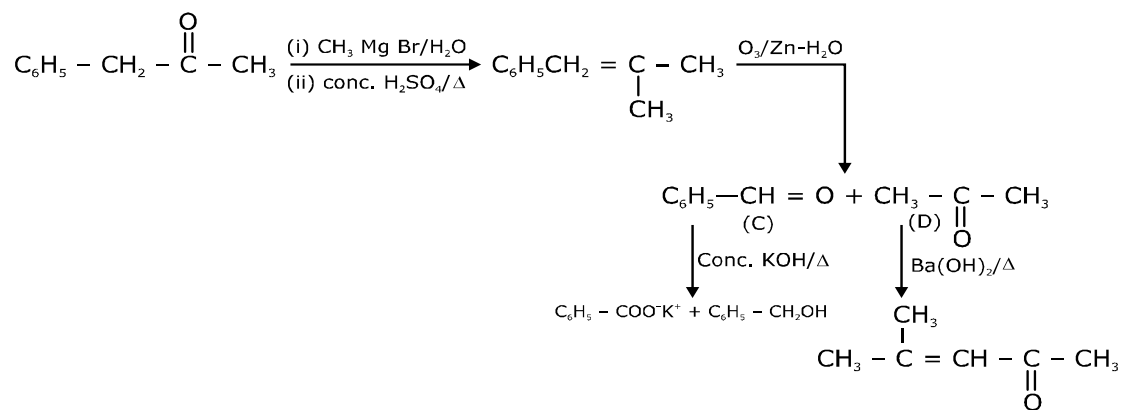
16. The compound A in the following reactions is:



निम्नलिखित अभिक्रियाओं में यौगिक A है :



Sol. 1



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17. A mixture of one mole each of H_2 , He and O_2 each are enclosed in a cylinder of volume V at temperature T. If the partial pressure of H_2 is 2 atm, the total pressure of the gases in the cylinder is: H_2 , He तथा O_2 प्रत्येक के एक मोल के मिश्रण को ताप T पर आयतन V वाले सिलिन्डर में बन्द किया जाता है। यदि H_2 का आंशिक दाब 2 atm है, तो सिलिन्डर में गैसों का सम्पूर्ण दाब है :

(1) 6 atm (2) 14 atm (3) 38 atm (4) 22 atm

Sol. 1

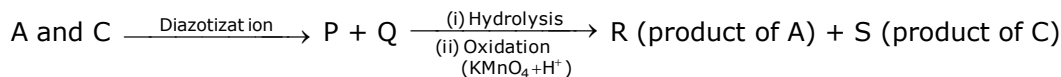
$$p_{H_2} = 2 \text{ atm} = x_{H_2} \times p_{\text{total}}$$

$$2 \text{ atm} = \frac{1}{1+1+1} \times P_{\text{total}}$$

$$P_{\text{total}} = 6 \text{ atm}$$

Ans. option (1)

18. Three isomers A, B and C (mol. formula $C_8H_{11}N$) give the following results:

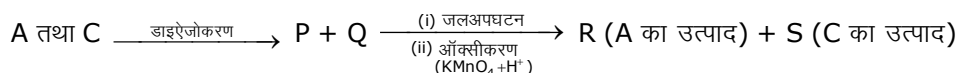


R has lower boiling point than S

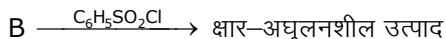


A, B and C, respectively are:

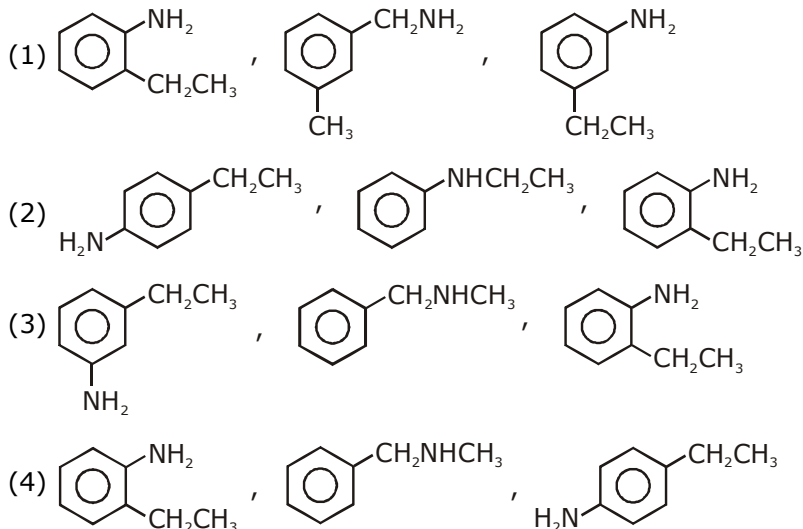
तीन समावयवी A, B तथा C (अणुसूत्र $C_8H_{11}N$) निम्नलिखित परिणाम देते हैं :



R का क्वथनांक S से कम है।



A, B तथा C क्रमशः हैं:



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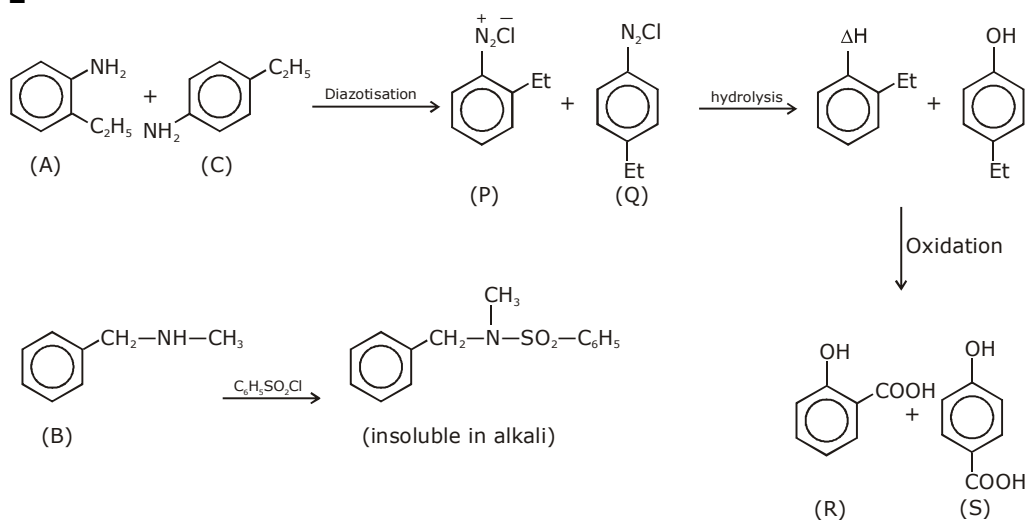
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Sol. 2

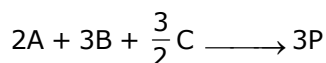


19. For the reaction $2A + 3B + \frac{3}{2}C \rightarrow 3P$,
which statement is correct?

अभिक्रिया $2A + 3B + \frac{3}{2}C \rightarrow 3P$ के लिए कौनसा कथन सही है ?

- (1) $\frac{dn_A}{dt} = \frac{dn_B}{dt} = \frac{dn_C}{dt}$ (2) $\frac{dn_A}{dt} = \frac{3}{2} \frac{dn_B}{dt} = \frac{3}{4} \frac{dn_C}{dt}$
- (3) $\frac{dn_A}{dt} = \frac{2}{3} \frac{dn_B}{dt} = \frac{4}{3} \frac{dn_C}{dt}$ (4) $\frac{dn_A}{dt} = \frac{2}{3} \frac{dn_B}{dt} = \frac{3}{4} \frac{dn_C}{dt}$

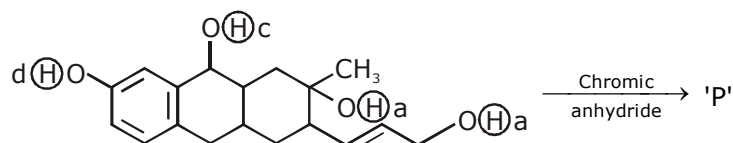
Sol. 3



$$\text{ROR} = \frac{1}{2} \left[\frac{-d[n_A]}{dt} \right] = \frac{1}{3} \left[\frac{-d[n_B]}{dt} \right] = \frac{2}{3} \left[\frac{-d[n_C]}{dt} \right] = \frac{1}{3} \left[\frac{+d[n_P]}{dt} \right]$$

$$\left[\frac{-dn_A}{dt} \right] = \frac{2}{3} \left[\frac{-d[n_B]}{dt} \right] = \frac{4}{3} \left[\frac{-d[n_C]}{dt} \right]$$

20. Consider the following reaction:



The product 'P' gives positive ceric ammonium nitrate test. This is because of the presence of which of these -OH group(s)?

- (1) (b) only (2) (b) and (d) (3) (c) and (d) (4) (d) only

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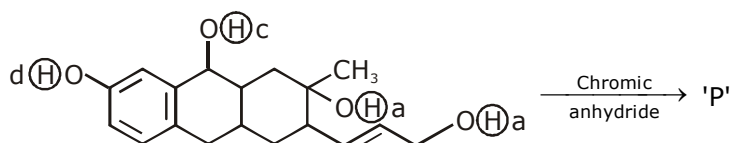
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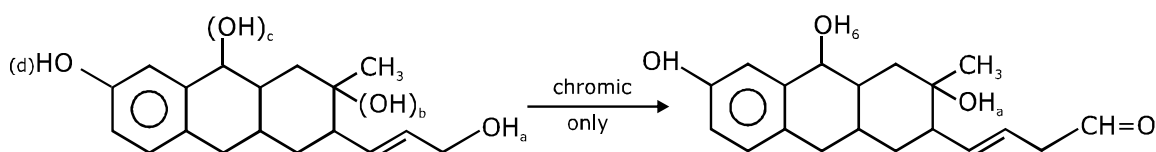
निम्नलिखित अभिक्रिया पर विचार कीजिए :



उत्पाद 'P' सकारात्मक सेरिक अमोनियम नाइट्रेट परीक्षण देता है। यह इनमें से किस -OH समूह की उपस्थिति के कारण है ?

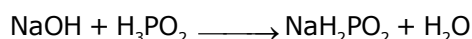
- (1) मात्र (b) (2) (b) तथा (d) (3) (c) तथा (d) (4) मात्र (d)

Sol. 1



- 21.** The volume (in mL) of 0.1 N NaOH required to neutralise 10 mL of 0.1 N phosphinic acid is _____.
0.1 N फॉस्फिनिक अम्ल के 10 mL को उदासीन करने के लिए आवश्यक 0.1 N NaOH का आयतन (mL में) है _____।

Sol. 10 ml

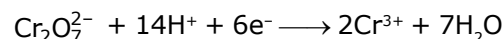


Phosphinic

$$\text{Vol.} \times 0.1 = 0.1 \times 10$$

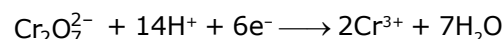
$$\text{vol} = 10 \text{ ml Ans.}$$

- 22.** An acidic solution of dichromate is electrolyzed for 8 minutes using 2A current. As per the following equation



The amount of Cr^{3+} obtained was 0.104 g. The efficiency of the process (in %) is (Take: $F = 96000 \text{ C}$, At. mass of chromium = 52) _____.

डाइक्रोमेट के एक अम्लीय विलयन को 2A विद्युतधारा का उपयोग करके 8 मिनट तक वैद्युत अपघटित किया गया। निम्नलिखित समीकरण के आधार पर



बने Cr^{3+} की आकलित मात्रा 0.104 g पायी गई। प्रक्रम की दक्षता (% में) है

(मानें : $F = 96000 \text{ C}$, क्रोमियम की परमाणु संहति = 52) _____.

Sol. 60 %

$$[\text{moles of Cr}^{3+}] \times 3 = \frac{8 \times 60 \times 2}{96000}$$

$$\text{moles of Cr}^{3+} = \frac{8 \times 4}{9600} = \frac{1}{300} \text{ mol} ; \text{mass of Cr}^{3+} = \frac{52}{300} \text{ g}$$

$$\% \text{ efficiency} = \frac{\text{Actual obtained Amt}}{\text{Theo. obtained Amt}} \times 100$$

$$= \frac{0.104}{\frac{52}{300}} \times 100 = 30 \times \frac{104}{52} = 60\%$$

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23. If 250 cm³ of an aqueous solution containing 0.73 g of a protein A is isotonic with one litre of another aqueous solution containing 1.65 g of a protein B, at 298 K, the ratio of the molecular masses of A and B is _____ × 10⁻² (to the nearest integer).

यदि प्रोटीन A के एक जलीय विलयन का 250 cm³ जिसमें A का 0.73 g है, प्रोटीन B के एक जलीय विलयन जिसके 1 लीटर में प्रोटीन का 1.65 g है, 298 K पर समपरासारी हैं A तथा B के आण्विक संहतियों का अनुपात है _____ × 10⁻² (निकटतम पूर्णक)।

Sol. 177

$$\frac{0.73}{M_A} \times \frac{1000}{250} = \frac{1.65}{M_B}$$

$$\begin{aligned} \frac{M_A}{M_B} &= \frac{73 \times 4}{165} = 1.769 \\ &= 176.9 \times 10^{-2} \\ &= 177 \times 10^{-2} \end{aligned}$$

24. 6.023 × 10²² molecules are present in 10 g of a substance 'x'. The molarity of a solution containing 5 g of substance 'x' in 2 L solution is _____ × 10⁻³.

एक पदार्थ 'x' के 10 g में 6.023 × 10²² अणु उपस्थित हैं। तो उस विलयन की मोलारिटी, जिसके 2 L विलयन में पदार्थ 'x' का 5 g है, होगी _____ × 10⁻³।

Sol. 25

$$\begin{aligned} \text{Mol. wt of 'x'} &= \frac{10}{6.023 \times 10^{22}} \times 6.023 \times 10^{23} \\ &= 100 \text{ g/mol} \end{aligned}$$

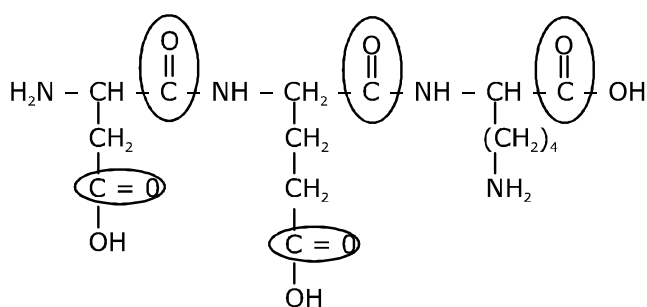
$$M = \frac{5/100}{2} = \left(\frac{5}{200} \times 1000 \right) \times 10^{-3}$$

$$M = 25 \times 10^{-3} \text{ mol/lit}$$

25. The number of >C=O groups present in a tripeptide Asp-Glu-Lys is _____.

एक ट्राइपेप्टाइड, Asp-Glu-Lys में उपस्थित >C=O समूहों की संख्या है _____।

Sol. 5



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