Redox Reactions JEE Main PYQ - 3

Total Time: 1 Hour **Total Marks:** 100

Instructions

Instructions

1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Redox Reactions

1. 0.01 M $KMnO_4$ solution was added to 20.0 mL of 0.05 M Mohr's salt solution through a burette. The initial reading of 50 mL burette is zero. The volume of $KMnO_4$ solution left in burette after the end point is _____ml. [nearest integer] **(+4, -1)**

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2. The number of statement(s) correct from the following for Copper (at. no. 29) is/are _____. **(+4, -1)**

A. Cu(II) complexes are always paramagnetic
B. Cu(I) complexes are generally colourless
C. Cu(I) is easily oxidized
D. In Fehling solution, the active reagent has Cu(I)

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3. Which one of the following is an example of disproportionation reaction? **(+4, -1)**

a. $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

b. $MnO_4^- + 4H^+ + 4e^- \rightarrow MnO_2 + 2H_2O$

c. $10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$

d. $8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

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4. Among the following which is the strongest oxidizing agent? **(+4, -1)**

a. Mn^{3+}

b. Fe^{3+}

c. Ti^{3+}

d. Cr^{3+}

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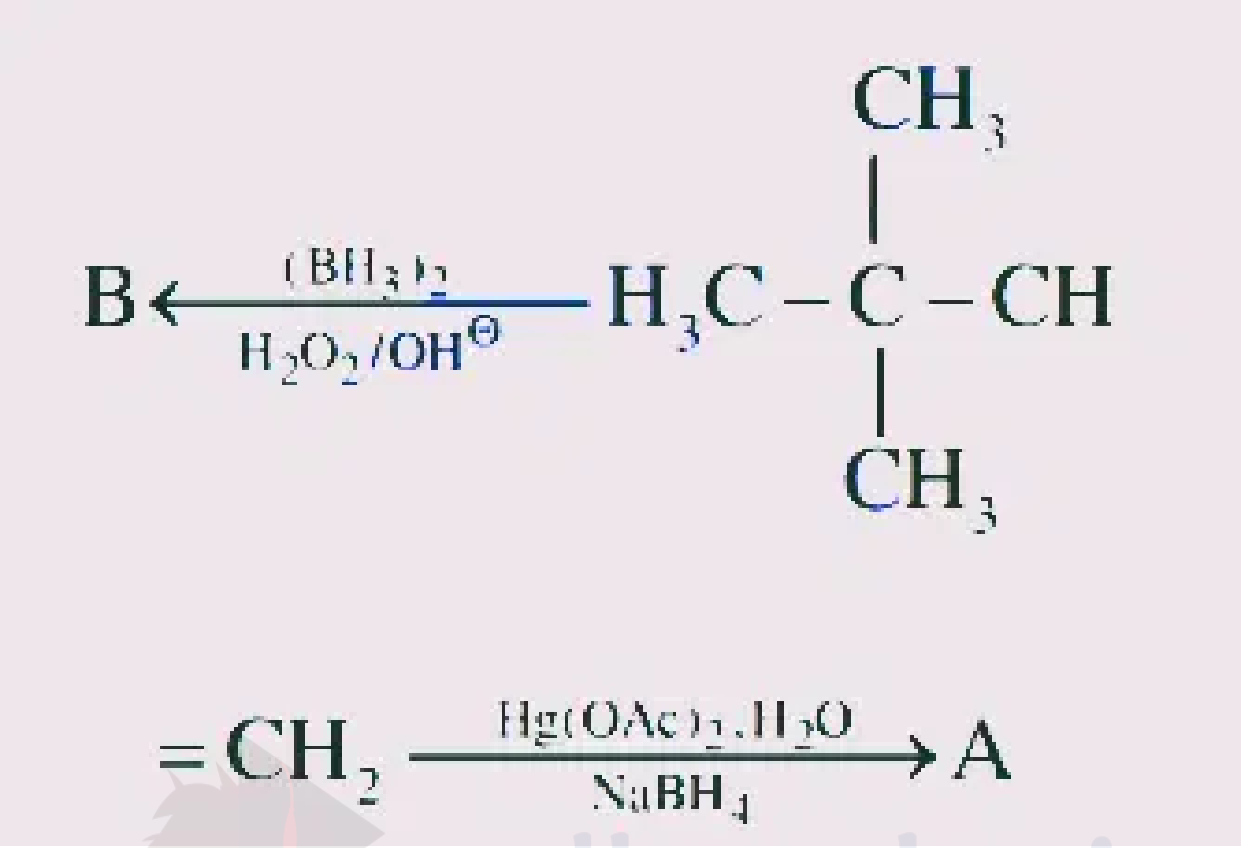
5. Choose the correct option for the following reactions **(+4, -1)**



a. 'A' and 'B' are both Markovnikov addition products.

b. 'A' is Markovnikov product and 'B' is anti-Markovnikov product.

c. 'A' and 'B' are both anti-Markovnikov products.

d. 'B' is Markovnikov and 'A' is anti-Markovnikov product.

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6. The dark purple colour of $KMnO_4$ disappears in the titration with oxalic acid in acidic medium. The overall change in the oxidation number of manganese in the reaction is : **(+4, -1)**

a. 5

b. 1

c. 7

d. 2

---

7. Which of the given reactions is not an example of disproportionation reaction? **(+4, -1)**

   a. $2H_2O_2 \rightarrow 2H_2O + O_2$

   b. $2NO_2 + H_2O \rightarrow HNO_3 + HNO_2$

   c. $MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$

   d. $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

---

8. Compounds which have different arrangements of atoms in space while having the same atoms bonded to each other are said to have **(+4, -1)**

   a. (A) Position isomerism

   b. (B) Functional group isomerism

   c. (C) Chain isomerism

   d. (D) Stereoisomerism

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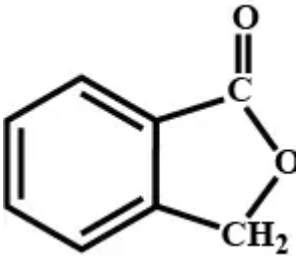
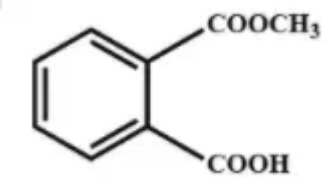
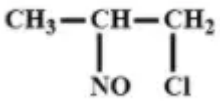
9. Which of the following reactants on reaction with conc. NaOH followed by acidification gives lactone as the only product? **(+4, -1)**



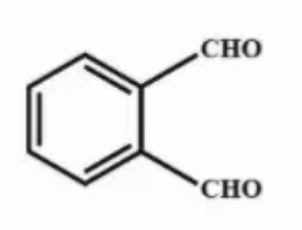
   a. (A)



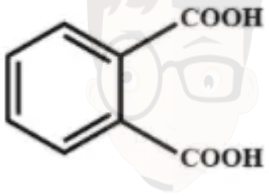
b. (B)



c. (C)



d. (D)



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10. The decomposition of formic acid on gold surface follows first order kinetics. If the rate constant at 300 is 1.0×10^{-3} $^{-1}$ and the activation energy = 11.488 $^{-1}$, the rate constant at 200 is ... ... $\times 10^{-5}$ $^{-1}$. (Round of to the Nearest Integer). (Given : = 8.314 $^{-1}$ $^{-1}$) **(+4, -1)**

a. (A) 10×10^{-7} $^{-1}$

b. (B) 10×10^{-5} $^{-1}$

c. (C) 10×10^{-7} $^{-1}$

d. (D) 10×10^{9} $^{-1}$

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11. If of $_{2}$ $_{3}$ is 8×10^{-12}, the molar solubility of $_{2}$ $_{3}$ in 0.1 $_{3}$ is: **(+4, -1)**

a. (A) 8×10^{-12} M

b. (B) 8×10^{-10} M

c. (C) 8×10^{-11} M

d. (D) 8×10^{-13} M

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12. **During the reaction of permanganate with thiosulphate, the change in oxidation of manganese occurs by value of 3. Identify which of the below medium will favour the reaction.** **(+4, -1)**

a. Strongly acidic

b. Strongly basic

c. Aqueous neutral

d. Weakly acidic

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13. Which of following are reducing and oxidising agent respectively. **(+4, -1)**

a. Eu^{+2}, Ce^{+4}

b. Ce^{+3}, Ce^{+4}

c. Eu^{+4}, Eu^{+2}

d. Tb^{+2}, Ce^{2+}

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14. Oxidation number of Mo in Ammonophosphomolybdate **(+4, -1)**

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15. The number of electrons involved in the reduction of permanganate to manganese dioxide in acidic medium is _____ **(+4, -1)**

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16. High density polythene (HDPE) is a polymer with: **(+4, -1)**

a. (A) Larger number of carbon atoms in the main chain of polymer

b. (B) More branched main carbon chain

c. (C) Less branched carbon atoms in the main chain.

d. (D) Smaller number of carbon atoms in the main chain.

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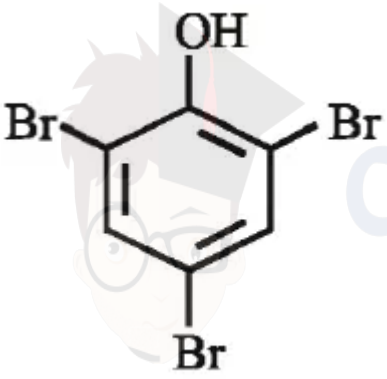
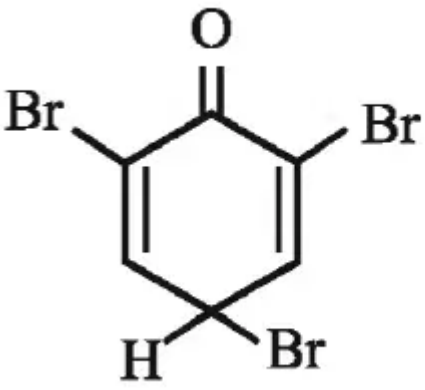
17. What is the structure of the major product when phenol is treated with bromine water? **(+4, -1)**

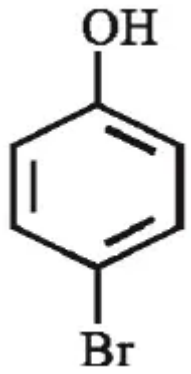
a. (A)



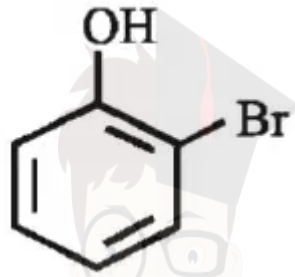
b. (B)



c. (C)



d. (D)



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18. A metal M which is not affected by strong acids like conc. HNO_3, conc. H_2SO_4 and concentrated solutions of alkalies like KOH and NaOH but dissolves in aqua-regia and forms MCl_3 which is used for toning in photography. The metal M is: **(+4, -1)**

a. (A) Ag

b. (B) Hg

c. (C) Au

d. (D) Cu

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19. The most suitable reagent for the conversion of RCH_2OH RCHO is: **(+4, -1)**

a. (A) $KMnO_4$

b. (B) $K_2Cr_2O_7$

c. (C) CrO_3

d. (D) PCC (Pyridinium Chlorochromate)

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20. Which one of the following species will disproportionate in the following reduction potential diagra **(+4, -1)**

a. (A) $^{+3}$, $^{+4}$

b. (B) $^{+}_{2}$, $^{+3}$

c. (C) $^{+}_{2}$, $^{+4}$

d. (D) None of these

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21. Potassium dichromate when heated with concentrated sulphuric acid and a soluble chloride, gives brown-red vapours of : **(+4, -1)**

a. CrO_3

b. $CrCl_3$

c. CrO_2Cl_2

d. Cr_2O_3

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22. Which of the following reactions is an example of a redox reaction? **(+4, -1)**

a. $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

b. $XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$

c. $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$

d. $XeF_2 + PF_5 \rightarrow [XeF]^+PF_6^-$

23. In order to oxidise a mixture one mole of each of \(${FeC2O_4, Fe2(C2O4)3, FeSO4}$\) and \(${Fe2(SO4)3}$\) in acidic medium, the number of moles of \(${KMnO_4 }$\) required is - **(+4, -1)**

a. 3

b. 2

c. 1

d. 1.5

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24. Given $E^{\circ}_{Cl_2/Cl^-} = 1.36\,V$, $E^{\circ}_{Cr^{3+}/Cr} = -7\cdot 74\,V$ $E^{\circ}_{Cr_2O_7^{2-}/Cr^{3+}} = 1.33\,V$, $E^{\circ}_{MnO_4^-/Mn^2+} = 1.51\,V$ Among the following, the strongest reducing agent is: **(+4, -1)**

a. Cr^{3+}

b. Cl^-

c. Cr

d. Mn^{2+}

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25. Copper becomes green when exposed to moist air for a long period. This is due to: **(+4, -1)**

a. the formation of a layer of cupric oxide on the surface of copper.

b. the formation of a layer of basic carbonate of copper on the surface of copper.

c. the formation of a layer of cupric hydroxide on the surface of copper.

d. the formation of basic copper sulphate layer on the surface of the metal.

Answers

1. **Answer: 30 - 30**

Explanation:

The correct answer is 30
Meq of oxidising agent = Meq of reducing agent
$(M \times V \times n_F)KMnO_4 = (M \times V \times n_F)_{Mohr'ssalt}$
0.01 × 20 × 5 = 0.05 × V × 1
Volume required = 20 ml
Since initial volume of $KMnO_4$ in burette is 50 ml. Hence volume of $KMnO_4$ left in the burette after end point is 30 ml.

Concepts:

1. **Redox Reactions:**

Redox Reaction:

Redox reactions are chemical reactions where oxidation and reduction take place simultaneously. In this type of reaction, there is a gain of electrons for one chemical species while the other loses electrons or simply involves transfer of electrons. The species that loses electrons is oxidized while the one that gains electrons is reduced.

Types of Redox Reactions:

Redox reactions can be differentiated into 4 categories namely combination reactions, decomposition reactions, displacement reactions, and disproportionation reactions. Each is explained separately below:

Combination Reaction:

In this, the molecules combine to form new compounds. For example, when magnesium reacts to nitrogen.

Decomposition Reaction:

Opposite to the combination reaction, here there is a breakdown of compounds to simpler substances. For example, electrolysis of water.

Displacement Reaction:

In this, the more reactive metal will displace the less reactive one in a chemical reaction. The reactivity of an element is represented in a series called the reactivity series (arranged in decreasing order of reactivity) which makes it easier to determine the chemical reaction and its products.

Disproportionation Reaction:

This is a peculiar type of reaction where an element showing a particular oxidation state will be oxidized and reduced simultaneously. Another thing to note is that these reactions will always have an element that can exhibit three oxidation states.

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2. Answer: 3 - 3

Explanation:

(A) Cu(II) complexes are always paramagnetic as they have one unpaired electron due to d^9 configuration of Cu(II).
(B) Cu(I) complexes are generally colourless due to d^{10} configuration.
(C) Cu(I) is easily oxidised to Cu^{+2} in aqueous solution.
$2Cu^{+} \rightarrow Cu^{+2} + Cu$
Cu^{+1} disproportionates to Cu^{+2} and Cu
($E^{\circ}_{cell} > 0$ for this cell reaction in aqueous solution)
In Fehling's solution, active reagent has Cu(II) which is reduced to Cu(I) on reaction with aldehydes.

Hence, (D) statement is incorrect.

So, the answer is 3.

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---

3. **Answer: a**

Explanation:

$\overset{+6}{M}\mathrm{nO}_4^{-2} \rightarrow \overset{+7}{M}\mathrm{nO}_4^{-}$

$\overset{+6}{M}\mathrm{nO}_4^{-2} \rightarrow \overset{+4}{M}\mathrm{nO}_2$

MnO_4^{-2} is an intermediate oxidation state and is converted into compounds having higher and lower oxidation states.

So, the correct answer is (A): $3\mathrm{MnO}_4^{2-} + 4H^+ + 2\mathrm{MnO}_4^- + MnO_2 + 2H_2O$

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4. Answer: a

Explanation:

$E^{\circ}_{Fe^{3+}|Fe^{2+}} = +0.77\ V$
$E^{\circ}_{Ti^{3+}|Ti^{2+}} = -0.37\ V$
$E^{\circ}_{Mn^{3+}|Mn^{2+}} = +1.57\ V$
$E^{\circ}_{Cr^{3+}|Cr^{2+}} = -0.41\ V$
Mn^{+3} is the best oxidising agent among the given series.

So, the correct option is (A): Mn^{+3}

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5. **Answer: b**

Explanation:

The correct option is (B): 'A' is Markovnikov product and 'B' is anti-Markovnikov product.

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6. **Answer: a**

Explanation:

The correct option is (A): 5.

Concepts:

1. Oxidation Number:

Oxidation number, also called **oxidation state**, the total number of electrons that an atom either gains or loses in order to form a chemical bond with another atom.

Oxidation number of an atom is defined as the charge that an atom appears to have on forming ionic bonds with other heteroatoms. An atom having higher electronegativity (even if it forms a covalent bond) is given a negative oxidation state.

The definition, assigns oxidation state to an atom on conditions, that the atom –

1. Bonds with heteroatoms.
2. Always form ionic bonding by either gaining or losing electrons, irrespective of the actual nature of bonding.

Oxidation number is a formalized way of keeping track of oxidation state.

Read More: Oxidation and Reduction

Way To Find Oxidation Number Of An Atom?

Oxidation number or state of an atom/ion is the number of electrons an atom/ion that the molecule has either gained or lost compared to the neutral atom. Electropositive metal atoms, of group I, 2 and 3 lose a specific number of electrons and have always constant positive oxidation numbers.

In molecules, more electronegative atom gain electrons from a less electronegative atom and have negative oxidation states. The numerical value of the oxidation state is equal to the number of electrons lost or gained.

Oxidation number or oxidation state of an atom or ion in a molecule/ion is assigned by:

1. Summing up the constant oxidation state of other atoms/molecules/ions that are bonded to it and
2. Equating, the total oxidation state of a molecule or ion to the total charge of the molecule or ion.

7. **Answer: c**

Explanation:

$$2\overset{-1}{H_2O_2} \longrightarrow 2\overset{2-}{H_2O} + \overset{0}{O_2} : \text{Disproportionation}$$

$$2\overset{+4}{NO_2} + H_2O \rightarrow \overset{+5}{HNO_3} + \overset{+3}{HNO_2} : \text{Disproportionation}$$

$$MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O : \text{reduction}$$

$$3\overset{+6}{MnO_4^{2-}} + 4H^+ \rightarrow 2\overset{+7}{MnO_4^-} + \overset{+4}{MnO_2} + 2H_2O : \text{Disproportionation}$$

So, the correct option is (C): $MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$

Concepts:

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8. **Answer: d**

Explanation:

Explanation:
Stereoisomer contrasts with structural isomers, which share the same molecular formula, but the bond connections or their order differs. By definition, molecules that are stereoisomers of each other represent the same structural isomer.Hence, the correct option is (D).

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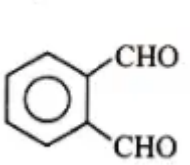
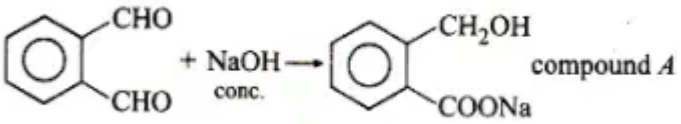
9. **Answer: d**

Explanation:

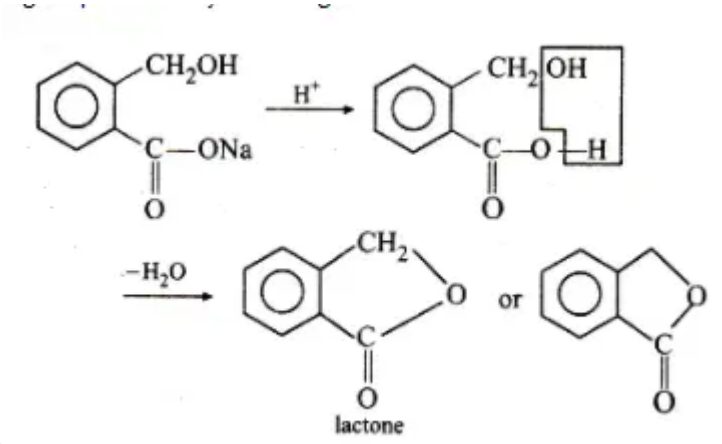
Explanation:

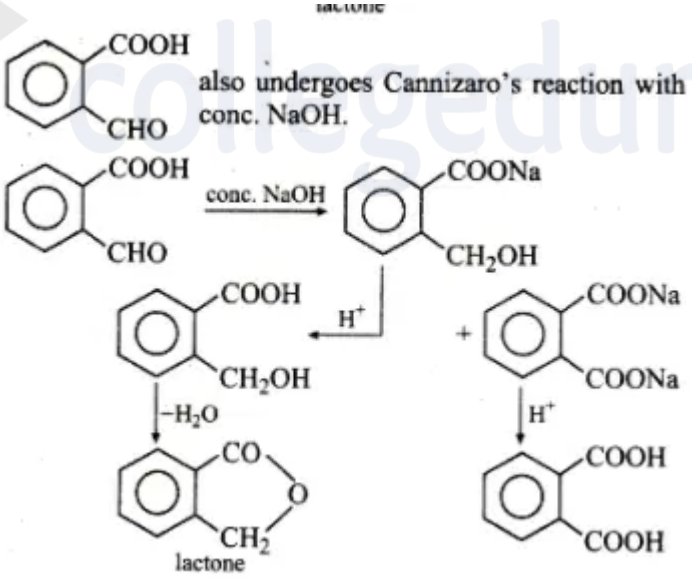


gives Cannizaro's reaction with conc. NaOH



This compound on acidification gives a compound which have $-CH_2OH$ and $-COOH$ group, such groups on dehydration give lactone.





Hence, the correct option is (D).

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10. Answer: b

Explanation:

Explanation:

Given: $_{300}$ = 10^{-4}, $_{200}$ = ? = 11.488 / , = 8.314 / so,

$(\frac{300}{200}) = —(\frac{1}{200} - \frac{1}{300})$ $(\frac{300}{200}) = \frac{11.488 \times 1000 \times 100}{8.314 \times 200 \times 300} = 2.303 =$ 10 $\frac{300}{200} =$ 10so, $\frac{300}{200} = 10$ $_{200} = \frac{1}{10} \times$ $_{300} = 10^{-4} = 10 \times 10^{-5}$ $^{-1}$ Hence, the correct option is (B).

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11. Answer: b

Explanation:

Explanation:

$_{2}$ $_{3}($ $)$ 2 $^{+}($ $.) +$ $^{-2}_{3}($ $)$ $= [$ $^{+}]^{2}[$ $^{-2}_{3}]8 \times 10^{-12} = (0.1 + 2$ $)^{2}($ $)$As $_{sp}$ is so small, so $0.1 + 2$ $= 0.1$ $= 8 \times 10^{-10}$ Hence, the correct option is (B).

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12. Answer: c

Explanation:

The correct option is (C): Aqueous neutral

$KMnO_4$ in the aqueous neutral medium that reduces to MnO_2

$2KMnO_4 + H_2O \rightarrow 2MnO_2 + 2KOH + \frac{3}{2} O_2$

∴ The oxidation state of Mn in $KMnO_4$ that changes from +7 to +4 i.e., by 3 units.

Concepts:

1. Oxidation Number:

Oxidation number, also called **oxidation state**, the total number of electrons that an atom either gains or loses in order to form a chemical bond with another atom.

Oxidation number of an atom is defined as the charge that an atom appears to have on forming ionic bonds with other heteroatoms. An atom having higher electronegativity (even if it forms a covalent bond) is given a negative oxidation state.

The definition, assigns oxidation state to an atom on conditions, that the atom –

1. Bonds with heteroatoms.
2. Always form ionic bonding by either gaining or losing electrons, irrespective of the actual nature of bonding.

Oxidation number is a formalized way of keeping track of oxidation state.

Read More: Oxidation and Reduction

Way To Find Oxidation Number Of An Atom?

Oxidation number or state of an atom/ion is the number of electrons an atom/ion that the molecule has either gained or lost compared to the neutral atom. Electropositive metal atoms, of group I, 2 and 3 lose a specific number of electrons and have always constant positive oxidation numbers.

In molecules, more electronegative atom gain electrons from a less electronegative atom and have negative oxidation states. The numerical value of the oxidation state is equal to the number of electrons lost or gained.

Oxidation number or oxidation state of an atom or ion in a molecule/ion is assigned by:

1. Summing up the constant oxidation state of other atoms/molecules/ions that are bonded to it and
2. Equating, the total oxidation state of a molecule or ion to the total charge of the molecule or ion.

---

13. Answer: a

Explanation:

- **Eu^{2+} (Europium in +2 Oxidation State):**
  - Eu^{2+} has a tendency to lose an electron and get oxidised to Eu^{3+}, which is a more stable oxidation state for europium due to the half-filled f-orbital configuration ($4f^7$).
  - This tendency to donate electrons makes Eu^{2+} a **reducing agent**.
- **Ce^{4+} (Cerium in +4 Oxidation State):**
  - Ce^{4+} has a tendency to gain an electron and get reduced to Ce^{3+}, which is a more stable oxidation state for cerium due to its $4f^1$ configuration.
  - This ability to accept electrons makes Ce^{4+} a strong **oxidising agent**.

Conclusion:

Eu^{2+} acts as a reducing agent, while Ce^{4+} acts as an oxidising agent.

Concepts:

1. Redox Reactions:

Redox Reaction:

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Types of Redox Reactions:

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Disproportionation Reaction:

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14. Answer: 6 - 6

Explanation:

Calculation of Oxidation Number of Mo in $(NH_4)_3PMo_{12}O_{40}$

Given Compound:

$(NH_4)_3PMo_{12}O_{40}$, which can also be written as $(NH_4)_3PO_4.12MoO_3$.

Step-by-Step Calculation:

1. Let the oxidation number of Mo be x.
2. The oxidation numbers of the other components are:
   - NH_4^+: $+1$ (3 ammonium ions contribute $3 \times +1 = +3$).
   - P: $+5$ (phosphorus in the phosphate group).
   - O: -2 (oxygen).
3. Write the total oxidation number equation for the compound:

$$3(+1) + (+5) + 12x + 40(-2) = 0$$

4. Simplify the equation:

$$3 + 5 + 12x - 80 = 0$$

5. Combine terms:

$$12x = 80 - 8$$

6. Simplify further:

$$12x = 72$$

7. Divide by 12:

$$x = 6$$

Conclusion:

The oxidation number of molybdenum (Mo) in $(NH_4)_3PMo_{12}O_{40}$ is **+6**.

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15. **Answer: 3 - 3**

Explanation:

Step 1: Reduction Reaction in Acidic Medium The reduction reaction is:

$$\mathrm{MnO_4^-} + 4\mathrm{H^+} + 3e^- \rightarrow \mathrm{MnO_2} + 2\mathrm{H_2O}.$$

In this reaction, 3 electrons are transferred during the reduction of $\mathrm{MnO_4^-}$ to $\mathrm{MnO_2}$.

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16. Answer: c

Explanation:

Explanation:
High-density polythene (HDPE) is a polymer with fewer branched carbon atoms in the main chain.It consists of linear molecules with close packing. Due to the close packing of the polymer chains, it occupies less volume. Thus, the polymer has a high density.It is prepared by heating ethene in a hydrocarbon solvent at about 333-343 K under a pressure of 6-7 atmosphere in the presence of a catalyst such as triethylaluminium and titanium tetrachloride (Zeigler Natta catalyst).The polymerisation reaction can be represented as:
$nCH_2 = CH_2 \xrightarrow[\text{2eigler - Natta catalyst}]{\text{333 - 343K, 6 - 7atm}} + CH_2 - CH_2 +$ Ethene polythene, it is tougher, harder and has greater tensile strength than low-density polythene (LDPE) and thus, used in the manufacture of containers, housewares and pipes.Hence, the correct option is (C).

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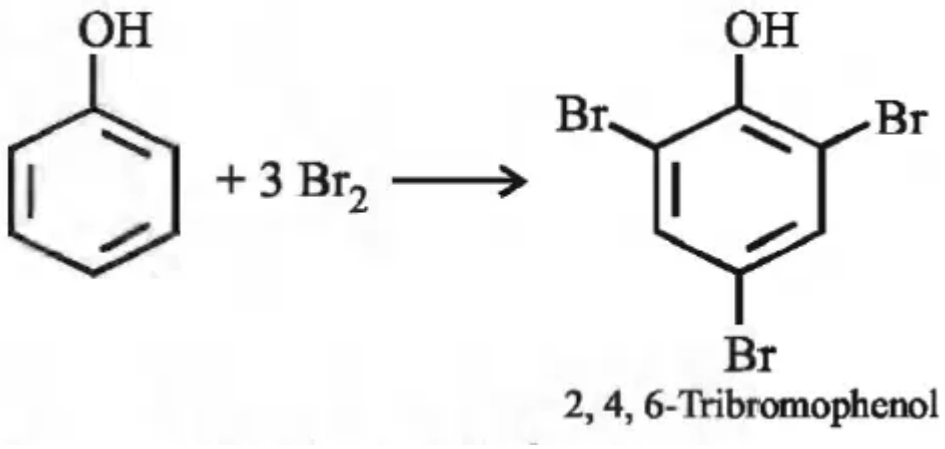
17. Answer: a

Explanation:

Explanation:
Phenol has to activate (electron releasing) – group and bromine water supplies $^{+}$ ion easily, hence under such conditions reaction does not stop at monobromo or dibromo stage but a fully brominated (2, 4, 6, -tribromophenol) compound is the final product.



2, 4, 6-Tribromophenol

Hence, the correct option is (A).

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18. Answer: c

Explanation:

Explanation:
Au is not affected by concentrated acids and strong alkalies. However, it dissolves in aqua-regia forming $AuCl_3$ which is used for toning in photography.
$[HNO_3 + 3HCl \quad NOCl + 2Cl + 2H_2O] \times 3[Au + 3Cl \quad AuCl_3] \times 2$
$2Au + 3HNO_3 + 9HCl \quad 2AuCl_3 + 3NOCl + 6H_2O$Hence, the correct option is (C).

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19. Answer: d

Explanation:

Explanation:
$R - CH_2OH \xrightarrow{PCC} R - CH = 0$ its an oxidation reaction.Pyridinium chlorochromate is a mild oxidising agent that oxidises primary alcohol to aldehydes and secondary alcohols to ketones. It does not affect any other functional group and therefore has high selectivity for oxidation of alcohols. Whereas acidic permanganate, acidic dichromate, chromic anhydride in glacial acetic acid are strong oxidising agents and can do further oxidation to carboxylic acid.The most suitable reagent for $RCH_2OH \quad RCHO$ is pyridinium chlorochromate (PCC).Hence, the correct option is (D).

---

20. Answer: d

Explanation:

Explanation:
The following electrode potential diagram:

We have to find the species which undergoes disproportionation.In general, if the value of emf at the right side of species is greater than that of left side, the species will undergo disproportionation, therefore, will undergo disproportionation reactions. $^{+}{}_{4}{}^{/}{}^{+3}$ = 2.62 $^{+2}{}^{/}{}^{+4}$ = 0.86 $_{cell}$ = $_{cathode}$ − $_{anode}$ = 2.62 − 0.86 = 1.76 Since, cell is positive $^{+4}$, $^{3+}$ can be converted to $^{+}_{2}$ simultaneously.Hence, the correct option is (D).

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21. **Answer: c**

Explanation:

Solid potassium dichromate when heated with concentrated sulphuric acid and a soluble chloride gives orange red vapours of a volatile oily liquid CrO_2Cl_2 $K_2Cr_2O_7 + 4NaCl + 6H_2SO_4 \rightarrow 2KHSO_4 + 4NaHSO_4 + 2CrO_2Cl_2$ chromyl chloride

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---

22. Answer: c

Explanation:

Xe is oxidised from $+4$ in (XeF_4) to $+6$ in (XeF_6)
Oxygen is reduced from $+1$ (in O_2F_2) to zero (in O_2)

So, the correct option is (C): $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$

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---

23. **Answer: b**

Explanation:

\(${n_{eq} \; KMnO_4 = n_{eq} . [FeC2O4 + Fe2(C2O4)3 + FeSO4]}$\) or \($n \times 5 = 1 \times 3 + 1 \times 6 + 1 \times 1$\) \($\therefore n = 2$\)

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---

24. Answer: c

Explanation:

For Cr^{3+}, $E_{Cr^{3+}/Cr_2O_7^{2-}} = -1.33\,V$

For Cl^-, $E^\circ_{Cl^-/Cl_2} = -1.36\,V$

For Cr, $E^\circ_{Cr/Cr^{3+}} = 0.74\,V$

For Mn^{2+}, $E^\circ_{Mn^{2+}/MnO_4^-} = -1.51\,V$

Positive E° is for Cr, hence it is strongest reducing agent.

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---

25. **Answer: b**

Explanation:

Copper when exposed to moist air having CO_2. It gets superficially coated with a green layer of basic carbonate $CuCO_3.Cu(OH)_2$.

Concepts:

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