

IRON and ITS COMPOUNDS

14.1. Explain: what are the properties of iron atoms structure. Which oxidation numbers does iron shows and its compounds? Show some examples of compounds.

14.2. Can pure iron be found in nature? If yes, where in particular?

14.3. Write the reaction equations of irons with the following substances:

- A. Oxygen B. Chlorine C. Sulfur
D. Hydrochloric acid E. Dilute sulfuric acid
F. Water

14.4. Chose the methods of separation of iron and aluminum samples with:

- A. NaOH (concentrated).
B. NaCl (concentrated).
C. Magnet
D. HCl (concentrated).

14.5. Chose the substances that can react with Iron:

- A. Cl_2 B. NaNO_3 C. Ar D. CuCl_2 E. O_2
F. Cu(OH)_2 G. H_2SO_4 dilute H. H_2O

Write down their equations.

14.6. An iron nail will be covered by a metal if it is dipped into a salty solution of

- A. Copper (II) sulfate B. Magnesium chloride
C. Lead (II) nitrate
D. Silver nitrate E. Aluminum chloride
F. Magnesium sulfate

14.8. Explain why;

A. Copper was discovered earlier than iron, even though abundance of copper in the earth crust is 0.01%, whereas iron's is 4.7%.

B. Iron is cheaper than aluminum, despite the fact that abundance of iron in the earth crust is 4.7%, whereas aluminum's 7.3%.

14.9. Explain what rust is. Write down the equation of iron rusting. What is the process of rust formation called and how can it be prevented?

14.10. Write down the formulas of iron (II) and (III) oxides and hydroxides. Write equations that confirm:

- A. iron (II) compounds have basic properties
B. iron (III) compounds have amphoteric properties

14.11. Determine which of the following

H_2O , H_2SO_4 , NaOH , CuSO_4 , HNO_3 , KCl , CuO , BaCl_2 , AgNO_3 , O_2 , H_2 and Mg react with:

- A. FeO B. Fe_2O_3 C. Fe(OH)_2
D. Fe(OH)_3 E. FeCl_3 F. FeSO_4

Write down both: molecular and ionic equations.

14.12. 3 tubes without labels contain solutions of Iron (II) sulfate, Iron (III) sulfate and aluminum sulfate. Propose a method to determine each substance. Write down the equations in both ionic and molecular form.

14.13. Purpose a plan to demonstrate the composition of the following salts:

- A. Iron (III) chloride B. Iron (III) sulfate
Write down the equations in both molecular and ionic form.

14.14. Write down the equations by which iron is obtained as a result of the reaction of:

- A. Iron (III) oxide and aluminum
B. Iron (II) oxide and coke.
C. Magnetite (Fe_3O_4) and carbon monoxide.
D. Hematite (Fe_2O_3) and hydrogen gas.
E. Iron (II) sulfate solution and aluminum.
F. Iron (II) chloride solution and magnesium.

14.15. Indicate which of the following substances reduce iron from its compounds:

- A. H_2 B. Al C. Ni D. Cu
E. CO F. C
G. H_2O H. Pb

Write down the reduction reactions of iron from:

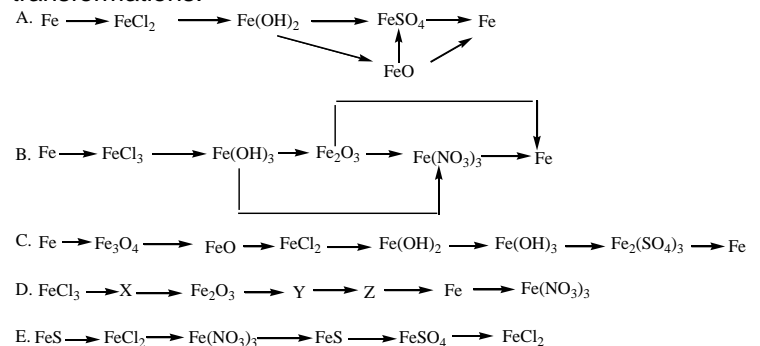
1. Fe_2O_3 2. Fe_3O_4

14.16. Propose a method in order to obtain iron from the following:

- A. Iron (II) hydroxide B. Iron (III) hydroxide
C. Iron (II) oxide
D. Iron (III) oxide

Method may contain more than one step.

14.17. Write down the reactions in order to perform the transformations:



14.18. Write down if possible in molecular and ionic form of the equations for the formation reactions by which the most important iron salts can be obtained:

- A. Iron (II) sulfate
B. Iron (III) sulfate
C. Iron (III) chloride

14.19. Thermite (used in welding) contains Fe_3O_4 and metallic aluminum. Calculate the mass of iron obtained by

thermite reaction, if the mass of aluminum used is 135 g.

14.20. Ratio of Al and Fe_3O_4 masses in a thermite mixture is 3/10. An inexperienced welder prepared a 1 kg thermite mixture, by taking 500 g of aluminum and 500 g slag. Calculate by how many percent one of the substances was excess.

14.21. Calculate the mass of iron that can be obtained from the reaction of hydrogen gas with 16 g of iron (III) oxide. Determine the volume of hydrogen gas in this reaction at STP.

14.22. Product of the reaction of 0.5 mole of iron with chlorine was dissolved in water with a volume of 502.5 mL. Calculate the mass part of the substance in the solution.

14.23. Calculate what is the mass of iron that can be obtained from a mineral with a mass of 100 kg that contains 20% impurities and magnetite mineral (Fe_3O_4) by using the aluminothermic method.

14.24. Calculate the volume of hydrogen gas necessary to completely reduce iron from magnetite with a mass of 100 kg (mass part of Fe_3O_4 is %65).

14.25. A 48 g sample of iron is introduced in a solution that contains 54 g of copper (II) chloride. Calculate if any copper salt will remain by the end of the reaction. Calculate the mass of copper collected.

14.26. Determine the mass of technical iron that contains 12% impurities necessary to reduce the metal from an 11 g lead (II) nitrate solution.

14.27. An iron alloy sample with a mass of 25 g was burnt in oxygen. Iron slag and carbon dioxide with a volume of 0.5 L at STP were obtained as a result. Calculate the mass part of carbon in the alloy and determine if it is steel or cast iron.

14.28. Calculate the mass of magnetite that contains 80% of Fe_3O_4 in order to obtain 1 tons of 95% cast iron, by mass.

14.29. A copper and iron mixture that contains 35% iron is treated with 20% hydrochloric acid solution ($d=1.1\text{g/mL}$). An unknown gas with the mass of 0.224 L at STP was obtained. Calculate the mass of mixture and the volume of the hydrochloric acid solution consumed.