***Chemistry***

**18: Representative Metals, Metalloids, and Nonmetals**

**18.9: Occurrence, Preparation, and Compounds of Oxygen**

79. Predict the product of burning francium in air.

Solution

FrO­2: ;

The heavier alkali metals (from K to Fr) react with oxygen to produce a superoxide compound that is a thermodynamically stable species. The francium oxidation state is 1+ and that of the superoxide  is 1–.

81. Write balanced chemical equations for the following reactions:

(a) zinc metal heated in a stream of oxygen gas

(b) zinc carbonate heated until loss of mass stops

(c) zinc carbonate added to a solution of acetic acid, CH3CO2H

(d) zinc added to a solution of hydrobromic acid

Solution

(a); (b) ;

(c);

(d) 

83. Illustrate the amphoteric nature of aluminum hydroxide by citing suitable equations.

Solution

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85. Write balanced chemical equations for the following reactions:

(a) sodium oxide added to water

(b) cesium carbonate added to an excess of an aqueous solution of HF

(c) aluminum oxide added to an aqueous solution of HClO4

(d) a solution of sodium carbonate added to solution of barium nitrate

(e) titanium metal produced from the reaction of titanium tetrachloride with elemental sodium

Solution

(a) ;

(b) ;

(c) ;

(d) ;

(e) 

87. Which is the stronger acid, HClO4 or HBrO4? Why?

Solution

HClO4 is the stronger acid because, in a series of oxyacids with similar formulas, the higher the electronegativity of the central atom, the stronger is the attraction of the central atom for the electrons of the oxygen(s). The stronger attraction of the oxygen electron results in a stronger attraction of oxygen for the electrons in the O–H bond, making the hydrogen more easily released. The weaker this bond, the stronger the acid.

89. Which is the stronger acid, H2SO4 or H2SeO4? Why? You may wish to review the chapter on acid-base equilibria.

Solution

As H2SO4 and H2SeO4 are both oxyacids and their central atoms both have the same oxidation number, the acid strength depends on the relative electronegativity of the central atom. As sulfur is more electronegative than selenium, H2SO4 is the stronger acid.

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