

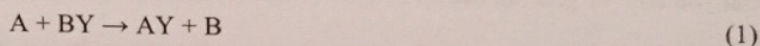
Experiment 6: OBSERVING CHEMICAL REACTIONS/WRITING CHEMICAL EQUATIONS

Introduction

The notion of chemical change is expressed by the use of balanced chemical equations. Chemical changes, or chemical reactions, are evidenced in one of several ways: evolution of heat, a color change, formation of a gas (as evidenced by the production of bubbles in solution), or formation of an insoluble solid (a precipitate.)

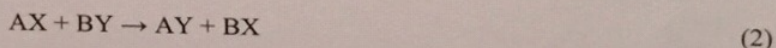
Simple chemical reactions can be categorized into several groups:

A *single displacement reaction* occurs when a free element A (usually a metal) displaces another element, B, from a compound to produce a different compound and a different free element (eq 1):



A common example of this type of reaction is the reaction of an elemental active metal with an aqueous solution of an acid. The metal displaces hydrogen on the acid and combines with the anion of the acid, liberating elemental hydrogen gas.

A *double displacement (metathesis) reaction* (eq 2) occurs when two compounds exchange ions to form new compounds. In all such reactions, one of the products is a compound that will separate from the reaction mixture in some way, frequently as a solid or gas, or as a stable molecular compound, like water.



To deduce whether the products AY and BX of a double-displacement reaction are soluble or insoluble, we use a solubility table, as shown in Table 1.

Table 1. Solubility Guidelines for Ionic Compounds in Water.

Soluble Ionic Compounds		Important Exceptions
Compounds Containing	NO_3^-	None
	CH_3COO^-	None
	Cl^-	Compounds of Ag^+ , Hg_2^{2+} , Pb^{2+}
	Br^-	Compounds of Ag^+ , Hg_2^{2+} , Pb^{2+}
	I^-	Compounds of Ag^+ , Hg_2^{2+} , Pb^{2+}
	SO_4^{2-}	Compounds of Sr^{2+} , Ba^{2+} , Hg_2^{2+} , Pb^{2+}
Insoluble Ionic Compounds		Important Exceptions
Compounds Containing	S^{2-}	Compounds of NH_4^+ , the alkali metal cations, and Ca^{2+} , Sr^{2+} , and Ba^{2+}
	CO_3^{2-}	Compounds of NH_4^+ and the alkali metal cations
	PO_4^{3-}	Compounds of NH_4^+ and the alkali metal cations
	OH^-	Compounds of the alkali metal cations, and Ca^{2+} , Sr^{2+} , and Ba^{2+} , NH_4^+