Conservation of Mass

1. It has been observed that 14.0 g of nitrogen will combine with 3.0 g of hydrogen to produce ammonia (NH_3).

a) How much ammonia is produced when 100.0 g of nitrogen gas is reacted with 50.0 g of hydrogen gas?

b) How much ammonia is produced when 10. grams of nitrogen gas is reacted with 10. grams of hydrogen gas?

c) If 25.0 grams of hydrogen gas is completely reacted, how much nitrogen is needed?

d) How much ammonia is produced?

2) Elemental tin and chlorine gas combine in a mass ratio of 11.0 g Sn to 10.0 g Cl_2 to produce tin(III) chloride ($SnCl_3$).

a) How much tin is needed to completely react 25.0 grams of chlorine gas?

b) How much tin(III) chloride is produced?

c) How much tin(III) chloride is produced when 100 grams of tin is reacted with 50 grams of chlorine gas?

d) How much tin(III) chloride is produced when 10 grams of tin is reacted with 10 grams of chlorine gas?

Heat & Specific Heat Capacity:

3. A metal object of mass = 20.00 g is heated from a temperature of 25.0 °C to 200.0 °C. During this process, the metal object absorbs 1.34×10^3 J of energy.

a) What is the specific heat capacity of the metal mass?

b) What is the heat energy required to raise the temperature of the metal object in calories?

4. The hot metal object (in problem 1 above) is then placed into a thermally isolated container with 20.00 g of water, initially at 25.0 °C.

a) What happens to the temperature of the water? The metal object?

b) Describe the flow of energy (heat) inside the container, *i.e. where is heat energy lost and where is it gained?*.

c) What is the final temperature of the water/metal object?

5. In a separate experiment, an identical metal object at a temperature of 100.0 °C is placed into a thermally isolated container containing 50.00 kg of a liquid (initial temperature of 20.0 °C) with an unknown specific heat capacity. The final temperature of the mystery liquid/metal object is 23.5 °C.

a) What is the specific heat capacity of the mystery liquid?

b) How much heat (in Joules) would be needed to raise the temperature of the unknown liquid from 25.0 °C to 100.0 °C?

c) How much heat (in calories) would be needed to raise the temperature of the unknown liquid from 25.0 °C to 100.0 °C?