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CSUSM
STEM Success Center

Stoichiometry

1) A 2.00 g sample of ammonia is mixed with 4.00 g of oxygen. Which is the limiting reactant and how much excess reactant remains after the reaction has stopped?

2) The thermite reaction has been used to "weld" pieces of metal together, since it releases a tremendous amount of energy. This reaction converts iron (III) oxide and aluminum metal into aluminum oxide and iron metal.
   a) Write a balanced chemical equation for this reaction.
   b) How many moles of aluminum oxide can be produced from 1.60 moles of aluminum metal? Show your work.
   c) How many moles of iron metal can be produced from 0.645 moles of aluminum metal? Show your work.
   d) How many moles of iron metal can be produced from 10 g iron (III) oxide? Show your work.
   e) How many grams of iron metal can be produced from 20 g of iron (III) oxide? Show your work.

Stoichiometry (Solutions)

1) A 2.00 g sample of ammonia is mixed with 4.00 g of oxygen. Which is the limiting reactant and how much excess reactant remains after the reaction has stopped?

$$NH_3 + O_2 \rightarrow NO + H_2O$$

Balanced: $\mathbf{4}NH_3 + \mathbf{5}O_2 \rightarrow \mathbf{4}NO + \mathbf{6}H_2O$

$$2.00\ g\ NH_3 * \frac{1\ mol\ NH_3}{17.031\ g\ NH_3} * \frac{4\ mol\ NO}{4\ mol\ NH_3} = 0.117\ mol\ NO$$

$$4.00\ g\ O_2 * \frac{1\ mol\ O_2}{31.998\ g\ O_2} * \frac{4\ mol\ NO}{5\ mol\ O_2} = 0.100\ mol\ NO$$

Limiting reactant is O_2

$$0.117\ mol\ NO - 0.100\ mol\ NO = 0.017\ mol\ NO$$

$$0.017\ mol\ NO * \frac{4\ mol\ NH_3}{4\ mol\ NO} * \frac{17.031\ g\ NH_3}{mol\ NH_3} = 0.289\ g\ NH_3$$

0.289 grams of excess NH_3 remain after the reaction has stopped.

2) The thermite reaction has been used to "weld" pieces of metal together, since it releases a tremendous amount of energy. This reaction converts iron (III) oxide and aluminum metal into aluminum oxide and iron metal.

a) Write a balanced chemical equation for this reaction.

$$Fe_2O_3 + \mathbf{2}Al \rightarrow \mathbf{2}Fe + Al_2O_3$$

b) How many moles of aluminum oxide can be produced from 1.60 moles of aluminum metal? Show your work.

$$1.60\ mol\ Al * \frac{1\ mol\ Al_2O_3}{2\ mol\ Al} = \mathbf{0.8\ mol\ Al_2O_3}$$

c) How many moles of iron metal can be produced from 0.645 moles of aluminum metal? Show your work.

$$0.645\ mol\ Al * \frac{2\ mol\ Fe}{2\ mol\ Al} = \mathbf{0.645\ mol\ Fe}$$

d) How many moles of iron metal can be produced from 10 g iron (III) oxide? Show your work.

$$10\ g\ Fe_2O_3 * \frac{1\ mol\ Fe_2O_3}{159.69\ g\ Fe_2O_3} * \frac{2\ mol\ Fe}{1\ mol\ Fe_2O_3} = \mathbf{0.125\ mol\ Fe}$$

e) How many grams of iron metal can be produced from 20 g of iron (III) oxide? Show your work.

$$20\ g\ Fe_2O_3 * \frac{1\ mol\ Fe_2O_3}{159.69\ g\ Fe_2O_3} * \frac{2\ mol\ Fe}{1\ mol\ Fe_2O_3} * \frac{55.845\ g\ Fe}{1\ mole\ Fe} = \mathbf{13.98\ g\ Fe}$$