Name Teacher Class Date

Chapter 11 The Mathematics of Chemical Equations

Find the answer to each problem and write it in the space at the right. In solving the problems, use the table of atomic masses below.

calcium, Ca	40.0 u	nitrogen, N	14.0
carbon, C	12.0	oxygen, O	16.0
chlorine, Cl	35.5	platinum, Pt	195
hydrogen, H	1.01	potassium, K	39.1
iron, Fe	55.8	sodium, Na	23.0
magnesium, Mg	24.3	sulfur, S	32.0

1. When water, H_2O, is decomposed, it produces hydrogen gas, H_2, and oxygen gas, O_2. In order to produce 4.0 moles of oxygen gas, how many moles of water must be decomposed? $2H_2O \longrightarrow 2H_2 + O_2$ — 1. 8.0 moles

2. In the reaction $FeS + 2HCl \longrightarrow FeCl_2 + H_2S$, how many moles of HCl are required to produce 3 moles of H_2S? — 2. 6 moles

3. A 100-g sample of a gas has a volume of 11.2 L at STP. What is its molecular mass? — 3. 200 g/mole

4. Ammonia burns in oxygen to produce nitric oxide and water, as represented by the equation $4NH_3(g)+5O_2(g) \longrightarrow 4NO(g)+6H_2O(g)$. If 10 L of ammonia are burned, what volume of steam is produced at constant temperature and pressure? — 4. 15 L

5. In the reaction, $Mg(s)+2HCl(aq) \longrightarrow MgCl_2(aq)+H_2(g)$, how many liters at STP of hydrogen are produced by 48.6 grams of magnesium? — 5. 44.8 L

20 (1) $\frac{4 \text{ mole } O_2}{X \text{ mole } H_2O} = \frac{1 \text{ mole } O_2}{2 \text{ mole } H_2O}$ $X =$ 8.0 mole H_2O balance, mole → mole

10 (2) $\frac{X \text{ mole HCl}}{3 \text{ mole } H_2S} = \frac{2 \text{ mole HCl}}{1 \text{ mole } H_2S}$ $X =$ 6 moles HCl mole → mole

20 (3) $\frac{1 \text{ mole}}{22.4 \text{ L}} = \frac{X \text{ mole}}{11.2 \text{ L}}$ $X = 0.500$ mole gas $\frac{100 \text{ g}}{0.500 \text{ mole}} =$ 200 g/mole mole → Mole, mole → mol MASS

25 (4) $\frac{1 \text{ mole } NH_3}{22.4 \text{ L}} = \frac{X \text{ mole}}{10 \text{ L}}$ $X = 0.4464$ mole NH_3 produces $\frac{3}{2} \times 0.4464$ mole $H_2O = 0.6696$ mole H_2O

$\frac{22.4 \text{ L}}{1 \text{ mole}} \quad \frac{X \text{ L}}{0.6696 \text{ mole}}$ $X = 15$ L L → mole, mole → mole, mole → L

25 (5) $\frac{48.6 \text{ g Mg}}{24.3 \text{ g/mole}} = 2.00$ mole Mg ⇒ 2 mole H_2 ⇒ 44.8 L H_2