Chemistry 141 Name

Dr. Cary Willard

Quiz 3a (20 points) September 14, 2010

All work must be shown to receive credit.

1. (4 points) Balance the equation for the reaction to produce “superphosphate” fertilizer.

\_\_\_\_\_\_Ca3(PO4)2(s) + \_\_\_\_2\_\_H2SO4(aq) 🡪 \_\_\_\_\_\_Ca(H2PO4)2 + \_\_\_2\_\_\_CaSO4

1. (8 points) The following reaction is used to produce tungsten metal from tungsten(VI) oxide.

WO3(s) + 3 H2(g) 🡪 W(s) + 3 H2O(l)

If this reaction proceeds with a 82.6% yield, how many kilograms of tungsten(VI) oxide are required to produce exactly 1 ton(2000 lbs) of tungsten?

$$?kg WO\_{3}=2000. lb W×\frac{454 g W}{1 lb W} ×\frac{100 g W attempted}{82.6 g W actual}×\frac{1 mol W}{183.84 g W}×\frac{1 mol WO\_{3} }{1 mol W}×\frac{231.84 g WO\_{3}}{1 mol WO\_{3}}×\frac{1 kg WO\_{3}}{1000 g WO\_{3}}=1386 kg WO\_{3}$$

1. (8 points) A sample of a compound containing carbon, hydrogen, and oxygen is burned in the to form carbon dioxide and water. If a 0.500 g sample of the compound forms 1.137 g CO2 and 0.465 g H2O, determine the empirical formula of the compound. The molar mass of the compound is 174 amu, what is the molecular formula of the compound?

$$1.137 g CO\_{2}×\frac{1 mol CO\_{2} }{44.01 g CO\_{2}}×\frac{1 mol C}{1 mol CO\_{2}}=0.0258 mol C×\frac{12.01 g C}{1 mol C}=0.310 g C$$

$$0.465 g H\_{2}O×\frac{1 mol H\_{2}O}{18.02 g H\_{2}O}×\frac{2 mol H}{1 mol H\_{2}O}=0.0516 mol H×\frac{1.008 g H}{1 mol H}=0.0520 g H$$

$$0.500 g cmpd-\left(0.310 g C+0.052 g H\right)=0.138 g O×\frac{1 mol O}{16.00 g O}=0.00863 mol O$$

$$C\_{\frac{0.0258}{0.00863}}H\_{\frac{0.0516}{0.00863}}O\_{\frac{0.00863}{0.00863}}$$

$$C\_{3}H\_{6}O\_{1}$$

Molar mass C3H6O = 58 174/58=3 so there are 3 units or the molecular formula is C9H18O3.

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Quiz 3b (20 points) September 14, 2010

All work must be shown to receive credit.

1. (4 points) Balance the equation for the reaction to produce “superphosphate” fertilizer.

\_\_\_\_\_\_Ca3(PO4)2(s) + \_\_2\_\_\_\_H2SO4(aq) 🡪 \_\_\_\_\_\_Ca(H2PO4)2 + \_\_2\_\_\_\_CaSO4

1. (8 points) The following reaction is used to produce tungsten metal from tungsten(VI) oxide.

WO3(s) + 3 H2(g) 🡪 W(s) + 3 H2O(l)

If this reaction proceeds with a 76.3% yield, how many grams of tungsten(VI) oxide are required to produce exactly 1 ton(2000 lbs) of tungsten?

$$?kg WO\_{3}=2000. lb W×\frac{454 g W}{1 lb W} ×\frac{100 g W attempted}{76.3 g W actual}×\frac{1 mol W}{183.84 g W}×\frac{1 mol WO\_{3} }{1 mol W}×\frac{231.84 g WO\_{3}}{1 mol WO\_{3}}×\frac{1 kg WO\_{3}}{1000 g WO\_{3}}=1501 kg WO\_{3}$$

1. (8 points) A sample of a compound containing carbon, hydrogen, and oxygen is burned in the to form carbon dioxide and water. If a 0.500 g sample of the compound forms 1.221 g CO2 and 0.500 g H2O, determine the empirical formula of the compound. The molar mass of the compound is 216 amu, what is the molecular formula of the compound?

$$1.221 g CO\_{2}×\frac{1 mol CO\_{2} }{44.01 g CO\_{2}}×\frac{1 mol C}{1 mol CO\_{2}}=0.0277 mol C×\frac{12.01 g C}{1 mol C}=0.333 g C$$

$$0.500 g H\_{2}O×\frac{1 mol H\_{2}O}{18.02 g H\_{2}O}×\frac{2 mol H}{1 mol H\_{2}O}=0.0555 mol H×\frac{1.008 g H}{1 mol H}=0.0559 g H$$

$$0.500 g cmpd-\left(0.333 g C+0.056 g H\right)=0.111 g O×\frac{1 mol O}{16.00 g O}=0.00694 mol O$$

$$C\_{\frac{0.0277}{0.00694}}H\_{\frac{0.0555}{0.00694}}O\_{\frac{0.00694}{0.00694}}$$

$$C\_{4}H\_{8}O\_{1}$$

Molar mass C4H8O = 72 216/72=3 so there are 3 units or the molecular formula is C12H24O3.