Name: _____ date: _____ period: _____

Ch. 13 (ngss) fuel / ch. 9 stoichiometry (chem) **test** 50 points (10 ec) ngss chem

In problems involving calculations, show your work in an organized manner, include the appropriate formula / equation, conversion factors, and units in your answer.

1. In the reaction: $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$, the $\Delta H = -5{,}308$ kJ. [25 points]

   a. 10 grams C_4H_{10} + excess $O_2 \rightarrow$ ___ grams CO_2 + H_2O [5 points]

4 pts
1

$10\text{ g } C_4H_{10} \times \frac{1\text{ mol } C_4H_{10}}{58\text{ g } C_4H_{10}} \times \frac{8\text{ mol } CO_2}{2\text{ mol } C_4H_{10}} \times \frac{44\text{ g } CO_2}{1\text{ mol } CO_2}$

$\approx 30.3\text{ g } CO_2$

   b. 30.0 grams C_4H_{10} + 50.0 grams $O_2 \rightarrow$ ___ grams CO_2 + H_2O [10 points]

2+2 pts
2
2
2

i) $30\text{ g } C_4H_{10} \times \frac{1\text{ mol } C_4H_{10}}{58\text{ g } C_4H_{10}} \times \frac{13\text{ mol } O_2}{2\text{ mol } C_4H_{10}} \times \frac{32\text{ g } O_2}{1\text{ mol } O_2} = 108\text{ g } O_2$ needed

have 50 g O_2 → O_2 is limiting

ii) $50\text{ g } O_2 \times \frac{1\text{ mol } O_2}{32\text{ g } O_2} \times \frac{8\text{ mol } CO_2}{13\text{ mol } O_2} \times \frac{44\text{ g } CO_2}{1\text{ mol } CO_2} =$

$\approx 42.3\text{ g } CO_2$

   c. How much heat; i.e. ΔH in the reaction: 10 grams C_4H_{10} + excess $O_2 \rightarrow CO_2 + H_2O$ [10 points; hint: ch 13 ngss; explain; part C; reflect & connect]

$\Delta H = \frac{-5308\text{ kJ}}{2\text{ mol } C_4H_{10}} \times 10\text{ g } C_4H_{10} \times \frac{1\text{ mol } C_4H_{10}}{58\text{ g } C_4H_{10}} = -4.58\text{ kJ}$

4 2 2 2 pts

2. What is the molar mass of __ ? [10 points]

a. $Ca(NO_3)_2$

4+1 pt

Ca : 1 · 40 = 40
N : 2 · 14 = 28
O : 6 · 16 = 96
164 g/mol

b. Barium phosphate

$Ba_3(PO_4)_2$

Ba : 3 · 137 = 411
P : 2 · 31 = 62
O : 8 · 16 = 128
601 g/mol

3. Solve. [15 points]

a. 15 grams of water = ___ moles of water

3+2 pt

$15\ g\ H_2O \times \frac{mol\ H_2O}{18\ g\ H_2O} = 0.83\ mol\ H_2O$

b. 7.0 moles of carbon dioxide = __ grams of carbon dioxide

$7\ mol\ CO_2 \times \frac{44\ g\ CO_2}{mol\ CO_2} = 308\ g\ CO_2$

c. 25 kg methane, CH_4 = ___ moles of methane

$25\ kg\ CH_4 \times \frac{10^3\ g}{kg} \times \frac{mol\ CH_4}{16\ g\ CH_4} = 1563\ mol\ CH_4$

$N_2 + 3H_2 \rightarrow 2NH_3$

1 pt

4. 5.0 grams of N_2 + excess H_2 → ___ grams NH_3; % yield = 88%. [10 points]

3 pt

(i) $5\ g\ N_2 \times \frac{mol\ N_2}{28\ g\ N_2} \times \frac{2\ mol\ NH_3}{1\ mol\ N_2} \times \frac{17\ g\ NH_3}{1\ mol\ NH_3} = 6.07\ g\ NH_3$

2 pt

(ii) % yield = $\frac{exp}{calc}$

$88\% = \frac{exp}{6.07}$

$exp = 5.3\ g\ NH_3$