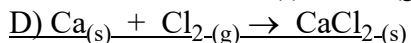
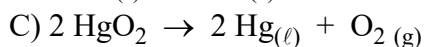
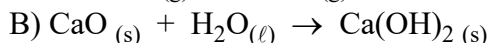
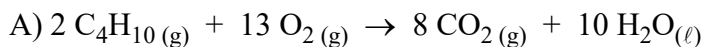


Multiple Choice: (4 points each. Put answers in left margin as capital letters.)

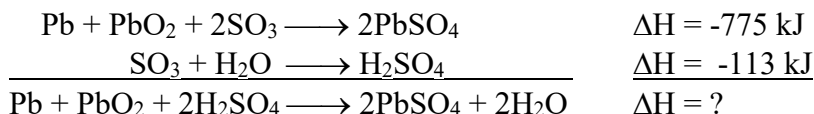
- Two isotopes of an element exist in the ratio 26.400 g/mol (47.222%) and 28.522 g/mol (52.778%). What is the weighted average of this sample (g/mol)?
A) 26.400 B) 27.402 C) 27.520 D) 27.461 E) 28.522
- Tomato soup is a
i) compound iii) heterogenous mixture v) solution
ii) pure substance iv) homogeneous mixture
A) i B) ii C) iii D) iv E) v
F) i and ii G) iii and v H) iv and v
- Which of the following aqueous acids is a weak acid?
A) HCl B) HClO₄ C) HNO₃ D) H₃PO₄ E) H₂SO₄
- Which of the following is a combustion reaction?
A) $\text{Cu}(\text{OH})_2(\text{aq}) + 2 \text{HNO}_3(\text{aq}) \rightarrow \text{Cu}(\text{NO}_3)_2(\text{aq}) + 2 \text{H}_2\text{O}(\ell)$
B) $\text{CH}_4(\text{g}) + 2 \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2 \text{H}_2\text{O}(\ell)$
C) $\text{FeCl}_3(\text{s}) + 3 \text{AgNO}_3(\text{g}) \rightarrow 3 \text{AgCl}(\text{s}) + 3 \text{Fe}(\text{NO})_3(\text{aq})$
D) $\text{Na}_2\text{CO}_3(\text{s}) \rightarrow \text{NaO}(\text{s}) + \text{CO}_2(\text{g})$
E) None is a combustion reaction.
- What is the oxidation number of the sulfur atom in MgSO₃?
A) -2 B) 0 C) +2 D) +4 E) +6
- For the reaction: $\text{Cu}(\text{OH})_2(\text{aq}) + 2 \text{HNO}_3(\text{aq}) \rightarrow \text{Cu}(\text{NO}_3)_2(\text{aq}) + 2 \text{H}_2\text{O}(\ell)$, which element is reduced?
A) Cu B) H C) N D) O E) None are reduced
- Enthalpy is the _____ for a system.
A) energy change D) heat change
B) energy change with no heat E) heat change at constant pressure
C) energy change with no work

8. Which of the following represents a heat of formation reaction?



E) None are formation reactions

9. What is ΔH for the net reaction below?



A) -1001 kJ B) -888 kJ C) -549 kJ D) 888 kJ E) 1001 kJ

Discussion Questions: (Show your work to receive credit.)

1. Provide names/formulae as appropriate. (10 points)

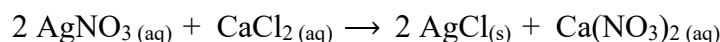
H_3PO_4 – phosphoric acid

potassium acetate – $\text{K}(\text{CH}_3\text{CO}_2)$

VS_2 – vanadium(IV) sulfide

hydriodic acid – $\text{HI}(\text{aq})$

2. When silver(I) nitrate is mixed with calcium chloride according to the reaction:



silver(I) chloride forms. What is the maximum mass of silver(I) chloride that can be produced by combining 3.00 g of each reactant? What is the percent yield if 1.50 g AgCl is produced? (15 points)

Determine the limiting reagent by first calculating the number of moles of each substance present.

$$\text{mol}_{\text{AgNO}_3} = (3.00 \text{ g}) \left(\frac{1 \text{ mol}_{\text{AgNO}_3}}{169.9 \text{ g}_{\text{AgNO}_3}} \right) = 0.0176 \text{ mol}_{\text{AgNO}_3}$$

$$\text{mol}_{\text{CaCl}_2} = (3.00 \text{ g}) \left(\frac{1 \text{ mol}_{\text{CaCl}_2}}{111.0 \text{ g}_{\text{CaCl}_2}} \right) = 0.0270 \text{ mol}_{\text{CaCl}_2}$$

Now determine how much calcium chloride is required to use up all of the silver(I) nitrate.

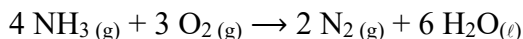
$$\text{mol}_{\text{CaCl}_2}(\text{required}) = (0.0176 \text{ mol}_{\text{AgNO}_3}) \left(\frac{1 \text{ mol}_{\text{CaCl}_2}}{2 \text{ mol}_{\text{AgNO}_3}} \right) = 0.00883 \text{ mol}_{\text{CaCl}_2}$$

But you have 0.0270 $\text{mol}_{\text{CaCl}_2}$, which is more than enough CaCl_2 so all of the AgNO_3 is consumed. Thus, silver(I) nitrate is the limiting reagent.

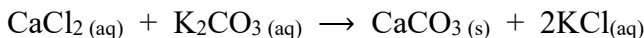
$$\text{mass}_{\text{AgNO}_3} = (3.00 \text{ g}) \left(\frac{1 \text{ mol}_{\text{AgNO}_3}}{169.9 \text{ g}_{\text{AgNO}_3}} \right) \left(\frac{2 \text{ mol}_{\text{AgCl}}}{2 \text{ mol}_{\text{AgNO}_3}} \right) \left(\frac{143.3 \text{ g}_{\text{AgNO}_3}}{1 \text{ mol}_{\text{AgCl}}} \right) = 2.53 \text{ g}$$

$$\text{percent yield} = \frac{1.50 \text{ g}}{2.53 \text{ g}} \times 100\% = 59.3\%$$

3. Complete the following: (10 points)



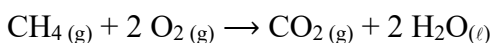
Calcium chloride reacts with potassium carbonate to yield calcium carbonate and potassium chloride. (Use solubility rules to predict the state of each material.)



4. When a 5.00 g sample of KCl is dissolved in water in a calorimeter that has a total heat capacity of $3.04 \text{ kJ}\cdot\text{K}^{-1}$, the temperature decreases by 0.380 K. Calculate the molar heat of solution of KCl. (5 points)

$$\text{molar heat of solution} = \left(\frac{3.04 \text{ kJ}}{\text{K}}\right) (0.380 \text{ K}) \left(\frac{1}{5.00 \text{ g}_{\text{KCl}}}\right) \left(\frac{74.56 \text{ g}_{\text{KCl}}}{\text{mol}_{\text{KCl}}}\right) = 17.2 \text{ kJ/mol} \quad (\text{Homework 5.13})$$

5. Is the following reaction endothermic or exothermic? Explain. (5 points)

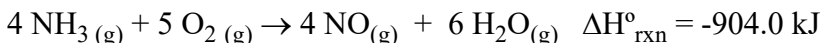


It is exothermic because this is a combustion reaction (see MC # 4). Burning releases heat from the system into the environment.

6. A system gains 782 kJ of heat, resulting in a change in internal energy of the system equal to +251 kJ. How much work is done? (5 points)

$$\text{work} = 251 \text{ kJ} - 782 \text{ kJ} = -531 \text{ kJ} \quad (\text{Homework 5.9})$$

7. From the following data: (14 points)



- Is the reaction endothermic or exothermic?
- How much energy would be absorbed or released if 13.75 g of nitrogen monoxide formed?
- If an unknown quantity of ammonia is burned with a heat change of -425 kJ, what mass of ammonia burned?

a) exothermic

$$\text{b) energy} = \left(\frac{-904.0 \text{ kJ}}{4 \text{ mol}_{\text{NO}}}\right) \left(\frac{1 \text{ mol}_{\text{NO}}}{30.01 \text{ g}_{\text{NO}}}\right) (13.75 \text{ g}_{\text{NO}}) = 103.6 \text{ kJ}$$

$$\text{c) mass}_{\text{NH}_3} = (425 \text{ kJ}) \left(\frac{4 \text{ mol}_{\text{NH}_3}}{904.0 \text{ kJ}}\right) \left(\frac{17.03 \text{ g}_{\text{NH}_3}}{1 \text{ mol}_{\text{NH}_3}}\right) = 32.0 \text{ g}_{\text{NH}_3}$$