

NAME: \_\_\_\_\_

**Written Answer Questions (points specified, show your work, box your answers)**

Standard molar enthalpies of formation at 298K and 1 bar

H <sup>+</sup> (aq)	0
OH <sup>-</sup> (aq)	-229.99 kJ/mole
H <sub>2</sub> O(l)	-285.83 kJ/mole
H <sub>2</sub> O(g)	-241.82 kJ/mole
CO <sub>2</sub> (g)	-393.51 kJ/mole

1) Write down the definition of enthalpy, name each variable, and state whether each variable is extensive or intensive. (5 points)

2) A solution of 1.000 M calcium hydroxide has a density of 0.995 g/mL. What volume of water is needed to make 1.000 L of 1.000 M calcium hydroxide? (5 points)

3) Write a balanced molecular equation for the reaction of aqueous sodium carbonate with aqueous calcium chloride. Identify any spectator ions. Write the net ionic equation. (5 points)

4) The work function of sodium metal is  $4.4 \times 10^{-19}$  J. Will visible light eject photoelectrons from a clean sodium metal surface? (5 points)

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- 5) Use the tabulated enthalpies of formation to calculate the standard enthalpy of reaction for:  
 $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$  (10 points)

- 6) At 1 kPa and 900K, 1 m<sup>3</sup> of sulfur vapor has a mass of 8.57 g. The atomic mass of sulfur is 32.04 g/mole. What is the molecular formula of sulfur under these conditions? (15 points).

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7) Combustion of 1.281 g of solid naphthalene ( $C_{10}H_8$ ) in a bomb calorimeter immersed in 2.000 L of water led to a temperature rise of 5.152 K. The heat capacity of the bare calorimeter (without water) was 1632 J/K. Calculate the internal energy of combustion for naphthalene. Write down a balanced combustion reaction for naphthalene, showing the form (*s*, *l*, *g*) of each reactant and product. Under the approximation  $\Delta H_{rxn} \approx \Delta E_{rxn}$ , estimate the standard enthalpy of formation for naphthalene from the tabulated enthalpies of formation. (25 points)