Take Home Exam Ch 1 – 5 &
Reaction Products: Precipitation
AP Chem
(50 pts)

Name:
I have neither given nor received aid on this exam, except from my group. If applicable, list the names:
Period: **Date:**

No credit will be given if work is not shown. Round atomic masses on the Periodic Table to the hundredths place and then perform any calculations with regard to significant figures. Final answers should include units and be boxed.

1. (35 pts) In most of its ionic compounds, cobalt is either Co (II) or Co (III). One such compound, containing chloride ion and waters of hydration, was analyzed. A 0.256 g sample was dissolved in water and an excess of silver nitrate was added. The resulting precipitate was filtered, dried, and found to have a mass of 0.308 g. A second sample of the original compound, with a mass of 0.416 g, was dissolved in water, and an excess of sodium hydroxide was added. The resulting precipitate was filtered and then, in a combustion reaction, was found to produce 0.145 g cobalt (III) oxide and water.

    a. (18 pts) Write complete and net ionic equations for each of the three reactions described.
        i. Complete:

           Net:

        ii. Complete:

           Net:

        iii. Complete:

           Net:

    b. (12 pts) What is the percent composition of each element, by mass, of the original compound?

    c. (5 pts) Assuming the compound contains one cobalt cation per formula unit, what is the molecular formula?

2. (15 pts) The combustion of 0.1584 g benzoic acid increases the temperature of a bomb calorimeter by 2.54 ºC. The energy released by combustion of benzoic acid is 26.42 kJ/g. A 0.2130 g sample of vanillin is then burned in the same calorimeter, and the temperature increases 3.25 ºC.

    a. (4 pts) Calculate the heat capacity of this calorimeter.

    b. (3 pts) Write a net ionic equation for the combustion of vanillin.

    c. (4 pts) What is the energy of combustion per gram of vanillin?

    d. (4 pts) What is the energy of combustion per mole of vanillin?