2 NaHCO3(s) → Na2CO3(s) + CO2(g) +H20(g)

1. NaHCO3 (*s*) (baking soda) decomposes upon heating to produce Na2CO3 (*s*) and two gaseous products, as shown by the equation above.
   1. A student claims that the reaction is an oxidation-reduction reaction because the oxidation number of carbon changes. Do you agree with the claim? In your answer include the oxidation number of carbon in each of the three carbon-containing species in the reaction.

The student conducts an experiment to determine the composition of a mixture of NaHCO3 (molar mass 84.01 g/mol) and Na2CO3 (molar mass 105.99 g/mol ). The student places a sample of the mixture into a preweighed test tube that is attached to a container that holds a drying agent. The student heats the test tube strongly with a Bunsen burner for 10 minutes, during which time all of the water produced by the reaction is captured by the drying agent. The following table shows the data the student recorded during the experiment

|  |  |
| --- | --- |
| Mass of empty test tube | 15.825 g |
| Mass of test tube and mixture before heating | 17.648 g |
| Mass of drying agent before reaction | 2.134 g |
| Mass of drying agent and water after reaction | 2.303 g |

* 1. Calculate the number of moles of NaHCO3 (*s*) present in the mixture in the test tube before the reaction was initiated.
  2. Determine the mass percent of NaHCO3 (*s*) in the mixture.
  3. If the student spills some of the mixture out of the test tube after weighing the test tube and mixture and before heating, how would this error affect the mass percent of NaHCO3 calculated in part (c)? Justify your answer.

When a sample of pure Na2CO3 is placed in distilled water, the student observes that the pH of the solution increases significantly. This process is represented by the balanced net-ionic equation shown below.

CO3**-2** (aq) + H2O(l) ↔ HCO3**-** (aq) + OH**-**(aq)

* 1. The student prepares a 0.10 *M* Na2CO3(aq)  solution and measures the pH of the solution to be 11.65.
     1. Calculate [OH-] is the Na2CO3(aq) solution.
     2. Write the expression of *Kb*  for the carbonate ion.
     3. Calculate the value of *Kb*  for the carbonate ion.

The student adds some 1.0 *M* Sr(NO3)2 (aq) to 0.10 *M* Na2CO3(aq) and observes the formation of a precipitate.

* 1. Write the balanced net-ionic equation for the reaction between Sr(NO3)2 and Na2CO3 that produces the precipitate