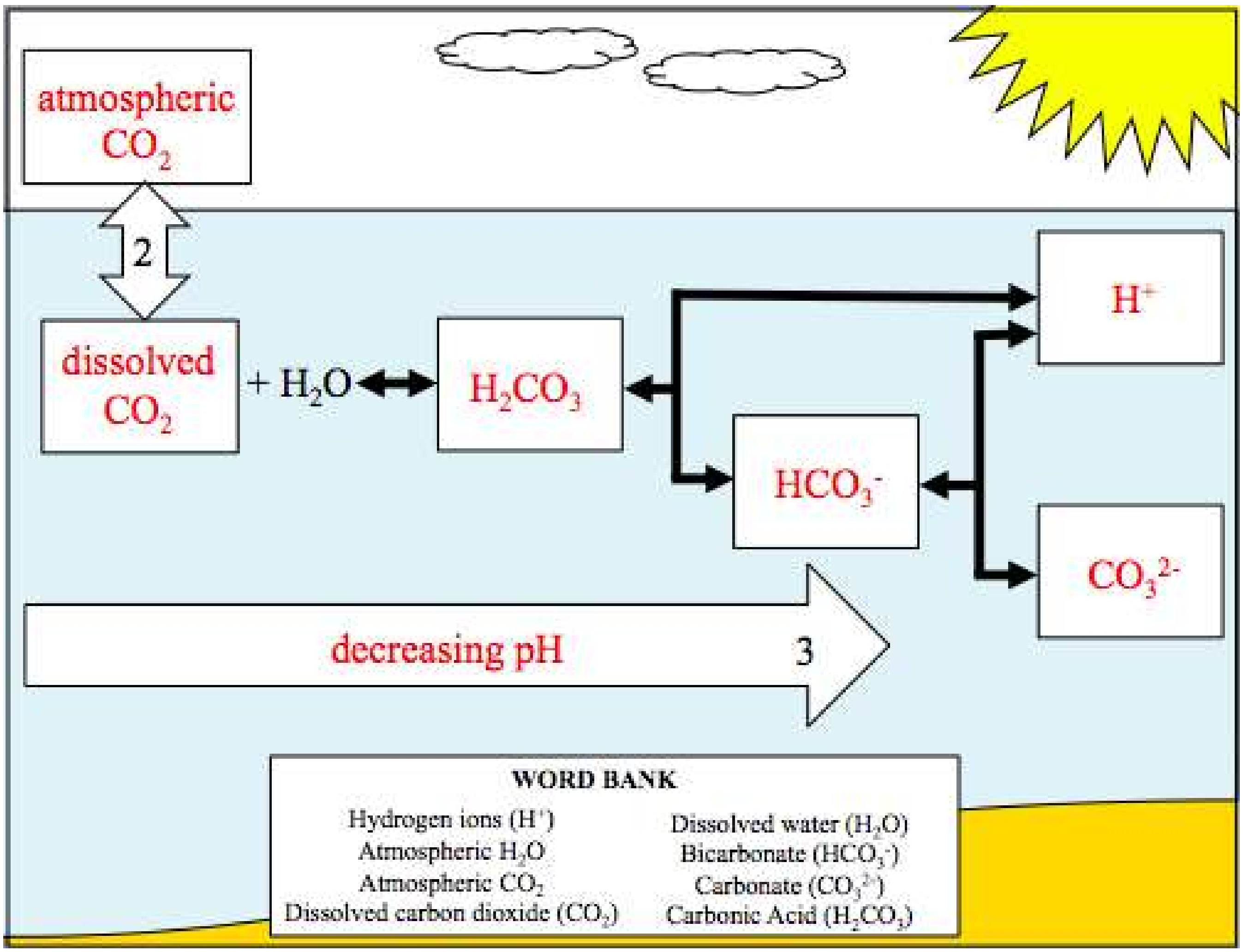
Activity 2.1 Solubility Chart **NAME______________________________**

Use the chart below to outline the solubility cycle for carbon in the ocean.

Questions:

1. Using the word bank provided, fill in the blank boxes on the solubility chart.
2. Name the process that is represented by the white arrow (labeled 2) that goes between the atmosphere and ocean (label arrow on chart below).
3. Notice that all arrows are double-ended. This is meant to indicate that these chemical reactions are not unidirectional. The large arrow near the base of the diagram represents the reactions you've outline proceeding to the right (in other words, release of H+). Does this direction represent increasing or decreasing seawater pH? (label arrow on chart below)



Ocean Carbon Cycle Guided Questions **NAME______________________________**

Use the data set provided to answer the following questions. Write in the name of the data set provided to your group:

Data Set: ____

1. Describe the trends in pCO_2, pH, and atmospheric CO_2 (if present) you see in the plots provided.
   pH appears to be decreasing and pCO_2 appears to be increasing through time.

2. Do pCO_2 and pH appear to be positively or negatively correlated? Positive correlation means when one parameter changes, the other changes in the same way (e.g., more heat trapped in the atmosphere causes temperature to rise). Negative correlation means when one parameter changes, the other changes in the opposite direction (e.g., more heat trapped in the atmosphere reduces the amount of ice coverage at the poles).
   Negatively correlated. As pCO_2 increases, pH decreases.

3. In the space below explain why pCO_2 and pH are correlated. It will help to apply the knowledge you learned in exercise 1 (ocean CO_2 flow chart) to your answer for question 2 (above).
   Partial pressure of CO_2 (pCO_2) increases as more CO_2 is absorbed by the ocean. This increased absorption causes increased $CO_2 + H_2O – H_2CO_3$, which dissociates to form $2H^+$ and CO_3^{2-}. Increased H^+ decreases pH.

4. Does the buffering system appear to be neutralizing all acidity associated with increased atmospheric carbon dioxide? What parameter/s in Question 1 tell you that?
   No, clearly pH is changing which means all of the H^+ ions are not being neutralized.

5. Predict what implications pH change will have for organisms that precipitate shells/skeletons made up of carbonate (CO_3^{2-}). Keep in mind that even small changes in pH (e.g., 0.1 on the pH scale) have large implications for carbonate-shelled organisms.
   Carbonate shells are constructed, in part, out of CO_3^{2-}. As H+ concentrates in seawater, carbonate shells are dissolved. Organisms with carbonate shells/skeletons experience thinning and weakening of their hard parts.

6. Compare your data to data analyzed by another group. Do the trends you identified in Question 1 appear to be local, regional, or global?
   The trends appear to be global in nature since they're evident in both the Atlantic and Pacific oceans.

7. In this last question draw connections between <u>human use of fossil fuels</u>, <u>atmospheric carbon dioxide concentration</u>, <u>atmospheric temperature</u>, <u>seawater pCO_2</u>, <u>seawater pH</u>, and <u>seawater</u>

temperature in the form of a flow chart. Boxes should consist of underlined terms above (human use of fossil fuels and seawater pH have been filled in for you). Arrows should be labeled "I" for increases and "D" for decreases.