Chemistry: Matter and Change

Activity 9.1B Exothermic and Endothermic

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Purpose: Observe energy being released or absorbed in a chemical reaction.

Materials: 2 large test tubes, test tube rack, thermometer, 10 ml graduated cylinder, citric acid, sodium hydroxide solution, calcium chloride, magnesium sulfate, sodium carbonate, water, balance, goggles and lab apron

Procedure:

Part 1

1. Put 10 ml of water in a test tube. Measure the temperature and record. Allow the thermometer 1-2 minutes in the water before recording the temperature in Table 1. Please be accurate in temperature, read to the nearest 0.1 degree.

2. Measure out 1 gram of citric acid and put in the test tube, measure the temperature and record in

Table 1. Measure out 1 ml of sodium hydroxide solution in a 10 ml graduated cylinder and put in a second test tube, measure the temperature and record in Table 1.

3. Once you have recorded the temperature of the two substances, pour them together and measure the temperature of the reaction that has taken place. Record your ***observations*** and temperatures in Table 2. The “Initial temp” in Table 2 will be the average temperature of "temp after dissolving of citric acid and temp of NaOH from Table 1.

Table 1

substance | initial temp of water | temp after dissolving | change in temp (+ or - )

Citric acid | | |

substance | temperature of NaOH solution

NaOH | |

Table 2

Observation:

reaction | initial temperature | temperature after reaction | change in temperature (+ or -)

citric acid + NaOH | | |

Part 2

1. In a test tubes put 2 ml of water, measure and record the temperature in Table 3.

2. Add .5 gram of calcium chloride in a test tube. Carefully mix the water to dissolve the compound. Calcium Chloride is harmful to your skin, eyes, body and clothes. Measure the temperature and record in Table 3.

Table 3

substance | initial temperature of water | temperature after dissolving | change in temperature (+ or -)

CaCl2 | | |

Part 3***: There is a small temperature change in this experiment, measure carefully.***

1. Put 3 ml of water in two different test tubes, measure and record the temperature in Table 4 after 2 minutes.

2. Mix 1 gram of magnesium sulfate in the first test tube and 1 gram of sodium carbonate in the second test tube. Mix until they are mostly dissolved. Measure the temperature and record in Table 4 after 2 minutes.

3. Pour the magnesium sulfate into the sodium carbonate, mix and record the temperature in Table 4.

Table 4

substance | initial temperature of water | temperature after dissolving | change in temperature (+ or -)

MgSO4  | | |

Na2CO3 | | |

reaction | | |

MgSO4 + Na2CO3 | | |

Conclusion:

1. If an object absorbs heat what happens to it temperature?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. If an object releases heat what happens to its temperature?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. In all chemical reactions energy is either \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. If a reaction absorbs heat what happens to the surrounding area's temperature?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. If a reactions releases heat what happens to the surrounding area's temperature?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. What is needed to break the bonds between different atoms of a compound?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. What is released when atoms combine to form a compound?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. In a chemical reaction, can both of these energy exchanges take place?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9. In an endothermic reaction what happens to the temperature?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. In an exothermic reaction what happens to the temperature?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. What happens to the particles of citric acid when you put them in water? Come together or break apart. circle one

12. What happens to the particles of citric acid and sodium hydroxide when you mixed them together?

Recombine or break apart. Circle one

13. What happens to the temperature of citric acid when dissolved in water?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

14. Explain why.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

15. What happens to the temperature of citric acid and NaOH where mixed together?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

16. Explain why.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

17. How do you know there was a reaction between the citric acid and the NaOH?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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18. When you dissolved the calcium chloride in water, wouldn't you expect the temperature to decrease,

because the particles are broken apart?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

19. In order to get an increase in temperature when calcium chloride dissolves in water, what has to happen to

the particles?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

20. What else is present in the test tube when you dissolved the calcium chloride?\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Hint: What is the solvent?)

21. Is it possible the calcium chloride combines with the water?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

22. What type of compound is water? polar covalent or nonpolar covalent?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

23. What type of compound is calcium chloride? ionic or covalent compound (circle one)

24. How might calcium chloride and water get together?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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25. Draw what it might look like in the space below.

26. Explain what happens in the dissolving (1) and reaction (2) of magnesium sulfate and sodium carbonate?

(1) dissolving part\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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(2) reaction part\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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27. What type of reaction was the citric acid and sodium hydroxide?

28. What type of reaction was the calcium chloride and water?

29. What type of reaction was the magnesium sulfate and sodium carbonate?

30. Determine the products of a reaction between cesium and water. Keep in mind the general forms of reactions.

Bonus: 31. Draw the Lewis structure for sulfate (SO4) in the space below.