Remote Learning Packet

NB: Please keep all work produced this week. Details regarding how to turn in this work will be forthcoming.

April 13-17, 2020

Course: 10 Chemistry

Teacher(s): Ms. Oostindie megan.oostindie@greatheartsirving.org

Weekly Plan:

Monday, April 13

- ☐ Read and record notes for sections 10.1-10.3 (pp.293-298)
- ☐ Complete the Common Acids and Bases chart

Tuesday, April 14

- ☐ Complete Acids and Bases packet questions 1-10

Wednesday, April 15

- ☐ Complete Acids and Bases packet questions 11-22

Thursday, April 16

- ☐ Read and record notes for sections 10.4-10.5 (pp.298-301)
- ☐ Complete Acid-Base Reactions worksheet

Friday, April 17

- ☐ Grade Acid-Base Reactions worksheet
- ☐ Acid and Base Reactions Lab

Statement of Academic Honesty

I affirm that the work completed from the packet is mine and that I completed it independently.

I affirm that, to the best of my knowledge, my child completed this work independently

_____

Student Signature

_____

Parent Signature

Greetings, chemistry students. This week we will be starting chapter 10: acids and bases. We will also be self-grading work again this week. I want to stress the importance of making an honest attempt at the work before looking to the answer key. You must first challenge yourself to try and solve the problem with your current knowledge before you look to see how it was accomplished. Scores for these assignments will be based on effort, both effort in your first attempt and in grading the assignment. This self-grading system does rely on your honesty, but it was chosen so that you can receive immediate feedback on your work and that you may learn from your mistakes. The only person you will harm in the process of copying directly from the answer key is yourself. I miss you all and hope to see you (in digital form) soon.

Monday, April 13

Read sections 10.1-10.3 (pp. 293-298). Take notes of the key vocabulary terms and their definitions as well as any diagrams, equations, and worked examples. Do not answer the questions in yellow boxes. Notes can be taken in a notebook or on separate paper.

For section 10.2, use the attached Common Acids and Bases chart to record your notes. The column titled "Strong or weak?" will be left blank until you complete your readings on Thursday.

Tuesday, April 14

Complete questions 1-10 in the attached Acids and Bases packet. This should be done without reference to your textbook and notes. Use only the information provided in the packet. Answer the questions in complete sentences in your notebook. Questions from today are to become a part of your chapter 10 notes.

Wednesday, April 15

Complete questions 11-22 in the attached Acids and Bases packet. Only use the information in the packet to answer your questions, do not reference your notes or textbook. Answer in complete sentences unless you are supplying chemical reactions or formulas. Use a new sheet of paper. Clearly label your responses. Questions from today will be turned in.

Thursday, April 16

Read sections 10.4-10.5 (pp. 298-301). Follow the same directions as listed under Monday's lesson. Notes can be taken in a notebook or on separate paper. Return to the Common Acids and Bases worksheet and fill in the "Strong or weak?" column.

Using Table 10.1 found on p. 300, complete the Acid-Base Reactions worksheet.

Friday, April 17

Using a different color pen, grade your Acid-Base Reactions worksheet using the attached key.

Complete the Acid and Base Reactions Lab using the attached worksheet. As always, if you do not have a printer, you may recreate the worksheet on a separate sheet of paper.

Pages to be turned in from this week are underlined.

_____
_____
_____
_____

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Common Acids and Bases

Directions: Fill in the blanks in the table below.

Name	**Formula**	**Acid or Base?**	**Strong or Weak?**	**Conjugate Formula**	**Uses**
Sulfuric acid	H_2SO_4	acid	strong	HSO_4^-	battery acid

Acids and Bases

How do acids and bases behave in water?

Why?

Acids and bases play an important role in our lives. Numerous biological processes, industrial applications, and even environmental problems are a function of the acidity or basicity (alkalinity) of aqueous solutions. It is therefore important to understand what makes a substance behave as an acid or a base when dissolved in water. In this activity, we will explore the physical and chemical properties of acids and bases.

Model 1 – Arrhenius Acids and Bases

Common Name for Aqueous Solution	Chemical Formula	Found in...	Tastes...	Turns Litmus Paper...	Conducts Electricity?	Acid or Base
Acetic acid	$HC_2H_3O_2(aq)$	Vinegar	Sour	Red	Yes	Acid
Benzoic acid	$HC_7H_5O_2(aq)$	Food preservative	Sour	Red	Yes	Acid
Phosphoric acid	$H_3PO_4(aq)$	Soda pop	Sour	Red	Yes	Acid
Hydrochloric acid	HCl(aq)	Stomach acid	Sour	Red	Yes	Acid
Citric acid	$H_3C_6H_5O_7(aq)$	Citrus fruits	Sour	Red	Yes	Acid
Ascorbic acid	$H_2C_6H_6O_6(aq)$	Vitamin C	Sour	Red	Yes	Acid
Magnesium hydroxide	$Mg(OH)_2(aq)$	Milk of magnesia	Bitter	Blue	Yes	Base
Aluminum hydroxide	$Al(OH)_3(aq)$	Antacids	Bitter	Blue	Yes	Base
Barium hydroxide	$Ba(OH)_2(aq)$	Lubricants	POISON	Blue	Yes	Base
Sodium hydroxide	NaOH(aq)	Drain cleaner	POISON	Blue	Yes	Base

1. Refer to Model 1.

   a. What is the common chemical name for Vitamin C?

   b. Is Vitamin C classified as an acid or a base?

2. Examine the properties of the Arrhenius acids in Model 1. List three properties that all Arrhenius acids have in common.

3. Examine the chemical formulas for the Arrhenius acids in Model 1. What feature do all the Arrhenius acid chemical formulas have in common?

4. Examine the properties of the Arrhenius bases in Model 1. List two properties that all Arrhenius bases have in common.

5. Examine the chemical formulas for the Arrhenius bases in Model 1. What anion do all the Arrhenius base chemical formulas have in common?

6. A student dissolved a small amount of baking soda in water and tested it with litmus paper. The litmus paper turned blue. Is baking soda likely an acid or a base?

Read This!

In 1903 Svante Arrhenius won the Nobel Prize in Chemistry for defining acids and bases in terms of the ions produced. An Arrhenius acid is any substance that produces hydrogen ions [or hydronium ions (H_3O^+) a hydrogen ion attached to a water molecule] when dissolved in water. An Arrhenius base is any substance that produces hydroxide ions when dissolved in water. While the Arrhenius definitions of acids and bases are useful, they are limited. Johannes Brønsted and Thomas Lowry developed more general definitions for acids and bases using H^+ ion (proton) transfer as the focus.

Model 2 – Brønsted-Lowry Acids and Bases

Reaction 1	$HCl(g)$ (acid)	+ $H_2O(l)$ (base)	$\rightleftarrows$	$H_3O^+(aq)$ + $Cl^-(aq)$
Reaction 2	$NH_3(aq)$ (base)	+ $HF(aq)$ (acid)	$\rightleftarrows$	$NH_4^+(aq)$ + $F^-(aq)$
Reaction 3	$NH_4^+(aq)$ (acid)	+ $H_2O(l)$ (base)	$\rightleftarrows$	$NH_3(aq)$ + $H_3O^+(aq)$
Reaction 4	$F^-(aq)$ (base)	+ $H_2PO_4^-(aq)$ (acid)	$\rightleftarrows$	$HPO_4^{2-}(aq)$ + $HF(aq)$

7. Identify the Brønsted-Lowry acids in Model 2.

   a. Atoms of which element are present in all of the Brønsted-Lowry acids in Model 2?

   b. How can you tell from Reaction 1 that HCl loses an H^+ ion rather than a hydrogen atom when the reaction occurs? *Hint:* Look at the products.

8. For each acid–base reaction in Model 2, describe the role of the Brønsted-Lowry *acid* in the H^+ ion (proton) transfer that occurs.

9. For each acid–base reaction in Model 2, describe the role of the Brønsted-Lowry *base* in the proton (H^+ ion) transfer that occurs.

10. As you saw in Model 1, all Arrhenius bases in Model 1 have an OH^- ion in their chemical formulas. Write a balanced chemical reaction for the reaction of HCl(aq) with OH^-(aq) to illustrate that the hydroxide ion is also a Brønsted-Lowry base.

11. If you reverse Reaction 1 in Model 2, the following reaction is obtained.

    $H_3O^+(aq) + Cl^-(aq) \rightleftarrows HCl(aq) + H_2O(l)$

    a. For the reaction above, which reactant is acting like a Brønsted-Lowry acid? How can you tell?

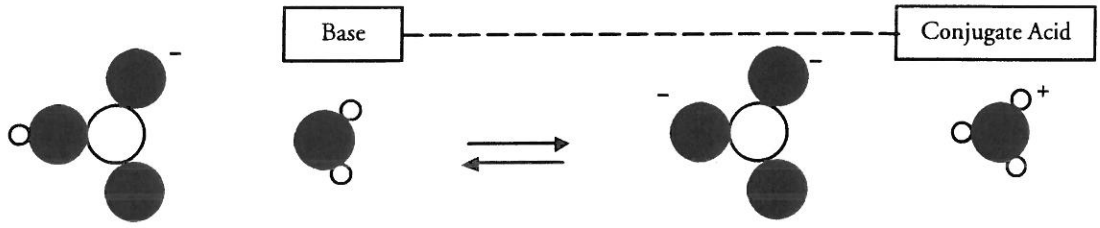
    b. For the reaction above, which reactant is acting like a Brønsted-Lowry base? How can you tell?

12. Write the reverse reactions for Reactions 2 and 3 in Model 2. Label the Brønsted-Lowry acid and base reactants for each reaction.

    Reaction 2

    Reaction 3

Model 3 – Conjugate Acid–Base Pairs



13. All acid–base reactions have two conjugate acid–base pairs. One conjugate acid–base pair in the reaction in Model 3 is H_3O^+/H_2O. List the other acid–base pair in the reaction.

14. Why is HCO_3^- considered the "acid" part of the pair in the reaction in Model 3?

15. Why is CO_3^{2-} considered the "base" part of the pair in the reaction in Model 3?

16. The *"Read This!"* box before Model 2 calls the transfer of a H^+ ion a "proton transfer." Explain why "H^+ ion" and "proton" are synonymous.

17. Examine the charges on the species in the Model 3 reaction. Why does the charge on the carbon-containing ion change from –1 to –2?

18. Using the list of substances below, select pairs that are conjugate acids and bases. Enter the pairs in the tables below. The first acid–base pair has been entered for you. Note that you may use a substance more than once or not at all.

H_3PO_4	H_3O^+	NO_2^-	$C_2H_3O_2^-$	H_2CO_3
H_2O	NH_2^-	CO_2	CO_3^{2-}	NH_3
$HC_2H_3O_2$	PO_4^{3-}	HPO_4^{2-}	OH^-	$H_2PO_4^-$

	Acid	Conjugate Base
1	H_3PO_4	$H_2PO_4^-$
2		
3		
4		

	Acid	Conjugate Base
5		
6		
7		

19. Write the formula for the conjugate base of each of the following acids. *Hint:* Be sure to consider charges.

a. HSO_3^- *b.* HF *c.* HS^-

20. Write the formula for the conjugate acid of each of the following bases. *Hint:* Be sure to consider charges.

a. SO_3^{2-} *b.* F^- *c.* HS^-

21. For the following reactions, label the acid and base in the reactants, and the conjugate acid and conjugate base in the products.

$$HCO_3^-(aq) + NH_3(aq) \rightleftarrows NH_4^+(aq) + CO_3^{2-}(aq)$$

$$HCO_3^-(aq) + HCl(aq) \rightleftarrows Cl^-(aq) + H_2CO_3(aq)$$

22. Is the role of a conjugate acid in the reverse direction the same as the role of an acid in the forward direction? Explain.

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Acid-Base Reactions

Directions: Fill in the missing information for the following acid-base reactions. Label all acids (A), bases (B), conjugate acids (CA) and conjugate bases (CB). Indicate if the acid or base is strong (S) or weak (W). The first reaction is completed for you as an example.

1)	HNO_3	+	NH_3	⇄	NO_3^-	+	NH_4^+
	A____		B_____		CB____		CA_____
	S____		W_____				
2)	OH^-	+	H_2SO_4	⇄	HSO_4^-	+	H_2O
	_____		_____		_____		_____
	_____		_____				
3)	HCl	+	F^-	⇄		+	
	_____		_____		_____		_____
	_____		_____				
4)		+	OH^-	⇄	$CH_3CO_2^-$	+	
	_____		_____		_____		_____
	_____		_____				
5)	NH_3	+	H_3O^+	⇄		+	
	_____		_____		_____		_____
	_____		_____				
6)	H_2CO_3	+	NO_3^-	⇄		+	
	_____		_____		_____		_____
	_____		_____				

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Acid-Base Reactions KEY

Directions: Fill in the missing information for the following acid-base reactions. Label all acids (A), bases (B), conjugate acids (CA) and conjugate bases (CB). Indicate if the acid or base is strong (S) or weak (W). Finally, circle the proton that is transferred from the acid to the base.The first reaction is completed for you as an example.

1) HNO_3 + NH_3 ⇄ NO_3^- + NH_4^+

A____ B_____ CB____ CA_____

S____ W_____

2) OH^- + H_2SO_4 ⇄ HSO_4^- + H_2O

B_____ A_____ CB_____ CA_____

S_____ S_____

3) HCl + F^- ⇄ Cl^- + HF

A_____ B_____ CB_____ CA_____

S_____ W_____ *order of conjugates does not matter

4) CH_3CO_2H + OH^- ⇄ $CH_3CO_2^-$ + H_2O

A_____ B_____ CB_____ CA_____

W_____ S_____

5) NH_3 + H_3O^+ ⇄ NH_4^+ + H_2O

B_____ A_____ CA_____ CB_____

W_____ S_____ *order of conjugates does not matter

6) H_2CO_3 + NO_3^- ⇄ HCO_3^- + HNO_3

A_____ B_____ CB_____ CA_____

W_____ W_____ *order of conjugates does not matter

_____

_____

_____

_____

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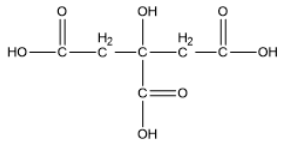
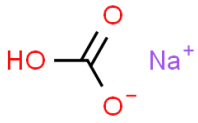
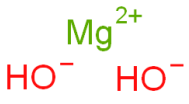
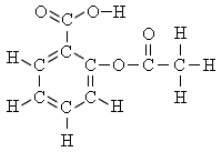
Acid and Base Reactions Lab

Directions: Fill in the blanks in the chart.

Common Name	Chemical Name	Formula	Structure	Acid or Base?
vinegar	acetic acid	CH_3COOH		
lemon juice	citric acid			
baking soda	sodium bicarbonate			
antacid	magnesium hydroxide			
aspirin	acetylsalicylic acid			
bleach	sodium hypochlorite			

Directions: Complete the following reactions. Indicate whether the substance is an acid (A), base (B), conjugate acid (CA), or conjugate base (CB). The reactions have already been balanced. *Note that metal cations are not involved in an acid-base reaction so they are not included in the written chemical reaction.*

Reaction 1: Vinegar and Baking Soda

CH_3COOH + _____ ⇄ H_2CO_3 + _____

_____ _____ _____ _____

Reaction 2: Lemon Juice and Antacid

2 $C_6H_8O_7$ + 3 OH^- ⇄ $C_6H_5O_7$ + 6 _____

_____ _____ _____ _____

Directions: Gather vinegar and baking soda (if they are available in your home). Mix small amounts of each substance in a large container. Always ask permission to use materials from your home and encourage your family members to observe the reactions with you. Answer the following questions in complete sentences. If you do not have baking soda and vinegar, have a parent sign underneath question 1 and skip to question 2.

1. What did you observe upon mixing baking soda and vinegar?

Carbonic acid is an unstable molecule and decomposes into water and carbon dioxide.

H_2CO_3 (*aq*) ⇄ H_2O (*l*) + CO_2 (*g*)

2. Using this information, explain the presence of bubbles in the chemical reaction.