GreatHearts
Irving

Remote Learning Packet

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

April 27 - May 1, 2020

Course: 10 Chemistry

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

Weekly Plan:

Monday, April 27
- [ ] Review notes covering sections 10.1, 10.3-10.6
- [ ] Complete Acids and Bases Quiz

Tuesday, April 28
- [ ] Answer and self-grade questions: p. 329 #71-73

Wednesday, April 29
- [ ] Read and record notes for section 10.10 (pp. 310-311)
- [ ] Complete a hypothetical experiment that uses an acid-base indicator

Thursday, April 30
- [ ] Read "Memoir on Combustion in General"
- [ ] Answer response questions

Friday, May 1
- [ ] Read "pH of body fluids" on p. 311
- [ ] Answer related questions in notes

Monday, April 27

Review your notes covering sections 10.1, 10.3-10.6. Pay close attention to vocabulary, key scientists and their discoveries (Arrhenius, Brønsted, and Lowry). Calculations will not be included in the quiz.

Assessments are learning tools, just like flashcards and note-taking. Do not complete this assessment as a routine “get-it-done” thing. Let it help you learn! Challenge yourself to complete as much as possible without assistance. This quiz is open note. Try! Then use your notes. Then refer to your book last, if you need to. Let this quiz help you activate the knowledge and understanding you’ve worked so hard to cultivate so far.

Complete the attached quiz.

Tuesday, April 28

Answer questions: p. 329 #71-73 to practice converting between pH, $[H_3O^+]$, and $[OH^-]$. Self-grade your responses using the attached answer key. These will not be turned in.

Wednesday, April 29

Read section 10.10 (pp. 310-311). Take notes of the key vocabulary terms and their definitions as well as any diagrams. Notes can be taken in a notebook or on separate paper.

Using the attached handout, complete the hypothetical experiment that makes use of an acid-base indicator.

Thursday, April 30

Read the excerpt from Antoine Lavoisier’s “Memoir on Combustion in General.” Antoine Lavoisier was a French scientist who lived in the 1700s and is credited with discovering the law of conservation of mass and the oxygen theory of combustion. Answer the attached response questions in complete sentences.

Friday, May 1

Read the section titled “pH of body fluids” on p. 311.

Answer the following questions related to the section in complete sentences at the end of your notes.

1. Which body fluid is the most acidic? How does the acidity of this fluid help it function?
2. Which body fluid is the most basic? How does the basicity of this fluid help it function?
3. Why is our blood slightly basic?
4. Why does urine have the widest range of pH?

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Quiz - Acids and Bases

Directions: Specify whether the compound is an acid or base with the letter A or B.

1. NaOH ________
2. HCl ________
3. H_3PO_4 ________
4. NH_3 ________
5. $CH_3CH_2CO_2H$ ________

Directions: Answer the following questions in relation to the reaction listed below.

$$H_2O + CH_3COO^- \rightleftharpoons CH_3COOH + OH^-$$

6. Which compound is the:
   a. Acid ________
   b. Base ________
   c. Conjugate acid ________
   d. Conjugate base ________

7. The K_a of water (H_2O) is 1.00×10^{-14}. The K_a of vinegar (CH_3COOH) is 1.76×10^{-5}. Based on these values, which of the two compounds is stronger?

   Circle one: H_2O / CH_3COOH

8. Which reaction is favored? Which arrow should be drawn larger?

   Circle one: forward / reverse

Directions: Answer the following questions in complete sentences.

9. What does it mean for a substance to be considered amphoteric?

10. What is the difference between an Arrhenius base and Brønsted-Lowry base?

11. Define the terms "strong" and "weak" in relation to the behavior of acids and bases.

71. What are the OH^- concentration and pOH for each solution in problem 10.70? Rank the solutions in order of increasing acidity.

a) $[H_3O^+] = 2.5 \times 10^{-8}$ M

$K_w = [H_3O^+][OH^-]$

$1.0 \times 10^{-14} = 2.5 \times 10^{-8} [OH^-]$

$[OH^-] = 4.0 \times 10^{-7}$ M

$pOH = -\log [OH^-]$

$pOH = -\log (4.0 \times 10^{-7})$

$pOH = 6.4$

rank #2

b) $[H_3O^+] = 5.0 \times 10^{-4}$ M

$1.0 \times 10^{-14} = 5.0 \times 10^{-4} [OH^-]$

$[OH^-] = 2.0 \times 10^{-11}$ M

$pOH = -\log (2.0 \times 10^{-11})$

pOH = ~~10.7~~ 11

rank #1 (most acidic)

c) $[H_3O^+] = 2.3 \times 10^{-12}$ M

$1.0 \times 10^{-14} = 2.3 \times 10^{-12} [OH^-]$

$[OH^-] = 4.3 \times 10^{-3}$ M

$pOH = -\log (4.3 \times 10^{-3})$

$pOH = 2.4$

rank #3 (least acidic)

72. What are the H_3O^+ and OH^- concentrations of solutions that have the following pH values?

a) pH 4

$[H_3O^+] = 10^{-pH}$

$[H_3O^+] = 10^{-4} = 1 \times 10^{-4}$ M

$K_w = [H_3O^+][OH^-]$

$1.0 \times 10^{-14} = 1 \times 10^{-4} [OH^-]$

$[OH^-] = 1 \times 10^{-10}$ M

b) pH 11

$[H_3O^+] = 10^{-11}$

$[H_3O^+] = 1.0 \times 10^{-11}$ M

$1.0 \times 10^{-14} = 1.0 \times 10^{-11} [OH^-]$

$[OH^-] = 1.0 \times 10^{-3}$ M

c) pH 0

$[H_3O^+] = 10^0$

$[H_3O^+] = 1$ M

$1.0 \times 10^{-14} = 1 [OH^-]$

$[OH^-] = 1 \times 10^{-14}$ M

d) pH 1.38

$[H_3O^+] = 10^{-1.38}$

$[H_3O^+] = \boxed{4.17 \times 10^{-2}\ M}$

$1.0 \times 10^{-14} = 4.17 \times 10^{-2}\ [OH^-]$

$[OH^-] = \boxed{2.40 \times 10^{-13}\ M}$

e) pH 7.96

$[H_3O^+] = 10^{-7.96}$

$[H_3O^+] = \boxed{1.10 \times 10^{-8}\ M}$

$1.0 \times 10^{-14} = 1.10 \times 10^{-8}\ [OH^-]$

$[OH^-] = \boxed{9.1 \times 10^{-7}\ M}$

73. About 12% of the acid in a 0.10M solution of a weak acid dissociates to form ions. What are the H_3O^+ and OH^- concentrations? What is the pH of the solution?

12% of 0.10 M acid = ? M H^+

$0.12 \times 0.10 = \boxed{0.012\ M\ H^+}$

$K_w = [H_3O^+][OH^-]$

$1.0 \times 10^{-14} = 0.012\ [OH^-]$

$[OH^-] = \boxed{8.3 \times 10^{-13}\ M\ OH^-}$

$pH = -\log [H_3O^+]$

$pH = -\log [0.012]$

$pH = \boxed{1.92}$

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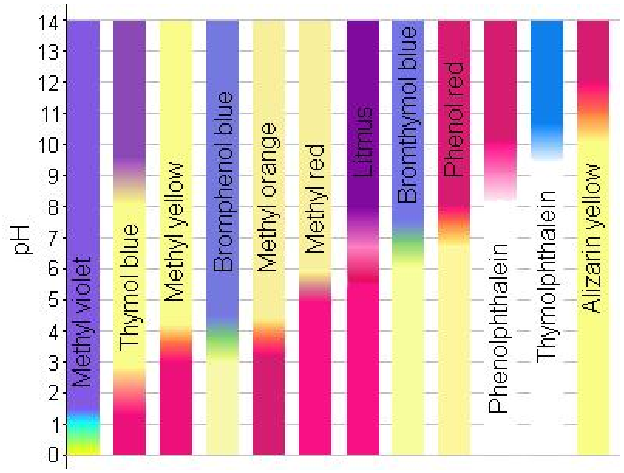
Acid-Base Indicator Experiment

Directions: Use the charts as reference and answer the following questions in complete sentences. For the methods section, fill in the appropriate blanks.

Table M
Common Acid–Base Indicators

Indicator	Approximate pH Range for Color Change	Color Change
methyl orange	3.2–4.4	red to yellow
bromthymol blue	6.0–7.6	yellow to blue
phenolphthalein	8.2–10	colorless to pink
litmus	5.5–8.2	red to blue
bromcresol green	3.8–5.4	yellow to blue
thymol blue	8.0–9.6	yellow to blue



Background:

1. What range of pH values is acidic? What range is basic?

2. What color would a solution with a pH of 5 be if using the indicator bromothymol blue?

3. A solution of an unknown pH is tested with litmus paper and the paper turns blue. Is the solution basic or acidic?

Materials:

Vinegar
Sodium hydroxide (NaOH)
Phenolphthalein
500mL beaker
50mL beaker
100mL graduated cylinder
10mL graduated cylinder
Pipet

Methods:

1. Using a __________________________ measure 5mL of phenolphthalein and pour it into the 500mL beaker.
2. Using a ___________________________ measure 100mL of vinegar and pour it into the __________________________.
3. Rinse and reuse the __________________________________ to measure 25mL of sodium hydroxide and pour it into the 50mL beaker.
4. Fill the _______________ by submerging the open end in the solution of sodium hydroxide and squeezing the bulb.
5. Carefully add the sodium hydroxide dropwise to the solution of ___________________ and ___________________. Record your observations.
    a. As sodium hydroxide is added, the pH in the 500mL is _____________ (increased or decreased).
    b. We predict that the solution will become the color ______________.

Conclusion:

1. Why did the solution change color? What substance was responsible for the color change?

2. If a very concentrated solution of hydrochloric acid (HCl) was added to the solution, what would happen to the pH? What would happen to the color of the solution?

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Lavoisier Response Questions

Directions: Answer the following questions in complete sentences related to the excerpt from "Memoir on Combustion in General" by Antoine Lavoisier.

1. Summarize what Lavoisier is trying to communicate in the first two paragraphs.

2. Define combustion in your own words. You may reference your textbook if necessary.

3. In the second phenomenon Lavoisier states, "Materials may not burn except in a very few kinds of air, or rather, combustion may take place in only a single variety of air." What element is this "single variety of air"? How does this relate to your definition of combustion from question 2?

4. In the third phenomenon, Lavosier states that "the burning body increases in weight exactly in proportion to the quantity of air destroyed or decomposed." Why does the burning body increase in mass? Which fundamental law of chemistry does this example demonstrate?

5. In the fourth phenomenon, "all combustion the body of which is burned changes into acid." Lavoiser then lists some examples of acids produced by combustion. What element(s) do all of these examples have in common?

6. Based on what you know about acids from chapter 10, can all acids be produced by combustion?

Memoir on Combustion in General, Antoine Lavoisier (1777)

As dangerous as is the desire to systematize in the physical sciences, it is, nevertheless, to be feared that in storing without order a great multiplicity of experiments we obscure the science rather than clarify it, render it difficult of access to those desirous of entering upon it, and finally, obtain at the price of long and tiresome work only disorder and confusion. Facts, observations, experiments--these are the materials of a great edifice, but in assembling them we must combine them into classes, distinguish which belongs to which order and to which part of the whole each pertains.

Systems in physical science, considered from this point of view, are no more than appropriate instruments to aid the weakness of our organs: they are, properly speaking, approximate methods which put us on the path to the solution of the problem; these are the hypotheses which, successively modified, corrected, and changed in proportion as they are found false, should lead us infallibly one day, by a process of exclusion, to the knowledge of the true laws of nature.

Encouraged by these reflections, I venture to propose to the Academy today a new theory of combustion, or rather, to speak with the reserve which I customarily impose upon myself, a hypothesis by the aid of which we may explain in a very satisfactory manner all the phenomena of combustion and of calcination[1], and in part even the phenomena which accompany the respiration of animals. I have already laid out the initial foundations of this hypothesis on pages 279 and 280 of the first volume of my "*Opuscules physiques et chimiques*," but I acknowledge that, having little confidence in my own ability, I did not then dare to put forward an opinion which might appear peculiar and was directly contrary to the theory of Stahl and to those of many celebrated men who have followed him.

While some of the reasons which held me back perhaps remain today, facts which appear to me to be favorable to my ideas have increased in number since and have strengthened me in my opinion. These facts, without being perhaps too strong, have made me more confident, and I believe that the proof or at least the probability is sufficient so that even those who are not of my opinion will not be able to blame me for having written.

We observe in the combustion of bodies generally four recurring phenomena which would appear to be invariable laws of nature; while these phenomena are implied in other memoirs which I have presented, I must recall them here in a few words.

First Phenomenon. In all combustions the matter of fire or light is evolved.

[1] Calcination is the process of heating a substance to high temperatures in the presence of air or oxygen. It is typically used on metal ores to break down the material thermally.

Second Phenomenon. Materials may not burn except in a very few kinds of air, or rather, combustion may take place in only a single variety of air: that which Mr. Priestley[2] has named *dephlogisticated air*[3] and which I name here *pure air*. Not only do those bodies which we call *combustible* not burn either in vacuum or in any other species of air, but on the contrary, they are extinguished just as rapidly as if they had been plunged into water or any other liquid.

Third Phenomenon. In all combustion, pure air in which the combustion takes place is destroyed or decomposed and the burning body increases in weight exactly in proportion to the quantity of air destroyed or decomposed.

Fourth Phenomenon. In all combustion the body of which is burned changes into acid by the addition of the substance which increases its weight. Thus, for example, if sulfur is burned under a bell, the product of the combustion is vitriolic acid[4]; if phosphorus be burned, the product of the combustion is phosphoric acid; if a carbonaceous substance be burned, the product of the combustion is fixed air[5], formerly called the acid of chalk[6], etc.

[2] Joseph Priestly (1773-1804) was an English chemist who is credited with the discovery of oxygen by being able to isolate the element in its gaseous state.
[3] Dephlogisticated air is air consisting of only oxygen gas.
[4] Vitriolic acid is another name for sulfuric acid, H_2SO_4.
[5] Fixed air is another name for carbon dioxide, CO_2.
[6] Chalk in this case is referring to calcium carbonate, $CaCO_3$.