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Unit 10: Acids & Bases & Salts

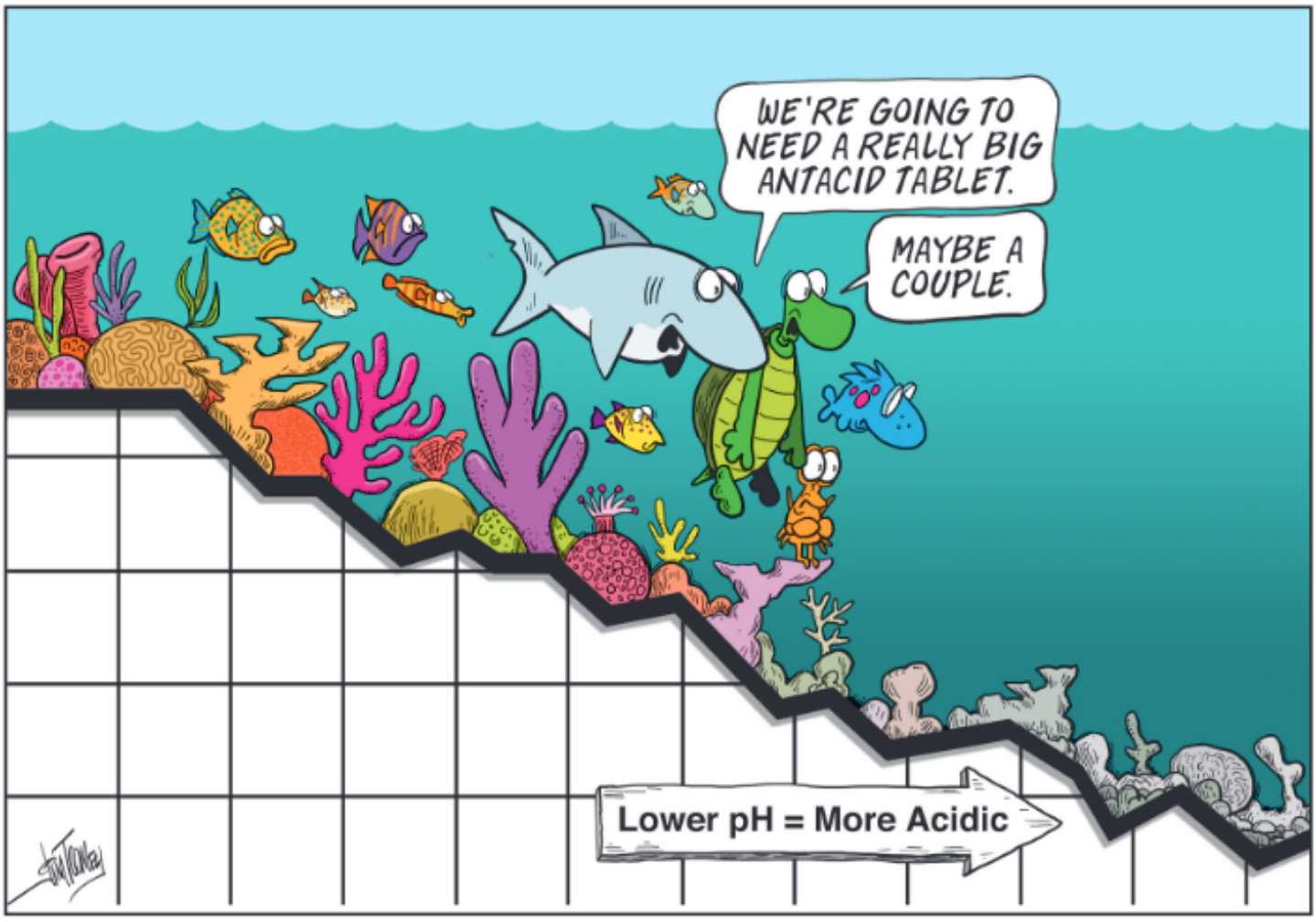
67	25	63	74	8	86	19
Ho	Mn	Eu	W	O	Rn	K
Holmium	Manganese	Europium	Tungsten	Oxygen	Radon	Potassium
164.93032	54.938045	151.964	183.84	15.9994	[222]	39.0983

The following pages are practice questions for this unit, and will be submitted for homework!

You must complete:

- Unit Vocabulary – **ALL QUESTIONS**
- Acid or Base – **ALL QUESTIONS**
- Conjugate Acid/Base Pairs – **ALL QUESTIONS**
- pH/Indicator Practice – **ALL QUESTIONS**
- Neutralization Practice – **ALL QUESTIONS**
- Acids and Metals – **ALL QUESTIONS**
- Titration Practice – **ALL QUESTIONS**

DUE: _____



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Unit Vocabulary

Directions: Use your notes and the orange review book to help define the following words.

- Acidity:

  _____

- Alkalinity:

  _____

- Arrhenius acid:

  _____

- Arrhenius base:

  _____

- Bronsted Lowery acid:

  _____

- Bronsted Lowery base:

  _____

- Electrolyte:

  _____

- Hydrogen ion:

  _____

- Hydronium ion:

  _____

- Hydroxide ion:

  _____

- Amphoteric:

  _____

- Conjugate Acid:

  _____

- Conjugate Base:

  _____

- Indicator:

  _____

- Neutralization:

  _____

- pH scale:

  _____

- Salt:

  _____

- Titration:

  _____

- Endpoint:

  _____

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Acid or Base

Directions: Fill in the table indicating if the property is characteristic of an acid or base.

Property	Acid or Base	Property	Acid or Base
Tastes sour		Tastes bitter	
Forms OH^-		pH 4	
HCl(aq)		KOH(aq)	
pH 12		Forms H_3O^+	

Conjugate Acid/Base Pairs

Directions: Fill in the blanks using your notes and your knowledge of chemistry.

- Acids are defined as proton (H^+) donators. They donate protons to the base. Bases are defined as proton acceptors. They accept protons from the acid.

$$\mathbf{HCl + NH_3 \longleftrightarrow NH_4^+ + Cl^-}$$

- According to Bronsted-Lowry theory, acid-base reactions involve a transfer of a proton.
- Above, the acid on the left, _____, transfers (donates) a proton (H^+) and becomes a base on the right, _____.
- The donating acid and the base it becomes are called *conjugate acid - base pairs.*
- The base on the left, _____, accepts a proton (H^+) and becomes an acid on the right, _____. This is also a conjugate pair.

Directions: Label the acid, base, conjugate acid, and conjugate base in each of the following reactions.

1. $HCl + NH_3 \rightarrow NH_4^+ + Cl^-$
2. $OH^- + HCN \rightarrow H_2O + CN^-$
3. $PO_4^{3-} + HNO \rightarrow NO_3^- + HPO_4^{2-}$
4. $HCO_3^- + HCl \rightarrow H_2CO_3 + Cl^-$

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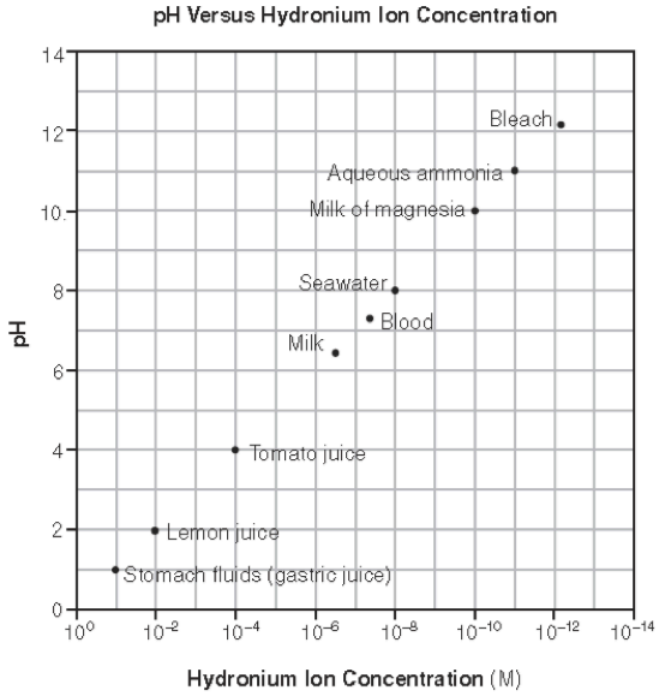
Directions: Fill in the following table.

Acid	Base	Conjugate Acid	Conjugate Bae	Equation
HNO_2	H_2O			$HNO_2 + H_2O \rightarrow NO_2^- + H_3O^+$
H_2O	F^-	HF	OH^-	
				$NH_3 + HCN \rightarrow NH_4^+ + CN^-$
		H_2O	ClO_3^-	
HSO_4^-	PO_4^{3-}			

pH/Indicator Practice – ALL QUESTIONS

Directions: Use the graph below to complete the table.

	[H_3O^+] (M)	pH	Acid or Base?
Stomach fluids			
Lemon juice			
Blood			
Seawater			
Bleach			



Directions: Circle one to complete the table.

	If an ACID is added…	If a BASE is added…
pH	Increases or Decreases	Increases or Decreases
[H^+] or [H_3O^+]	Increases or Decreases	Increases or Decreases
[OH^-]	Increases or Decreases	Increases or Decreases
Solution becomes more…	Acidic or Basic	Acidic or Basic

Directions: Answer the following questions and fill in the chart.
Remember:

- increasing or decreasing the pH by 1 changes the [H^+] by a factor of 10^1 (10 times, "ten-fold")
- increasing or decreasing the pH by 2 changes the [H^+] by a factor of 10^2 (100 times, hundred-fold)
- increasing or decreasing the pH by 3 changes the [H^+] by a factor of 1000 (thousand-fold)

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1. Describe what happens to the concentration of hydrogen ions in a solution if the pH is changed from 7 to 5.

2. Describe what is happening to the concentration of hydrogen ions in a solution if the pH is changed from 5 to 8.

3. Complete table

pH Change	$[H_3O^+]$ increase or decrease	$[OH^-]$ increase or decrease	More acidic or more basic?	By a factor of…
6 to 8				
8 to 5				
3 to 7				
11 to 9				
14 to 13				
4 to 8				

Directions: Determine the approximate pH of each mystery solution.

1. Mystery solution #1 turns blue when bromcresol green is added and yellow when bromthymol blue is added.

2. Mystery solution #2 turns litmus red and is yellow when methyl orange is added.

3. Mystery solution #3 is clear when phenolphthalein is added but turns litmus paper blue.

4. Mystery solution #4 is blue in the presence of thymol blue and pink in the presence of phenolphthalein.

5. Mystery solution #5 is yellow in the presence of both bromthymol blue and methyl orange.

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Neutralization Practice

Directions: Predict the products in each of the following reactions. Make sure your compounds are neutral (Hint: use the criss-cross method if needed). Make sure your equations are balanced at the end. Use the space provided to show your work. Remember Acid + Base → salt + water

1. ___ $HF_{(aq)}$ + ___ $LiOH_{(aq)}$ → _____ $_{(aq)}$ + ___ $HOH_{(l)}$

2. ___ $HNO_{3\ (aq)}$ + ___ $KOH_{(aq)}$ → _____$_{(aq)}$ + ___ $HOH_{(l)}$

3. ___ $HCl_{(aq)}$ + ___ $Ca(OH)2_{(aq)}$ → _____$_{(aq)}$ + ___ $HOH_{(l)}$

4. ___ $HClO_{3\ (aq)}$ + ___ $Mg(OH)_{2\ (aq)}$ → _____$_{(aq)}$ + ___ $HOH_{(l)}$

5. ___ $H_2CO_{3\ (aq)}$ + ___ $NaOH_{(aq)}$ → _____$_{(aq)}$ + ___ $HOH_{(l)}$

Acids and Metals

Directions: Predict the products of the following reactions.
(Hint: acid + more active metal → $H_{2(g)}$ + salt

1. Zn (s) + 2HCl (aq) → _____ + _____

2. Ag (s) + H_2SO_4 (aq) → _____ + _____

Directions: Answer the following questions based on your knowledge of chemistry.

1. Because tap water is slightly acidic, water pipes made of iron corrode over time, as shown by the balanced ionic equation below. Explain, in terms of chemical reactivity, why copper pipes are less likely to corrode than iron pipes.

$$2Fe(s) + 6H^{+}(aq) \rightarrow 2Fe^{3+}(aq) + 3H_2(g)$$

2. Many ancient cultural statues and buildings were made out of marble. Marble is a type of rock which contains the metal calcium in it. Explain, using Table J, why marble statues are damaged by acid rain.

3. During a laboratory activity, a student reacted a piece of zinc with 0.1 M HCl(aq).
   a. Complete the equation below by writing the formula of the missing products.

$$Zn + HCl \rightarrow \_\_\_\_ + \_\_\_\_$$

   b. Identify one metal that does not react spontaneously with HCl(aq). _____

Titration Practice

1. A 25.0-milliliter sample of $HNO_{3\ (aq)}$ is neutralized by 32.1 milliliters of 0.150 M $KOH_{(aq).}$ What is the concentration of the acid?

2. How many milliliters of 0.200 M NaOH are needed to neutralize 100. mL of 0.100 M HCl?

3. In a titration, 20.0 milliliters of 0.15 M HCl(aq) is exactly neutralized by 18.0 milliliters of KOH(aq). What is the concentration of KOH?

4. In a laboratory activity, 0.500 mole of $NaOH_{(s)}$ is completely dissolved in distilled water to form 400. milliliters of $NaOH_{(aq)}$. This solution is then used to titrate a solution of $HNO_{(aq).}$
   a. What is the molarity of NaOH

b. If 26.4 milliliters of the NaOH solution is needed to exactly neutralize 44.0 milliliters of the HNO_3 solution, what is the molarity of the HNO_3 solution?

5. If 6.00M HI is neutralized by 50.0mL of 4.50M RbOH, what is the volume of the acid added?

6. **If 25.5mL H_3PO_4 is neutralized by 50.0mL of 2.00M LiOH, what is the molarity of the acid?

7. **If 65.0mL of 1.50M H_3PO_4 is neutralized by 25.0mL of $Ca(OH)_2$, what is the molarity of the base?