9. Acids, bases, and salts

1. **How do you characterize acids? How do you characterize bases? And salts?**

2. **What do the following properties refer to – acids, bases or salts?**

1. are bitter to taste and corrosive in nature
2. convert blue litmus paper to red in color
3. feel slippery and soapy
4. react with oils and grease to form soap molecules
5. are formed by neutralization reaction
6. convert red litmus paper to blue in color
7. also have the tendency to corrode metal surfaces
8. compounds which yield hydroxide ion (OH-), when dissolved in water
9. compounds which yield hydrogen ion (H^+), when dissolved in water
10. have a tendency to corrode metal surfaces quickly
11. are sour to taste and corrosive in nature
12. the pH value is less than 7
13. the pH depends on the strength of acids and bases combined in the neutralization reaction
14. show a pH value of more than 7

3. **Reading** http://chemistry.tutorvista.com/inorganic-chemistry/acids-bases-and-salts.html

   a) **Find the names of these compounds in the text:**

1. CH_3COOH
2. $C_6H_8O_7$
3. HCl
4. HNO_3
5. NH_3
6. H_2SO_4

   b) **Correct the false information in the text – 6 of the words are in the wrong places**.

Acids and bases affect chemistry and our day to day life as well. Acids are found in many substances including food items but their presence in fruits is very prominent, e.g., acetic acid is present in citrus fruits such as orange and lemon. Vinegar contains citric acid. Apart from these, some acids are widely used in the household, like hydrochloric acid, sulfuric acid and nitric acid.

In general, bases are found in laboratory cleaners to clean grease from windows and floors and also in soaps, toothpastes, egg whites, dish washing liquids and household ammonia. The bases which are soluble in water are called alkalis.

Our body contains some very common acids like dilute hydrochloric acid in the stomach, which causes indigestion of food. If the contents of our stomach become too acidic, we get indigestion and a burning sensation in the body. Acids and bases also regulate metabolic activities in the human stomach through equilibrium processes. Bee stings are acidic in nature while wasp stings are alkaline in nature.

Acids, bases and salts – definitions

1. watch the video and complete the text below with missing pieces of information.
www.gpb.org/chemistry-physics/chemistry/1101

The Swedish chemist Svante Arrhenius introduced the theory of ionization and used this theory to explain much about the behaviour of acids and bases.

An Arrhenius acid is defined as any compound that _____ in aqueous solution to form _____ ions.

$HNO_3(aq) \rightarrow$ _____(aq) $+ NO_3^-(aq)$

An Arrhenius base is defined as any compound that _____ in aqueous solution to form _____ ions.

$KOH(aq) \rightarrow K^+(aq) +$ _____(aq)

Salts are compounds that _____ in aqueous solution releasing _____ ions.

$KCl \rightarrow$

2. Classifying compounds; using the Arrhenius definition, classify the following examples as acids, bases and salts

HBr	H_2SO_4
$Mg(OH)_2$	NaCl
HCl	CH_3COOH
KNO_3	$Al(OH)_3$
$KC_2H_3O_2$	Na_2SO_4
$Ba(OH)_2$	HNO_3

Writing ionic formulas

1. Try to explain how to write formulas of ionic compounds – complete the rules with your ideas:

1. Write the **a)** _____ for the **b)** _____
   - The **c)** _____ is written first
   - The **d)** _____ is written second
2. Determine the **e)** _____ on each ion.
3. Select **f)** _____ that will make **g)** _____ _____ charge equal to the **h)**_____ _____ charge.

Examples:
Sodium chloride
Magnesium chloride

Mg, which is in the group II, is a metal that **I)** _____ 2 electrons to become **j)** _____, creating a cation with a **k)** _____ charge. Cl is a non-metal that **l)** _____ one electron to become **m)**_____, creating an anion with a **n)** _____ charge.

We would need two **o)** _____ ions for every one magnesium ion so that the overall charge of the compound would be zero. So the formula for magnesium chloride is **p)** _____ . The *number 2* after the Cl is called a **r)** _____ and it represents the number of **s)** _____ ions in the formula. The **t)** _____of *1* in the formula is understood but not written.

Check your answers with the video http://www.gpb.org/chemistry-physics/chemistry/601 6.40 – 10.40

Examples of names of ions

Hydrogen	H^+	Chloride	Cl^-
Sodium	Na^+	Bromide	Br^-
Silver	Ag^+	Fluoride	F^-
Potasssium	K^+	Iodide	I^-
Lithium	Li^+	Hydroxide	OH^-
Ammonium	NH_4^+	Nitrate	NO_3^-
Barium	Ba^{2+}	Oxide	O^{2-}
Calcium	Ca^{2+}	Sulphide	S^{2-}

2. Naming acids and bases; (source: www.gpb.org/chemistry-physics/chemistry/1101)

a) watch the video and complete the text below

Since bases are _____ compounds, they are named in the usual way:

NH_4 OH –

$Al(OH)_3$ –

Binary acids consist of _____ elements, the first being _____. Binary acids are named using the format: _____+(root word of second element)+IC acid

Ternary acids consist of _____ elements. Do not use a prefix. Simply change the ending of the polyatomic ion's name and add the word _____. *–ate* ending becomes _____ and *–ite* becomes _____.

Polyatomic ion's names - match names with symbols:

phosphite	*phosphate*	*carbonate*	*acetate*	*sulfite*	*sulfate*	*nitrite*	*nitrate*
NO_2^-		PO_3^{3-}		SO_3^{2-}		$CH_3CO_2^-$	
NO_3^-		PO_4^{3-}		SO_4^{2-}		CO_3^{2-}	

b) Now name the following acids:

HBr

HNO_3

HNO_2

HI

$H_3 PO_3$

$HC_2 H_3 O_2$

$H_2 CO_3$

$H_2 SO_3$

HF

3. Naming salts (http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/ions/acidsbasesrev4.shtml)

The names of salts made from hydrochloric acids end in **–chloride,** while the name of salts made from sulfuric acid end in **–sulfate.**

Complete the names of salts in these reactions

1. sodium hydroxide	reacts with	hydrochloric acid	to make
2. sodium hydroxide		sulfuric acid	
3. zinc oxide		sulfuric acid	
4. ammonia		hydrochloric acid	

b) write formulas of the reactions above

HOMEWORK

1. Give formulas of these acids, bases and salts

boron silicide	magnesium phosphide
sodium hydroxide	zinc hydroxide
iron(III)chloride	aluminium sulfide
sulfuric acid	sulfurous acid

2. http://www.bbc.co.uk/apps/ifl/schools/gcsebitesize/science/quizengine?quiz=add_aqa_acidsbasestest&templateStyle=science

1. A solution has a pH of 4 - what does this mean?
   - It is acidic.
   - It is neutral.
   - It is alkaline.
2. Which of the statements below is correct?
   - Bases are acids that dissolve in water.
   - Bases are alkalis that dissolve in water.
   - Alkalis are bases that dissolve in water.
3. A liquid has a pH of 7. What does this tell you about the liquid?
   - It is water.
   - It is sodium chloride solution.
   - It is neutral.
4. Which salt is made when calcium carbonate reacts with hydrochloric acid?
   - sodium chloride
   - calcium chloride
   - calcium sulphate
5. Which pair of substances will react together to make copper sulfate?
   - copper and sulfuric acid
   - copper oxide and sulfuric acid
   - copper oxide and hydrochloric acid

3. GRAMMAR: Defining relative clauses. Complete the sentences below with an appropriate relative pronoun: (source: Oreska et al, 2006, *English for Chemists*)

1. Elements are substances _____ cannot be broken down by chemical methods any further.
2. Silver and gold are elements _____ are widely used in jewellery.
3. Campus is the part of Masaryk University ____ seminar rooms are equipped with modern audio-visual systems.
4. Salt ____ comes from the sea is considered to be the best for cooking.
5. Our teacher is the person _____ instructions we must obey.
6. The scientists ____ discovered the presence of sodium in the Sun are Robert Bunsen and Gustav Kirchhoff.
7. _____ of you can describe a Bunsen burner?
8. _____ knows the symbols of all the chemical elements?