

Name: _____ date turned in: _____

AP Chemistry Preparatory Assignment

		Due Date
Topic 0	• Join Google Classroom • "Turn in" Letter of Introduction (on Google Classroom) • look at suggested materials • turn on Classroom notifications	6/24/26
Topic 1	Significant Figures & Measurement Practice	9/11/25
Topic 2	Metric and Temperature Conversions	9/11/25
Topic 3	Nomenclature	9/11/25
Topic 4	Atomic Structure	9/10/25
Topic 5	Writing and Balancing Chemical Equations	9/11/25
Topic 6	Moles and Stoichiometry	9/11/25
Topic 7	Graphing and Data Analysis	9/11/25
Topic 8	Particulate Drawings	9/11/25
Topic 9	Thermochemistry	9/11/25
Topic 10	Elements and Ions to Memorize (Prepare Flash Cards)	9/11/25
Topic 11	Introduction to Acids, Bases, & pH (EdPuzzle)	9/11/26
Topic 12	Introduction to Titration (POGIL)	9/11/26

Google Classroom code: **n7h2soyw**

Link to my webpage: <https://sites.google.com/oceanschools.org/mcc-chemistry/home>

I am SO excited for the year! And I really hope you are too- it is going to be great!
If you need anything/have questions- please email!!! (kmccconnell@oceanschools.org)

McC :)

Topic 1: Significant Figures

1. Identify the number of significant figures in each of the following:

a. 0.7540 _____

b. 12500 _____

c. 1000.01 _____

d. 1.04×10^3 _____

e. 0.0080050 _____

2. Perform the following calculations and round to the appropriate number of significant figures:

a. $34.66 + 333.0$ _____

b. $455 - 1.22$ _____

c. 18.2×1.998 _____

d. $10.20 \div 1.34$ _____

e.
$$\frac{100.23 + 59.4}{5.22}$$

3. Round each of the following numbers to three significant figures:

a. 170 _____

b. 0.00445345 _____

c. 25.0545 _____

d. 8504.0435 _____

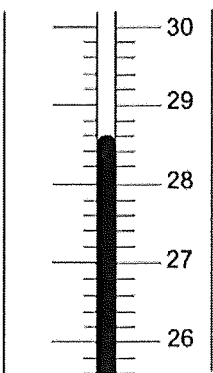
e. 14.50 _____

Measurement Practice

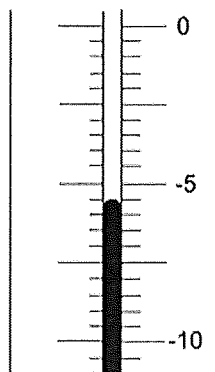
During the course of the year, you will need to make several laboratory measurements. Here is a sampling of equipment to practice reading to the correct number of significant figures (smallest increment $\div 10$).

READING THERMOMETERS

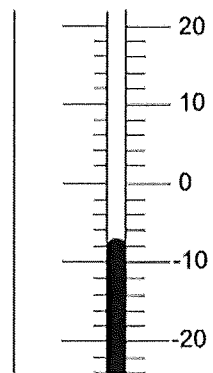
For the thermometers below, read the temperature in degrees Celsius.



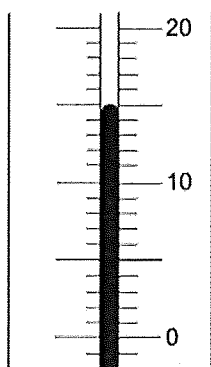
a)



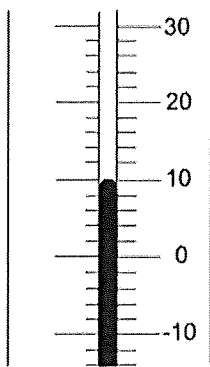
b)



c)



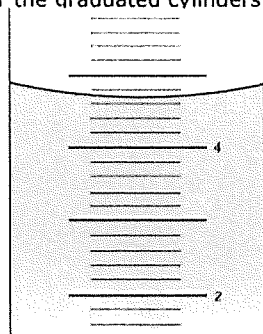
d)



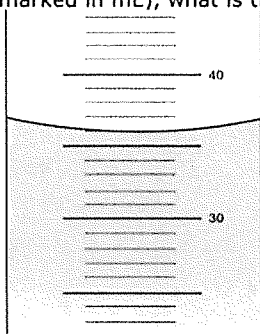
e)

READING VOLUMES IN GRADUATED CYLINDERS

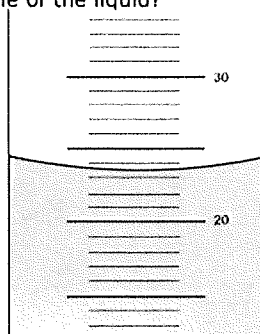
For the graduated cylinders below (marked in mL), what is the volume of the liquid?



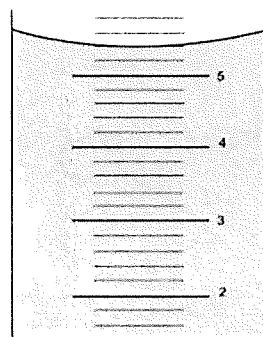
a) _____



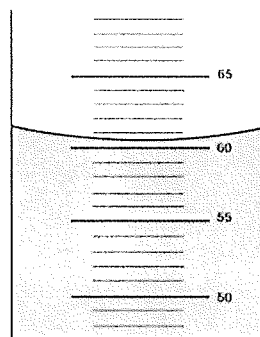
b) _____



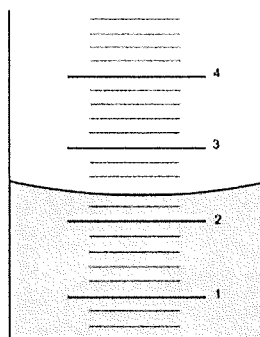
c) _____



d) _____



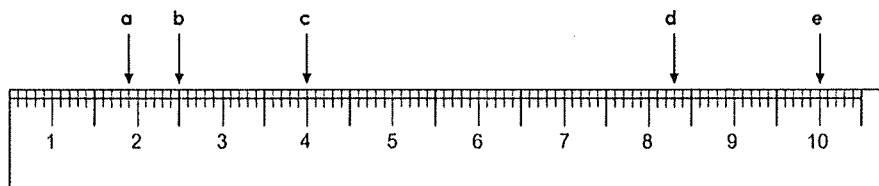
e) _____



f) _____

MEASURING LENGTH

Provide both the cm and mm lengths indicated on the ruler.

**cm****mm**

a) _____

b) _____

c) _____

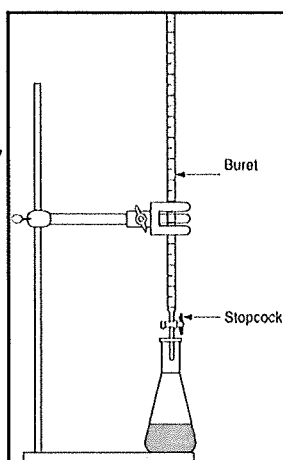
d) _____

e) _____

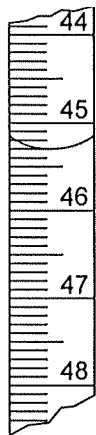
The Buret

The buret is a long vertical glass tube with volumetric graduations along its length and a valve, or stopcock, at the bottom. The burets used in this course are graduated from 0.00 mL to 50.00 mL.

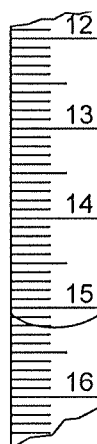
The buret is divided into numbered 1 mL increments, from 0 at the top to 50 at the bottom. These 1 mL increments are sub divided into unnumbered 0.1 mL increments. Burets must be read to 2 decimal places and so a second decimal place must be estimated when reading the scale.



Reading a BURETTE

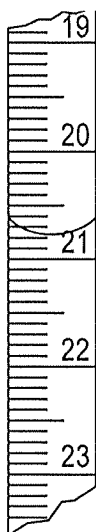


a) _____

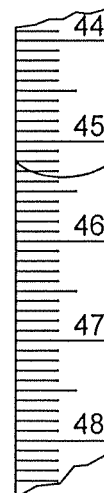


c) _____

b) _____



d) _____



Topic 2: Metric and Temperature Conversions

1. Use dimensional analysis (factor-label method) to make the following metric conversions (show ALL work/equalities used):

a. 3.40 g to cg = _____

b. 289 cm to nm = _____

c. 125145 J to kJ = _____

d. 46.5 mL to L = _____

2. Make the following temperature conversions:

a. 162 °C to °F _____

b. -18 °C to K _____

c. 212 K to °C _____

d. 98.6 °F to K _____

Topic 3: Nomenclature

1. Name or write the formula for the following ionic compounds:

a. LiCl		g. tin(II) bromide	
b. $\text{Mg}(\text{OH})_2$		h. silver phosphate	
c. K_3P		i. nickel (II) perchlorate	
d. Fe_2O_3		j. sodium hydroxide	
e. FeO		k. zinc phosphate	
f. ZnCl_2		l. ammonium sulfate	

2. Name or write the formula for the following covalent compounds:

a. CO		e. nitrogen tribromide	
b. CBr_4		f. tetraphosphorus decoxide	
c. SO_2		g. xenon hexafluoride	
d. N_2O_4		h. dicarbon tetrafluoride	

3. Name or write the formula for the following acids:

a. HCl		e. hydrobromic acid	
b. HNO_3		f. hydronitric acid	
c. $\text{HC}_2\text{H}_3\text{O}_2$		g. phosphoric acid	
d. H_2SO_4		h. hydrosulfuric acid	

Topic 4: Atomic Structure

1. Determine the number of protons, neutrons and electrons in each of the following:

a. ${}^{39}_{19}\text{K}$ protons: _____ neutrons: _____ electrons: _____

b. ${}^{23}_{11}\text{Na}^{1+}$ protons: _____ neutrons: _____ electrons: _____

c. ${}^{208}_{82}\text{Pb}$ protons: _____ neutrons: _____ electrons: _____

d. ${}^{33}_{15}\text{P}^{3-}$ protons: _____ neutrons: _____ electrons: _____

2. Write the symbol for the atom that contains

a. 24 protons, 24 neutrons, 21 electrons

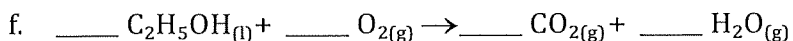
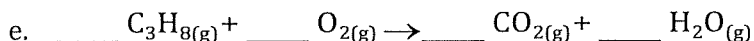
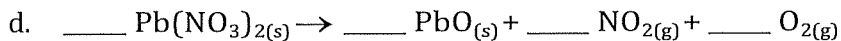
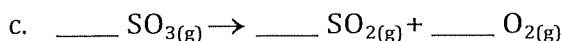
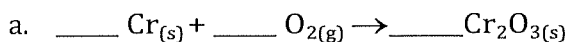
b. 34 protons, 45 neutrons, 34 electrons

c. 8 protons, 10 neutrons, 10 electrons

3. How has the atomic model change over time from Dalton's Atomic Theory to the modern Quantum Mechanical model?

Topic 5: Writing and Balancing Chemical Equations

1. Balance the following chemical equations:



2. Write a balanced chemical equation for each of the following reaction descriptions:

a. When solid calcium carbonate is heated, solid calcium oxide and gaseous carbon dioxide are formed.

b. Aluminum metal reacts with oxygen to form solid aluminum oxide.

c. When solid mercury(II) sulfide is heated with oxygen, liquid mercury metal and gaseous sulfur dioxide are produced.

d. When aqueous solutions of aluminum sulfate and barium chloride are mixed, solid barium sulfate and aqueous aluminum chloride are formed.

e. Solid sodium bicarbonate reacts with hydrochloric acid to produce sodium chloride, water, and carbon dioxide gas.

f. Gaseous ammonia and oxygen react to produce nitrogen monoxide gas and water.

Topic 6: Moles and Stoichiometry

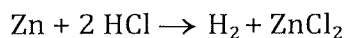
1. Vinegar is a dilute solution of acetic acid, CH_3COOH .

a. Calculate the molar mass of acetic acid.

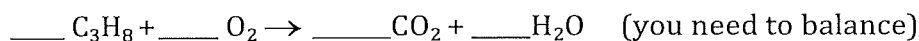
b. How many molecules of CH_3COOH are contained within 43.4 g of acetic acid?

c. How much would 0.450 moles of acetic acid weigh?

2. How many moles of hydrogen gas can be produced if 1.35 g of solid zinc reacts with excess hydrochloric acid according to the given equation?



3. The reaction for the combustion of propane is:



a. If 20.0 g of C_3H_8 and 20.0 g of O_2 are reacted, how many moles of CO_2 can be produced?

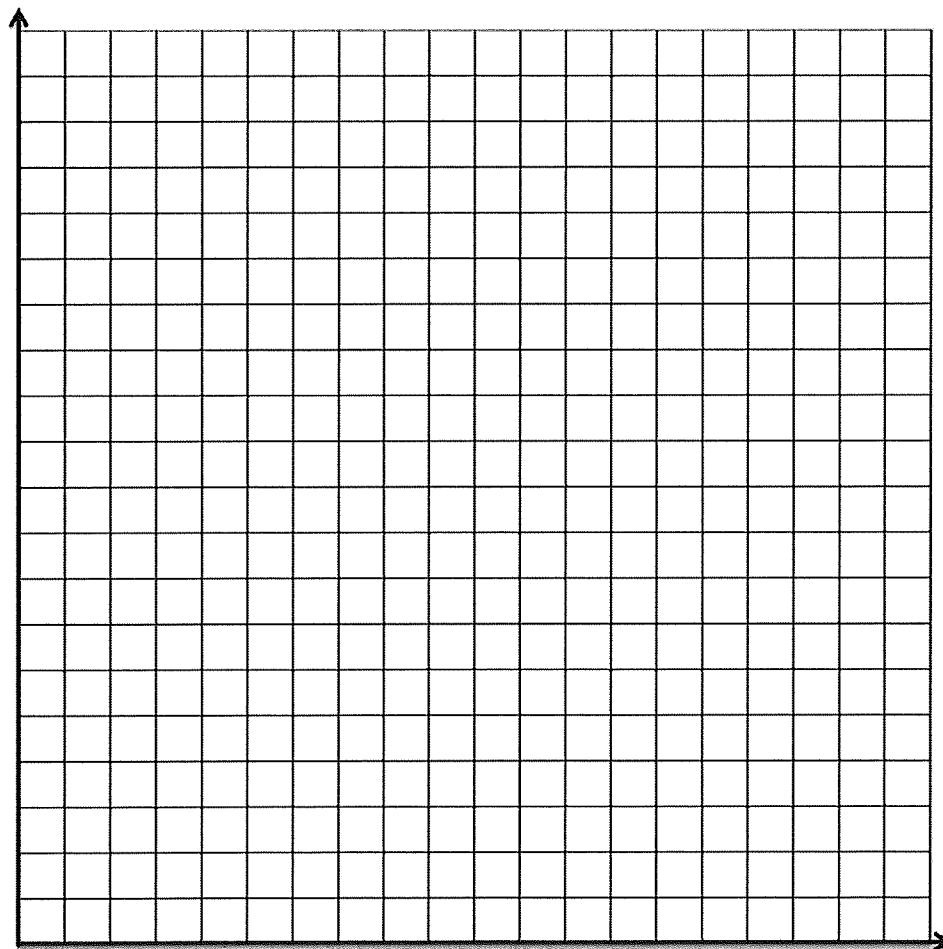
4. If 20.0 g of C_3H_8 and 80.0 g of O_2 are reacted, how many grams of CO_2 can be produced?

Topic 7: Graphing and Data Analysis

4. When anhydrous calcium chloride is dissolved in water, the temperature of the system changes. A student obtains the following data when dissolving increasing amounts of CaCl_2 into 100 mL of water:

Mass of CaCl_2 dissolved, g	ΔT , $^{\circ}\text{C}$
0.50	2.7
2.92	11.4
5.38	20.0
7.54	29.3
9.99	38.5

Plot the data on the graph below. Choose an appropriate scale and label the axes appropriately. Provide a descriptive title for the graph.



Refer to the graph to answer the following questions.

Independent Variable: _____

Dependent Variable: _____

5. Describe the relationship between grams of calcium chloride salt and change in temperature in a sentence.

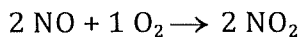
6. Draw a line of best fit. Determine its slope, including units. Show all work.

7. Using the calculated slope, predict the change in temperature when 4.33 g of CaCl_2 are dissolved. As expected, show all work; be mindful of units and significant figures.

8. Using the calculated slope, predict what mass of CaCl_2 will result in a 12.4°C change in temperature. As expected, show all work; be mindful of units and significant figures.

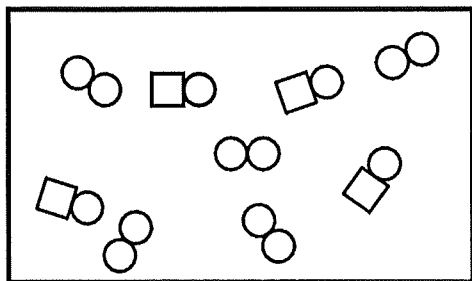
Topic 8: Particulate Diagrams

1. Consider the synthesis of nitrogen dioxide.



- a. In the diagram below, nitrogen atoms are represented with squares and oxygen atoms are represented with circles. Using the conservation of matter, draw what you would expect to find in the reaction vessel once the reaction is complete. ***Create a key.

Before Reaction:



After Reaction

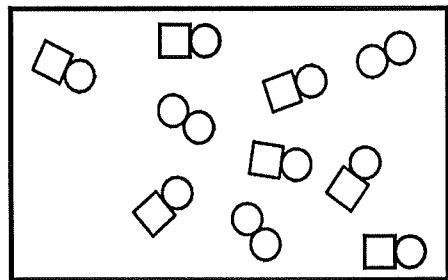
Key

Limiting Reactant:

Excess Reactant:

- b. Consider the same reaction, with different starting quantities. Draw the contents of the reaction vessel after the reaction is complete.

Before Reaction:



After Reaction

Key

Limiting Reactant:

Excess Reactant:

Topic 9: Thermochemistry

Note: We may not have fully covered Thermochemistry in Honors or Advanced Chem. Please feel free to find videos on YouTube to assist you. If not, here is the formula information, which could also be enough to guide you.

$$q = mC\Delta T$$

$$q_{\text{sys}} = -q_{\text{surr}}$$

where q = heat (in Joules or calories)

m = mass (in grams)

c = specific heat

$$c_{\text{H}_2\text{O}} = 1.000 \text{ cal/g}^\circ\text{C} = 4.184 \text{ J/g}^\circ\text{C}$$

ΔT = change in temperature

$$\Delta T = T_f - T_i \text{ (usually in } ^\circ\text{C, but can be in K)}$$

1. How much energy, in calories, is needed to change the temperature of 50.0 g of water by 15.0°C ?
2. How many grams of water can be heated from 20.0°C to 75.0°C using 12.50 kJ?
3. A piece of metal weighing 59.047 g was heated to 100.0°C and then put it into 100.0 g of water (initially at 23.7°C). The metal and water were allowed to come to an equilibrium (final) temperature, determined to be 27.8°C . Assuming no heat lost to the environment, calculate the specific heat of the metal in $\text{J/g}^\circ\text{C}$. (Hint: First calculate the heat absorbed by the water then use this value for " q_{surr} " to determine the specific heat of the metal in a second calculation since $q = -q$)

4. A scientist heated an iron bar to 1175.0°C . The scientist then dropped the heated bar into 55.0 L of water at a temperature of 17.0°C . The final temperature of the system was measured to be 45.1°C . What was the mass (in grams) of the iron bar? The specific heat of iron is $0.451\text{ J/g}^{\circ}\text{C}$. (reminder... the density of water is assumed to be 1.00 g/mL)
5. Given the following: $\text{CH}_4(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \quad \Delta H = -890\text{ kJ}$
- Write the balanced thermochemical equation (enthalpy as a reactant or product).
 - Is the reaction exothermic or endothermic? _____
 - How much heat is given off by the reaction of 3.5 moles of CH_4 ?
 - How much heat is given off by the reaction of 40.0 g of O_2 ?
6. Given the following: $\text{Fe} + \text{CO}_2 \rightarrow \text{Fe}_2\text{O}_3 + \text{CO} \quad \Delta H = +26.3\text{ kJ}$
- Write the balanced thermochemical equation.
 - Is the reaction exothermic or endothermic? _____
 - How many grams of iron will be produced when 54.0 J of heat are absorbed?

Topic 10: Elements and Ions to Memorize

Suggested: prepare flash cards for the following elements/ions and their symbols (you are NOT given names or ions on the AP exam, although context clues are helpful).

H	hydrogen
He	helium
Li	lithium
Be	beryllium
B	boron
C	carbon
N	nitrogen
O	oxygen
F	fluorine
Ne	neon
Na	sodium
Mg	magnesium
Al	aluminum
Si	silicon
P	phosphorus
S	sulfur
Cl	chlorine
Ar	argon
K	potassium
Ca	calcium
Cr	chromium
Mn	manganese
Fe	iron
Cu	Copper
Zn	zinc
Ag	silver
Pb	lead

$\text{C}_2\text{H}_3\text{O}_2^{-1}$	acetate
ClO_4^{-1}	perchlorate
ClO_3^{-1}	chlorate
ClO_2^{-1}	chlorite
CN^{-1}	cyanide
HCO_3^{-1}	bicarbonate
OH^{-1}	Hydroxide
NO_3^{-1}	nitrate
NO_2^{-1}	nitrite
ClO_4^{-1}	perchlorate
MnO_4^{-1}	permanganate
SCN^{-1}	thiocyanate
CO_3^{2-}	carbonate
CrO_4^{2-}	chromate
SO_4^{2-}	sulfate
SO_3^{2-}	sulfite
S^{2-}	sulfide
PO_4^{3-}	phosphate
PO_3^{3-}	phosphite
P^{3-}	phosphide
N^{3-}	nitride
NH_4^{+}	Ammonium

Topic 11: Introduction to Acids, Bases & pH [EdPuzzle posted to Google Classroom]

Topic 12: Introduction to Titration (POGIL)

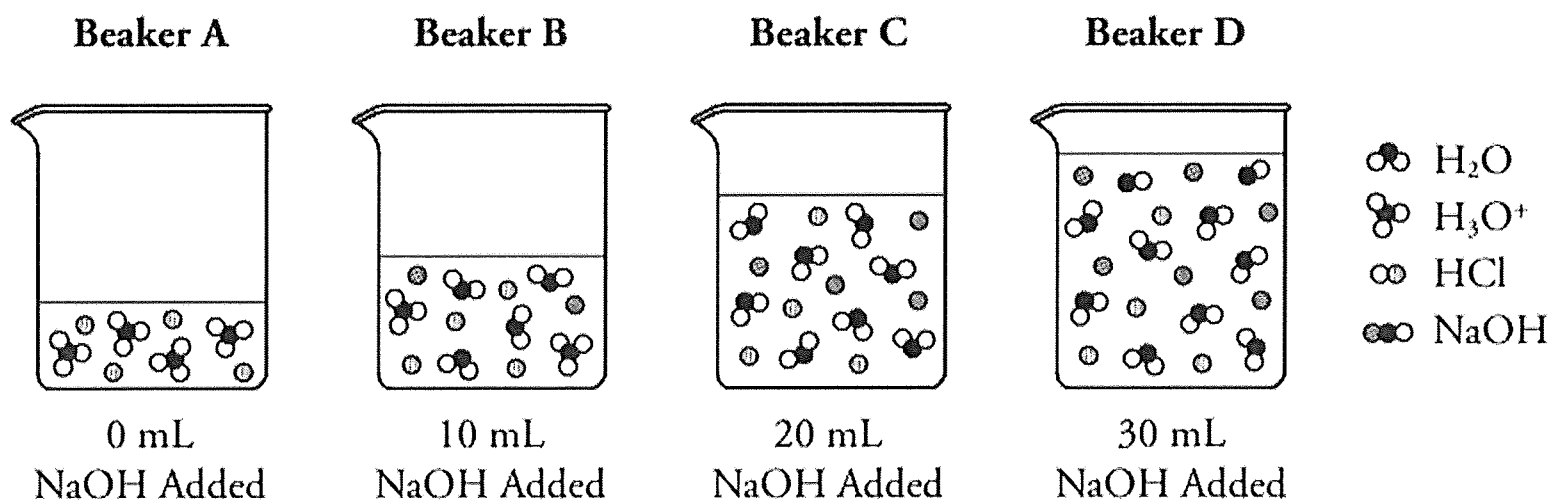
Titration Curves

What is in the beaker at each stage of a titration?

Why?

Titration is a very useful technique for determining the properties of an unknown solution. The unknown is reacted with a known titrant solution by adding small volumes until an equivalence point is reached. Titrations can be done using an acid–base reaction, redox reaction or precipitation. Most commonly it is used to find the concentration of a solute. Depending on the type of reaction used, a chemist might also be able to determine the strength of an unknown acid or base, the potential of a species to oxidize or reduce another species, or the solubility of a substance. This activity will focus on an acid–base titration.

Model 1 – HCl Sample Titrated with NaOH



1. Consider the diagrams in Model 1.
 - a. Which beaker illustrates the solution before the titration begins?
 - b. Why does the volume increase from Beaker A to Beaker D?
2. Explain why there are no HCl molecules in any of the beakers.
3. Write a balanced net ionic equation for the reaction between HCl and NaOH during the titration.
4. Which species in the illustrations in Model 1 are simply spectator ions?
5. Complete the table in Model 1 by counting the number of each species in each of the four beakers. Record the numbers in the appropriate box in the table. The first column has been done for you as an example.
-  6. For each beaker in Model 1 determine if the solution would be acidic, basic or neutral when checked with a pH meter. Justify your reasoning.

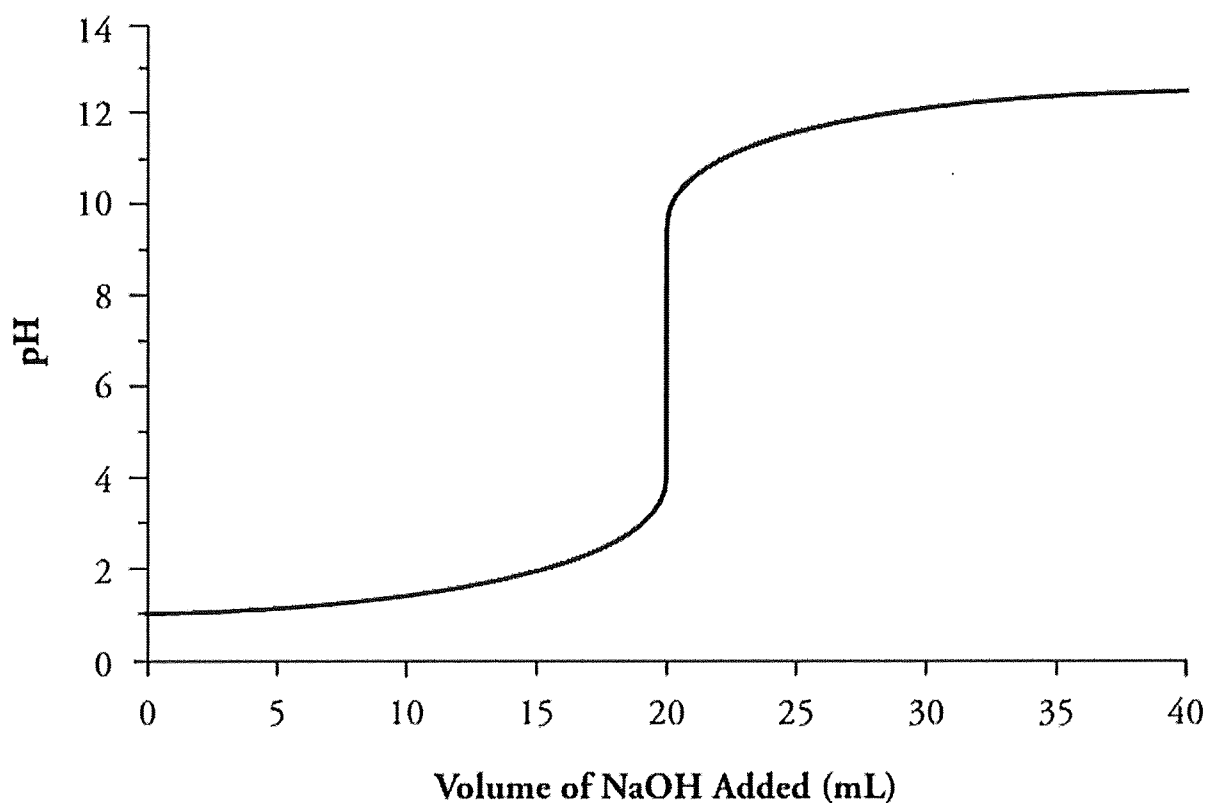
Beaker A –

Beaker B –

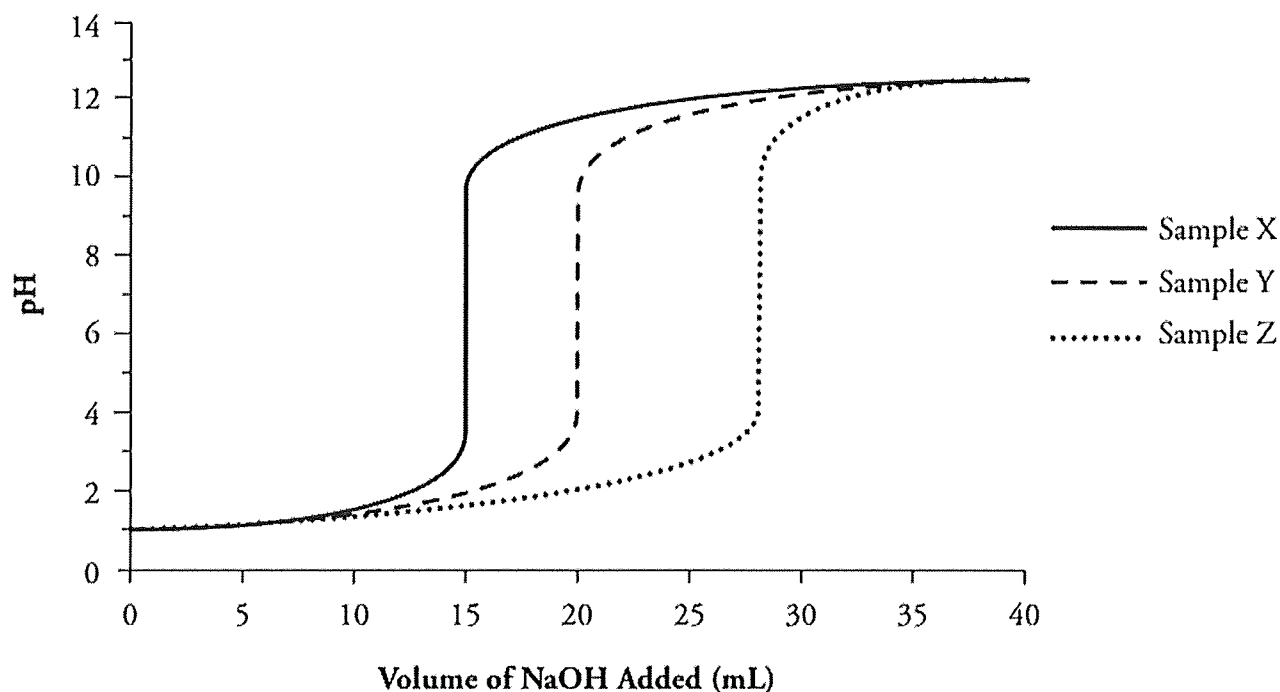
Beaker C –

Beaker D –

Model 2 – A Titration Curve



7. The graph in Model 2 shows the pH of the resulting solution from the titration illustrated in Model 1. Label four points on the graph in Model 2 to correspond with the four beakers in Model 1.

Model 3 – Determining the Unknown Concentration

8. The graph in Model 3 shows the titration curves of three samples of hydrochloric acid, each having the same volume (20.00 mL) but different concentrations. All three samples were titrated with the same sodium hydroxide solution. What feature of the titration curve changes the most when samples with different concentrations are titrated?
9. Does changing the concentration of the sample have a significant effect on the initial or final pH for the titration curve?
10. Circle the equivalence point of each titration in Model 3. Notice that the pH at all three equivalence points is 7.00. Explain how this can be the case even though the initial samples were different concentrations.