SIT Session Lesson Plan

Week/Chapter: Week 1 __ Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Introduction to SIT, Study techniques, note-taking strategies, benefits of outlining chapters/reading/preparing before going to class.

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm-up	Introduce yourself- Students will introduce their name, their occupations, home town, favorite television programs, and/or the best books they have read in the last year	3-5 min
Intro to what we do.	Explain what SIT is and why it is beneficial to the students; make myself seem less scary.	2-3 min
Study Techniques and Note taking strategies	Scribe will write a list of the different study techniques used by students and note taking strategies. Students will discuss how each one is beneficial for them	10 min
Outlining Benefits – before lecture	Chapter Outline- Students will open their texts to Ch. 1 (Timberlake & Timberlake, 2013) and select a single scribe to head to the white board to outline the chapter as the other students provide instruction on what to write. Then a short discussion on why they selected the main topics they did and what some would have done differently if they had been writing their own outline.	15 min
Check for understanding	Discussion – short discussion lead by the students, each student will share two things they learned during the session and/or how they will tackle the class	5-10 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 2 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Different substances (Chp.2), Conversions (Chp.2), Heat equation for specific heat (Chp.3)

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm up	Stage Name– Students will make a stage name by combining the name of their first pet + the name of the first street they lived on. After they make up their name, the students will share it to the class	2-5 mins
Difference between homogenous/heterogeneous mixtures, compounds	Mix & Match – separate into 2 groups, give each slips with substances that they have to categorize into groups as mixtures, comp. etc	10 mins
Conversions – length, temp, volume, mass, energy	Scribe writes problems on the board and solves as each person says what the next step is.	15 mins
Heat Equations – variables and specific heat	Divide and conquer- working in pairs, students will answer the problems in the handout	10 mins
Check for understanding	So what- Students are asked to come up with the take home message of what they learned during the session	5 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Conversions Problems

Length

1. 5.00 ft = ____ cm
2. O.250 mi = _____in

Temp

1. 50 degrees Celsius = ____ K
2. 375 K = _____ degrees Fahrenheit

Volume

1. 16 qt = ____ mL
2. 420. cm^3 = _____ L

Mass

1. 3.0 lb = ____ g
2. 4.40 kg = ____ oz

Energy

1. 67.8 J = ____ calories
2. 2.2 Kcal = _____ J

Answers Conversions Problems

Length

1. 5.00 ft = 12.7 cm
2. O.250 mi = 15800 in

Temp

1. 50 degrees Celsius = 323 K
2. 375 K = 216 degrees Fahrenheit

Volume

1. 16 qt = 15000 mL
2. 420. cm^3 = 0.420 L

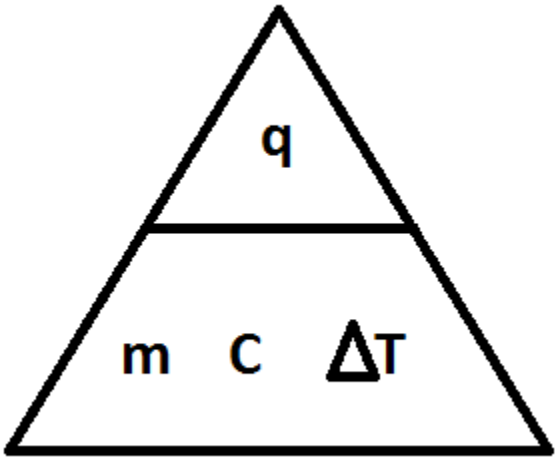
Mass

1. 3.0 lb = 1400 g
2. 4.40 kg = 141 oz

Energy

1. 67.8 J = 16.2 calories
2. 2.2 Kcal = 9200 J

Specific Heat Exercises



3.36b.) Calculate the **energy**, in joules, lost when 18.0g of gold (Au) cools from 224°C to 118°C.

(The specific heat of gold is equal to 0.129 J/ g°C)

3.40b.) Calculate the **mass**, in grams, for a sample of iron (Fe) that loses 2.52 kJ when its temperature decreases from 252°C to 75°C.

(The specific heat of iron is equal to 0.452 J/ g°C)

3.44a.) Calculate the **change** in **temperature** for 0.650 kg of water that loses 5.48 kJ of heat.

(The specific heat of H_2O should be memorized: 4.184 J/ g°C for *liquid* water)

(Timberlake & Timberlake, 2013)

Mix and Match – after cutting out the pieces match the items in the first table with the items in the second

Oil and water	Sand	Blueberry pancake
Sugar and water	Helium	Salt
Air in Atmosphere	Brass	Water
Chocolate chip cookie	Sugar	Nitrogen

Element	Compound	Heterogeneous mixture
Compound	Homogenous mixture	Homogenous mixture
Compound	Element	Homogenous mixture

Heterogeneous mixture	Heterogeneous mixture	Heterogeneous mixture

Answer Key Mix and Match

Oil and water HM	Sand HM	Blueberry pancake - HM
Sugar and water - HoM	Helium E	Salt C
Air in Atmosphere - HoM	Brass HoM	Water C
Chocolate chip cookie HM	Sugar C	Nitrogen E

HM = heterogeneous mixture

HoM = homogenous mixture

E = element

C = compound

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 3 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Specific heat (Chp 5) and Atomic Mass Calculation (Chp3)

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm up	Two lies and a truth- 3 statements will be given to the students relating to chapter 3 and 5. Two statements will be false while the other statement will be true. Together the students will decide which statement is true and why the other statements are false.	5 min.
Specific Heat	Paired Problem Solving/ Think Aloud- In groups, students will verbalize what they are thinking about as they solve a specific heat problem. How will this be done? In the group, one student will be the thinker while the other student will be the listener. The thinker will say every step in the thinking process and the listener will listen and understand their every step. After the problem is solved, the groups will rejoin the large group and share the problem solving process with the group. Two problems will be used.	20 min.
Atomic Mass	Summarizing the Steps- Together, we will review the steps in calculating the atomic mass by sharing our knowledge with one another. One problem will be used.	10 min.

Checking for Understanding	Assess the Session- Ask the students how they felt the session went, if their questions were answered, if they have any suggestions that to make the sessions more beneficial to them.	5 min.
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Problems for challenge concept #1:

3.80 A large bottle containing 883 g of water at 4.0 degrees Celsius is removed from the refrigerator. How many kilojoules are absorbed to warm the water to room temperature 27 degrees Celsius?

Answer: 85 kJ

3.10) When 655 J is added to a sample of ethanol, its temperature rises from 18.2 degrees Celsius to 32.8 degrees Celsius. What is the mass, in grams, of the ethanol sample?

Answer: 18.2 g

Problem for challenge concept #2:

4.84) Antimony has two naturally occurring isotopes: Sb-121 and Sb-123. If Sb-121 has a 57.21% abundance and a mass of 120.9 amu, and Sb-123 has a 42.79% abundance and a mass of 122.9 amu, what is the atomic mass of antimony?

Answer: 121.8 amu

(Timberlake & Timberlake, 2013)

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 4 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Electron configuration (chp 5) and trends in periodic table (chp 5)

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm-up	My name is- Ask students to state their name and attach something they learned about in chapter 3 or 4 that starts with the same letter as their name e.g. chemical changes Cristina	2-3 mins
Electron Configuration: written out	Do an example as a group first from "Basic Chemistry": 5.6, pg 151 (Timberlake & Timberlake, 2013)	15mins
	Worksheet in pairs for 3 elements.	
Trends in Periodic Table	Group/Period: Chart on board made with help of scribe for characteristics and examples of elements in same group vs. same period	25mins
	Ionization energy and size: Make the classroom a periodic table and have students walk to the part of the room that corresponds with pattern energy or size on the periodic table	
Check for Understanding	1 minute paper – have students write a paper about the concepts learned in the session, then they will share their response	2-3 mins
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Electron Configuration Problems

1. Fe

2. Br

3. Cu*

Answers:

1. Fe : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$

2. Br : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^5$

3. Cu : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$

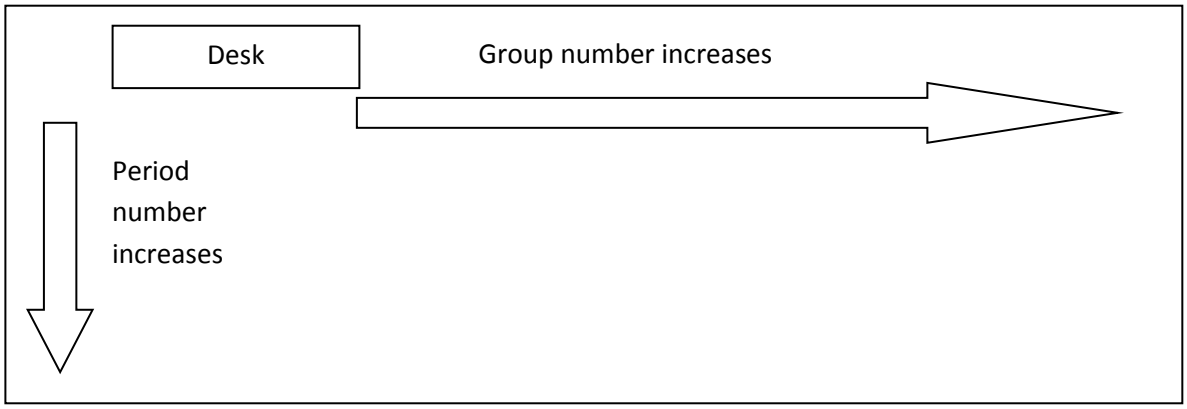
(Timberlake & Timberlake, 2013)

Trends in Periodic Table

Answer Key – Group/Period (pg 159)

Group	Period
• Same characteristics down the group • Same number of valence electrons • Atomic size increases going down • Ionization energy decreases going down • Metallic character increases going down • Ex: Mg and Ca	• Valence electrons in the same energy level • Atomic size decreases going from left to right • Ionization energy increases from left to right • Metallic character decreases from left to right • Ex: N and O

Class Room Blueprint for Atomic Size and Ionization energy



1. An element with high ionization energy (F)
2. An element with large radius
3. An element with low ionization energy
4. An element with small radius

Answers:

1. Top right corner of blueprint
2. Bottom left

3. Bottom left
4. Top right

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 5 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? 1) Naming ionic and molecular compounds (Chp. 6), Polyatomic ions (Chp. 6), Calculating molecular mass (Chp 7)

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Intro-Warm Up	Interview- Students will be assigned to a partner. Each will be given 3-5 min to ask questions that have been prepared by the course assistant (e.g. Would NaCl be considered a covalent or ionic bond?). When they are done, they will share their interviews with the class.	5 minutes
Naming ionic and molecular compounds	Do an example as a group first 6.3, pg 179 and 6.5, pg 190 (Timberlake & Timberlake, 2013) and create cheat sheet for naming compounds, Then in pairs, work together to name 3 compounds	15min
Polyatomic ions	Chart- Scribe writes on the board variations of the polyatomic ions with the same element and talk about ways to memorize them will continue naming other compounds	10 min
Mole and Avogadro's Number	Discussion- Students will discuss how to calculate molar mass using their book pages 215 – 217 (Timberlake & Timberlake, 2013)	10 min
Check for understanding	Guess test questions- From the material covered, a scribe will write 3 questions given by the students that may be on the next exam	5 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Interview Questions:

Do metals tend to lose or gain valence electrons?

Answer: Lose

What is the total charge of a neutral atom?

Answer: 0

In which type of bond to elements share their valence electrons?

Answer: Covalent

What is a polyatomic ion?

Answer: A covalently bonded group of atoms with an electrical charge.

Ionic compounds consist of cations and anions. When naming them which ion goes in front of the other one? The cation or the anion?

Answer: Cation

How many valence electrons do noble gases have?

Answer: 8

A cation has a positive or negative charge?

Answer: Positive

Why do nonmetals want to gain electrons?

Answer: In order to obtain 8 electrons in their outer shell.

Would NaCl be considered a covalent or ionic bond?

Answer: Covalent

Naming Compounds

1. SiO_2

2. Al_2O_3

3. BaF_2

Answers

1. SiO_2 : Silicon Dioxide
2. Al_2O_3 : Aluminum oxide
3. BaF_2 : barium fluoride

(Timberlake & Timberlake, 2013)

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 6 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? 1. Converting Particles to Moles; 2. Calculating Empirical/Molecular Formula

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm up	Verbal Volleyball-In pairs, students will review as many math concepts from class as they can remember. Student A will shout out any concept, idea, issue, covered in class followed by student B. Students will continue volleying concepts back and forth until they run out of ideas. They cannot repeat something said by their partner. Then in a large group we will share the concepts.	5 min
Converting particles to moles	Peer Lessons- Select 4 problems over this topic and divide the students into groups of four or five depending on how many show up. Then give each group one problem and have them write out the solution using their textbook and class notes. Each group come up to the board and explain the problem in much detail as they can.	20 min
Calculating Empirical/Molecular Formula	Structured problem solving- Identify the steps in calculating molecular formula and then separate the students into groups. Because the steps for solving the problem were given, it will be easier for the students to help find the answer to a sample problem given. When the groups finish with the problem, ask them to explain the steps	15-20 min

	that led to their answer.	
Check for understanding	Summarize the session- Students will be asked to summarize the session in few sentences	5 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Problems for challenging concept number one

Allyl sulfide $(C_3H_5)_2S$, gives garlic, onions, and leeks their characteristic odor.

1) How many moles of sulfur are in 23.2 g of $(C_3H_5)_2S$?

2) How many atoms of hydrogen are in .075 mol of $(C_3H_5)_2S$?

3) How many grams of carbon are in 4.20×10^{23} molecules of $(C_3H_5)_2S$?

4) How many atoms of carbon are in 15.0 g of $(C_3H_5)_2S$?

(Timberlake & Timberlake, 2013)

Problems for Challenging concept number two

1) Calculate the empirical formula for:
    a. 19.8% C, 2.20% H, and 78.0% Cl

    b. 5.52 g of K, 1.45 g of P, and 3.00 g of O

2) Choral hydrate, a sedative, contains 14.52% of C, 1.83% H, 64.30% Cl, and 19.35% O. If it has an experimental molar mass of 165 g, what is its molecular formula?

3) Adenine, a nitrogen containing compound found in DNA and RNA is 44.5% C, 3.70% H, and 51.8% N. If adenine has an experimental molar mass of 135 g, what is its molecular formula?

(Timberlake & Timberlake, 2013)

Answer Key:

Problems for challenging concept number one

Allyl sulfide $(C_3H_5)_2S$, gives garlic, onions, and leeks their characteristic odor.

1) How many moles of sulfur are in 23.2 g of $(C_3H_5)_2S$?

Answer: 0.203 mol of S

2) How many atoms of hydrogen are in .075 mol of $(C_3H_5)_2S$?

4.0×10^{24} **atoms of H**

3) How many grams of carbon are in 4.20×10^{23} molecules of $(C_3H_5)_2S$?

50.3 g of C

4) How many atoms of carbon are in 15.0 g of $(C_3H_5)_2S$?

4.75 x 10^23 atoms of C

Problems for Challenging concept number two

4) Calculate the empirical formula for:
   a. 19.8% C, 2.20% H, and 78.0% Cl

   Answer: $C_3H_4Cl_4$

   b. 5.52 g of K, 1.45 g of P, and 3.00 g of O

   Answer: K_3PO_4

5) Choral hydrate, a sedative, contains 14.52% of C, 1.83% H, 64.30% Cl, and 19.35% O. If it has an experimental molar mass of 165 g, what is its molecular formula?
   a. Answer: $C_2H_3Cl_3O_2$

6) Adenine, a nitrogen containing compound found in DNA and RNA is 44.5% C, 3.70% H, and 51.8% N. If adenine has an experimental molar mass of 135 g, what is its molecular formula?
   a. Answer: $C_5H_5N_5$

References

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SIT Session Lesson Plan

Week/Chapter: _Week 7_ Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Calculating Limiting Reactants and Percent Yield

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm up	Memory- 12 note cards are prepared in which half will have vocabulary terms and the other half will have corresponding definitions (Exothermic, reactants, combustion reaction, percent yield, limiting reactant, Law of conservation of mass, Combination Reaction, Theoretical yield, Decomposition Reaction, Endothermic reaction, Products, Double replacement reaction). Students will get into groups and each will take turns to find a match with the corresponding card. They will continue taking turns until all the cards have been paired together.	5 min
Calculating Limiting Reactants	Clusters-students will be divided into smaller groups for discussion on the steps for calculating limiting reactants. After discussing the assigned topic the cluster will report the steps to the other groups and check if they have all the steps that their groups have. Then two problems will be given to the groups so that they can apply those steps.	20 min
Percent Yields	First Line Only- A variety of types of problems from chapter 9 (Timberlake & Timberlake, 2013) will be presented but will ask the students which problem is specifically relating to percent yield	20 min

	(they will also be ask to identify what the other problems are asking for). Then once they have identified the problem about percent yield, they will be asked how they would begin solving the percent yield problem taking it step by step until they get their final answer.	
Check for understanding	A-Ha moment- Students will be asked to write their A-ha moment during the session	
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Problems for challenging concept one

1. When nitrogen dioxide from car exhaustion combines with water in the air, it forms nitrogen oxide and nitric acid, which causes acid rain.
    a. $3NO_2 (g) + H_2O (l) \rightarrow NO (g) + 2HNO_3 (aq)$
        i. How many moles of NO_2 are needed to react with .250 mol of H_2O?

        ii. How many grams of HNO_3 can be produced if 225 g of NO_2 is mixed with 55.2 g of H_2O?

2. Propane gas C_3H_8, reacts with oxygen to produce water and carbon dioxide.
    a. $C_3H_8 (g) + 5O_2 (g) \rightarrow 3CO_2 (g) + aH_2O (l)$
        i. How many moles of H_2O form when 5.00 mol of C_3H_8 completely reacts?

Problems for challenging concept two

1) $2Fe (s) + 3S (s) \rightarrow Fe_2S_3$
    a. How many moles of iron are needed to react with 2.75 mol if sulfur?

2) Hydrogen sulfide burn with oxygen to give sulfur dioxide and water. How many grams of sulfur dioxide are formed from the reaction of 8.52 g of H_2S and 9.60 g of O_2?
    a. $2H_2S (g) + 3O_2 (g) \rightarrow 2SO_2 (g) + 2H_2O (g)$

3) 3.00 mol of CO and 5.00 mol of H_2 are the initial reactants, how many moles of methanol can be produced?

a. $CO\ (g) + 2H_2\ (g) \rightarrow CH_3OH\ (g)$

4) When 56.6 g of calcium is reacted with nitrogen gas, 32.4 g of calcium nitride is produced. What is the percent yield of calcium nitride for this reaction?
   a. $3Ca\ (s) + N_2\ (g) \rightarrow Ca_3N_2$

5) Mercury (II) oxide decomposes to mercury and oxygen.
   a. $2HgO\ (s) \rightarrow 2Hg\ (l) + O_2\ (g)$ delta H = +182 kJ
      i. How many kj are needed to react 25.0 g of mercury (II) oxide?

(Timberlake & Timberlake, 2013)

Key

Problems for challenging concept one

3. When nitrogen dioxide from car exhaustion combines with water in the air, it forms nitrogen oxide and nitric acid, which causes acid rain.
   a. $3NO_2\ (g) + H_2O\ (l) \rightarrow NO\ (g) + 2HNO_3\ (aq)$
      i. How many moles of NO_2 are needed to react with .250 mol of H_2O?
      Answer: .750 mol of NO_2
      ii. How many grams of HNO_3 can be produced if 225 g of NO_2 is mixed with 55.2 g of H_2O?
      Answer: 205 g of HNO_3
4. Propane gas C_3H_8, reacts with oxygen to produce water and carbon dioxide.
   a. $C_3H_8\ (g) + 5O_2\ (g) \rightarrow 3CO_2\ (g) + aH_2O\ (l)$
      i. How many moles of H_2O form when 5.00 mol of C_3H_8 completely reacts?
      Answer: 20.0 mol of H_2O

Problems for challenging concept two

6) $2Fe\ (s) + 3S\ (s) \rightarrow Fe_2S_3$
   a. How many moles of iron are needed to react with 2.75 mol if sulfur?
   Answer: Calculating Moles of a Reactant
7) Hydrogen sulfide burn with oxygen to give sulfur dioxide and water. How many grams of sulfur dioxide are formed from the reaction of 8.52 g of H_2S and 9.60 g of O_2?
   a. $2H_2S\ (g) + 3O_2\ (g) \rightarrow 2SO_2\ (g) + 2H_2O\ (g)$
   Answer: Calculating Limiting Reactant
8) 3.00 mol of CO and 5.00 mol of H_2 are the initial reactants, how many moles of methanol can be produced?
   a. $CO\ (g) + 2H_2\ (g) \rightarrow CH_3OH\ (g)$
   Answer: Calculating Limiting Reactant

9) When 56.6 g of calcium is reacted with nitrogen gas, 32.4 g of calcium nitride is produced. What is the percent yield of calcium nitride for this reaction?
    a. 3Ca (s) + N2 (g) → Ca3N2
    Answer: Calculating percent yield → 46.4%
10) Mercury (II) oxide decomposes to mercury and oxygen.
    a. 2HgO (s) → 2Hg (l) + O2 (g) delta H = +182 kJ
        i. How many kj are needed to react 25.0 g of mercury (II) oxide?

    Answer: Calculating Heat in a Reaction

(Timberlake & Timberlake, 2013)

References

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SIT Session Lesson Plan

Week/Chapter: Week 8 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Shapes of molecules and polarity

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm up	Fact or Fiction- Ask everyone to write on a piece of paper THREE things about themselves which may not be known to the others in the group. Two are true and one is not. Taking turns they read out the three 'facts' about themselves and the rest of the group votes which are true and false.	5 min
Shape of molecules	Grab Bag- Students will get into groups and each group will pick out a shape molecule from a bag (e.g. linear) and together describe how many bonded atoms, lone pair, and electron groups that shape molecule has as well as give an example	15 min
Polarity	Divide and Conquer-Students will get into groups and each group will be assigned a section. Each group will read and summarize their section in their group. After each group reads their material, I will have all the groups read aloud their summary. I will encourage the groups to ask questions about the other group's material if they feel they need to. (Timberlake & Timberlake, 2013)	20 min
Check for understanding	Big Idea- Ask each student to tell what s/he thought was the most important concept, idea	5-10 min

	or new information they learned during a particular lecture or even a session.	
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Activities: Week 8

Molecule shapes that the students will be presented with and the properties they have to describe about each shape:

1. **Linear: has 2 electron groups, central atom is bonded to 2 atoms, has 0 lone pairs**
2. **Trigonal planar: has 3 electron groups, central atom is bonded to 3 atoms, has 0 lone pairs**
3. **Trigonal planar (bent): has 3 electron groups, central atom is bonded to 2 atoms, has 1 lone pair**
4. **Tetrahedral: has 4 electron groups, central atom is bonded to 4 atoms, has 0 lone pairs**
5. **Trigonal pyramidal: has 4 electron groups, central atom is bonded to 3 atoms, and has 1 lone pair**
6. **Tetrahedral (bent): has 4 electron groups, central atom is bonded to 2 atoms, and has 2 lone pairs**

(Timberlake & Timberlake)

Important sections that groups will discuss about:

- **Types of bonds**
- **Nonpolar molecules**
- **Polar molecules**
- **Electronegativity**

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 9 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Review: Shapes of molecules (10.2), Attractive forces (10.4) and Changes of state (10.5)

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use:	Time
Warm up	5 seconds –go around the room and allow each student to define the term in five seconds or less	5 min
Change of state	Structured problem solving- heating and cooling curve problems can be a bit confusing to students so what we are going to do is together work on a problem and identify the steps for solving heating and cooling curve problems. Hints will also be given so that they can know when to use which formulas. 2 problems will be used	10-15 min
Gas laws	Turn to a partner-a worksheet with different gas law problems will be given to the students. They will pair up with one of their classmates and determine which gas law is going to be used in each problem and pick two out of the five that they find challenging.	10-15 min
Check for understanding	Discussion- encourage students to discuss over what was covered in the session	5 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

5 sec go- Terms

Deposition: gas to solid

Heat of fusion: energy required to melt exactly 1g of a substance

Heat of vaporization: energy required to vaporize 1 g of a substance

Sublimation: solid to gas

Problems for activity one:

How many kJ are released when 85.0 g condenses at 100 degrees celcius and the liquid cools to 0 degrees Celsius?

How many joules are needed to melt a 525 g ice sculpture at 0 degrees Celsius and to warm the liquid to 15 degrees Celsius?

(Timberlake & Timberlake, 2013)

Problems for activity two:

A weather balloon has a volume of 750 L when filled with helium at 281 Kelvin at a pressure of 380 torr. What is the final volume, in liters, of the balloon when the pressure is 0.20 atm and the temperature -45 degrees Celsius?

A steel cylinder with a volume of 15.0 L is filled with 50.0 g of nitrogen gas at 25 degrees Celsius. What is the pressure, in atmospheres, of the N_2 gas in the cylinder?

A tank of oxygen holds 20.0 L of oxygen at a pressure of 15.0 atm. What is the volume, in liters, of this gas when it is released at a pressure of 1.00 atm?

A sample of helium gas with a pressure of 250 torr at 0 degrees Celsius is heated to give a pressure of 1500 mmHg. What would be the final temperature in degrees Celsius?

An air bubble has a volume of 0.500 L at 18 degrees Celsius. What is the final volume, in liters, of the gas when the temperature changes to 425 K?

(Timberlake & Timberlake, 2013)

Hints that will be given to the students for any heating or cooling curve problems:

Heat of Fusion = 334 J/ 1 g

Heat of Vaporization = 2260 J/ 1 g

Heat equation = mass **x** temp change **x** specific heat of water

Anytime you see the key words, **melting** or **freezing** in the problem, use the heat of fusion equation

Anytime you see the key words, **vaporize** or **condensation**, use the heat of vaporization equation

Anytime you see the key words, **warming** or **cooling**, use the heat equation

Example: if you see **melting** and **warming** in the problem then you will use the heat of fusion equation and heat equation.

Answers to Problems for activity one:

How many kJ are released when 85.0 g condenses at 100 degrees celcius and the liquid cools to 0 degrees Celsius?

Answer: 192 kj

How many joules are needed to melt a 525 g ice sculpture at 0 degrees Celsius and to warm the liquid to 15 degrees Celsius?

Answer: 208000 j

(Timberlake & Timberlake, 2013)

Answers to Problems for activity two:

A weather balloon has a volume of 750 L when filled with helium at 281 Kelvin at a pressure of 380 torr. What is the final volume, in liters, of the balloon when the pressure is 0.20 atm and the temperature -45 degrees Celsius?

Answer: Combined gas law; 1500 L

A steel cylinder with a volume of 15.0 L is filled with 50.0 g of nitrogen gas at 25 degrees Celsius. What is the pressure, in atmospheres, of the N_2 gas in the cylinder?

Answer: Ideal gas law; 2.90 atm

A tank of oxygen holds 20.0 L of oxygen at a pressure of 15.0 atm. What is the volume, in liters, of this gas when it is released at a pressure of 1.00 atm?

Answer: Boyle gas law; 300. L

A sample of helium gas with a pressure of 250 torr at 0 degrees Celsius is heated to give a pressure of 1500 mmHg. What would be the final temperature in degrees Celsius?

Answer: Gay Lussac's law; -23 degrees Celsius

An air bubble has a volume of 0.500 L at 18 degrees Celsius. What is the final volume, in liters, of the gas when the temperature changes to 425 K?

Answer: Charles' law; 0.730 L

(Timberlake & Timberlake, 2013)

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 10 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Heat of vaporization/ fusion, gas laws and formulas

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Icebreaker		5 min
Gas Laws	Mini quiz: Identify the formula needed, perform reasonably simple calculations. (Side one only will be completed individually)	15 min
Gas law computations, heat of fusion, STP, molar density	Quiz side 2 will completed in clusters (or as a class for very small groups)	20 min
Closing- What to know for chapter 12	Memorize Solubility Rules! We will use our textbook and slides (Timberlake & Timberlake, 2013) to look up and review the solubility rules, allowing students to independently find information, then discuss as a group.	5 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Week 10 Quiz

1.) What is the **freezing point** of H_2O _____*C _____*F _____K

2.) What is the **boiling point** of H_2O _____*C _____*F _____K

3.) **True** or **False:** During the time when a solid changes to liquid, there is a **simultaneous** phase change and temperature change occurring.

4.) 1 atm = _____mmHg

5.) 1 Torr = _____mmHg

6.) Write the combined gas law:

7.) What are the standard values for the following in **STP (Standard Temperature and Pressure)?**

Temperature _____K (_____*C)

Pressure _____ atm (_____mmHg)

8.) At **STP**, one mole of gas occupies how much space?

_____ L (per one mole)

9.) What does PV= nRT stand for?

P=

V=

n=

R=

T=

10.) An ice bag containing 275 g of ice at 0*C was used to treat sore muscles. When the bag was removed, the ice had melted and the liquid water had a temperature of 24.0 *C.

How many kilojoules of heat were absorbed?

(Timberlake & Timberlake, 2013)

11.) A sample of helium gas has a volume of 6.50 L at a pressure of 845 mmHg and a temperature of 25 *C. What is the final pressure of the gas, in atmospheres, when the amount of gas remains the same, the volume changes to 2.25 L and the temperature decreases to 12 *C ?

(Timberlake & Timberlake, 2013)

12.) How many grams of Cl_2 (g) are in 5.00 L of Cl_2 ?

13.) What is the density, in grams per liter, of hydrogen gas at **STP**?

(Timberlake & Timberlake, 2013)

References

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SIT Session Lesson Plan

Week/Chapter: Week 11 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Review practice problems and Calculating equilibrium constants

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm up	Fish bowl- Students will pick a piece of paper from a bowl or cup that has important key terms. They will each draw out a term and write the definition or information related to that term.	10 min
Practice Problems Review	Divide and conquer- have students work on problems that they need the most help with from the review or from previous homework assignments	15 min
Calculating Equilibrium Constants	Turn to a partner- Students will pair up with a classmate and together work on 2 equilibrium problems referring to pg 450. This page has a sample problem that will help guide them in solving the 2 problems assigned correctly.	15 min
Check for Understanding	Informal quiz- students will be given three questions over what was covered in lecture	5 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Fish Bowl will include the following terms:

Activation energy

Factors that increase rate of reaction

Chemical equilibrium

Equilibrium constant expression

Homogeneous equilibrium

Heterogeneous equilibrium

Equilibrium constant *Kc*

Problems that students will work with partner:

What is the numerical value of Kc for the following reaction if the equilibrium mixture contains 0.030 M N_2O_4 and 0.21 M NO_2?

$N_2O_4\ (g) \rightleftharpoons 2NO_2\ (g)$

Answer: 1.5

(Timberlake & Timberlake, 2013)

What is the numerical value of Kc for the following chemical reaction if the equilibrium mixture at 750 degrees Celsius contains 0.20 M CO and 0.052 M CO_2?

$FeO\ (s) + CO\ (g) \rightleftharpoons Fe(s) + CO_2\ (g)$

Answer: 0.26

(Timberlake & Timberlake, 2013)

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter:: Week 12 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Le Chatelier's Principle (Chp 13) and Conjugate acids and bases (Chp 14)

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm-up	Match them up! - Students will pair up and will be given a sheet that has important key terms and definitions. Together, they will match the correct key term with its definition	5 min
Le Chatelier's Principle	Incomplete Chart - Ask a volunteer to explain what the principle is and then groups will work on filling in the missing information in the chart.	15 min
Conjugate acids and bases	Clusters-students will get into groups and look for the three steps needed to help guide them on writing conjugate acid-base pairs. We will discuss about it and work out one example together, then a problem will be given to their group and together they will try to find out the conjugate acids and bases with their group. When done, all the groups will compare answers.	20 min
Checking for understanding	Open discussion- students discussed what was covered or concepts learned	5 min
Tutoring = Q & A		5-10 minutes

After session comments/thoughts:

Match them Up!

____ Heterogeneous mixture	a. increasing temperature, concentration, and adding a catalyst
____ Activation energy	b. the reactants must collide, correct orientation of reactants, and enough energy
____Chemical equilibrium	c. products over reactants
____Factors that increase reaction rate	d. when the reactants an products are in two or more states
____Homogeneous mixture	e. numerical value obtained by substituting experimentally measured molar concentrations at equilibrium into the equilibrium constant expression.
____Equilibrium constant expression	f. minimum amount of energy required to break the bonds between atoms of the reactants
____Conditions required for a reaction to occur	g. when a stress is placed on a reaction at equilibrium, the equilibrium will shift in the direction that relieves stress

____Le Chateliers Principle

h. a reaction in which all the products and reactants are in the same state

____Equilibrium Constant, Kc

i. no further change takes place in the concentration of the reactants and products even though the two reactions continue at equal but opposite rates

Conjugate Acids and Bases

3 steps needed:

1. Identify the reactant that loses H+ as the acid
2. Identify the reactant that gains H+ as the base
3. Write the conjugate acid-base pairs for each

Problems

14.13a) $H_2CO_3\ (aq) + H_2O\ (l) \rightleftharpoons HCO_3^-\ (aq) + H_3O^+\ (aq)$

Answer: The conjugate acid-base pairs are H_2CO_3/ HCO_3^- and H_3O^+/ H_2O

14.13b) $NH_4^+\ (aq) + H_2O\ (l) \rightleftharpoons NH_3\ (aq) + H_3O^+\ (aq)$

Answer: The conjugate acid-base pairs are NH_4^+/ NH_3 and H_3O^+/ H_2O

(Timberlake & Timberlake, 2013)

References

Timberlake, K.C., & Timberlake, W. (2013). *Basic Chemistry* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

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SIT Session Lesson Plan

Week/Chapter: Week 13 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Identifying acid and bases (chp 14), Writing equations for reactions of acids and bases (Chp 14), Calculating molarity or volume of an acid or base in a titration (Chp.),

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use:	Time
Warm Up	Shout Out Loud- Students will be encouraged to shout out any concepts that were covered last week	5 min
Products, concentrations, identifying conjugate acids and bases	Practice problems- Students will work together to answer problems given	10mins
Writing equations for reactions of acids and bases	Divide and-conquer let students work in pairs to divide and answer the problems in a short amount of time	10mins
Calculating molarity or volume of an acid or base in a titration	Scribe- have a volunteer come up to the board and work out the two problems given with the help of everyone else	10mins
Check for understanding	Opinion chart- On the board, scribe will list opinions about the content learned in the left column of a T-chart, and support the students opinions in the right column	10 min
Tutoring = Q & A		5-10 min

After session comments/thoughts:

Practice Problems

Match the reactants or process with its products

1. Acid and metals
2. Acid with carbonate/bicarbonate
3. Neutralization

a) Water and salt
b) Hydrogen gas (H_2) and salt
c) Carbon dioxide gas, water and salt

4. Which equation is used to calculate concentrations of H_3O^+ and OH^- ?
   a. $K_w = [H_3O^+] / [OH^-]^2$
   b. $K_w = [H_3O^+] [OH^-]$
   c. $K_w = [H_3O^+] / [OH^-]$
   d. $K_w = [H_3O^+] [OH^-]^2$

5. Which of the following does not include the proper conjugate acid-base pairs?
   e. $HCN + H_2O \rightarrow F^- + H_3O^+$
   f. $HCN + H_2O \rightarrow H_3O + CN^-$
   g. $OCl^- + H_2O \rightarrow HOCl + OH^-$
   h. $KCl + H_2O \rightarrow HK + ClOH$

6. What are the 6 strong acids?

   1) _____
   2) _____
   3) _____
   4) _____
   5) _____
   6) _____

(Timberlake & Timberlake, 2013)

Writing equations for reactions of acids and bases

1. Write the balanced equation for the reaction of Ca(s) and HCl(aq).

(Timberlake & Timberlake, 2013)

2. Write the balanced equation for the reaction for HBr(aq) and $NaHCO_3$(aq).

(Timberlake & Timberlake, 2013)

3. Write the balanced equation for the neutralization of HCl(aq) and $Fe(OH)_3$(s).

Calculating molarity or volume of an acid or base in a titration/ Buffer

1. A solution of a 0.162M NaOH is used to neutralize 25.0mL of a H_2SO_4 solution. If 32.8mL of the NaOH solution is required to reach the endpoint, what is the molarity of the H_2SO_4 solution?

$$H_2SO_4\ (aq) + 2NaOH\ (aq) \rightarrow 2H_2O\ (l) + Na_2SO_4\ (aq)$$

(Timberlake & Timberlake, 2013)

2. Which of the following represents a buffer system?
   a. $HClO_2$
   b. $NaNO_3$
   c. $HC_2H_3O_2$ & $NaC_2H_3O_2$
   d. HCl & NaOH

(Timberlake & Timberlake, 2013)

Answers:

Practice Problems

1. b, 2.a , 3.c (pg 513) 4.b, 5. d

Writing equations for reactions of acids and bases

1. $Ca(s) + 2HCl(aq) \rightarrow H_2(g) + CaCl_2(aq)$
2. $HBr(aq) + NaHCO_3(aq) \rightarrow CO_2(g) + H_2O(l) + NaBr(aq)$
3. $3HCl(aq) + Fe(OH)_3(s) \rightarrow 3H_2O(l) + FeCl_3(aq)$

References

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SIT Session Lesson Plan

Week/Chapter:: Week 14 Course Assistant: _____

Course: Introduction to Chemistry Instructor: _____

Objective: What are the one or two most difficult concepts that the students need to work on today? Review for final exam

Beginning reminders:

1. Arrange seats in a circle
2. Make sure everyone has signed in
3. Review lesson plan with group
4. Remember to relax and be flexible!

Content to Cover:	Processes to Use*:	Time
Warm-up	Ghost Game- Students will add a letter to a fragment, however they must not repeat the letter that someone already said and they should not spell a word.	5 min
Review	Outline the chapter- Divide students into groups and assign each group a chapter from the final exam review topic list. Each group will write down everything they can remember from that chapter. Once they have written everything they can remember, they can look up the chapter and write down anything they missed.	30 min
Check for understanding	Scribe will write a list of the different study techniques used by students and note taking strategies. Students will discuss how each one is beneficial for them	10 min
Tutoring = Q & A	Tutoring for the time left to answer any questions students may have before the final	10 minutes

After session comments/thoughts:

Final Exam Study Topics

Chapter 2

Significant Figures, review all rounding rules and use in calculations

Density

Conversion of units (i.e. mL to L, cm to m, etc)

Scientific notation

Chapter 3

Pure compounds vs mixtures

Physical and chemical properties, physical and chemical changes

Temperature conversion

Specific heat

Chapter 4

Review chemical symbols and the periodic table (periods and groups), metals and nonmetals,

Parts of an atom (nucleus, protons, neutrons, electrons)

Atomic number, mass number, isotopes, atomic mass

Electron configuration

Chapter 5

Electron configuration and the periodic table

Periodic trends: group number, valence number, atomic size, Ionization energy

Chapter 6

Octet rule and ions

Ionic and covalent compounds

Naming and writing compounds (be sure and review polyatomic ions)

Chapter 7

The mole

Molar mass

Percent composition

Molecular vs Empirical Formulas

Use of mole and molar mass as conversion factors

Chapter 8

Writing and balancing a chemical equation

Types of reactions (be able to predict the products of a reaction)

Exothermic vs endothermic reactions

Chapter 9

Using mole-mole ratios as conversion factors from a balanced equation

Limiting reactants

Percent yield

Chapter 10

Electron dot formulas

VSEPR theory (shapes of molecules and ions)

Electronegativity and polarity

Changes of state: heat of fusion, sublimation, evaporation, condensation, boiling pt, melting pt, freezing pt

Heating and cooling curves

Combining energy calculations

Chapter 11

Kinetic Molecular Theory of Gases

Pressure conversions

Boyle's Law, Charles Law, Combined Gas Law, Ideal Gas Law

STP

Chapter 12

Solutions: Like Dissolves Like

Electrolytes and nonelectrolytes

Solubility: unsaturated, saturated, supersaturated solutions

Soluble and insoluble salts and net ionic equations

Percent Concentration

Molarity and Dilutions (M1V1=M2V2)

Chapter 13

Rate of Reaction and Factors that affect it (Temperature, Concentration of Reactants, Catalysts)

Equilibrium constants and Le Chatelier's Principle

Chapter 14

Naming acids and bases

Strength of acids and bases

pH and calculation of pH,pOH, [H3O+], [OH-]

Balancing neutralization equations

Be able to identify a buffer system

Chapter 15

Oxidation and reduction (oxidizing and reducing agents)

Assigning oxidation numbers

Balancing redox equations

Use of activity series

Chapter 16

Radioactivity: alpha particles, beta particles, positron, gamma rays

Be able to complete a nuclear equation

Be able to calculate and use half-lives

Formulas/Constants to memorize

Know conversions for milli-, centi-, and kilo-

R = 0.0821 L atm /mol K

1 atm = 760 mm Hg

Density = mass/volume

Molarity = moles/Liter

pH = - log (hydronium ion concentration H_3O^+)

p1V1 = p2V2

Ksp = [product concentrations] / [reactant concentrations] be sure to raise each reactant/product to the power of its coefficient

References

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