Attribution Key

for more information see: http://open.umich.edu/wiki/AttributionPolicy

Use + Share + Adapt

{ Content the copyright holder, author, or law permits you to use, share and adapt. }

PD-GOV — **Public Domain – Government**: Works that are produced by the U.S. Government. (17 USC § 105)

PD-EXP — **Public Domain – Expired**: Works that are no longer protected due to an expired copyright term.

PD-SELF — **Public Domain – Self Dedicated**: Works that a copyright holder has dedicated to the public domain.

ZERO — **Creative Commons – Zero Waiver**

BY — **Creative Commons – Attribution License**

BY-SA — **Creative Commons – Attribution Share Alike License**

BY-NC — **Creative Commons – Attribution Noncommercial License**

BY-NC-SA — **Creative Commons – Attribution Noncommercial Share Alike License**

GNU-FDL — **GNU – Free Documentation License**

Make Your Own Assessment

{ Content Open.Michigan believes can be used, shared, and adapted because it is ineligible for copyright. }

PD-INEL — **Public Domain – Ineligible**: Works that are ineligible for copyright protection in the U.S. (17 USC § 102(b)) *laws in your jurisdiction may differ

{ Content Open.Michigan has used under a Fair Use determination. }

FAIR USE — **Fair Use**: Use of works that is determined to be Fair consistent with the U.S. Copyright Act. (17 USC § 107) *laws in your jurisdiction may differ

Our determination **DOES NOT** mean that all uses of this 3rd-party content are Fair Uses and we **DO NOT** guarantee that your use of the content is Fair.

To use this content you should **do your own independent analysis** to determine whether or not your use will be Fair.

MELO3D

Learning Objects for CH216

Dr. Ginger Shultz

Renata Everett

Grace Winschel

08

Review Subjects

- Continued topics from 210/211
  - pKa
  - Calculations
  - Thin Layer Chromatography
  - Physical Properties of Chemicals
  - Filtration
  - Recrystallization
  - Safety
  - Recording in a Lab Notebook

10

New Concepts

- New topics in 216
  - Writing a lab report
  - Running Organic Reactions
  - Using Reaxys
  - Distillation
  - Reflux
  - NMR / IR Spectroscopy
  - Column Chromatography
  - Drying Agents / Mol Sieves
  - Extractions
  - Beilstein Test

- **Fall Term:**
  - Compile a large amount of LOs
    - pKa
    - Calculations
    - Physical Properties
    - Spectroscopy
  - Integrate the best LOs into Renata and Gracie's lab sections
  - Analyze LO effectiveness

04

Topics

PLAN EXPERIMENT
PREPARE SAMPLE
DESIGN EXPERIMENT
LOAD SAMPLE
RECORD SPECTRUM
SET UP EXPERIMENT
MONITOR PROGRESS
ANALYZE DATA
PROCESS DATA
INTERPRET RESULTS

NUTS QUICK START
NUTS COMMANDS
NMR PROBLEMS
NMR DICTIONARY
NMR PERIODIC TABLE
NMR LINKS

Welcome
NMR-C

Welcome to the
Training Project
hope that you wi
aspects of NMR
analyzing the res

If you have any c
contact either Ar

For more informa

Table of Contents:

IR Spectroscopy Tutorial

Alkanes
Alkenes
Alkynes
Alkyl halides
Aromatics
Alcohols
Ketones
Aldehydes
Carboxylic acids
Esters
Amines
Nitro group

How to analyze an IR spectrum

References:

IR Spectroscopy Tutorial: Alkanes

The spectra of simple alkanes are characterized by absorptions due to C–bands are either too weak or of too low a frequency to be detected in IR bands, each band in the spectrum can be assigned.

- C–H stretch from 3000–2850 cm^{-1}
- C–H bend or scissoring from 1470-1450 cm^{-1}
- C–H rock, methyl from 1370-1350 cm^{-1}
- C–H rock, methyl, seen only in long chain alkanes, from 725-720

The IR spectrum of octane is shown below. Note the strong bands in the scissoring (1470), methyl rock (1383), and long-chain methyl rock (728) have these features, these C-H vibrations are usually not noted when inter

The region from about 1300-900 cm^{-1} is called the **fingerprint region**. modes resulting in a complex absorption pattern. Usually, this region is q organic compound has its own unique absorption pattern (or fingerprint) compound by matching it with a sample of a known compound.

WebSpe

Problems in NMR and IR

Welcome to WebSpectra - This site was establis is a technique that requires practice - this site pr interpret. Hopefully, these problems will provide

This project is supported by Cambr

Project Director
NMR Facility Contributor

Instructional Documents

- Solving Spectral Problems
- Overview of NMR Spectroscopy
- Notes on NMR Solvents
- Types of NMR Spectra
- Introduction to IR Spectroscopy
- Table of IR Absorptions

chemtutor

EXPLANATION OF ACID - BASE PROBLEMS

TITRATION AND pH PROBLEMS

THE FOLLOWING SALTS IN WATER SOLUTION WILL HAVE A pH OF 7, -7(less than 7), +7(more than 7), OR INDETERMINATE (I). FOR EACH PREDICT THE pH OF THE SOLUTION.

1. Na_2CO_3 is a basic salt because NaOH is a strong base and H_2CO_3 is a weak acid. pH is above 7.
2. $FeCl_3$ is an acid salt because $Fe(OH)_3$ is weak base and HCl is a strong acid. pH is less than 7.
3. KNO_3 is a neutral salt. Both HNO_3 and KOH are strong. pH = 7.

Science Help Online

Home
Lessons
Links
Worksheets
Search

CHEMISTRY

Chemistry

FAIR USE

Lesson 1-5

Physical and Chemical Proper

The properties of a substance are those characteristics that are used to ide "wet", or that silver is "shiny", we are describing materials in terms of their p categories of physical properties and chemical properties. **Physical propert** or smell. **Chemical properties** are only observable during a chemical react is combustible unless you tried to burn it.

Another way of separating kinds of properties is to think about whether particular property. No matter how much pure copper you have, it always h much water you have, it always freezes at zero degrees Celsius under standa combustible, no matter the size of the sample. Properties, which do not depe described above, are called **intensive properties**. Some of the most commo color, melting point, reactivity, luster, malleability, and conductivity.

Extensive properties are those that do depend on the size of the sample up a bigger area than a small sample of carbon, so volume is an extensive pr extensive properties are; length, volume, mass and weight.

Pieces of matter undergo various changes all of the time. Some changes, minor. Other changes, like the combustion of a piece of wood, are fairly dra

THE BIOLOGY PROJECT • BIOCHEMISTRY

Acids & Bases Problem Set

Question 9: Acids & pK$_a$

Acids are defined as compounds with pK$_a$ values below 7.0.

A. True
B. False

◀ PROBLEM 8   TUTORIAL   PROBLEM 10 ▶

INTRODUCTION   BIOCHEMISTRY   VOCABULARY   THE BIOLOGY PROJECT

The Biology Project
Department of Biochemistry and Molecular Biophysics
The University of Arizona
January 6, 1999
Revised: October 2004
Contact the Development Team

http://www.biology.arizona.edu
All contents copyright © 1999. All rights reserved.

1. Se
of

○ Strong A

○ Weak Ac

3. Select
the Acid
and Base

4. Selec
Indi

Stoichiometry

Return to ChemTeam Main Menu

Tutorials and Problem Sets

Tutorials

1. What is Stoichiometry?
2. Molar Ratios
3. Mole-Mole: Given Moles, Get Moles
4. Mole-Mass: Given Grams, Get Moles and Given Grams, Get Grams
5. Mass-Mass: Given Grams, Get Grams (the most common type of problem)
6. Limiting Reagent

Problem Sets

1. Mole Ratio Worksheet
2. Stoichiometry Worksheet (mostly mass-mass) as HTML file. The answers are linked to this page.
3. Same problems as Stoichiometry Worksheet plus some lecture notes
4. More mass-mass problems, but no answers
5. Mass-Volume Stoichiometry Problems (with Answers)
6. More mass-volume Stoichiometry Problems; Some Answers
7. Volume-Volume Stoichiometry Problems
8. Limiting Rea
9. Limiting Rea

Other Resources

Videos

1. Mole-Mole I
2. Mole-Mole II
3. Mass-Mole I
4. Mass-Mass I
5. Mass-Mass II
6. Mass-Mass III
7. Mass-Volume I
8. Mass-Volume II
9. Volume-Volume I
10. Volume-Volume II
11. Using a gravimetric factor I
12. Using a gravimetric factor II
13. A problem using limiting reagents and percent yield
14. An interesting problem

Links

Phases of Matter

This tutorial describes the three phases of matter: solid and gases.

Bottomless Worksheet of Molarity

Find the molarity in moles per liter.

a) 221.7 moles of solute, 19.4 liters of solutio
b) 119 moles of solute, 14.2 liters of solution
c) 26.8 moles of solute, 3.9 liters of solution
d) 188.9 moles of solute, 18.7 liters of solutio

Find the moles of solute.

e) 12.2 moles per liter, 31.7 liters of solution
f) 6.7 moles per liter, 11.4 liters of solution
g) 10.4 moles per liter, 29.6 liters of solution

Find the liters of solution.

h) 133.2 moles per liter, 15.6 moles of solute
i) 247.4 moles per liter, 19.9 moles of solute
j) 91.6 moles per liter, 21.5 moles of solute

Virtual Chembook
Elmhurst College
Charles E. Ophardt, c. 2003

Study of Matter	Compounds	Elmhurst College
Atoms	Physical Properties	Chemistry Department
Elements	Chemical Properties	Virtual ChemBook
	Mixtures	

What are Chemical Properties and Changes?

Hydrogen Balloon

Chemical Properties:

Chemical properties of matter describes its "potential" to undergo some chemical change or reaction by virtue of its composition. What elements, electrons, and bonding are present to give the potential for chemical change.

It is quite difficult to define a chemical property without using the word "change". Eventually you should be able to look at the formula of a compound and state some chemical property. At this time this is very difficult to do and you are not expected to be able to do it.

For example hydrogen has the potential to ignite and explode given the right conditions. This is a chemical property.

Metals in general have they chemical property of reacting with an acid. Zinc reacts with hydrochloric acid to produce hydrogen gas. This is a chemical property.

Zinc + Hydrochloric acid ->
Hydrogen gas + zinc chloride
Zn + HCl --> H_2 + Zn Cl_2

Hydrogen + Oxygen -->
Water + Energy
$2 H_2$ + O_2 -->$2 H_2O$

C. Ophardt, c. 2003

Magnesium and Oxygen Reaction

Chemical Changes or Reactions:

Chemical change results in one or more substances of entirely different composition from the original substances. The elements and/or compounds at the start of the reaction are rearranged into new product compounds or elements.

A **CHEMICAL CHANGE** alters the composition of the original matter. Different elements or compounds

UNIVERSITY OF MICHIGAN

- Compile a large amount of LOs for each topic

- Integrate the best LOs into Renata and Gracie's lab sections

- Analyze exam grades between these lab sections vs. the other sections to determine effectiveness

02

Lab Sections

UNIVERSITY OF MICHIGAN

- **Winter Term:**
  - Successful Fall Term LOs will be integrated into every lab section
  - New, technique-based, visual-learning LOs will be tested in Renata and Gracie's winter lab sections

02

Term Goals

10
Concepts

- Technique-Based Topics
  - ○ Thin Layer Chromatography
  - ○ Filtration
  - ○ Recrystallization
  - ○ Safety
  - ○ Distillation
  - ○ Reflux
  - ○ Column Chromatography
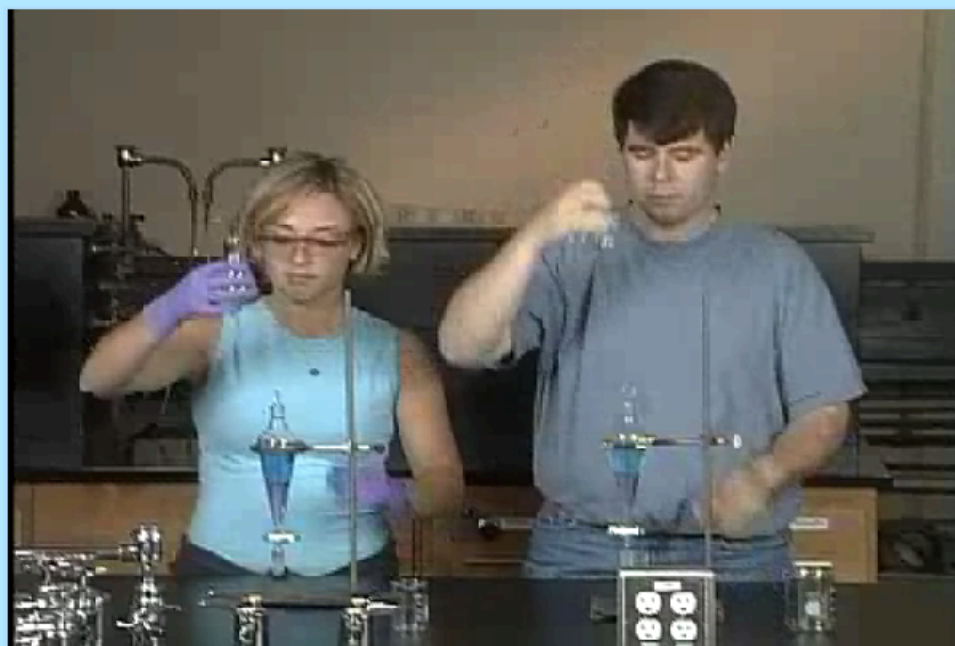 - ○ Drying Agents / Mol Sieves
  - ○ Extractions
  - ○ Beilstein Test

- Students encounter new techniques each week

- Lab time is lost explaining techniques to each student

- A video tutorial explaining new techniques before each lab should alleviate strain on both the student and GSI

01

Main Idea for Winter

UNIVERSITY OF MICHIGAN

Inappropriate shirt   **No lab apron**   **Not in a hood**

10+

Potential Videos

05
Questions Per Video

- **Making our own video-based LOs would be more effective**
  - Videos will include questions to test comprehension before the experiment is performed
  - Students will need to include their answers to the LO questions in their prelab
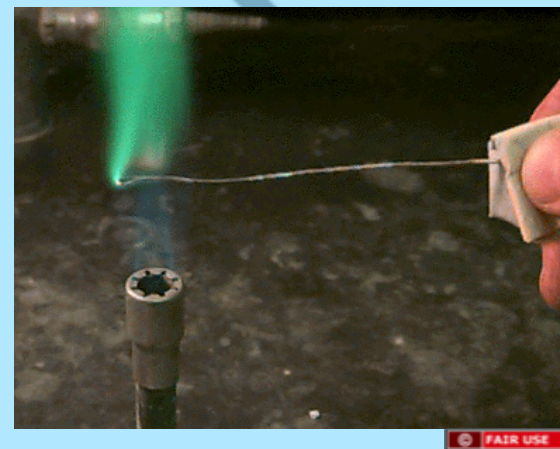
10

Experiments

- Synthesis of Acetamides from Aniline and Substituted Anilines: Preparation of an Analgesic

  - Beilstein Test
  - What is it for?
  - How does one perform the test?
  - What does a positive result look like?
  - What does a negative result look like?
  - What does a false positive look like?

FAIR USE

01

End Year One

- Questions from video LOs will appear on the exams
- Analyze scores between sections to determine effectiveness of video LOs
- Integrate successful LOs into curriculum

Thank You

Questions?

UNIVERSITY OF MICHIGAN