

# CH2250: Techniques in Laboratory Chemistry

## Outline

- **Introduction to CH2250**
- Grades of Laboratory Reagents
- Laboratory Ware
- Keeping a Good Notebook
- Today's lab

# Logistics

- **Instructor:** Dr. Jeremiah Duncan
- **Office:** Boyd 122      **Phone:** 535-2289
- **e-mail:** jsduncan@plymouth.edu
- **Office Hours:** Mon, Tues: 1:00-2:00 pm
- Wed: 2:00-3:00 pm, Fri: 12:00-1:00 pm
- **Course Websites:**
  - <http://go.plymouth.edu/moodle>
  - [http://jupiter.plymouth.edu/~jsduncan/courses/2014\\_Spring/Techniques/](http://jupiter.plymouth.edu/~jsduncan/courses/2014_Spring/Techniques/)

# Websites

[http://jupiter.plymouth.edu/~jsduncan/courses/2014\\_Spring/Techniques](http://jupiter.plymouth.edu/~jsduncan/courses/2014_Spring/Techniques)

- Syllabus with Course Schedule
- Labs
- “Keeping a Good Laboratory Notebook”
- Other resources

<http://go.plymouth.edu/moodle>

- Same resources as the other, plus:
- Gradebook
- Electronic submissions
- Link to other website

# Purpose of Course

- To learn good general laboratory skills
- To learn to accurately perform a number of standard chemistry-laboratory techniques

# Graded Items

• Mid-term Exam	100 pts
• Final Exam	150 pts
• Lab Reports (9×60pts)	540 pts
• Lab Performance	50 pts
• Formal Report	<u>160 pts</u>
– Total:	1000 pts

Mid-Term (Take-home): March 25

Final (cumulative): Tues, May 13, 11am – 1:30pm

“Reports” are duplicate pages due at the next lab.

“Formal Report” on Lab 10, includes draft

# Required Materials

- **Textbook:** *Exploring Chemical Analysis*, 4<sup>th</sup> edition (2008) or 5th edition (2012), by Daniel C. Harris
- **Lab Notebook** : Carbonless Duplicate
- **Safety Glasses**

Bring textbook and a calculator to each class.

# CH2250: Techniques in Laboratory Chemistry

## Outline

- Introduction to CH2250
- **Grades of Laboratory Reagents**
- Laboratory Ware
- Keeping a Good Notebook
- Today's lab

# Grades of Chemicals

- Technical or Practical
- C.P.
- U.S.P. or N.F.
- A.C.S. Reagent
- Primary Standard
- Reference Standards (NIST)
- Ultra pure
- Spectrometric
- HPLC

# Technical or Practical Grade

- Purity may or may not be specified.
- May contain 10% or more impurities.
- Not very useful except for qualitative work or as initial solvents for washing labware.

## C.P.

- “chemically pure”
- More refined than Technical grade
- Impurities still not always specified
- Not useful for quantitative work

# U.S.P or N.F.

- United States Pharmacopeia or National Formulary
- Meets standards for health if ingested
- May contain substances that interfere with chemical reactions or analyses

# A.C.S. Reagent

- Conforms to standards of the American Chemical Society
- High purity
- Important contaminants are listed by % on bottle
- Generally fine for most reactions

# Primary Standard

- Very high purity, usually 99.9% or better
- Purity specified on bottle after careful assay by manufacturer
- Best for making solutions for quantitative work

# Reference Standards

- Material has been exhaustively analyzed for all components
- % of each component specified.
- Important source is the National Institute of Standards and Technology (NIST)
- ([http://ts.nist.gov/MeasurementServices/ReferenceMaterials/PROGRAM\\_INFO.cfm](http://ts.nist.gov/MeasurementServices/ReferenceMaterials/PROGRAM_INFO.cfm))

# Ultra Pure

- Usually: To be used when trace amounts of metals cannot be tolerated (e.g. trace metal analysis, semiconductor work)
- Also: other chemicals especially purified to avoid catalytic or other effects on reactions (e.g. for biotech applications)

# Spectrometric

- Solvents suitable for dissolving samples for qualitative spectrometric work
- May contain impurities but none that absorb in region specified for use

# HPLC

- Solvents purified for use in high pressure liquid chromatography
- Generally purified to contain no particles (would clog columns) and no chemicals that would interfere with analysis

# CH2250: Techniques in Laboratory Chemistry

## Outline

- Introduction to CH2250
- Grades of Laboratory Reagents
- **Laboratory Ware**
- Keeping a Good Notebook
- Today's lab

# Laboratory Ware

Different materials for different uses!

- Glass
  - Soft glass
  - Borosilicate glass
  - Alkali-resistant glass
  - Fused quartz
  - High-silica glass
- Porcelain
- Metal
- Plastic

# Types of Lab Glassware

Material	Maximum working temp.	Sensitivity to thermal shock	Chemical inertness	Brand Names
Soft glass	<200 °C	Poor	Attacked by alkalis	
Borosilicate glass	200 °C	150 °C change tolerated	Attacked by hot alkalis	Pyrex®, Kimax®
Alkali-resistant glass	<200 °C	Not as good as borosilicate		
Fused quartz	1050 °C	Excellent	Resistant to most acids	Vycor®
High-silica glass	1000 °C	Excellent	Resists alkalis better than borosilicate	

# Other Labware Materials

Material	Maximum working temp.	Sensitivity to thermal shock	Chemical inertness	Comments
Porcelain	1100 (glazed) 1400 (unglazed)	Good	Excellent	
Nickel and iron			Fused samples may become contaminated	
Stainless steel	400-500	Excellent	Attacked by conc. acids	
Platinum	1500		Highly Resistant	
Polyethylene LDPE & HDPE	115		Not attacked by acid, base, some solvents. many organics will soften	Flexible
Teflon	250		Inert to most chemicals	Expensive

# Laboratory Glassware

- Soft glass
  - Older test tubes, beakers and flasks
  - Most glass bottles and jars
  - NOT suitable for heating.
- Pyrex® or Kimax®
  - Borosilicate glass
  - MUST be used when heating
- Thick walled glass
  - Used to prevent breaking
  - May or may not be heated (is it Pyrex or Kimax?)

# Bases in Glass

## **Bases will dissolve glass!**

- Do not leave them in glass for long times.
- NEVER store alkali solutions in glass bottles with glass stoppers.
  - Stoppers will permanently stick as glass surfaces dissolve together.

# Spectral Cells

- Cells for use in the visible region (but not UV)
  - Made of highly polished glass
  - Tight control over size and shape.
- Cells for use in the UV region
  - Made of quartz
  - May be used in visible region
  - Very expensive!
- Do not use glass when you need quartz.
- Do not to scratch the cells
- Do not clean with strong base

# Laboratory Porcelain Ware

- Used for very high temps
- Examples include:
  - Evaporating dishes
  - Crucibles
  - Casseroles
  - Filtration funnels and crucibles
- Expensive!
- Easily cracked or shattered

# Metal Lab Containers

- Used primarily to heat samples very hot or when using base fluxes which would dissolve glass or porcelain
- Will react with acids

# Plastic Lab Ware

- Low density polyethylene (LDPE)
  - Used for squirt bottles – water, some organic solvents
  - Used for Storage bottles
    - especially for bases
    - NOT generally for organic solvents
- High density polyethylene (HDPE)
  - Used for reagent bottles.
- Hard plastics like polycarbonate are used for
  - Graduated cylinders
  - Beakers
  - Petri dishes
  - Test tubes and spectral cells
- Teflon
  - Used when there is a need for inertness.

# CH2250: Techniques in Laboratory Chemistry

## Outline

- Introduction to CH2250
- Grades of Laboratory Reagents
- Laboratory Ware
- **Keeping a Good Notebook**
- Today's lab

# A Good Notebook

- The notebook should be NEAT AND EASY TO FOLLOW.
- Pages should be numbered.
- Dates should appear frequently.
- Use ONLY the front side of the page.
- Be sure each page is duplicated
- Use a ball point pen, not a gel pen.
- The first page is continuously UPDATED Table of Contents.
- Sign and date at the end of your work of each lab.

# A Good Notebook

- Clearly label the various sections
  - Double underline or draw a box around keywords.
- Clearly label all tables, charts, graphs, and data collected.
  - e.g. Table 1.1. Glassware Identification and Uses
- Include units with ANY data or number
- Record data and observations as the experiment proceeds
- Drawings are useful and welcome in a notebook.
- Clearly label and explain any calculations.
  - May include only one sample calculation

# Notebook: Pre-lab work

- Title and Experiment Number
- Purpose / introduction
  - Why are you doing this experiment and what, briefly, will be done? Write any reactions that are to be run
- Calculations needed for Procedure
- Procedure
  - easy-to-follow, including amounts of chemicals needed
- References: Source of lab procedure
- Safety: any special concerns for this lab
- Equipment: what is needed to run lab?
- Optional: Begin Results
  - Set up tables to collect data

# CH2250: Techniques in Laboratory Chemistry

## Outline

- Introduction to CH2250
- Grades of Laboratory Reagents
- Laboratory Ware
- Keeping a Good Notebook
- **Today's lab**

# Start Your Notebook

- Write your name and the course name on the cover
- Start the “Table of Contents” on the first page (if one not already in your notebook)
- Start “Experiment 1: Math check and Lab check-in” on the next page

# Today's Lab: Fundamental Math and Lab Check-in

- Purpose:
  - To review some fundamental math skills necessary for success in the course
  - To become familiar with the equipment you will use in the course

# Today's Lab: Procedure

- Download 1-CheckIn.pdf from
  - [http://oz.plymouth.edu/~jsduncan/courses/2014\\_Spring/Techniques](http://oz.plymouth.edu/~jsduncan/courses/2014_Spring/Techniques)
  - Moodle
- Check the equipment assigned to you. In the process:
  - In your notebook, sketch a small drawing, write the name, and the use of each piece of equipment
  - Check each piece of equipment off the list. If anything is missing or you have too many of something, let me know.
- Answer the Exercises in your notebook