9:40-10:30 Designing and Grading Assessment: Testing is the most effective way for students to learn, but what is the most effective way to test? This workshop discusses a staged approach to assessment, to encourage and verify learning and increase student engagement.

Designing and Grading Assessment

John L. Falconer

University of Colorado Boulder

What is purpose of assessment?

- Feedback for Professor
- Motivate students
- Accede...
- Feedback to students
- Rank students
Purpose of assessment (Mazur)

○ rate students
○ rate professor and course
○ motivate students to keep up with work
○ provide feedback on learning to students
○ provide feedback to instructor
○ provide instructional accountability
○ improve teaching and learning

The Silent Killer of Learning, by Eric Mazur, [https://youtu.be/CBzn9RAJG6Q](https://youtu.be/CBzn9RAJG6Q)

Testing is the most effective way to learn
Multiple assessments

○ Exams
○ Reading quizzes 7.5%
○ Clicker questions 7.5%
○ Group assignments 15%

Catme.org
Peer evaluation of group work
Fixed course grading scale to encourage cooperation

Frequent quizzing

○ Help students consolidate learning
○ Make the stakes low for individual quiz
○ Grade quizzes: students in classes where practice exercises are graded learn better

Give students practice tests
Space, interleave, and vary topics and problems in class so students are frequently shifting gears.
Start with desired outcomes
Design course to assess these outcomes

Make assessment fair by making expectations clear
Learning objectives for each chapter

Chapter 7, sections 1, 2, 4-8 (Elliott-Lira, 2nd Edition)

By the end of this chapter, you should be able to:

1. Calculate properties (U, S, H, A, G, V, f) of real fluids using the Peng-Robinson (PR) equation of state (EOS) spreadsheet, which also uses heat capacity data.
2. Explain why the PR cubic EOS has three roots and what the physical meaning of each root is.
3. Interpret the EOS spreadsheet results to determine which state (root) is most stable.
4. Describe what corresponding states means.
5. Apply the concepts of ideal gases to gas mixtures to predict behavior.
6. Apply the concept of vapor pressure to predict behavior of single-component, two-phase systems when process parameters change.
7. Sketch and interpret processes on P-V-T diagrams and their projections.
8. Apply the Lever rule to calculate amounts of liquid and vapor in a 2-phase, single component system.
9. Calculate reduced temperature, reduced pressure, and compressibility factor.
10. Explain which terms are repulsive and which are attractive in a cubic EOS.
11. Explain what is unique about the critical point, both physically and mathematically.

Make assessments fair

- Clear expectations: post previous year's exams
- Don’t use problems from last few years
- Don’t rush students on exam
- Have enough questions
- Don’t isolate students from resources
- Provide suggestions on how to take exams
- Instructor work through exam, multiply time by 3 or 4
- TA work through exam
- Exam contains 107 points, maximum grade 100
Assessment that can be googled is not a good assessment

Eric Mazur

Fair assessments

• Don’t isolate students from all resources - increases stress/anxiety
  Open book or pages with equations and notes
  Exams should be about knowing how to use information, not memorizing

• When are professional engineers isolated from all information?
My exams
40% short answer conceptual questions
60% calculation problems

Making exam grading easier
○ TA work through exam - look for alternate interpretations
○ Eliminate long math calculations
○ Use easy-to-use numbers (5.0 instead of 4.78)
○ Use different numerical values for different parameters
don’t use: \( V = 6.0 \, \text{L} \), \( C_{Ao} = 6.0 \, \text{mol/L} \)
○ Grade problem x for everyone
○ Format for easier grading online

Provide axes for requested graph
(d) (7 points) Consider an ideal-gas mixture of 60% A and 40% B at 1.2 bar. At 50°C, the bubble pressure is 1.6 bar and the dew pressure is 1.4 bar ($P_A^{\text{sat}} = 2.0$ bar and $P_B^{\text{sat}} = 1.0$ bar). Plot the fugacities of A and B as the pressure increases from 1.2 bar to 1.8 bar. Indicate a scale on the y-axis.
Problem 3 (15 points) When the reaction $2A(g) \rightleftharpoons B(g)$ reaches equilibrium isothermally in a constant-pressure reactor set to 3.0 bar, the equilibrium conversion is 40% (i.e., 40% of A initially present reacts to form B). What is the equilibrium conversion when this reaction takes place at the same temperature (isothermally) in a constant-volume reactor, starting with pure A at 3.0 bar?

Diagram

Answer:
Provide exam strategies for students

- Read through the entire exam first
- Set time limits for each question
- Try a hard problem first, if stuck after a few minutes, do easy problem. Repeat.
- Check your work

Suggest students complete pre-exam survey

Pre-exam survey Final Exam

1. Successful high achievers use resources strategically when preparing for exams. Indicate which resources will facilitate your studying so as maximize the effectiveness of your learning. Briefly describe how you plan to use that resource.

☐ Solving practice exams
☐ Re-solving homework problems
☐ Re-doing in-class ConcepTests (clicker questions)
☐ Re-watching some screencasts
☐ Going to office hours to clarify unclear aspects
☐ Discussing with and explaining to classmates
☐ Using interactive simulations
☐ Reading over test taking tips
☐ Looking at the equation pages that you will bring to the exam
☐ Other (describe)

2. Having a **concrete schedule** for studying so that your studying is spread over multiple days will better prepare you for the exam. Describe a concrete plan for your studying (what you will study each day, at what time, and for how long) for the 9 days before the exam. You are more likely to follow the plan if you schedule the time each day that you will study. Each day might look something like this:

   **Sunday 4:00-5:00 PM**  Answer Chap 17 ConcepTests;
   8:30-9:30 PM  Solve Chap 4 example problems