Alternative Grading

Goals

Student Buy-In

Assessment Modules

Re-assessment

Letter Grades

Student Performance

Department of CHEMISTRY
Clemson University

Implementing Specifications Grading in General Chemistry

Click the magnifying glass for more information!

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Teaching Excellence Conference 2024
Lecturer, Clemson University

Department of CHEMISTRY Clemson University

Un-grading

Promote elimination/minimization of traditional letter grade
Reduce academic anxiety and focus on learning

Contract grading

Agreement between students and instructor on the amount of labor required for each letter grade

Specifications grading

Emphasize mastery of learning objectives
Clear expectations of the mastery required for each letter grade

Alternative Grading

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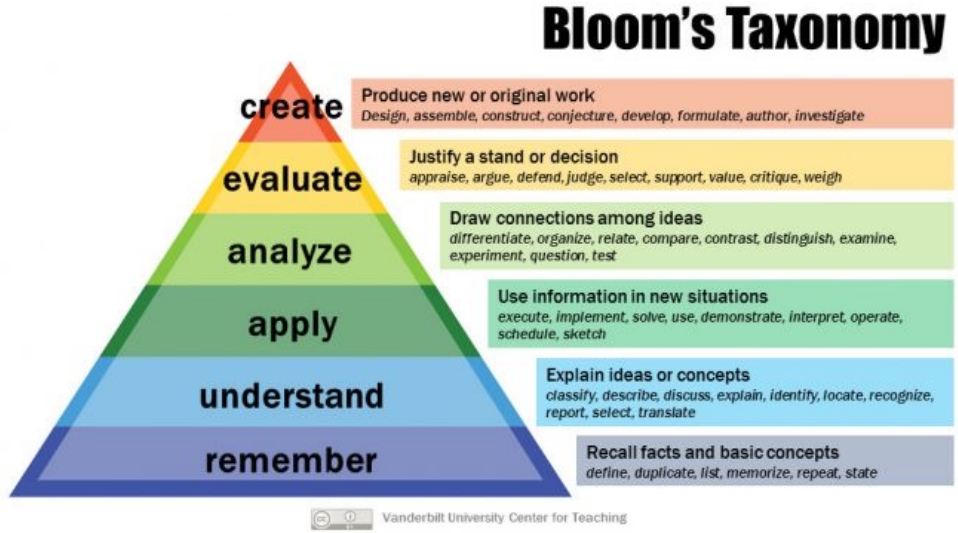
- Encourage students to put in the hours to re-learn concepts after "failing" any of the chapters throughout the course.
- Encourage students to become more comfortable with temporary "failure" before passing the assessment and accomplishing the tasks designated in the learning objectives.
- Discourage point-grubbing associated with partial points and focus solely on mastery of learning objectives.



Goals

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CH1020 General Chemistry II
Summer 2023

→ 5 week summer course
→ Mon–Fri at 8 am, fast-paced (even more than usual)

How can I get the students to trust me with specs grading?

→ Productive failure + Growth mindset
→ Reassessments = "Practice Runs" or "Second Chances"
→ Motivation to make the summer session count!

Student Buy-In

Chapter 11 Assessment v1

Name: _____

Basic	High Pass	Pass	Needs work
Advanced	High Pass	Pass	Needs work

You have 45 minutes to complete this assessment.

Show your work when applicable.

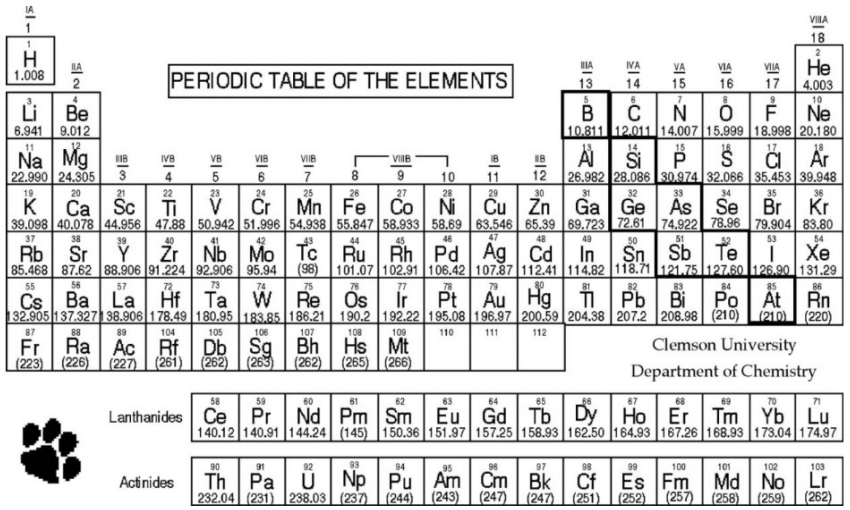
Useful Equations and Constants:

$\Delta T_b = i \cdot K_b \cdot m$ $\Delta T_f = i \cdot K_f \cdot m$

$P_{solution} = X_{solvent} \cdot P°_{solvent}$ $S = k_H \cdot P$ $\Pi = i \cdot M \cdot R \cdot T$

760 torr = 1 atm

R = 0.08206 L · atm/ K · mol



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Each chapter assessment was divided into basic and advanced modules that aimed to assess learning outcomes at different cognitive levels according to Bloom's Taxonomy.

Each module was graded as a "high pass", "pass" or "needs work".

Assessment Modules

Chapter 11 Assessment v1

Name: _____

Basic	High Pass	Pass	Needs work
Advanced	High Pass	Pass	Needs work

You have 45 minutes to complete this assessment.

Show your work when applicable.

Useful Equations and Constants:

$\Delta T_b = i \cdot K_b \cdot m$ $\Delta T_f = i \cdot K_f \cdot m$

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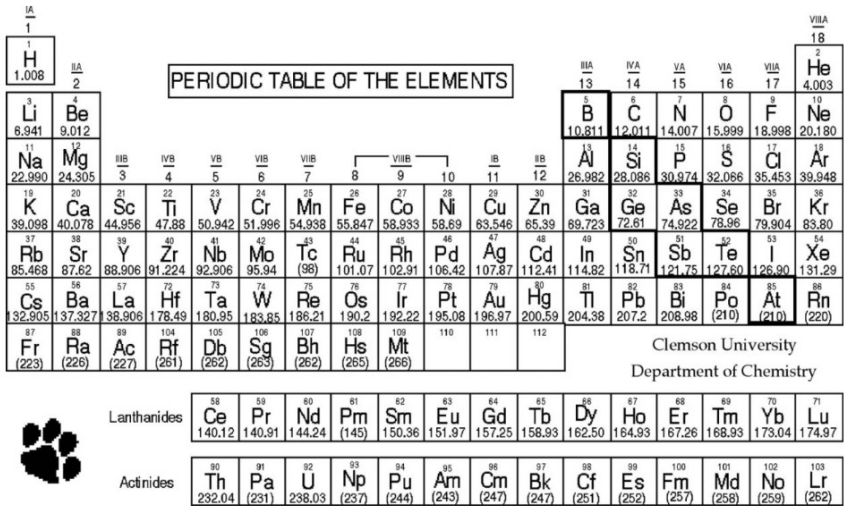

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→ For consistent grading, a rubric was set to award a "**pass**" when students have answered at least 80% of the material correctly and 90% for "**high pass**".

→ **No partial points** were given to encourage complete mastery of each objective/skill and to move students away from point-grubbing mindset.

Assessment Modules

3. Determine whether each statement about general solubility trends is true or false. Circle the correct answers.

Changing the pressure has little to no effect on the solubility of liquid solutes.	True / False
Increasing the temperature will decreases the solubility of gaseous solutes.	True / False
Decreasing the temperature will increase the solubility of solid solutes.	True / False

4. Rank the following aqueous solutions in order of their freezing point. Fill in the blanks below in the appropriate order.

I. 0.20 *m* NaOH
II. 0.05 *m* $Mg(NO_3)_2$
III. 0.33 *m* CH_3CH_2OH
IV. 0.14 m $CaBr_2$

_____ < _____ < _____ < _____

7. What is the molarity of a 2.35 m solution of $Ca(NO_3)_2$ in water? Report your answer to three significant figures. Don't forget the units.

- Molar mass of $Ca(NO_3)_2$ is 164.09 g/mol
- Molar mass of H_2O is 18.02 g/mol
- Density of this solution is 1.28 g/mL

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→ **Basic** questions asks students to remember, understand and apply the *factual and conceptual knowledge*.

→ **Advanced** questions asks students to analyze and evaluate the various chemical situations using *procedural and metacognitive knowledge*.

→ There were often overlap of these skills.

Assessment Modules

CH1020
Summer '23

Chapter 11 Assessment v1

Name: _____

Basic	High Pass	Pass	Needs work
Advanced	High Pass	Pass	Needs work

CH1020
Summer '23

Chapter 11 Assessment v2

Name: _____

Basic	High Pass	Pass	Needs work
Advanced	High Pass	Pass	Needs work

CH1020
Summer '23

Chapter 11 Assessment v3

Name: _____

Basic	High Pass	Pass	Needs work
Advanced	High Pass	Pass	Needs work

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- An important component of specs grading is allowing students multiple attempts at passing the specifications!
- Students were given three tries to pass each module. First assessment was taken in class, then returned with written feedback.
- Second and third attempts were scheduled outside of class time.

Re-assessments

Each version of the modules assessed the same learning outcomes (skills) using different chemical situations.

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3. Determine whether each statement about general solubility trends is true or false. Circle the correct answers.

Changing the pressure has little to no effect on the solubility of liquid solutes.	True / False
Increasing the temperature will decreases the solubility of gaseous solutes.	True / False
Decreasing the temperature will increase the solubility of solid solutes.	True / False

3. Determine whether each statement about general solubility trends is true or false. Circle the correct answers.

Increasing the pressure will decrease the solubility of solid solutes.	True / False
Increasing the temperature will increase the solubility of liquid solutes.	True / False
Decreasing the temperature will increase the solubility of gaseous solutes.	True / False

7. What is the molarity of a 2.35 m solution of $Ca(NO_3)_2$ in water? Report your answer to three significant figures. Don't forget the units.

- Molar mass of $Ca(NO_3)_2$ is 164.09 g/mol
- Molar mass of H_2O is 18.02 g/mol
- Density of this solution is 1.28 g/mL

7. What is the molality of a solution that is 15.5% $Ca(NO_3)_2$ by mass in water? Report your answer to three significant figures. Don't forget the units.

- Molar mass of $Ca(NO_3)_2$ is 164.09 g/mol
- Molar mass of H_2O is 18.02 g/mol
- Density of this solution is 1.28 g/mL

Re-assessments

4. Rank the following aqueous solutions in order of their freezing point. Fill in the blanks below in the appropriate order.

I. 0.20 *m* NaOH
II. 0.05 *m* $Mg(NO_3)_2$
III. 0.33 *m* CH_3CH_2OH
IV. 0.14 m $CaBr_2$

_____ < _____ < _____ < _____

4. Rank the following aqueous solutions in order of their boiling point. Fill in the blanks below in the appropriate order.

I. 0.10 *m* KCl
II. 0.05 *m* $MgSO_4$
III. 0.23 *m* $(NH_4)_2S$
IV. 0.40 m CH_3OH

_____ < _____ < _____ < _____

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→ Encourage understanding the bigger chemical picture and discourage simple "rote memorization" or "plug and chug"

→ By the third attempt, students ideally realize which concept or equation had to be used when and why.

Re-assessments

To assign a letter grade in CH1020 that accounts for students' lab course performance, a percentage grade had to be assigned for the lecture course.

Lecture Grade =

70 – 4 (# basic failed) + 4 (# advanced passed)

Course Grade =

0.8 (lecture grade) + 0.2 (lab grade)

Letter Grades

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Student	Ch 12		Ch 11		Ch 17.1		Ch 17.2		Ch 13		Ch 14.1		Ch 14.2		Ch 16		Ch 20	Attendance	Modules Passed	Numeric Grade	Lecture Grade	Course Grade
1	f/f/p	f/p	f/f/f	f/p	f/f/f	f/f/hp	f/f/f	f/p	f/f/f	f/hp	–/f/p	–/f/p	f/f/f	f/f/f	f/f/f	f/f/f	f/p	100%	9	74	C	C
2	p	hp	f/hp	hp	f/p	hp	f/p	f/p	f/f/hp	f/f/p	f/p	f/hp	f/f/p	f/f/f	f/hp	f/f/f	p	80%	15	98	A	A
3	f/p	f/f	f/p	f/f	f/f/f	f/f/f	f/f/f	f/f/f	f/f/f	f/f/f	–/p	–/-	–/p	–/f	–/f	–/f	f	40%	4	54	F	D
4	f/p	f/hp	f/p	f/-	f/hp	f/-/f	f//f/p	p	f/hp	f/f/p	f/f/hp	f/–/-	p	f	f	f	f/f/hp	100%	11	82	B	B
5	–/f/f	–/f/f	f/f/p	f/f/f	f/f/f	f/f/f	–/f/f	–/f/f	–/f/f	–/f/f	–/f/f	–/f/f	–/f/f	–/f/f	–/f/f	–/f/f	p	7%	2	46	F	F
6	f/hp	p	–/p	–/f/f	–/p	–/f/p	f/p	f/f/hp	f/f/f	f/f/f	–/p	–/f/f	f/-/f	f/-/f	f/f	f/f	f/p	53%	9	74	C	C
7	f/p	f/p	f/p	f/p	f/f/f	f/f/-	–/f/f	–/f/p	–/f/p	–/-/-	f/f/f	f	f/p/f	f/–/-	f/f	f/f	f/f/f	53%	7	66	D	C
8	p	f/hp	f/f/f	f/f/p	–/p	–/f/hp	f/f/f	p	f/hp	p	p	p	f/p	f/f	hp	hp	f/f/f	100%	13	90	A	B
9	p	p	f/p	f/f	f/f/f	p	f/f/f	p	f/p	f/f	p	f	f/f/p	f/f/-	f/f/f	f/f/f	f/f	100%	8	70	C	C
10	–/p	–/p	f/f/p	f/–/-	f/p	f/–	–/f/f	–/f/f	–/f/p	-	-	-	-	-	-	-	p	33%	6	62	D	D
11	p	hp	f/f/p	p	f/p	hp	f/f	hp	f/f/hp	f/p	f/hp	f/hp	f/p	f/f/hp	f/hp/f	f/hp/f	f/p	87%	16	102	A	A
12	p	f/hp	f/p	f/f/f	f/p	f/f/f	–/f/f	–/f/p	–/f/p	–/f/f	f/p	f/f	f/f/f	f/f/f	f/hp	p	p	87%	10	78	C	B

Student Performance