

Standards-based Grading in College Physics

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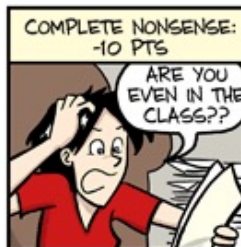
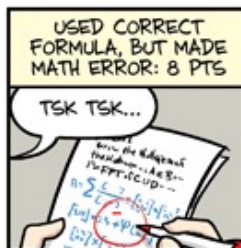
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Grading: The worst part of the job!

GRADING RUBRIC

PROBLEM 1 (TOTAL POINTS: 10)



JORGE CHAM © 2010

Typical points model of grading

- What are the benefits?
- What are the problems?

Scenario A

- Adam has been averaging 70/100 on his tests, a bit lower than the average. With attendance and participation points, his final grade is a B+.
- Do you think Adam is a B+ student?

Scenario B

- Beth is getting near perfect scores on every test, but she never shows up to class. She told you that she had a really good high school class and learned it all then. With participation and attendance points, her final grade is a B+.
- Do you think Beth is a B+ student?

Scenario C

- Curtis is an engineering student who did great work on labs and projects, though his tests scores were around the B- mark. When he takes the next course in his major, the teacher is frustrated because Curtis can't do a basic skill he should have learned in your class. But he got a B+ in your class.
- How do grades tell you what a student has learned?

Summative only grading

- Typical course assessments are focused on the summative—tests, final exam
- Learning is a process
- Growth mindset
- How does summative assessment help with growth?
- Why do we put feedback on exams?

Grading Philosophies

- Norm-referenced grading: standard curve, your grade tells you where you are relative to the class
- Criterion-referenced grading: your grade is based on a predetermined set of criteria

(Your philosophy might be between these two)

An Alternative to Points: Standards-based grading (Objectives-based grading)

- Been used for years at various educational levels
- Outcomes based
- Focuses on formative assessment

My journey to SBG

- Colleague in department tried it
- Community of practice in department
- Spring 2012 and onwards
- Started easy—used colleague's list of standards/course objectives
- Adjusted every semester
- Still adjusting!

What it looks like for me

- No points, no attendance checked, no participation grades
- No homework collected
- Grades based solely on quizzes (assessments)
- Assessments directly tied to course objectives/standards
- Students have three tries per assessment
- Assessments weekly
- No final exam

Schedule

- Thursday: start content (projectile motion concepts)
- Friday: projectile motion concepts and start problem solving [homework/practice available on D2L]
- Monday: lab on projectile motion
- Tuesday: practice problem solving [more practice on D2L]
- Wednesday: practice (1 hour) and assess (1 hour) on projectile motion
- Thursday: hand back assessment
- Friday through Thursday: Students re-assess up to two more times if necessary

Reassessing

- Pros:
 - Students have motivation to go back and learn material
 - Three tries allows almost every student to pass
- Cons:
 - Can be lots of grading
 - Need many versions of assessments
- What other pros & cons can you think of?

Grading

- Simplified scheme, no points
 - High Pass
 - Pass
 - Minor Error
 - Major Error
 - Insufficient/Incomplete
- Very fast; minimal feedback

Student Responsibility

- Students are responsible for their own learning, keeping track of what they need, what grade they are earning
 - They step up!
- Do homework as needed, do practice as needed
- Some students are comfortable skipping classes and showing up to assessments only

The Good Parts

- Student feedback is positive about the grading system
- I feel like students are more motivated
- Definitely puts the responsibility of learning on the student
- No keeping track of attendance or participation
- No graded homework
- No arguing about 87 vs 88 on a test
- Start hard and they have a chance to improve without hurting their grade

The Bad Parts

- Students really like points; they understand how they are doing and they understand how to make the system work to their advantage
- Can be a lot of grading (though FAST)
- Takes time to implement
- Requires proctors or your time
- Might be uncomfortable at first

Unexpected Benefits

- No disability accommodations for tests
- Accrediting agencies ❤️❤️❤️ it!
- Other teachers use proctoring room too
- Students read feedback!

The Details—Objectives

- Used old tests to determine what I really was assessing/testing for
- Decided which objectives were absolutely essential to pass the class (to get a C)
- Other objectives help improve grade above C
 - Ended up with C-level and A-level objectives

The Details—Objectives

Projectile Motion

(C) I can solve problems involving objects experiencing projectile motion with horizontal launch *in a clear and understandable manner*.

(A) I can solve problems involving objects experiencing projectile motion with angled launch *in a clear and understandable manner*.

Balanced Forces

(C) I can draw a properly labeled force diagram showing all forces acting on an object.

(C) I can relate balanced/unbalanced forces to an object's constant/changing motion.

The Details—Objectives

Lab Standards

- (C) I can communicate clearly in complete sentences.
- (C) I include all necessary information in a lab report.
- (C) I use correct physics in my labs.
- (C) I understand the errors associated with experimental design.

Science Communication

- (C) I can communicate clearly about science topics.
- (C) I can apply scientific principles to science writing.

Learning

- (C) I actively and respectfully participate in this course.
- (C) I have shown commitment to learning physics and I take responsibility for my learning.

The Details--Reassessing

- Google form for students to sign up
- I print at end of day for next day
- Different version for each day or each student
- Open lab for retakes
- Student workers as proctors
- Available 10-20 hours a week
- Students show up, give name, get assessment
- Picked up at end of day for grading

The Details--Assessment

Assessment #8D for Forces

Name: _____

Objectives being assessed:

9 I can solve problems using Newton's 2nd Law ($F_{\text{net}} = ma$).

10 I can solve force problems that involve solving kinematics too.

- 9: _____ Black Widow slides a set of handcuffs up a ramp to Iron Man. The cuffs leave her hand at 0.89 m/s, and after sliding up the ramp a distance, they
- 10: _____ have slowed to 0.12 m/s. The ramp is at 8° and the coefficient of friction between the cuffs and the ramp is 0.16. How far have the cuffs traveled?

The Details--Gradescheme

- Different for each course
- Based on objectives
 - C-level objectives
 - A-level objectives
- Pass on C-level earns *experience points* towards “C”
- High pass or A-level earns *skill points* towards “A”
- Number of points needed carefully calculated
 - All pass, no high pass → “B”
 - All high pass on C-level, no A-level → “B”

Details: Gradescheme

A-level objectives (earn SP)

5 ___ = ___ SP	9 ___ = ___ SP	10 ___ = ___ SP	12 ___ = ___ SP	15 ___ = ___ SP	16 ___ = ___ SP	17 ___ = ___ SP	18 ___ = ___ SP	22 ___ = ___ SP	25 ___ = ___ SP	29 ___ = ___ SP
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A-level:

P = 10 SP

HP= 20 SP

C-level objectives (earn XP and SP)

1 ___ = ___ XP	2 ___ = ___ XP	3 ___ = ___ XP	4 ___ = ___ XP	6 ___ = ___ XP	7 ___ = ___ XP	8 ___ = ___ XP	11 ___ = ___ XP	13 ___ = ___ XP
14 ___ = ___ XP	19 ___ = ___ XP	20 ___ = ___ XP + ___ SP	21 ___ = ___ XP	23 ___ = ___ XP	24 ___ = ___ XP	26 ___ = ___ XP	27 ___ = ___ XP	28 ___ = ___ XP
30 ___ = ___ XP	31 ___ = ___ XP	32 ___ = ___ XP	33 ___ = ___ XP	Learning				
				40 ___ = ___ XP		41 ___ = ___ XP		

Lab Standards (score of top 5)

34 ___ = ___ XP	35 ___ = ___ XP	36 ___ = ___ XP	37 ___ = ___ XP
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Science Communication (score of top 5)

38 ___ = ___ XP	39 ___ = ___ XP
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C-level:

Pass = 1 XP

High Pass =

1 XP + 10 SP

	F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A
XP needed (of 30) and	<15	15	18	21	24	27	28	28	28	28	28	28
SP needed (of 200)							20	70	110	130	160	180
Your level												

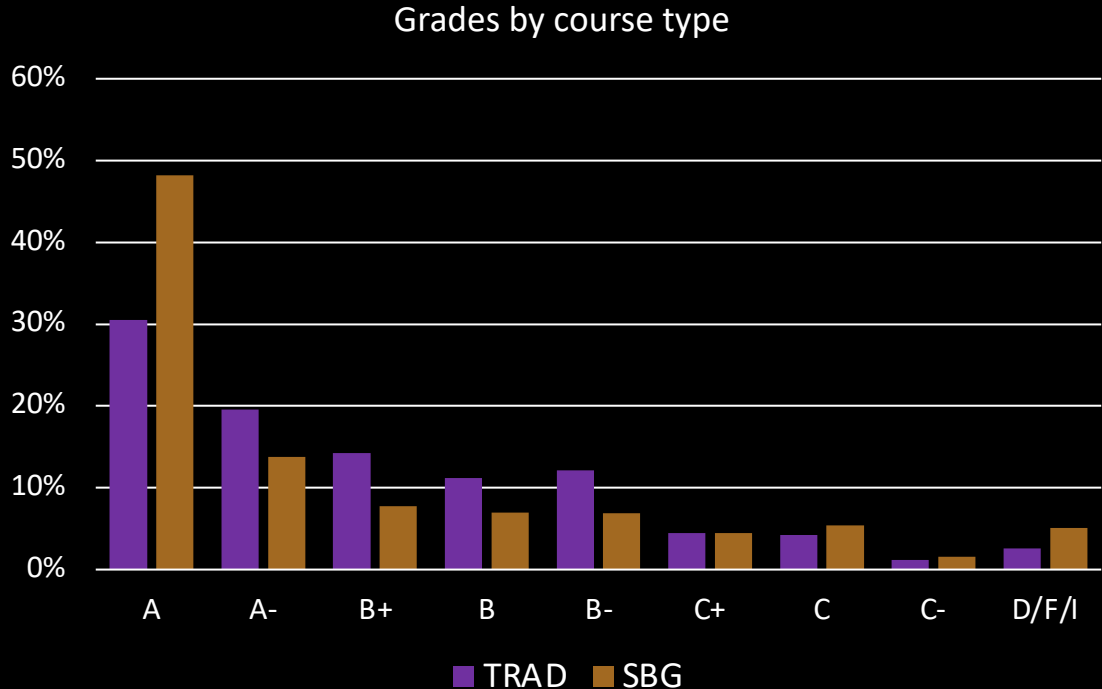
Details: Gradebook

5	I can solve problems involving objects experiencing projectile motion with horizontal launch.															
6	I can solve problems involving objects experiencing projectile motion with angled launch.															
	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6
Student 1	3								3	3	2	3	3			
Student 2																
Student 3	4	4														
Student 4	2	3	5	5					2	1	3	5	5			
Student 5	1	1							1	1						
Student 6	5	5							5	5						
Student 7	4	4	5	5					5	5						
Student 8	1	1							2	2						
Student 9	3	5							5	5						
Student 10	5	5							3	3	5	3				
Student 11	4	2							5	1						
Student 12	5								4	3						
Student 13	4	4							2	4						
Student 14	5	3							5							
Student 15	5	2							3	1	5	3				
Student 16	5	5							3	3						

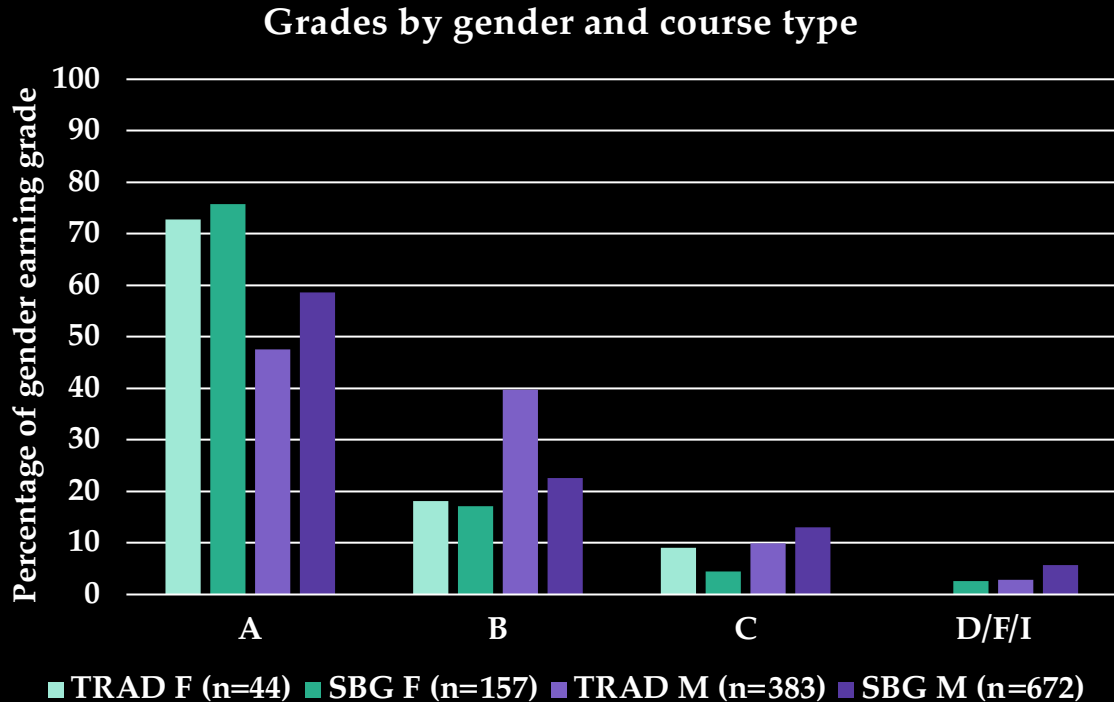
Details: Gradebook

[illegible]

The Details: Effect on Grades

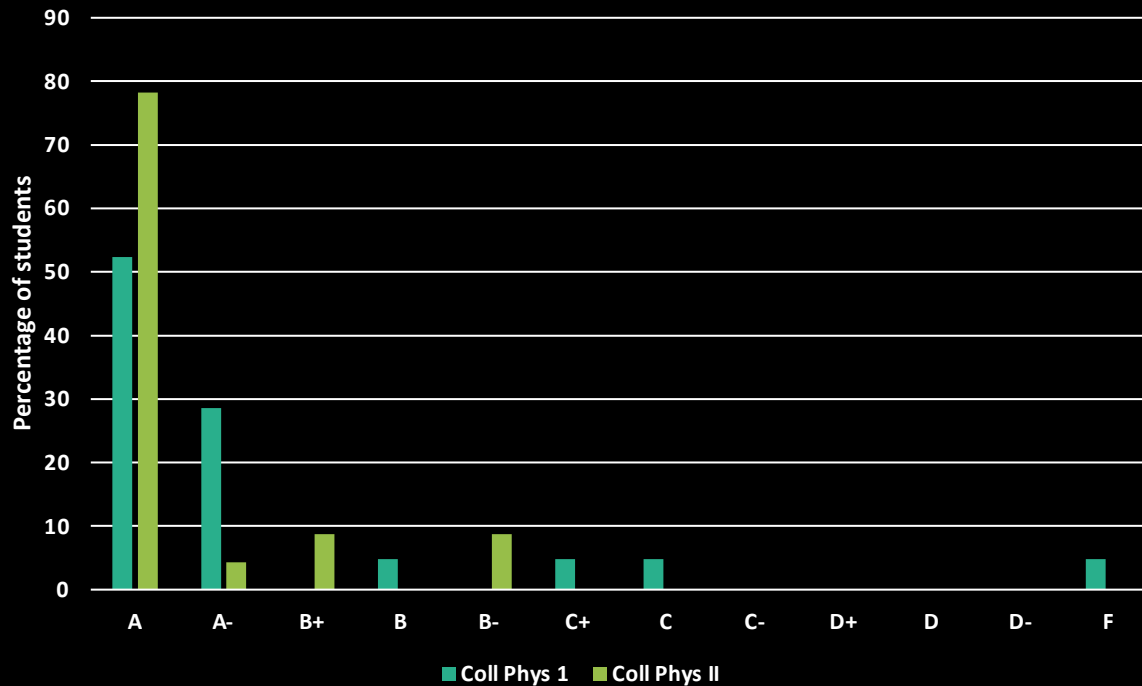


Grades by Gender



<Whoa>

Fall 2021 SBG grades



Is SBG Right for You?

- Criteria-based or norm-based grading?
- Clear set of objectives?
- Resource availability?
- Other issues?

How Could You Start?

- Step one: develop set of objectives based on current class
 - Decide if all objectives are equal or if you want levels
 - Determine what needs to be known for passing/"C" grade
- Step two: determine resources (current/needed)
 - Grading help?
 - Proctor room and proctors?
- Step three: given your resources and your philosophy, how many retakes? Timeframe for retakes?

Moving Towards SBG

- Step four: develop grading scheme
 - Ease of understanding how grade is earned
 - Ease of calculating grade
 - Ease of keeping track of grades
 - Level of feedback given
- Step five: write an assessment designed for one or more objectives
- Step six: get colleagues to look at your plan***
- Step seven: make (frantic, last-minute) changes

Moving Towards SBG

- Step eight: set low expectations for the first run
- Step nine: give it a try!
- Step ten: tweak, adjust, retry
- Step eleven: repeat step ten

Resources on Standards-Based Grading

- Laura McCullough: McCulloughL@uwstout.edu
- <https://www.chemedx.org/article/standards-based-grading-chemistry-classroom>
- <http://mctownsley.net/top-10-standards-based-grading-articles/>

Thank you!

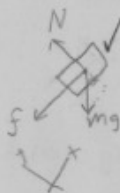


<http://lauramccphd.com/>

High pass

8: ~~HP~~

Black Widow slides a set of handcuffs up a ramp to Iron Man. The cuffs leave her hand at 0.89 m/s , and after sliding up the ramp a distance, they have slowed to 0.12 m/s . The ramp is at 8° and the coefficient of friction between the cuffs and the ramp is 0.16 . How far have the cuffs traveled?



$$x_i = 0$$

$$x_f =$$

$$v_i = .89 \text{ m/s}$$

$$v_f = .12 \text{ m/s}$$

$$a = -2.91$$

$$t =$$

$$\mu = .16$$

$$\theta = 8^\circ$$

F	X	Y
N	-	+N
f	-f	-
mg	-mg sin θ	-mg cos θ

$$mg$$

$$\Sigma F_x \neq 0$$

$$\Sigma F_y = 0$$

$$N = mg \cos \theta$$

$$-f - mg \sin \theta = ma$$

$$f = \mu N$$

$$.12^2 = .89^2 + 2(-2.91)\Delta x$$

$$.014 = .79 - 5.82\Delta x$$

$$\frac{5.82\Delta x}{5.82} = \frac{.776}{5.82}$$

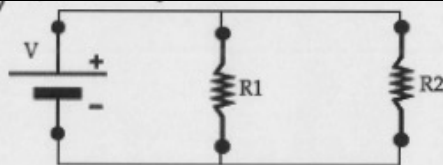
$$\Delta x = .13 \text{ m}$$

$$-\mu mg \cos \theta - mg \sin \theta = ma$$

$$a = -.16(9.8)\cos(8) - (9.8)\sin(8)$$

$$a = -2.91$$

Pass-OK



27: P-OK

Fill in the table below for three examples of a two-resistor parallel circuit.

$\frac{1}{3} + \frac{1}{6} = \frac{1}{R_{eq}}$

$I = \frac{V}{R}$

$I_1 = \frac{V_1}{R_1}$

$R = \frac{32}{18.67} = 1.7$

$4 \div 0.7 = 5.7$

$\frac{32}{10.67}$

	R_1	R_2	V_{battery}	V_{R1}	V_{R2}	I_{battery}	I_{R1}	I_{R2}
0.5 A	#4 3 Ω	6 Ω	18 V	18 v	18 v	9 A	6 A	3 A
5.7 A	#5 14.3 Ω	10 Ω	4 v	4 V	4 v	0.7 A	0.28 A	0.48 A
1.7 A	#6 3 Ω	4 Ω	32 v	32 v	32 V	18.67 A	10.67 A	8 A

$\frac{1}{10} + \frac{1}{5.7} = \frac{1}{R_1}$

College Physics II

$\frac{1}{R_1} = 0.17$

$\frac{1}{0.17} = 0.07 = 14.3$

Assessment

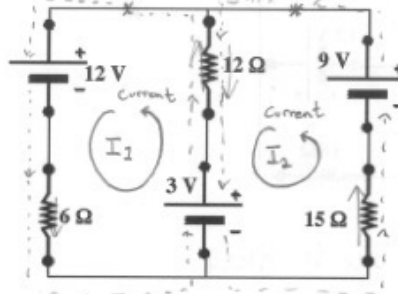
$I_{R1} = \frac{4}{14.3} = 0.28$

Page 1

Self-reflection

29: M

What is the current in each part of this circuit?



$$[\text{Left}]: -12\text{V} + 6I_1 + 3\text{V} - 12I_1 + 12I_2 = 0$$

$$\rightarrow -9\text{V} - 6I_1 + 12 \rightarrow 3\text{V} - 6I_1 = 0$$

$$\frac{6I_1}{6} = \frac{3}{6}$$

$$I_1 = .5\text{A}$$

$$[\text{Right}]: +12I_2 + 12I_1 - 3\text{V} - 15I_2 + 9\text{V} = 0\text{V}$$

$$\rightarrow 6\text{V} - 27I_2 + 12I_1 \rightarrow 18\text{V} - 27I_2 = 0$$

$$\frac{27I_2}{27} = \frac{18\text{V}}{27}$$

$$I_2 = \frac{2}{3}\text{A} \approx .67\text{A}$$

$$[\text{Outer}]: -12\text{V} - 6I_1 - 15I_2 + 9\text{V} = 0$$

I'll need to retake this, I am definitely missing something.