MISSOURI S&T

Optimizing the Use of **Clickers** in the Classroom

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Writing Multiple-Choice Questions

http://tep.uoregon.edu/resources/assessment/multiplechoicequestions/importantconsider.html

Important Considerations

- What role should testing play in the learning process?
- How can tests create a *real* dialogue between ourselves and our students about what students do and do not understand?
- How can we avoid using tests to simply punish or reward cramming?

Writing Multiple-Choice Questions

http://tep.uoregon.edu/resources/assessment/multiplechoicequestions/importantconsider.html

Some suggestions

- Use frequent, small quizzes and tests rather than monolithic once-or-twice per-term exams.
- Give students instant feedback on their performance (for example, putting the correct answers up on an overhead after all the tests are turned in).
- Consider allowing students to take quizzes first as individuals and then the same quiz again in groups.

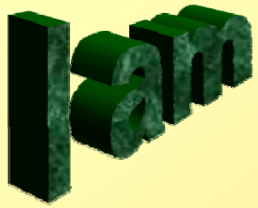
Writing Multiple-Choice Questions

http://tep.uoregon.edu/resources/assessment/multiplechoicequestions/importantconsider.html

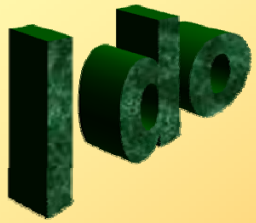
- Multiple-choice questions are easiest to write when there is a definitively right or wrong answer.
- Multiple-choice testing of more interpretive material should always include an appeal mechanism in which students can and must make a written, evidence-supported case for their answer

Taxonomy of Clicker Utilization

- **6 basic categories**
  - *3 categories to test the current standing or stipulation of students*
    - Attendance
    - Preparedness
    - Interest



  - *3 categories to probe into the learning progress*
    - Learning
    - Understanding
    - Applying



Click — *I am here*

Attendance:

- Taking and honoring attendance reduces the number of students dropping out or finishing with low grades (D's and F's).
- Doing it with clickers is particularly efficient in large entry-level classes.

What does the term "***mole***" refer to?

16%	1.	A small rodent digging through our backyards
12%	2.	Avogadro's number
40%	3.	The number 6.02214×10^{23}
8%	4.	Loschmidt's number
4%	5.	A TV reality show of physical and mental challenges
16%	6.	A Mexican hot sauce (from the Aztec word "molli")
4%	7.	A small dark spot on the skin (melanocytic naevus)

Click — *I am prepared*

- **<u>Preparedness:</u>**
- Clicker quizzes on assigned reading assure preparedness for the topics covered in class.
- Well-picked question and appropriate grading are essential.

rvive
a Falls in a
old woman.

69% 1. Fact

31% 2. Crap

Annie Taylor did it in 1901, and afterwards was quoted as saying: “No one ought ever do that again.”

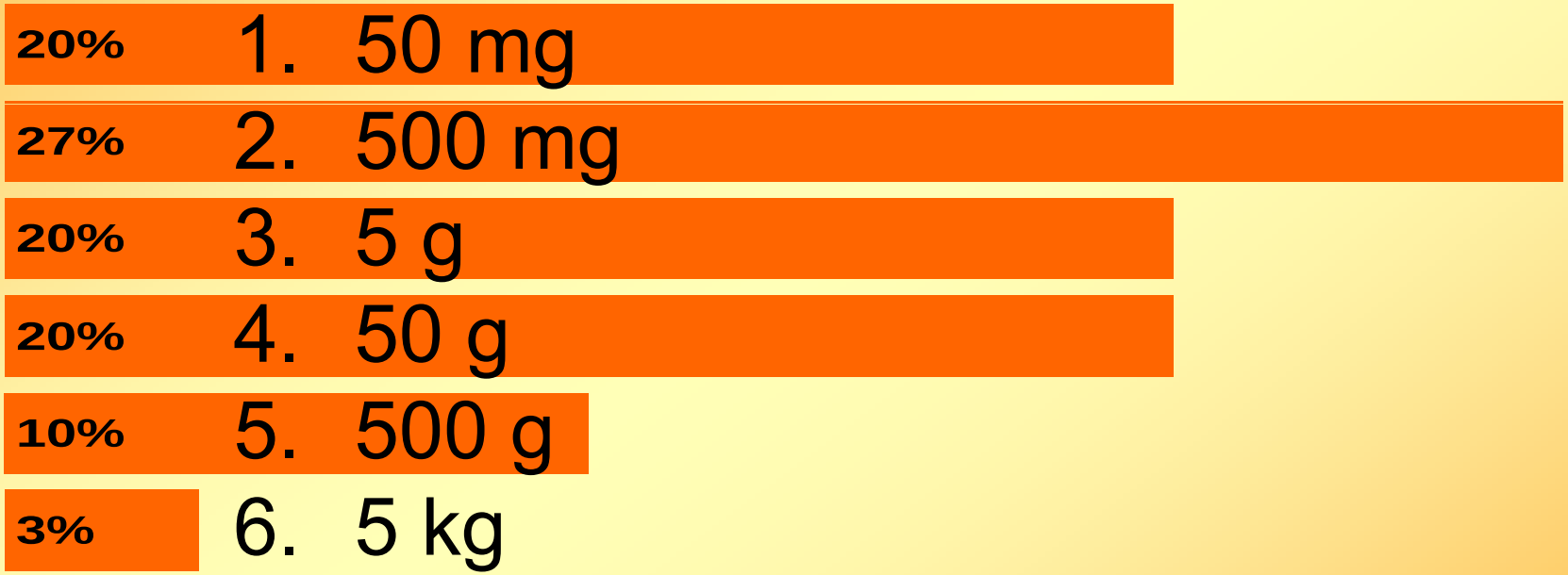
I am interested

Motivation:

- Polling on common knowledge or opinions (even on controversial issues or common misconceptions) creates initial interest and motivation.
- It is crucial that students have developed trust in the technology, especially, if responses are collected anonymously.

Question before teaching about concentration:

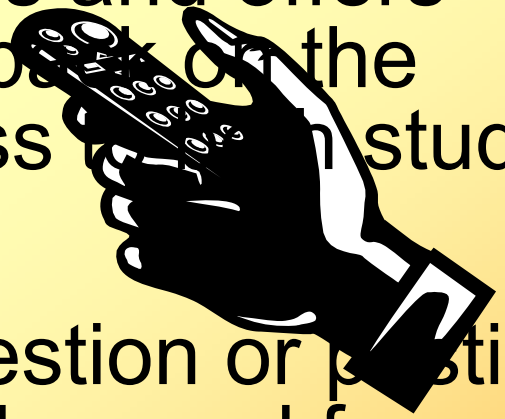
What ***mass of salt*** (NaCl) is found in the **blood stream** of a **normal human**? Please estimate!



Click — *I learn*

Learning:

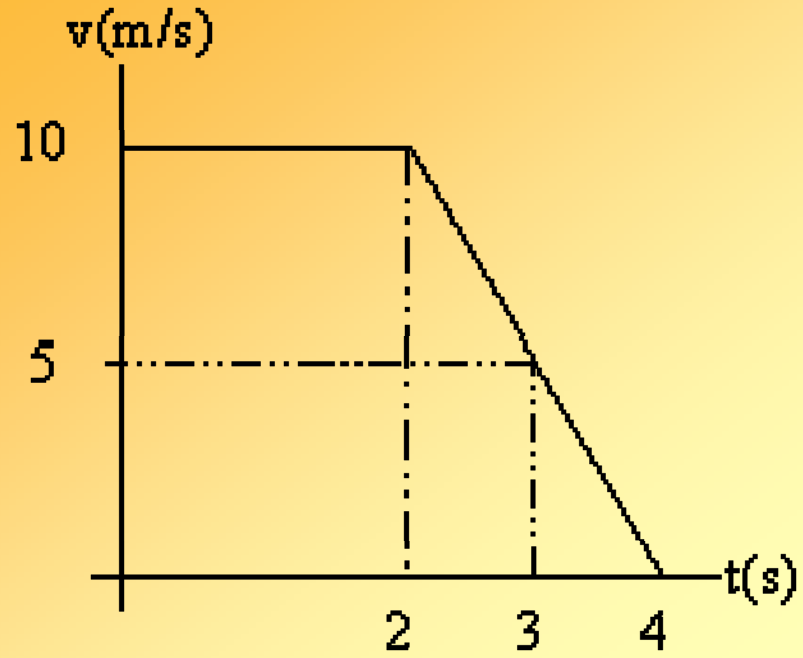
- On-the-spot assessment improves student alertness and offers immediate feedback on the learning progress between student and instructor.
- Repeating a question or posting a similar one can be used for progress evaluation and student satisfaction.



Are you really testing learning?

The true shape of the Earth is best described as a

3%	1.	… perfect sphere
0%	2.	… perfect ellipse
91%	3.	… slightly oblate sphere
6%	4.	… highly eccentric ellipse



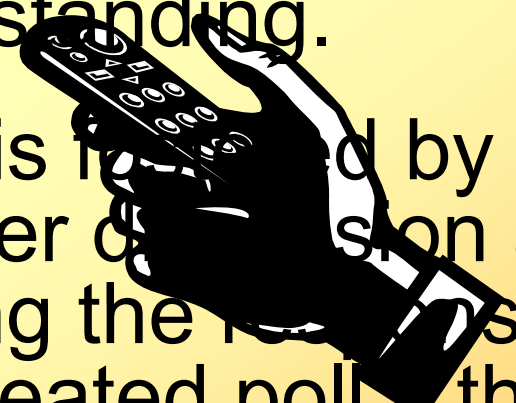
Given the *v* - *t* graph to the left, determine the particle's acceleration when t = 3.

20%	1.	-1.67 m/s^2
20%	2.	- 5 m/s^2
20%	3.	-10 m/s^2
20%	4.	-15 m/s^2
20%	5.	none of the above

Click — *I understand*

Understanding:

- Asking about a subject matter in different ways provides insight into students' understanding.
- Active learning is facilitated by encouraging peer discussion and instruction during the response time or by a repeated poll if the responses are split between different answers.

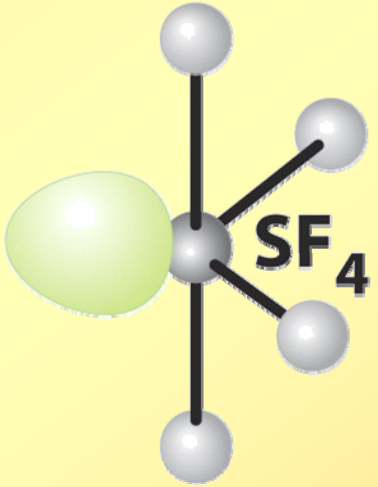


Is a concept understood?

At which location would an observer find the ***greatest force*** due to Earth's gravity?

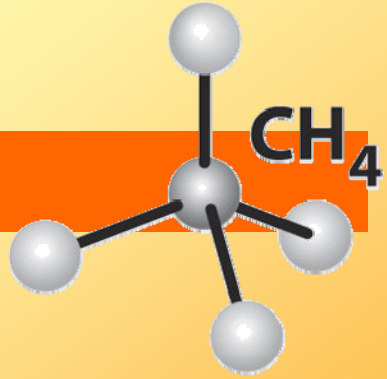
38%	1. The north pole
14%	2. The middle of everywhere
7%	3. The tropic of Cancer (23.5 N)
41%	4. The equator

Sulfur tetrafluoride is a polar molecule.



47% 1. Fact

53% 2. Crap



Click — *I apply*

Applying:

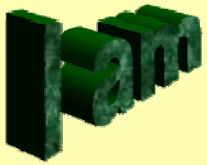
- Conceptual knowledge and mastery is created when clicker questions branch to areas beyond the material covered in class or in the textbook, requiring the application of newly learned concepts to real-world or open-ended problems.

To facilitate the conversion of $H_2S_2O_8$ to yield S_2H_4, you must add as a key reactant …

6%	1.	… a strong acid.
3%	2.	… a weak acid.
12%	3.	… a base.
41%	4.	… an oxidizing reactant.
24%	5.	… a reducing agent.
3%	6.	… a polar solvent.
0%	7.	… a non-polar solvent.
12%	8.	… nothing (the reaction will occur by itself).

Summary

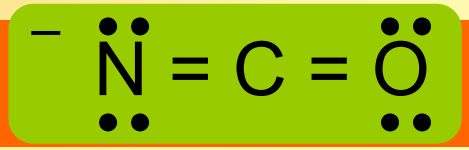
- **Clickers are found in many highschool, college, and university classrooms**
- They provide more than just immediate feedback to instructor and students
- Six basic ways of utilizing the power of clickers
  - Attendance
  - Preparedness
  - Initial interest and motivation

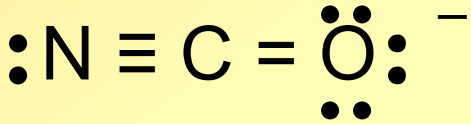


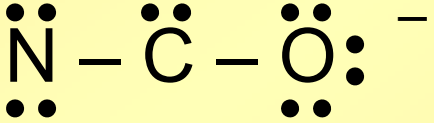
  - On-the-spot assessment (formative assessment)
  - Active learning (peer discussion and instruction)
  - Problem-based, deep learning (mastery of concepts, applications to real-world, or open-ended problems)

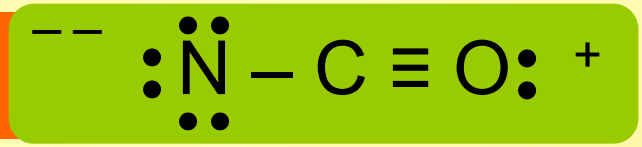
Open-ended Problems:

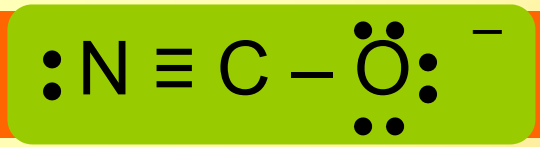
What is a ***valid Lewis Structure*** for the cyanate ion?

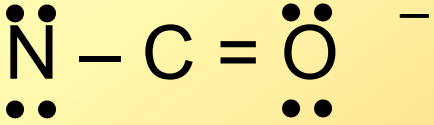
37% 1. 

2% 2. 

6% 3. 

20% 4. 

27% 5. 

9% 6. 

Using Open-ended Problems

Click — *I will be here*

Click — *I will be prepared*

Click — *I will be interested*

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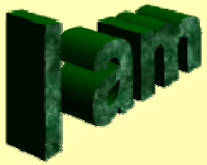

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