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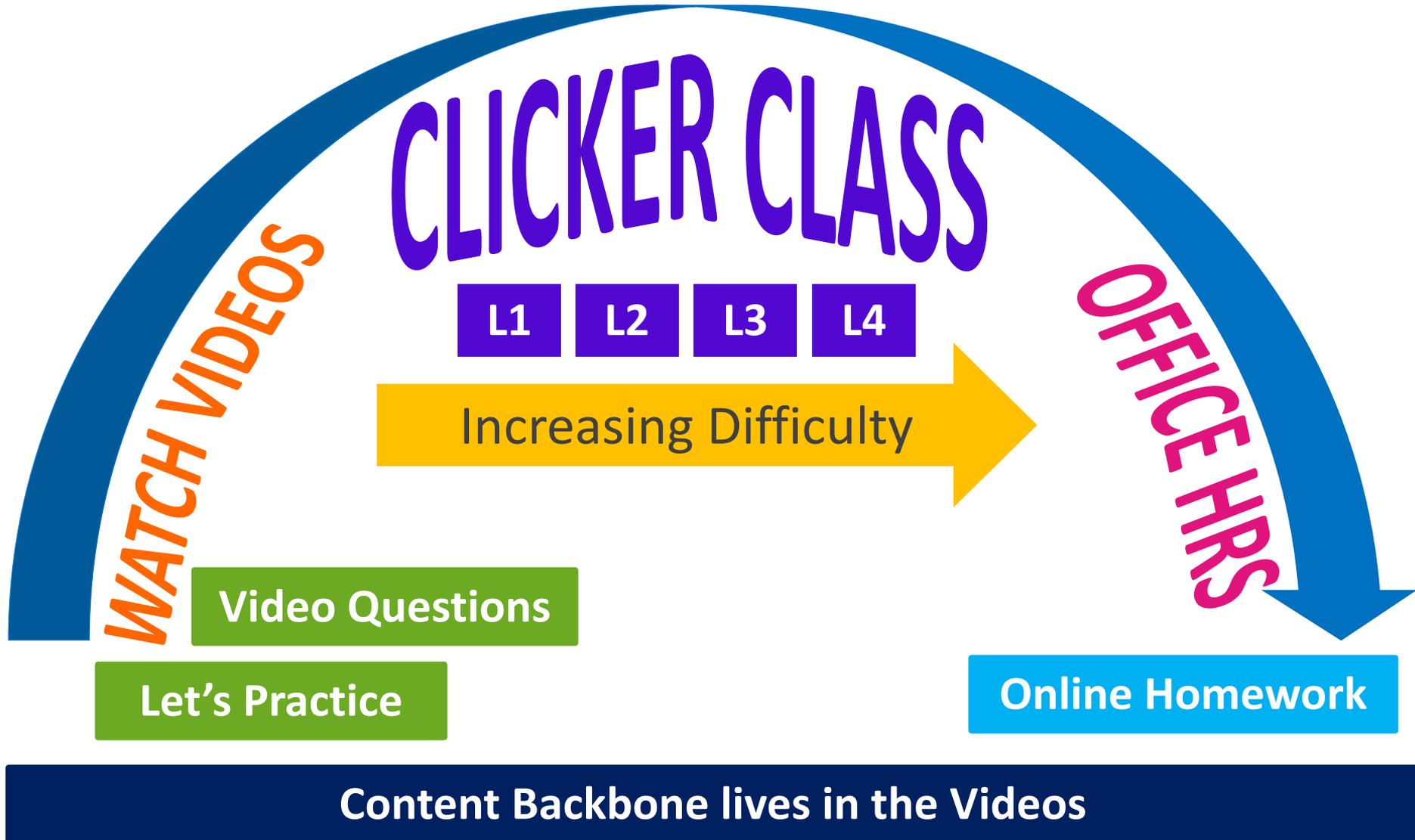


A Structured, Flipped and Active Learning Classroom for General Chemistry

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The Learning Arc



Online Platform: Tophat

CHE168 - General Chemistry 2 - Spring 2022 (McGr...)

Join Code: 511489



CLASSROOM

ASSIGNED

357

GRADEBOOK

Looking for your textbook?

All Items

Unanswered 357

Course Documents
13 items

Course Tools
4 items

Topic 19: Equilibrium
7 items

Topic 19 LGA
Review

Topic 19 Videos & Questions
4 items

Topic 19 Video A Assignment
Review

Topic 19 Video B Assignment
Review

Topic 19 Video C Assignment
Review

Topic 19 Video D Assignment
Review

Topic 19 Homework
2 items

Topic 20: Predicting Chemical Change
8 items

Topic 21: Acids and Bases
6 items

Topic 19 Video A Assignment
Review

Topic 19 Video A: Visualizing Equilibrium

Watch the video and then answer the questions that follow.

The video player displays a title card with the following text and images:

- Topic 19
- Chemical Equilibrium
- Video A
- Visualizing Equilibrium

The video player includes a play button, a progress bar showing 08:10, and a Vimeo logo. A 'Fullscreen' button is visible in the bottom right corner.

The Videos

The video content is the **BACKBONE** of the course
(Tell the content story and teach fundamental principles)

CLEAR and SLOW

GUIDED PRACTICE

COHERENT

**INSTRUCTIONAL
VIDEOS and NOT
Edutainment**

Topic 19

**Chemical
Equilibrium**



Video A

**Visualizing
Equilibrium**

All molecules in this video were generated using the program [HyperChem](#) by HYPERCUBE, INC

Build on this video content BACKBONE during class time

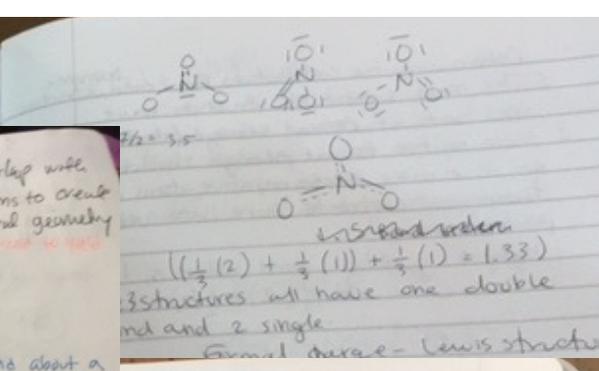
Students take Notes from the Videos

POLYATOMIC IONS

ION	NAME
Hg ₂ ²⁺	Mercury (I)
NH ₄ ⁺	Ammonium
NO ₂ ⁺	Nitronium
NO ₃ ⁻	Nitrate
SO ₃ ²⁻	Sulfite
SO ₄ ²⁻	Sulfate
HSO ₄ ⁻	Hydrogen sulfate
OH ⁻	Hydroxide
CN ⁻	Cyanide
ASO ₄ ³⁻	
PO ₄ ³⁻	
HPO ₄ ²⁻	
H ₂ PO ₄ ⁻	
SCN ⁻	
MnO ₄ ⁻	
CO ₃ ²⁻	
HCO ₃ ⁻	
ClO ⁻	
ClO ₂ ⁻	
ClO ₃ ⁻	
ClO ₄ ⁻	
2H3O ₂ ²⁻	

Predicting Shapes of covalent compounds

1000



Sp, Sp² and Sp³ hybrid orbitals

Hybrid orbitals have 1 large lobe and 1 small lobe

There's some electronic density at the nucleus (important for bonding)

Orbitals can interact constructively or destructively

- When there's a constructive overlap → **sigma bond (σ)**
- When orbitals interact destructively (head-on) they form a **sigma bond** sharing 2 electrons → **Single bond**

Orientation matters for bond formation

Orientation determines whether or not they overlap constructively and **form the bond** or destructively and **don't form the bond**

In order to bond, one part of the lobe has to be on the other side and must overlap head on.

Small lobe (destructive) large lobe (constructive)

Try to get all p-orbitals perpendicular orientation

Head on overlap will result in the formation of **sigma (single) bonds** → (sp, sp², sp³ and sp)

Sigma bonding in Methane (CH₄)

1 sp³ hybrid orbitals of C overlap with the 1 2s orbitals of 4H atoms to create 4 sigma bonds with tetrahedral geometry

All 4 unpaired orbitals become hybridized to yield 4 sp³ hybrid orbitals

Single bonding in ethane (C₂H₆)

There is free rotation around about a sigma bond & the 109.5° bond angle does not change

Each C is tetrahedral

Sigma bonding in hexane (C₆H₁₄)

There's still free rotation these sigma bonds. The angles are still tetrahedral

The sigma backbone

H-C-C=C-C≡C-C-H

A sigma bond represents the sharing of 2 electrons

- Every single bond is a sigma bond
- One of the bonds in a double bond is sigma and one of the bonds in a triple bond is sigma

Topic 11: Valence Bond theory

covalent bonding (based on overlap of atomic orbitals)

Covalent Bonding → **Molecular Orbital Theory**

no are formed based on all charges present in the system.

Valence Bond theory's hybridization theory is built upon VSEPR model

VSEPR Predicts hybridization

orbitals get mixed together to create hybrid atomic orbitals

Linear electron geometry

the hybrid orbitals on central atom are sp hybrid orbitals and will always be 2 of them.

3-2p orbitals

1s + 1p → 2sp hybrid orbitals

2sp hybrid atomic orbitals

Linear geometry → sp² hybridization

Trigonal Planar geometry → sp² hybridization

1s + 2p → sp² hybrid orbitals

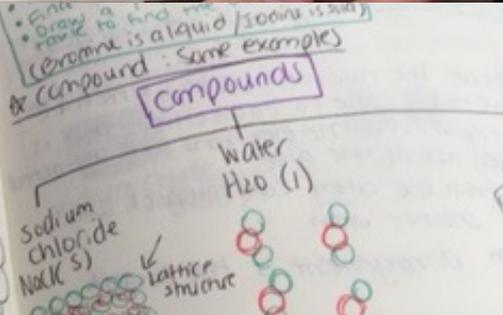
has a fixed (unchanging) composition

This means that if you take samples from a jar of a substance, each sample will have the same

Acetate Dichromate

1 type of Atom Example: Pencil Lead (Carbon Graphite)

more than 1 type of Atom Example: Table Salt (NaCl (sodium chloride))



1s + 1p → 2sp hybrid orbitals

2sp hybrid atomic orbitals

Linear geometry

Trigonal Planar Geometry → sp² hybridization

2s + 2p_x + 2p_y = 3sp² hybrid orbitals

(atom has 3 sp² hybrid orbitals & 1 unhybridized p orbital)

Linear geometry → sp² hybridization

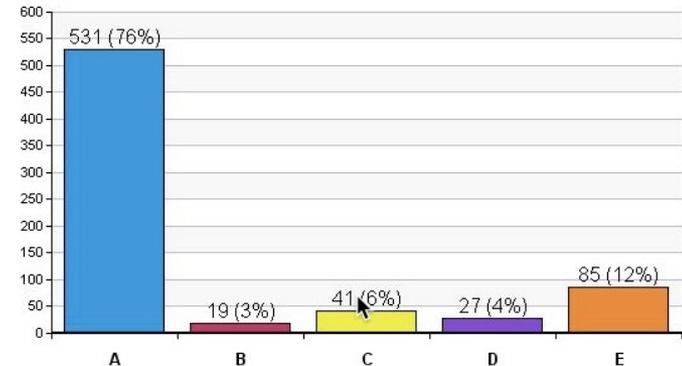
1s + 2p → sp² hybrid orbitals

The Videos are Important

What is your *primary* source for course information?

- A. Videos
- B. A textbook
- C. My friends
- D. A prior course
- E. Sapling homework

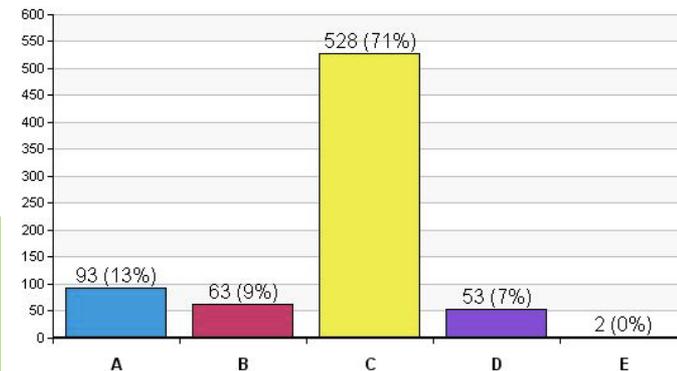
76% → Videos
3% → Textbook



How do you use the videos?

- A. I watch each one then do the Sapling Skills
- B. I watch them all once and then watch them again this time taking notes
- C. I watch each one and take notes while watching and stop the videos often
- D. I watch the videos only to help me work the Sapling problems

71% → Stop them often while taking notes



Clicker Class: Modified Peer Instruction

Students engage with one another, peer leaders and their instructor to solve problems.

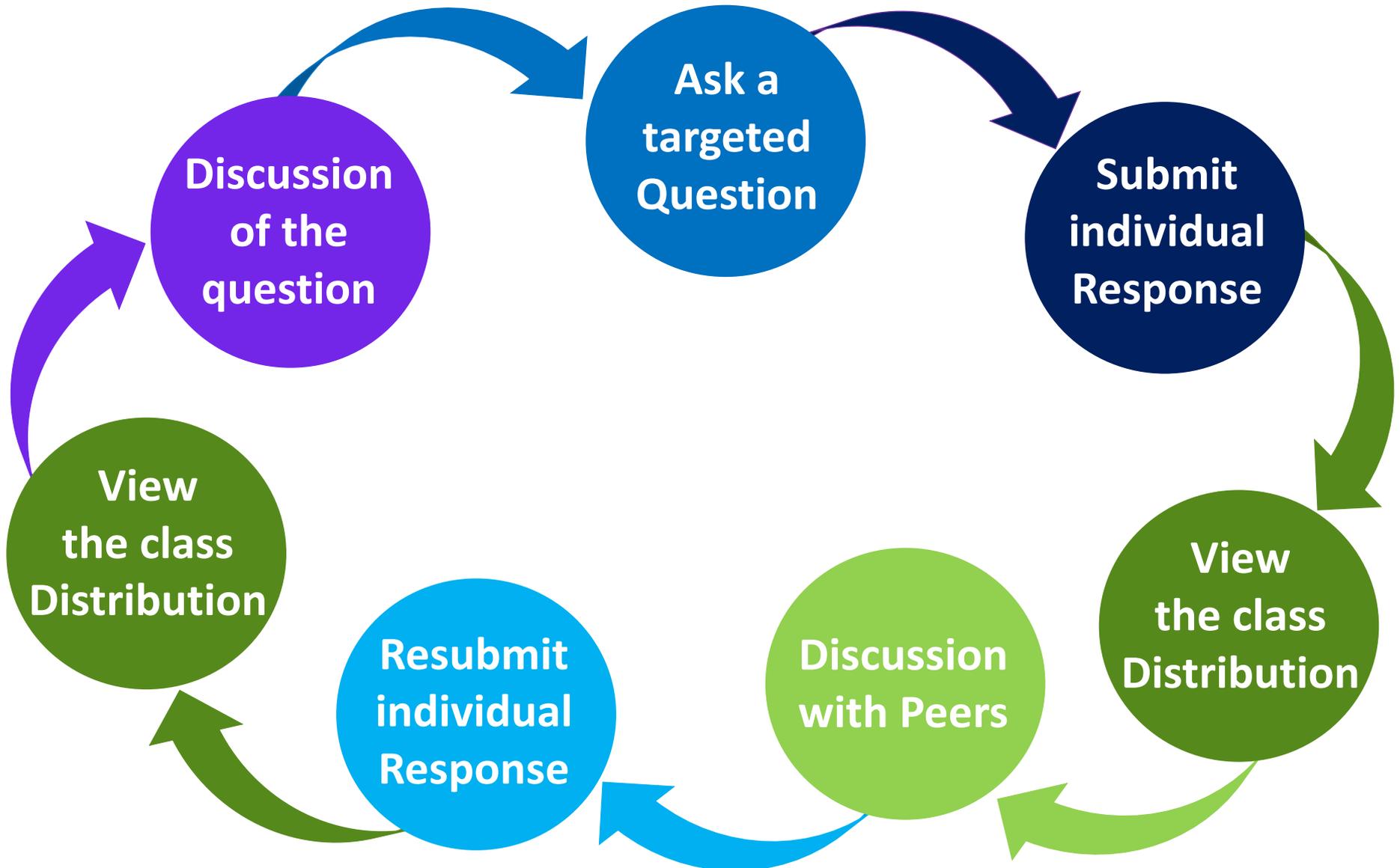


Clicker Session 8
Topic 13 & Topic 14

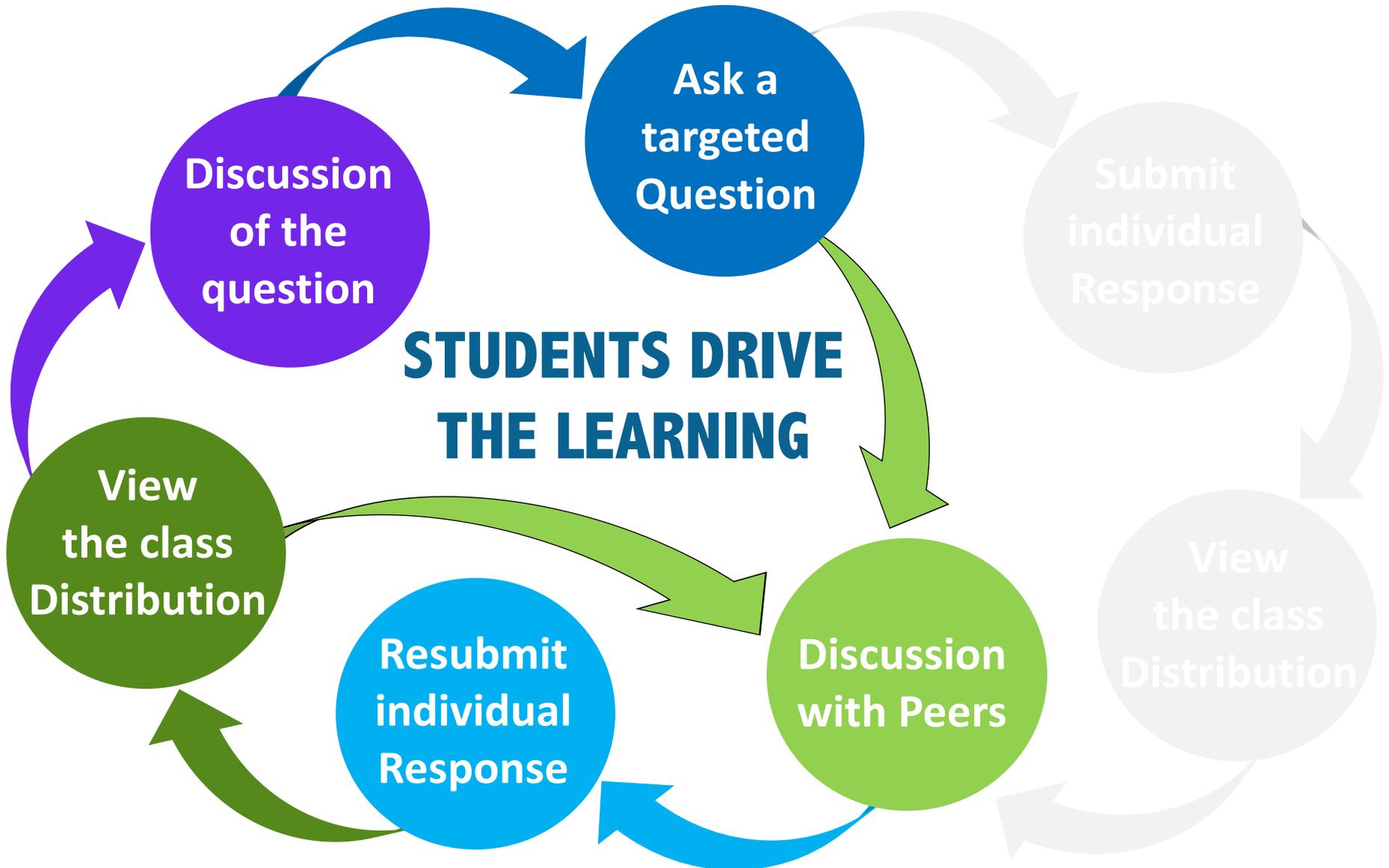


LEARNING through Problem Solving

Peer Instruction Cycle



Modified Peer Instruction Cycle



Clicker Question Taxonomy

Level	Type	Explanation	
Level 1 81.6%	Foundational Single concept Single step	Students expected to know answers based on videos (flipped classroom), prior work or immediately prior mini-lecture. (1-2 mins)	BLOOMS: Remember
Level 2 72.9%	Basic Single concept Multi step	Students expected to find answers based on videos, prior work or immediately prior mini-lecture. (2-5 mins)	BLOOMS: Understand & Apply
Level 3 64.5%	Advanced Multi concept Multi step	Students not expected to know the answers from recall or prior practice. Similar comprehensive questions in videos or concepts and procedures From prior mini-lecture. Provide opportunity for Peer Instruction and deep integration of conceptual and procedural knowledge. (2-8 mins)	BLOOMS: Analyze & Evaluate
Level 4 45.0%	Stretch Multi concept Multi step	Students asked to apply knowledge to new setting. Encourage more collaboration and provide opportunities for seeing the most complicated forms of questions. About one level 4 question per class (4-10 mins)	BLOOMS: Evaluate & Create

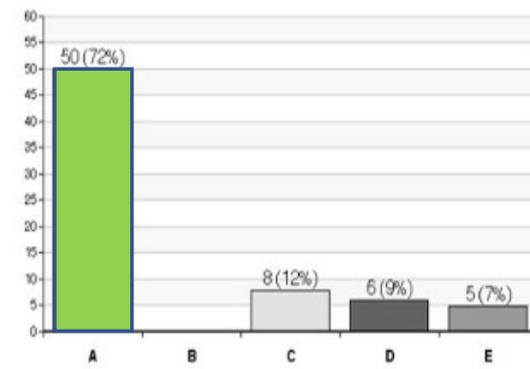
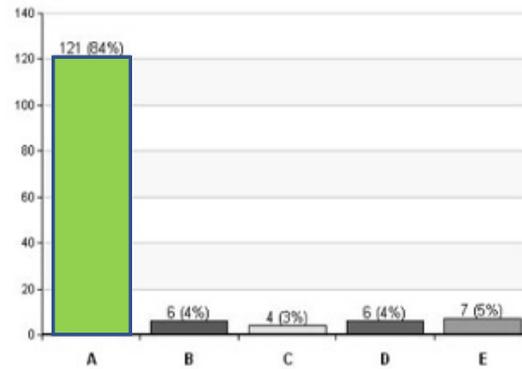
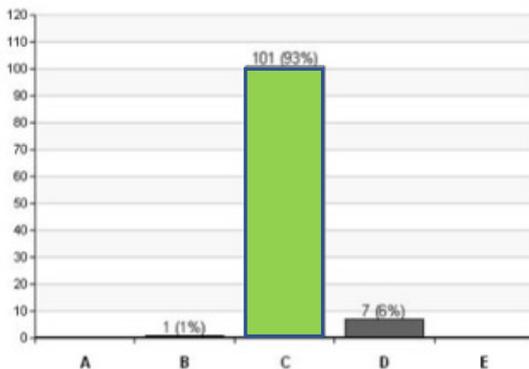
The Learning Arc



Level 1 (T1, L.G. 14)

Match the correct order of magnitude for each of the following metric terms: Kilo, Mega, Nano, Centi, Milli

- A. $10^2, 10^{-4}, 10^9, 10^2, 10^{-3}$**
- B. $10^2, 10^{-6}, 10^9, 10^2, 10^3$**
- C. $10^3, 10^6, 10^{-9}, 10^{-2}, 10^{-3}$**
- D. $10^3, 10^6, 10^{-9}, 10^{-2}, 10^3$**



Level 2 (T1, L.G. 15)

Now how many kilometers are there in 1 centimeter?

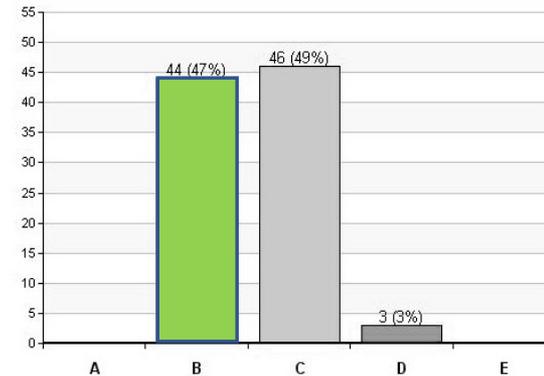
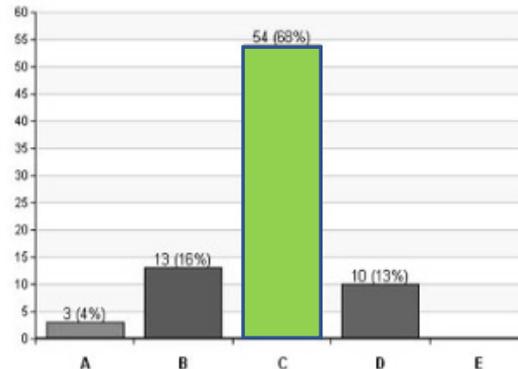
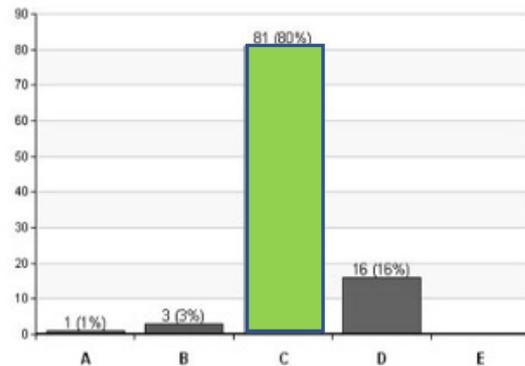
A. 10^{-1}

B. 10^{-2}

C. 10^{-5}

D. 10^5

E. 10^1



Level 3 (T1, L.G. 15)

1 hectare = 2.47 acres;

1 mi = 5280 ft;

12 in = 1 ft;

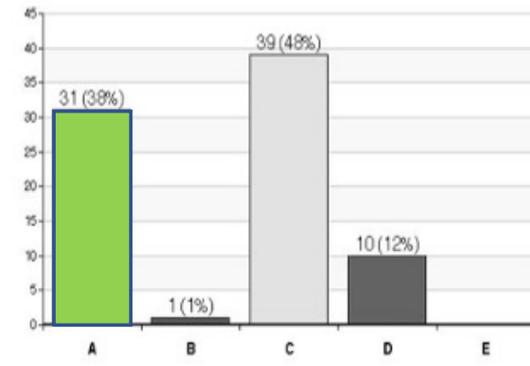
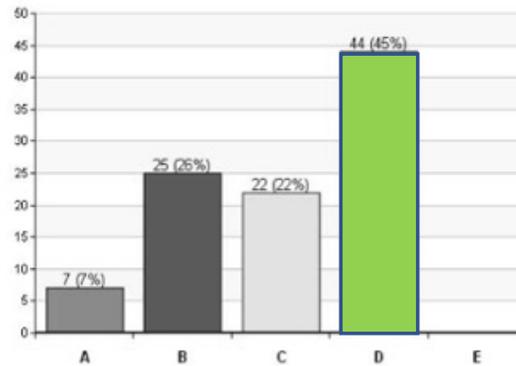
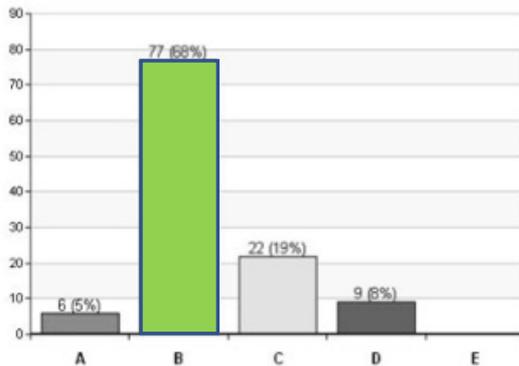
1 acre = 43560 sq ft

1.6 km = 1 mile

1 km = 1000 m

How many hectare are there in a field that is 2.2 km² ?

- A. 8900 hectare**
- B. 222 hectare**
- C. 1460 hectare**
- D. 0.174 hectare**

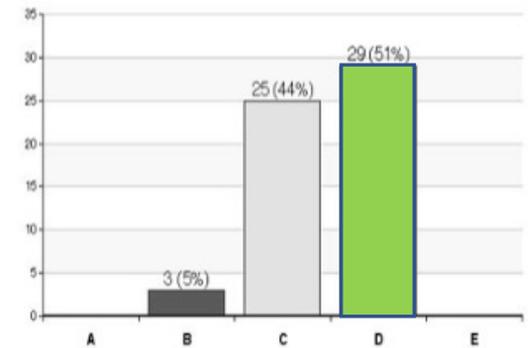
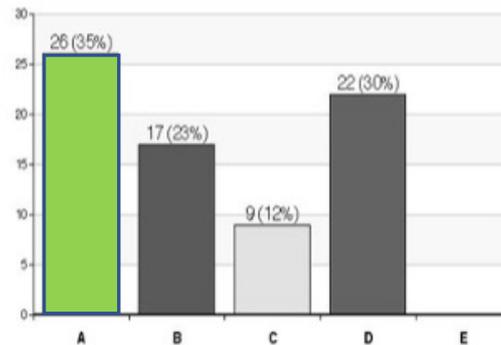
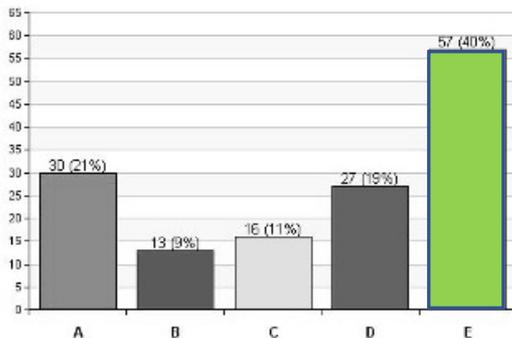


BLOOMS:
Evaluate &
Create

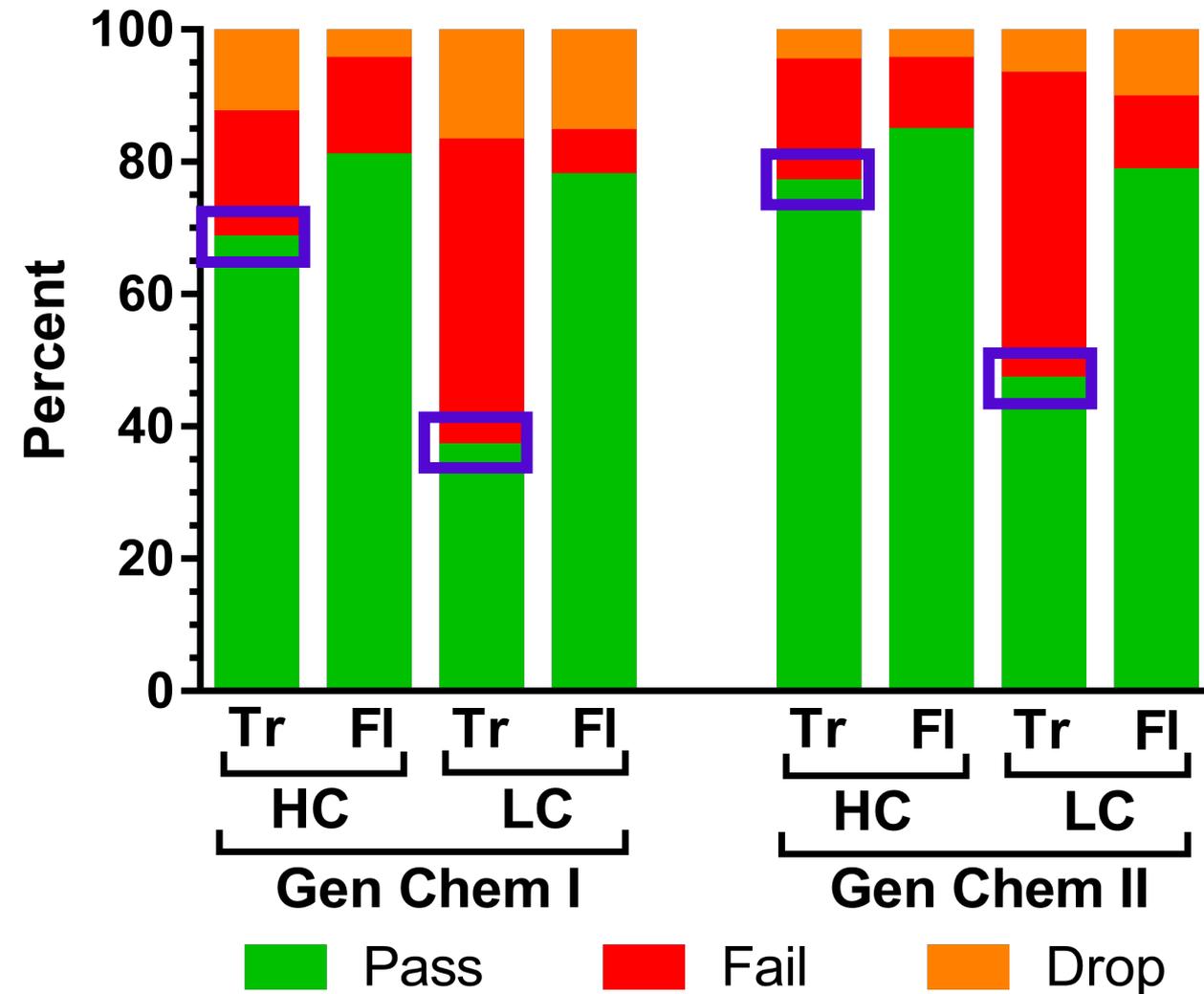
Level 4 (T1, L.G 15)

Consider a lawn that is 21.0 feet wide and 20.0 feet long. If an average snow flake has a mass of 1.80 mg and each square foot of lawn accumulates 1560 snow flakes per minute, how much snow accumulates on your lawn per hour?

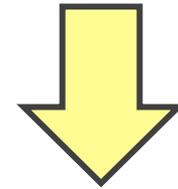
- A. 16.8 kg/h**
- B. 21.8 kg/h**
- C. 70.7 kg/h**
- D. 124 kg/h**



Passing Rates Increase Dramatically



40% difference in performance in TRADITIONAL



6% difference in performance in FLIPPED



Positive Student Commentary

“It was the first time I had ever taken a course in a "flipped classroom" setting and I love it! I was skeptical at first to whether or not it would work but it has!!!! It is a great way to learn.”

“The fact that I can go at my own pace and teach myself the topics is a huge plus.”

“The best features of this course were the videos, although they were long, the majority were very thorough in teaching me the material.”

“I really appreciate how much structure there is in this course because it has been crucial for me in terms of staying on track. ... For me it kept me accountable.”

“I was skeptical about the flipped classroom model but having been through it twice now I absolutely love it!”



Negative Student Commentary

“Although the videos were informative and helped in my learning, the time necessary to really get through the videos was just too much.”

“it required many hours to understand and deal with the work load. Its very hard for someone like me who has to work full time.”

“the flipped classroom takes time to get used to. This model is very annoying.”

“I wish [workshop] would have just been dissolved and clicker session extended.”

“The flipped model uses up a lot of your time, so it is very hard to study for other classes.”



Thank you! Any Questions?

