Guided Practice

Science Instructional Lesson Type

Uncommon Schools | Change History.

Do Now & Launch → **I Do** → **You Do, 1st Round** → **We Do Go Deeper** → **You Do, 2nd Round** → **Assessment**

Lesson Plan Background	
Teacher:	**Lesson:** U2L7 (50 minutes)
Course: AP Chemistry	**Unit Title:** Molecular Structure and Properties

Objectives	
Skills/Content: SWBAT name and implement key strategies for answering AP-level FRQs. SWBAT score >50% of points on FRQ questions on intermolecular forces.	**Standard:** SAP-4C, SAP-5A SP-4, SP-6

Lesson Goals

Guiding Question: How can we earn maximum points on a free-response question on intermolecular forces?
The purpose of this lesson is for students to practice FRQ strategy, writing, and revision. This is the first longer FRQ that students see this year, so it is essential that teachers emphasize strategies. Students will first independently read and annotate the free response, where they should look for the easy points. Then students will chart their answers to the FRQ. Lastly, students will independently answer the same FRQ and have the opportunity to grade each other using the rubric. As an exit ticket, students choose one portion of the free-response to revise. Teachers should emphasize to students that it is important to identify and earn all the easy points first, so that more time can be spent on challenging questions. Students should not simply answer the easy points, then move on to another question.

Planning

Planning

Vocabulary:

- Lewis Structure
- Intermolecular Forces
- Bond length
- Bond strength
- Hybridization
- Bond angle

Key Understanding/Skill:

- Read through the entire question first so that we can locate the easy points.
- When answering, start with the easy points to ensure we earn those, then use remaining time for more challenging questions.
- Always utilize data given in the question to guide your response. Your answer and the data should not disagree.
- For boiling point justification questions, include intermolecular forces exhibited by BOTH substances.

Setup/Materials

- Chart Paper + markers (1 per group of 2-3 students)
- Printed copies of intermolecular force FRQ Rubric (1 per student)
- Students should be in groups of 2-3 (mix of 1 high, 1 medium, 1 low)
- Problem Set 6 Answer Key printed for homework check during the Daily Drill.

Exit Ticket (5 minutes)

Exit Ticket:

1. State TWO strategies that you utilized during FRQ practice today and explain the value of using these strategies.

Strategy	Value
Reading through the entirety of the free-response question first	**Allows us to identify easy and challenging points within the question**
Answering easy questions first, even if they are out of order	**Ensures that we earn those easy points and frees up time to tackle tougher questions**
For intermolecular forces – utilizing any data provided to justify a response	**The data provided in the question gives us clues as to how we should structure our response.**

2. List TWO content pieces that you need to remember below.
3. Use the feedback your partner gave you to rewrite *one* portion of the response below.
   See rubric for exemplar.

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Science Instructional Lesson Type

Uncommon Schools | Change History.

<table>
<tr><td rowspan="2">Do Now & Review

(5 minutes)</td><td>Start to Class</td></tr>
<tr><td>
Do Now (3 minutes):
1: B

2: Sulfur has valence electrons in a higher energy level (3) compared to the valence electrons of oxygen, which are in energy level 2. Therefore, sulfur has a larger atomic radius.

3: K and Li have the same ionic charge of +1. However, K is a larger ion, and so the distance between K and Cl is greater than the distance between Li and Cl. The greater distance contributes to a weaker force of coulombic attraction between K and Cl, resulting in a lower lattice energy.

Monitoring Laps:
<table>
<tr><th>#...</th><th>...for:</th><th>If mastery is...</th><th>...respond by:</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">B</td><td>>70%</td><td>Move onto Lap 2</td></tr>
<tr><td><70%</td><td>Stop the Show (<45 sec)</td></tr>
<tr><td>2</td><td>Valence electrons and specific energy level</td><td colspan="2">Note trend in mastery, common error and students to call on.</td></tr>
<tr><td>3</td><td>Larger ion → distance between ions is larger</td><td colspan="2">Note trend in mastery, common error and students to call on.</td></tr>
</table>
Review:
• Cold Call for question 1, and Show Call an exemplar response for questions.

Mini-Stamp:
• Ions/atoms within a chemical bond that are further apart have a weaker force of attraction between them.
</td></tr>
<tr><td>Daily Drill
(4 minutes)</td><td>Pass out the answer key for Problem Set 6 and have students check their answers.</td></tr>
<tr><td>Launch
(3 minutes)</td><td>
Guiding Question: How can we earn maximum points on a free-response question on intermolecular forces?

Say: Today we will be practicing with free-response questions on intermolecular forces. This will help us to do well on free-response questions on the AP exam and also on our upcoming quiz.

Last time, we focused on writing strong explanations for periodic trends questions and went over some guidelines for writing explanations in AP Chemistry: our explanations should be concise, clear, and should utilize precise vocabulary. Our goal for today's FRQ practice is to continue to utilize these strategies to earn at least 7 out of 10 points. Let's get started.

The strategy we should all use moving forward for free-response and multiple-choice questions is to read the entire question and locate the easy parts. Each part is worth one or two points, and it doesn't matter which order you answer them in. You want to make sure to answer the easy points first so you know you earned them, before going back and thinking about the more challenging questions.

This is a longer free-response question, so first, take up to 3 minutes to read through the entirety of the question. Do <u>NOT answer the question. Predict the easy points and be prepared to share with your partner which part you will start with.</u>
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Science Instructional Lesson Type

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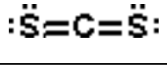
Delivery of Content (12 minutes)	I Do/Think Aloud/Lecture:
	N/A
	You Do Round 1:

Setup:

- (3 minutes) Students independently read and annotate question.
- (1 minutes) Students Turn & Talk to share which question they would start with.
- (8 minutes) Students move into groups of 2-3 and answer the question at chart paper.

[1]Exemplar:

Part a:

	One point is earned for the correct structure.

Part b:

180°	One point is earned for the correct bond angle.

Part c:

The carbon-to-selenium bond length in CSe_2 is greater than the carbon-to-sulfur bond length in CS_2. The valence electrons in Se are in a higher shell (n = 4) than the valence electrons in S (n = 3), and so Se has a greater radius compared to S. Therefore the distance between Carbon and Selenium is greater than that of Carbon and sulfur, leading to a longer bond length.	One point is earned for comparing the number of energy levels in Selenium and sulfur. One point is earned for stating that the distance between carbon and selenium is greater than the distance between carbon and sulfur.

Part d:

The bond energy of Carbon to selenium should be less than the bond energy of carbon to sulfur. The bond length between selenium and carbon is greater because Se is a larger atom, therefore the distance between atoms is greater. This leads to a weaker force of attraction between atoms.	One point is earned for comparing the number of energy levels in Selenium and sulfur. One point is earned for stating that the distance between carbon and selenium is greater than the distance between carbon and sulfur.

Part e

sp^2	One point is earned for the correct hybridization

Part f:

Propane has dispersion forces. Methanoic acid has dispersion forces and hydrogen bonding forces.	One point is earned for IMFs in propane. One point is earned for IMFs in methanoic acid.

Part g:

Hydrogen bonding IMFs among methanoic acid molecules are much stronger than dispersion forces among propane molecules. The stronger the IMFs, the more energy it takes to overcome them. Therefore, methanoic acid has a higher boiling point than propane.	One point is earned for comparing the strengths of the IMFs.

Guided Practice

Science Instructional Lesson Type

Uncommon Schools | Change History.

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Academic Monitoring:

<table>
<tr><th>Question #</th><th>Monitor For</th><th>Common Error</th><th>How to Respond</th></tr>
<tr><td>Strategy</td><td>Starting with easy questions – a, b, e, f</td><td>Students may get stuck on c because it is more challenging</td><td>Stop the Show: Part b is worth the same as part f, which is much easier. Earn the easy points first.</td></tr>
<tr><td>A, b, e, f</td><td>Correct responses to easy points (see rubric)</td><td>Habits errors (counting domains/valence electrons)</td><td>Stop the Show: This is an easy point – what strategy should we use to always get this question right?</td></tr>
<tr><td>Part g</td><td>Mentioning intermolecular forces present in both molecules.

Connection of intermolecular forces to energy</td><td>Missing the connection between intermolecular forces and energy</td><td>Show Call the error: How do intermolecular forces relate to boiling point?</td></tr>
</table>

</td></tr>
<tr><td>We Do & Go Deeper
(7 minutes)</td><td>

Review:

Part 1 – Content: Based on monitoring students at chart paper, execute a comparative Show Call to highlight a content gap.

- Show Call a chart with the common mistake and an exemplar and have students compare – *Which response is correct and why?*
- Turn & Talk: *What content do we need to remind ourselves of to answer this question correctly?*
- Examples of key content reminders:
  - Larger atoms = Longer bonds = less orbital overlap= weaker bond energy
  - State intermolecular forces exhibited by both molecules when making a comparison
  - Stronger intermolecular forces = more energy required to break intermolecular forces = higher boiling point

Part 2 – Strategy: Review an exemplar FRQ that uses the strategies, then stamp the strategies before moving to the Apply.

- Have students Turn & Talk – *Why was the strategy we used to approach the FRQ effective?*
- *Why should we read the entire free-response question first?*
- *What is the value in first answering the easy questions?*
- *Why is it important that we determine the trend in data provided?*

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<tr><td>Stamp the Under-standing
(2 minutes)</td><td>

Stamp: How can we earn maximum points on a free-response question about intermolecular forces?

- Read through the entire question first so that we can locate the easy points.
- When answering, start with the easy points to ensure we earn those, then use remaining time for more challenging questions.
- Always utilize data given in the question to guide your response. Your answer and the data should not disagree.
- For boiling point justification questions, include intermolecular forces exhibited by BOTH substances.

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<tr><td>Apply
(12 minutes)</td><td>

Setup:

- (7 minutes) Students will independently answer the same free-response question. Chart papers should be covered so that all students have a chance to tackle the question independently.
- (3 minutes) Students will read each other responses, grade using the rubric and silently write feedback. Prompts for feedback are included in the student handout.
- (2 minutes) Students will Turn & Talk to share feedback.
- Last 5 minutes – Exit Ticket – Students will choose a portion to redo based on feedback and summarize strategies and content practiced today.

Exemplar

See rubric.

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