


# Short Performance Assessment: HS-PS1-3

Grade Level: **High School**

Title	Comparing Intermolecular Forces- Sally and her Nails		
Designed by	Fiona Recchia & Colette Alonge-Watz	Course(s)	Chemistry
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Performance Expectation	<p><b>HS-PS1-3:</b> Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.</p> <p><b>Clarification Statement:</b> Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.</p> <p><b>Assessment Boundary:</b> Assessment does not include Raoult's law calculations of vapor pressure.</p>
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Science and Engineering Practice	<p><b>Planning and Carrying Out Investigations</b></p> <ul style="list-style-type: none"> <li>Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.</li> </ul>
Disciplinary Core Ideas	<p><b>PS1.A: Structure and Properties of Matter</b></p> <ul style="list-style-type: none"> <li>The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.</li> </ul>
Crosscutting Concept	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.</li> </ul>

Student Performance	<ol style="list-style-type: none"> <li>Identifying the phenomenon to be investigated</li> <li>Identifying the evidence to answer this question</li> <li>Planning for the investigation</li> <li>Collecting the data</li> <li>Refining the design</li> </ol>
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Name\_\_\_\_\_

1. Sally was removing her nail polish to get ready for a dance. She was also drinking a bottle of water. The doorbell rang and she rushed to answer it, leaving the open bottle of nail polish remover (acetone) and the bottle of water open. Sally forgot about them until the next morning and when she checked, the nail polish remover (acetone) was empty and the water looked untouched.

Sally believes the particles in water stick together more. In terms of your knowledge of the strength of electrical forces and the structure of substances, explain Sally's statement.

2. Plan an investigation, using the graphic organizer below, that gathers data to support Sally's belief (water molecules "stick together more") and provides evidence that represents a pattern between the strength of electrical forces and a bulk property.

## Planning and Carrying Out Investigations

**1** Identify the  
Research Question

**3** Identify the  
Independent Variable

**4** Identify the  
Dependent Variable

**2** Sketch and label the  
Lab Set-up

**5** List 10  
Constants

**2** Record the  
Data

**Cause**

**Mechanism**

**Effect**

1.  
2.  
3.  
4.  
5.  
6.  
7.  
8.  
9.  
10.

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Adapted from: Amy & Jeremy Peacock



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3. List two limitations in your investigation and the effect on the accuracy or precision of your data.

4. David conducted an experiment similar to the one that you have planned above when he found three unlabeled beakers in his Chemistry classroom. He collected the following data by recording the temperature that each of the substances melts at in order to help identify each of them. He needs help to determine the answers to the following questions:

- a. List the unknown substances from weakest to strongest in terms of strength of electrical forces between particles.

UNKNOWN SUBSTANCE	MELTING POINT(°C)
A	170
B	95
C	210

- b. List the pattern that exists between the boiling point and the strength of the electrical forces between particles.



Assessment Rubric* - Question 1				
	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Assessment Rubric* - Question 2				
	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				



Sample student responses				
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Insert additional Assessment Rubrics (if needed) here.

