Properties of Matter
Summative Assessment
7th Grade

1.a. Draw a diagram to show the difference in the amount of energy of the particles AND the spacing between the particles in a solid, a liquid, and a gas. You may use labels in your diagram.

This item measures the student's ability to describe the particle model and understand how it explains the differences of energy and space between particles in various phases of a substance.

Criteria for a complete Response:

1. Shows the correct relationship of spacing between particles and the phase of matter (e.g., least space–solid, some space–liquid, lots of space–gas).
2. Shows the correct relationship between energy in particles and phase (e.g., little energy–solid, some energy–liquid, lots of energy–gas). This may be shown with arrows, motion symbols, or by labeling the diagram.

Code	Response
	Correct Response
20	Meets criteria above.
29	Any other completely correct response.
	Partially Complete Response
10	Shows correct spatial relationships between particles but does not indicate movement of particles.
11	Meets criteria above, but particles are drawn in different sizes (shows particles "expanding" not necessarily space "expanding").
19	Any other partially correct response.
	Incorrect Response
70	Does not meet criteria above.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

1.b. Describe the difference in the amount of energy of the particles AND the spacing between the particles in a solid, a liquid, and a gas.

This item measures the student's ability to describe the particle model and understand how it explains the differences of energy and space between particles in various phases of a substance.

Criteria for a complete response:

1. Describes the correct relationship of spacing between particles and the phase of matter (e.g., least space–solid, some space–liquid, lots of space–gas).
2. Describes the correct relationship between energy in particles and phase (e.g., little energy–solid, some energy–liquid, lots of energy–gas).

Code	Response
	Correct Response
20	Meets criteria above.
21	Meets criteria above but student equates movement with energy.
22	Meets criteria above but student does not use the term particles.
29	Any other completely correct response.
	Partially Complete Response
10	Explains that solids, liquids, and gases each have comparatively increasing space between particles, but student does not include information about energy and/or movement.
11	Explains that solids, liquids and gases each have comparatively increasing energy and/or movement of particles, but student does not include information about spacing.
12	Meets criteria above except incorrectly describes the movement and/or energy of a solid's particles.
19	Any other partially correct response.
	Incorrect Response
70	Explanation does not incorporate space or energy but includes description of solid, liquid, and gas.
71	Equates particles with energy.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

2.	Examine the two materials given to you. Using the tools provided, decide which material you would use as a floatation device in fresh water. Show all calculations, and explain why your choice is the best.

This item measures the student's understanding of the concept of density and its relationship to floatation. It also measures their procedural knowledge of measurement and calculation of density.

****NOTE** See teacher instructions sheet for preparation.**

Criteria for a complete response:

1. Shows calculation of densities for materials provided. (If calculators are used, a number given for density will suffice.)
2. Explains that a density less than water (1 g/cm^3) is needed for floatation in water.
3. Makes explicit connection between the density of the object and its relationship with the density of water that allows floatation.

Code	Response
	Complete Response
20	Meets criteria above and chooses material with least density.
21	Meets criteria above but chooses material with greater density and explains that, if molded correctly, combination of material with air or other substance will create a density less than 1 g/cm^3 but provides some benefit over less dense material.
29	Any other completely correct response.
	Partially Correct Response
10	Explains that a density less than 1 g/cm^3 is necessary for a substance to float but does not calculate or miscalculates the densities of the materials.
11	Chooses material with greater density. Explanation states that molding or combining with another material can reduce overall density and allow floatation in water.
12	Units are not used or are incorrect.
13	Shows correct calculations and chooses material with least density but does not relate floatation to the density of water.
19	Any other partially correct response.
	Incorrect Response
70	Calculations and/or measurements are incorrect and student logic for floatation is flawed (object is lighter, object is flatter, object has less volume etc.)
71	Calculation of densities is shown, but no choice of material or explanation of floatation is provided.
76	Repeats stem of question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

3.	Peter Piper needs to use salt to pickle his peppers. Unfortunately, he has no salt. Bo Peep tells him not to worry since he lives less than 200 meters from the ocean. Explain what steps Peter must perform to obtain the salt he needs from the ocean water.

This item measures the student's understanding of solutions and their ability to be separated by physical means. It also measures the student's understanding of phase change and evaporation.

Criterion for a complete response:

1. Explains that to separate the salt water solution the water must be evaporated leaving the salt behind.

Code	Response
	Complete Response
20	Meets criterion above.
23	Meets above criterion but includes filtration.
29	Any other completely correct response.
	Partially Correct Response
10	Explanation of separation (water and salt) is correct, but student distills and collects the water instead of the salt.
11	Student fails to mention the process of evaporation (e.g., contents "dried up").
19	Any other partially correct response.
	Incorrect Response
70	States that the ocean water (untouched) can be used for the pickling.
72	Uses filtration with no mention of evaporation.
76	Repeats the stem of the question.
79	Any other incorrect response
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

4.	Carefully examine the mystery object provided. Using the data sheet of physical and characteristic properties for four different metals, determine what metal makes up your mystery object. Record your data and show density calculations.

This item measures the student's understanding that physical (e.g., color, mass, volume, shape) and characteristic (e.g., hardness, density, boiling point, melting point) properties are used to distinguish and separate one substance or material from another.

Criteria for a complete response:

1. Includes correctly computed data regarding the density of the mystery object.
2. States the identity of the mystery object.

Code	Response
	Complete Response
20	Meets above criteria.
29	Any other completely correct response.
	Partially Correct Response
10	Shows correct density calculations and/or hardness observations but incorrectly identifies the mystery object.
11	Meets the criteria above, but units are incorrect or missing.
19	Any other partially correct response.
	Incorrect Response
70	Shows density calculations that are incorrect.
71	Clearly identifies mystery object, but student does not provide appropriate evidence.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

5. Using the materials provided to you, determine how many grams of salt can be dissolved in 10 mL (10 grams) of water before saturation occurs.
   a. How will you know when saturation has occurred?

This item measures a student's understanding of saturation:

Criterion for a complete response:

1. Indicates that saturation occurs when a solute no longer will dissolve and can be seen settling in the solution.

Code	Response
	Complete Response
10	Meets above criterion.
19	Any other completely correct response.
	Incorrect Response
70	Does not indicate how saturation is observed with the salt.
71	Meets criterion but confuses vocabulary (e.g., reverses solute and solvent).
76	Repeats stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

5. Using the materials provided to you, determine how many grams of salt can be dissolved in 10 mL (10 grams) of water before saturation occurs. b. Describe your procedure for completing this task.

This item measures the student's ability to design, implement, and plan for interpretation of a scientific experiment.

Criteria for a complete response include the following:

1. Measurement procedures (must include measuring out 10 mL of water and measuring the mass of salt).
2. Instructions for interpretation of data, including when to stop adding the mix.

Code	Response
	Complete Response
20	Meets criteria above.
22	Meets criteria above and may include further procedures that are accurate and relevant to the experiment (such as multiple trials, heating to increase saturation point, etc.).
29	Any other completely correct response.
	Partially Correct Response
10	Does not include instructions for interpretation of data.
11	Does not include some procedures.
12	Design is vague and/or difficult to understand.
19	Any other partially correct response.
	Incorrect Response
70	Shows lack of understanding of determination of saturation point, and design is seriously flawed.
71	Does not show coherent structure of design or is VERY hard to understand.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible or impossible to interpret.
99	Blank.

5. Using the materials provided to you, determine how many grams of salt can be dissolved in 10 mL (10 grams) of water before saturation occurs.
   c. Use the area below to organize your data and show any calculations. Circle your final answer.

This item measures a student's ability to organize and interpret data.

Criterion for a complete response:

1. Shows data, calculations, and a reasonable amount of salt needed to reach saturation.

Note: Usual class data ranges from about 2 grams to about 7 grams. Generally the best results are around 4 grams +/- 1 gram.

Code	Response
	Complete Response
10	Meets criterion above.
11	Meets criterion above and organizes data in a table format.
19	Any other completely correct response.
	Incorrect Response
70	Meets criteria above, but units are missing or incorrect.
71	Expresses final answer only (no data to support answer).
72	Data and calculations are present, but no final answer is given.
73	Organizes data and calculations, but final answer is not reasonable.
76	Repeats stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

6. The following graph shows the solubility of a sweetener in water. Point S on the graph represents a saturation point (at 40°C) of the sweetener in water.
   a. Using information from the graph, how could you get more of the sweetener to dissolve in water? Use specific data from the graph to support your suggestion.

This item measures the student's ability to determine from the graph that an increase in the temperature of solution increases solubility.

Criteria for a complete response include the following:

1. Indicates that increasing the temperature of the solution will increase solubility.
2. Uses specific data from the graph to illustrate criterion number one. For example: "At 22 degrees there was 1 gram of solute, but at 36 degrees there were 2 grams, and at 44 degrees there were 3.5 grams. Therefore I concluded that …."

Code	Response
	Complete Response
20	Meets criteria above.
21	Meets criteria above and relates saturation to energy and the particle model.
29	Any other completely correct response.
	Partially Correct Response
10	Indicates that increasing the temperature of the solution will increase solubility, but data is not used to support the answer.
11	Indicates that increasing the temperature of the solution will increase solubility, but data is incomplete or incorrect.
12	Meets all criteria, but units are absent or incorrect.
19	Any other partially correct response.
	Incorrect Response
70	Does not indicate that increased temperature is necessary to add more sweetener to the solution, or indicates that a lower temperature is necessary to add more sweetener to the solution.
72	Suggests that the addition of water will increase solubility.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

6. The following graph shows the solubility of a sweetener in water. Point S on the graph represents a saturation point (at 40°C) of the sweetener in water. Using information from the graph, how could you get more sweetener to dissolve in water? Use specific data from the graph to support your suggestion.
   b. What is happening to the particles and energy in the solution to allow a greater amount of solute to be added?

This item measures the student's understanding that the particles in matter are in constant motion.

Criterion for a complete response includes the following:

1. Explains that heating the solution increases energy (causing particles to move faster and/or spread farther apart) thereby allowing more solute to become dissolved in the solvent.

Code	Response
	Complete Response
10	Meets criterion above.
19	Any other completely correct response.
	Incorrect Response
70	Indicates that increasing temperature allows more solute to dissolve, but does not explain the mechanism involved.
71	Discusses movement and/or spacing of particles but does not discuss energy.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

7.	A cube of ice with a mass of 18.6 grams is in a sealed container. The next day the ice is melted. What is the mass of the water in the container? Explain why.

This item measures student's understanding of the conservation of matter.

Criterion for a complete response includes the following:

1. Indicates that the mass of the water is the same because no matter is able to enter or leave the system.

Code	Response
	Complete Response
10	Meets criterion above.
11	Meets criterion above and specifically indicates conservation of matter/mass.
19	Any other completely correct response.
	Incorrect Response
70	Indicates the mass stays the same without explanation.
71	Indicates the mass of water increased.
72	Indicates the mass of water decreased.
76	Repeats the stem of the question.
79	Any other incorrect response.
	Non-Response
90	Crosses out, erases, illegible, or impossible to interpret.
99	Blank.

