Properties of Substances CWA

The Properties of Substances CWA can be used as the alchemy unit assessment. The overarching question is: Which of the three substances Keisha should choose to add to the beaker of distilled water to light up the light bulb? The following handouts are included:

- Prompt with scaffolding for response
- Content specific rubric
- Sample student response

Students should be provided the prompt and the graphic organizer. In addition to providing a specific CERR rubric that corresponds to this topic, a sample student response is included.

Properties of Substances

Unit/Chapter: *Investigation V- Lesson I Alchemy: Properties of Substances*
Title: Classifying Substances Based on Physical Properties

Keisha entered into a science competition and was selected to compete for a one million dollar prize. For her final question, Keisha must select one substance that will make the light bulb light up (see Figure 1). The three substances she must select from are in the table below (see Table 1).

Figure 1: Illustration of investigation set-up

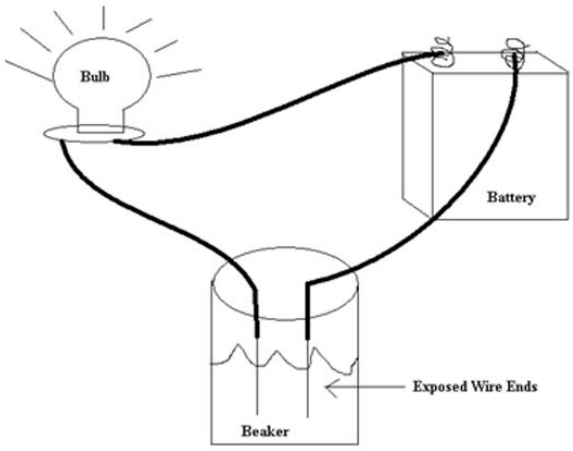

Table 1: Data on substances that can be added to the beaker of distilled water in Figure 1.

Substance	Conducts electricity as solid	Soluble in distilled water	Conducts electricity when dissolved in distilled water
A	Yes	No	Does not apply
B	No	Yes	No
C	No	Yes	Yes

Question: Which substance in Table 1 will light up the light bulb in Figure 1?

Write a paragraph that clearly makes a ***claim*** about which of the three substances Keisha should choose to add to the beaker of distilled water to light up the light bulb. Use ***evidence*** and ***reasoning*** to support your claim for the substance you selected. Write a ***rebuttal*** that explains why (an)other substance(s) will not light up the light bulb.

Use this chart for your outline / pre-writing (describing your claim, evidence, and reasoning) and write your scientific explanation in the space below.

Claim: Write a statement that answers the question.	
Evidence: Provide at least 2 pieces of scientific data that support the claim. It needs to be appropriate and sufficient. Evidence should be from your observations or measurements.	
Reasoning: Provide an explanation of what your evidence means, how it supports the claim using scientific principles. Each piece of evidence may have a different justification for why it supports the claim.	
Rebuttal: Critique an alternative claim using evidence and reasoning.	

Properties of Substances: Rubric

	Exemplary	Proficient	Needs Improvement	Critical Area
Claim:	□ Accurately states that Substance C will light up the light bulb			□ Does not make a claim, **OR** □ Makes a completely inaccurate claim (does not include Substance C)
Evidence:	□ Identifies that Substance C ○ Dissolves in water **AND** ○ Conducts electricity when dissolved in water	□ Identifies that Substance C ○ Dissolves in water	□ Summarizes the data for all of the substances (data dump): ○ Identifies that substance A conducts electricity as a solid, but does not dissolve in water ○ Identifies that substance B dissolves in water, but does not conduct electricity ○ Identifies that substance C dissolves in water and conducts electricity when dissolved	□ Does not provide evidence, **OR** □ Only provides inappropriate evidence (evidence that does not support claim)
Reasoning:	□ Correctly and clearly connects the evidence to the claim (i.e., Identifies 6 or 7 of the connections below) ○ Substance C is an Ionic Compound ○ Ionic compounds are composed of positive (or cations or metal) and negative (or anions ions or nonmetal) ions ○ Ions separate in water ○ Negative ions travel to the positive electrode (exposed wire end), and transfer an electron ○ Positive ions travel to the negative electrode (opposite exposed wire end) and gain electrons	□ Correctly and adequately connects the evidence to the claim (i.e., Identifies 3 to 5 of the connections below) ○ Substance C is an Ionic Compound ○ Ionic compounds are composed of positive (or cations or metal) and negative (or anions ions or nonmetal) ions ○ Ions separate in water ○ Negative ions travel to the positive electrode (exposed wire end), and transfer an electron ○ Positive ions travel to the negative electrode (opposite exposed wire end) and gain electrons	□ Applies inappropriate scientific concepts □ Correctly connects the evidence to the claim, but leaves out important details (i.e., Identifies less than 3 of the connections below) ○ Substance C is an Ionic Compound ○ Ionic compounds are composed of positive (or cations or metal) and negative (or anions ions or nonmetal) ions ○ Ions separate in water ○ Negative ions travel to the positive electrode (exposed wire end), and transfer an electron ○ Positive ions travel to the	□ Does not provide reasoning, **OR** □ Only applies inappropriate scientific concepts, **OR** □ Restates the evidence

	Exemplary	Proficient	Needs Improvement	Critical Area
	○ The overall effect on the circuit of the simultaneous donation and acceptance of electrons is the movement of electrons between the anode and the cathode ○ The transfer of electrons means that electricity is being conducted and the light bulb will light up	○ The overall effect on the circuit of the simultaneous donation and acceptance of electrons is the movement of electrons between the anode and the cathode, ○ The transfer of electrons means that electricity is being conducted and the light bulb will light up	negative electrode (opposite exposed wire end) and gain electrons ○ The overall effect on the circuit of the simultaneous donation and acceptance of electrons is the movement of electrons between the anode and the cathode ○ The transfer of electrons means that electricity is being conducted and the light bulb will light up	
Rebuttal	□ Provides 2 rebuttals that use evidence and reasoning to critique an alternative claim **Substance A:** ○ Identifies Substance A can cannot be dissolved in water (evidence) ○ Identifies that a substance must dissolve in water in order to separate into its ions (reasoning) ○ Identify that separating into ions when dissolved in water is necessary for a substance to conduct electricity (reasoning) ○ Identify that Substance A will not light up the light bulb because it does not have ions to transfer electrons (reasoning) **Substance B:** ○ Identifies substance B cannot conduct electricity even though it dissolves in water (evidence)	□ Provides 1 rebuttal that uses evidence and reasoning to critique an alternative claim, **OR** □ Provides incomplete logic within 2 rebuttals **Substance A:** ○ Identifies Substance A can cannot be dissolved in water (evidence) ○ Identifies that a substance must dissolve in water in order to separate into its ions (reasoning) ○ Identify that separating into ions when dissolved in water is necessary for a substance to conduct electricity (reasoning) ○ Identify that Substance A will not light up the light bulb because it does not have ions to transfer electrons (reasoning) **Substance B:** ○ Identifies substance B cannot conduct electricity even	□ Provides incomplete logic within 1 rebuttal **Substance A:** ○ Identifies Substance A can cannot be dissolved in water (evidence) ○ Identifies that a substance must dissolve in water in order to separate into its ions (reasoning) ○ Identify that separating into ions when dissolved in water is necessary for a substance to conduct electricity (reasoning) ○ Identify that Substance A will not light up the light bulb because it does not have ions to transfer electrons (reasoning) **Substance B:** ○ Identifies substance B cannot conduct electricity even though it dissolves in water (evidence) ○ Identifies that this substance	□ Does not provide a rebuttal, **OR** □ Only applies an inappropriate rebuttal

	Exemplary	Proficient	Needs Improvement	Critical Area
	○ Identifies that this substance does not consist of ions because it does not conduct electricity when dissolved in water (reasoning) ○ Identify that it is necessary for a substance to dissolve in water in order to separate into the cations and anions (reasoning) ○ Identify that separating into ions is necessary in order to transfer electrons and light up the light bulb (reasoning) ○ Identify that Substance B will not light up the light bulb because it does not have ions to transfer electrons (reasoning)	though it dissolves in water (evidence) ○ Identifies that this substance does not consist of ions because it does not conduct electricity when dissolved in water (reasoning) ○ Identify that it is necessary for a substance to dissolve in water in order to separate into the cations and anions (reasoning) ○ Identify that separating into ions is necessary in order to transfer electrons and light up the light bulb (reasoning) ○ Identify that Substance B will not light up the light bulb because it does not have ions to transfer electrons (reasoning)	does not consist of ions because it does not conduct electricity when dissolved in water (reasoning) ○ Identify that it is necessary for a substance to dissolve in water in order to separate into the cations and anions (reasoning) ○ Identify that separating into ions is necessary in order to transfer electrons and light up the light bulb (reasoning) □ Identify that Substance B will not light up the light bulb because it does not have ions to transfer electrons (reasoning)	
Writing:	□ Writing contains no grammatical or spelling errors □ Writing is clear, concise, and persuasive	□ Writing contains very few grammatical or spelling errors □ Writing is clear, mostly concise, and well developed		□ Writing is difficult to follow, with many grammatical errors and no clear structure □ Writing is either too wordy or too incomplete

Properties of Substances: Sample Response

Question: Which substance in Table 1 will light up the light bulb in Figure 1?

Claim: If Substance C were added to the beaker of distilled water, it would light up the light bulb.

Evidence: Substance C dissolves in water and conducts electricity when dissolved in water.

Reasoning: Since ionic compounds dissolve in water and conduct electricity, substance C is an ionic compound. When an ionic compound dissolves in water it creates negative ions (anions) and positive ions (cations). Negative ions travel to the positive electrode (exposed wire end), and transfer an electron. The positive ions travel to the negative electrode (opposite exposed wire end) and gain electrons. Because both processes happen simultaneously, the overall effect on the circuit is the movement of electrons between the anode and the cathode, which means that electricity is being conducted and the light bulb will light up.

Rebuttal 1: Someone who believes Substance A can light up the light bulb is wrong because it cannot be dissolved in water. A substance must dissolve in water in order to separate into its ions, which is necessary for it to conduct electricity and light up the light bulb. Because Substance A can conduct electricity as a solid and cannot dissolve in water it is a metal.

Rebuttal 2: Someone who believes Substance B can light up the light bulb is wrong because, it does not conduct electricity even though it dissolves in water. While it is necessary for a substance to dissolve in water in order to separate into the cations and anions, which is necessary in order to transfer electrons and light up the light bulb, this substance does not consist of ions because it does not conduct electricity when dissolved in water. It, therefore, will not light up the light bulb because it does not have ions to transfer electrons. Substance B is a covalent compound because it does not conduct electricity as a solid or when dissolved in water, but does dissolve in water.