The Mendeleev Lab of 1869

Adapted from Holt Chemistry: Visualizing Matter, 2000

**Problem**:

Use your knowledge of the periodic table to determine the identity of each of the nine unknown elements in this activity.

 The unknown elements are from the following groups in the periodic table. Each group listed below contains at least one unknown.

1 2 11 13 14 17 18

 None of the known elements serve as one of the nine unknown elements.

 No radioactive elements are used during this experiment. The relevant radioactive elements include Fr, Ra, At, and Rn.

 You may not use your textbook or other reference materials. You have been provided with enough information to determine each of the unknown elements.

**Procedure**:

1. Arrange the cards of the known elements in a representation of the periodic table.

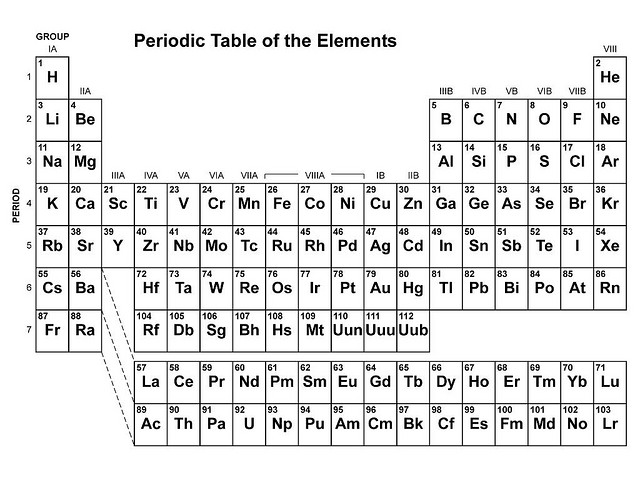
2. Inspect the properties of the known elements.

3. Analyze the properties of the unknowns to see where their properties would best fit the trends of the elements of each group.

4. In your data table, assign the proper element name to each of the unknowns and justify your reasoning.

**Identifying the Unknowns**:

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| **Unknown** | **Justification** |
| Unknown #1 |  |
| Unknown #2 |  |
| Unknown #3 |  |
| Unknown #4 |  |
| Unknown #5 |  |
| Unknown #6 |  |
| Unknown #7 |  |
| Unknown #8 |  |
| Unknown #9 |  |



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| **Li**  Physical State solid  Density 0.534 g/cm3  Hardness soft, claylike  Conductivity good  Solubility (H2O) reacts with water  Melting Point 180oC  Color silver | **Cl2**  Physical State gas  Density 0.00321 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) slight  Melting Point -101oC  Color greenish yellow |

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| **Ag**  Physical State solid  Density 10.50 g/cm3  Hardness somewhat soft  Conductivity excellent  Solubility (H2O) none  Melting Point 961oC  Color silver | **He**  Physical State gas  Density 0.00018 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) none  Melting Point -272oC  Color colorless |

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| **Cu**  Physical State solid  Density 8.96 g/cm3  Hardness somewhat soft  Conductivity excellent  Solubility (H2O) none  Melting Point 1803oC  Color | **Na**  Physical State solid  Density 0.971 g/cm3  Hardness soft, claylike  Conductivity good  Solubility (H2O) reacts rapidly  Melting Point 98oC  Color silver |

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| **C**  Physical State solid  Density 2.10 g/cm3  Hardness soft, yet brittle  Conductivity good  Solubility (H2O) negligible  Melting Point 3550oC  Color black | **Ca**  Physical State solid  Density 1.57 g/cm3  Hardness medium  Conductivity good  Solubility (H2O) reacts  Melting Point 845oC  Color silvery white |

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| **Unknown #8**  Physical State solid  Density 1.74 g/cm3  Hardness medium  Conductivity good  Solubility (H2O) reacts slowly  Melting Point 651oC  Color silvery white | **Unknown #9**  Physical State solid  Density 11.85 g/cm3  Hardness very soft  Conductivity medium  Solubility (H2O) none  Melting Point 303oC  Color silvery white |

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| **Be**  Physical State solid  Density 1.85 g/cm3  Hardness brittle  Conductivity excellent  Solubility (H2O) none  Melting Point 1287oC  Color gray | **Sn**  Physical State solid  Density 7.31 g/cm3  Hardness somewhat soft  Conductivity good  Solubility (H2O) none  Melting Point 232oC  Color silver |

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| **Ne**  Physical State gas  Density 0.00090 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) none  Melting Point -249oC  Color colorless | **Br2**  Physical State gas  Density 3.12 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) negligible  Melting Point -7.2oC  Color reddish brown |

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| **K**  Physical State solid  Density 0.86 g/cm3  Hardness soft, claylike  Conductivity good  Solubility (H2O) reacts rapidly  Melting Point 63oC  Color silver | **Ba**  Physical State solid  Density 3.6 g/cm3  Hardness soft  Conductivity good  Solubility (H2O) reacts strongly  Melting Point 710oC  Color silvery white |

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| **Xe**  Physical State gas  Density 0.00585 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) none  Melting Point -119.9oC  Color colorless | **In**  Physical State solid  Density 7.31 g/cm3  Hardness very soft  Conductivity medium  Solubility (H2O) none  Melting Point 157oC  Color silvery white |

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| **I2**  Physical State solid  Density 4.93 g/cm3  Hardness soft  Conductivity very poor  Solubility (H2O) negligible  Melting Point 113.5oC  Color bluish-black | **Pb**  Physical State solid  Density 11.35 g/cm3  Hardness somewhat soft  Conductivity poor  Solubility (H2O) none  Melting Point 327.5oC  Color gray |
| **Ar**  Physical State gas  Density 0.00178 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) none  Melting Point -189.2oC  Color colorless | **Ga**  Physical State solid  Density 5.904 g/cm3  Hardness soft  Conductivity medium  Solubility (H2O) none  Melting Point 30oC  Color silvery |

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| **Cs**  Physical State solid  Density 1.87 g/cm3  Hardness soft  Conductivity good  Solubility (H2O) reacts violently  Melting Point 29oC  Color silvery white | **Unknown #1**  Physical State solid  Density 2.33 g/cm3  Hardness brittle  Conductivity intermediate  Solubility (H2O) none  Melting Point 1410oC  Color gray |

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| **Unknown #2**  Physical State gas  Density 0.00170 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) slight  Melting Point -219.6oC  Color pale yellow | **Unknown #3**  Physical State solid  Density 1.53 g/cm3  Hardness soft  Conductivity good  Solubility (H2O) reacts violently  Melting Point 39oC  Color silvery white |

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| **Unknown #4**  Physical State gas  Density 0.00374 g/cm3  Hardness none  Conductivity very poor  Solubility (H2O) none  Melting Point -156.6oC  Color colorless | **Unknown #5**  Physical State solid  Density 19.3 g/cm3  Hardness soft  Conductivity excellent  Solubility (H2O) none  Melting Point 1064oC  Color gold |

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| **Unknown #6**  Physical State solid  Density 2.54 g/cm3  Hardness somewhat soft  Conductivity good  Solubility (H2O) reacts rapidly  Melting Point 769oC  Color silvery white | **Unknown #7**  Physical State solid  Density 5.32 g/cm3  Hardness fairly brittle  Conductivity fair to poor  Solubility (H2O) none  Melting Point 937oC  Color gray |