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 solidDensity 0.534 g/cm3Hardness soft, claylikeConductivity goodSolubility (H2O) reacts with waterMelting Point 180oCColor silver | **Cl2**Physical State gasDensity 0.00321 g/cm3Hardness noneConductivity very poorSolubility (H2O) slightMelting Point -101oCColor greenish yellow  |

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| **Ag**Physical State solidDensity 10.50 g/cm3Hardness somewhat softConductivity excellentSolubility (H2O) noneMelting Point 961oCColor silver | **He**Physical State gasDensity 0.00018 g/cm3Hardness noneConductivity very poorSolubility (H2O) noneMelting Point -272oCColor colorless |

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| **Cu**Physical State solidDensity 8.96 g/cm3Hardness somewhat softConductivity excellentSolubility (H2O) noneMelting Point 1803oCColor  | **Na**Physical State solidDensity 0.971 g/cm3Hardness soft, claylikeConductivity goodSolubility (H2O) reacts rapidlyMelting Point 98oCColor silver |

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| **C**Physical State solidDensity 2.10 g/cm3Hardness soft, yet brittleConductivity goodSolubility (H2O) negligibleMelting Point 3550oCColor black | **Ca**Physical State solidDensity 1.57 g/cm3Hardness mediumConductivity goodSolubility (H2O) reactsMelting Point 845oCColor silvery white |

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| **Unknown #8**Physical State solidDensity 1.74 g/cm3Hardness mediumConductivity goodSolubility (H2O) reacts slowlyMelting Point 651oCColor silvery white | **Unknown #9**Physical State solidDensity 11.85 g/cm3Hardness very softConductivity mediumSolubility (H2O) noneMelting Point 303oCColor silvery white |

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| **Be**Physical State solidDensity 1.85 g/cm3Hardness brittleConductivity excellentSolubility (H2O) noneMelting Point 1287oCColor gray | **Sn**Physical State solidDensity 7.31 g/cm3Hardness somewhat softConductivity goodSolubility (H2O) noneMelting Point 232oCColor silver |

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| **Ne**Physical State gasDensity 0.00090 g/cm3Hardness noneConductivity very poorSolubility (H2O) noneMelting Point -249oCColor colorless | **Br2**Physical State gasDensity 3.12 g/cm3Hardness noneConductivity very poorSolubility (H2O) negligibleMelting Point -7.2oCColor reddish brown |

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| **K**Physical State solidDensity 0.86 g/cm3Hardness soft, claylikeConductivity goodSolubility (H2O) reacts rapidlyMelting Point 63oCColor silver | **Ba**Physical State solidDensity 3.6 g/cm3Hardness softConductivity goodSolubility (H2O) reacts stronglyMelting Point 710oCColor silvery white |

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| **Xe**Physical State gasDensity 0.00585 g/cm3Hardness noneConductivity very poorSolubility (H2O) noneMelting Point -119.9oCColor colorless | **In**Physical State solidDensity 7.31 g/cm3Hardness very softConductivity mediumSolubility (H2O) noneMelting Point 157oCColor silvery white |

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| **I2**Physical State solidDensity 4.93 g/cm3Hardness softConductivity very poorSolubility (H2O) negligibleMelting Point 113.5oCColor bluish-black | **Pb**Physical State solidDensity 11.35 g/cm3Hardness somewhat softConductivity poorSolubility (H2O) noneMelting Point 327.5oCColor gray |
| **Ar**Physical State gasDensity 0.00178 g/cm3Hardness noneConductivity very poorSolubility (H2O) noneMelting Point -189.2oCColor colorless | **Ga**Physical State solidDensity 5.904 g/cm3Hardness softConductivity mediumSolubility (H2O) noneMelting Point 30oCColor silvery  |

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| **Cs**Physical State solidDensity 1.87 g/cm3Hardness softConductivity goodSolubility (H2O) reacts violentlyMelting Point 29oCColor silvery white | **Unknown #1**Physical State solidDensity 2.33 g/cm3Hardness brittleConductivity intermediateSolubility (H2O) noneMelting Point 1410oCColor gray |

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| **Unknown #2**Physical State gasDensity 0.00170 g/cm3Hardness noneConductivity very poorSolubility (H2O) slightMelting Point -219.6oCColor pale yellow | **Unknown #3**Physical State solidDensity 1.53 g/cm3Hardness softConductivity goodSolubility (H2O) reacts violentlyMelting Point 39oCColor silvery white |

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| **Unknown #4**Physical State gasDensity 0.00374 g/cm3Hardness noneConductivity very poorSolubility (H2O) noneMelting Point -156.6oCColor colorless | **Unknown #5**Physical State solidDensity 19.3 g/cm3Hardness softConductivity excellentSolubility (H2O) noneMelting Point 1064oCColor gold |

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| **Unknown #6**Physical State solidDensity 2.54 g/cm3Hardness somewhat softConductivity goodSolubility (H2O) reacts rapidlyMelting Point 769oCColor silvery white | **Unknown #7**Physical State solidDensity 5.32 g/cm3Hardness fairly brittleConductivity fair to poorSolubility (H2O) noneMelting Point 937oCColor gray |