

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

Notations:

- 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. Inspect the properties of the known elements.
2. **WITHOUT LOOKING AT A PERIODIC TABLE**, arrange the cards of the known elements in a crude representation of the periodic table.
3. Once the known elements are in place, inspect 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 and symbol to each of the unknowns.

Some Hints:

- A. Remember that a group (a column on the periodic table) are elements that have some things in common. (like color, reactivity with water and conductivity).
- B. There should also be some sort of trend in density, boiling point, atomic mass etc. as you go down a family.
- C. Remember that the Mendeleev arranged the PT (roughly) by increasing atomic mass.
- D. Arrange the gas groups first (they are the easiest).

Conclusion:

1. What is the identity of each of the unknown elements (name and symbol)?
 - A. Unknown #1: _____
 - B. Unknown #2: _____
 - C. Unknown #3: _____
 - D. Unknown #4: _____
 - E. Unknown #5: _____
 - F. Unknown #6: _____
 - G. Unknown #7: _____
 - H. Unknown #8: _____
 - I. Unknown #9: _____

 2. In general, what happens to atomic mass as you:
 - A. Go down a family? _____
 - B. What accounts for this trend? _____
 - C. Go across a period? _____
 - D. What accounts for this trend? _____

 3. Examine the melting points as you go down a family and across a period. Is there a trend? If there is a trend, what is it?
 - A. down a family: _____
 - B. across a period: _____

 4. Examine the densities as you go down a family and across a period. Is there a trend? If there is a trend, what is it?
 - A. down a family: _____
 - B. across a period: _____

 5. Examine the conductivity of the elements as you go across the periodic table. What is the general trend for conductivity as you go across the periodic table? _____
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6. Examine physical state as you go across the periodic table. What is the general trend in physical state as you go across the periodic table? _____

7. Examine each family. What characteristics (list at least two) that the elements in each family share:
- A. Family 1: _____
 - B. Family 2: _____
 - C. Family 11: _____
 - D. Family 13: _____
 - E. Family 14: _____
 - F. Family 17: _____
 - G. Family 18: _____
8. Helium is an element that would be directly above Neon on the periodic table. Based on the trends, predict the following for helium:
- A. Approximate atomic mass: _____
 - B. Physical state: _____
 - C. Approximate density: _____
 - D. Approximate melting point: _____
 - E. Hardness: _____
 - F. Conductivity: _____
 - G. Solubility in water: _____
 - H. Color: _____

Li	atomic mass: 7	Cl	atomic mass: 35
Physical State	solid	Physical State	gas
Density	0.534 g/cm ³	Density	0.00321 g/cm ³
Hardness	soft, claylike	Hardness	none
Conductivity	good	Conductivity	very poor
Solubility (H ₂ O)	reacts with water	Solubility (H ₂ O)	slight
Melting Point	180°C	Melting Point	-101°C
Color	silver	Color	greenish yellow
Ag	atomic mass: 108	Unknown #7	
Physical State	solid	Physical State	solid
Density	10.50 g/cm ³	Density	5.32 g/cm ³
Hardness	somewhat soft	Hardness	fairly brittle
Conductivity	excellent	Conductivity	fair to poor
Solubility (H ₂ O)	none	Solubility (H ₂ O)	none
Melting Point	961°C	Melting Point	937°C
Color	silver	Color	gray
Cu	atomic mass: 64	Na	atomic mass: 23
Physical State	solid	Physical State	solid
Density	8.96 g/cm ³	Density	0.971 g/cm ³
Hardness	somewhat soft	Hardness	soft, claylike
Conductivity	excellent	Conductivity	good
Solubility (H ₂ O)	none	Solubility (H ₂ O)	reacts rapidly
Melting Point	1803°C	Melting Point	98°C
Color	red-brown	Color	silver
C	atomic mass: 12	Ca	atomic mass: 40
Physical State	solid	Physical State	solid
Density	2.10 g/cm ³	Density	1.57 g/cm ³
Hardness	soft, yet brittle	Hardness	medium
Conductivity	good	Conductivity	good
Solubility (H ₂ O)	negligible	Solubility (H ₂ O)	reacts
Melting Point	3550°C	Melting Point	845°C
Color	black	Color	silvery white
Unknown #8		Unknown #9	
Physical State	solid	Physical State	solid
Density	1.74 g/cm ³	Density	11.85 g/cm ³
Hardness	medium	Hardness	very soft
Conductivity	good	Conductivity	medium
Solubility (H ₂ O)	reacts slowly	Solubility (H ₂ O)	none
Melting Point	651°C	Melting Point	303°C
Color	silvery white	Color	silvery white

Be	atomic mass: 9	Sn	atomic mass: 119
Physical State	solid	Physical State	solid
Density	1.85 g/cm ³	Density	7.31 g/cm ³
Hardness	brittle	Hardness	somewhat soft
Conductivity	excellent	Conductivity	good
Solubility (H ₂ O)	none	Solubility (H ₂ O)	none
Melting Point	1287°C	Melting Point	232°C
Color	gray	Color	silver
Ne	atomic mass: 20	Br	atomic mass: 80
Physical State	gas	Physical State	gas
Density	0.00090 g/cm ³	Density	3.12 g/cm ³
Hardness	none	Hardness	none
Conductivity	very poor	Conductivity	very poor
Solubility (H ₂ O)	none	Solubility (H ₂ O)	negligible
Melting Point	-249°C	Melting Point	-7.2°C
Color	colorless	Color	reddish brown
K	atomic mass: 39	Ba	atomic mass: 137
Physical State	solid	Physical State	solid
Density	0.86 g/cm ³	Density	3.6 g/cm ³
Hardness	soft, claylike	Hardness	soft
Conductivity	good	Conductivity	good
Solubility (H ₂ O)	reacts rapidly	Solubility (H ₂ O)	reacts strongly
Melting Point	63°C	Melting Point	710°C
Color	silver	Color	silvery white
Xe	atomic mass: 131	In	atomic mass: 114
Physical State	gas	Physical State	solid
Density	0.00585 g/cm ³	Density	7.31 g/cm ³
Hardness	none	Hardness	very soft
Conductivity	very poor	Conductivity	medium
Solubility (H ₂ O)	none	Solubility (H ₂ O)	none
Melting Point	-119.9°C	Melting Point	157°C
Color	colorless	Color	silvery white
I	atomic mass: 127	Pb	atomic mass: 207
Physical State	solid	Physical State	solid
Density	4.93 g/cm ³	Density	11.35 g/cm ³
Hardness	soft	Hardness	somewhat soft
Conductivity	very poor	Conductivity	poor
Solubility (H ₂ O)	negligible	Solubility (H ₂ O)	none
Melting Point	113.5°C	Melting Point	327.5°C
Color	bluish-black	Color	gray

Ar	atomic mass: 40	Ga	atomic mass: 70
Physical State	gas	Physical State	solid
Density	0.00178 g/cm ³	Density	5.904 g/cm ³
Hardness	none	Hardness	soft
Conductivity	very poor	Conductivity	medium
Solubility (H ₂ O)	none	Solubility (H ₂ O)	none
Melting Point	-189.2°C	Melting Point	30°C
Color	colorless	Color	silvery
Cs	atomic mass: 133	Unknown #1	
Physical State	solid	Physical State	solid
Density	1.87 g/cm ³	Density	2.33 g/cm ³
Hardness	soft	Hardness	brittle
Conductivity	good	Conductivity	intermediate
Solubility (H ₂ O)	reacts violently	Solubility (H ₂ O)	none
Melting Point	29°C	Melting Point	1410°C
Color	silvery white	Color	gray
Unknown #2		Unknown #3	
Physical State	gas	Physical State	solid
Density	0.00170 g/cm ³	Density	1.53 g/cm ³
Hardness	none	Hardness	soft
Conductivity	very poor	Conductivity	good
Solubility (H ₂ O)	slight	Solubility (H ₂ O)	reacts violently
Melting Point	-219.6°C	Melting Point	39°C
Color	pale yellow	Color	silvery white
Unknown #4		Unknown #5	
Physical State	gas	Physical State	solid
Density	0.00374 g/cm ³	Density	19.3 g/cm ³
Hardness	none	Hardness	soft
Conductivity	very poor	Conductivity	excellent
Solubility (H ₂ O)	none	Solubility (H ₂ O)	none
Melting Point	-156.6°C	Melting Point	1064°C
Color	colorless	Color	gold
Unknown #6			
Physical State	solid		
Density	2.54 g/cm ³		
Hardness	somewhat soft		
Conductivity	good		
Solubility (H ₂ O)	reacts rapidly		
Melting Point	769°C		
Color	silvery white		