

The Mendeleev Lab of 1869

Problem:

Use your knowledge of the periodic table to identify 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 21 elements named on the cards serve as one of the nine unknown elements. No radioactive elements are used during this experiment. 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. 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 to each of the unknowns. Record the symbol for each of the "unknowns" in your data table.

Data Table:

Be sure to construct your data table with enough space for all your unknown elements.

Conclusion:

Summarize your group's reasoning for choosing each unknown. Explain in a few sentences exactly how you predicted the identity of the unknowns.

Li Li			
- -	Cl ₂		
Physical State solid Physical	State gas		
Physical State solid Physical Density 0.534 g/cm ³ Density	0.00321 g/cm ³		
Hardness soft, claylike Hardnes			
Conductivity good Conduct			
Solubility (H ₂ O) reacts with water Solubility			
Melting Point 180°C Melting			
Color silver Color	greenish yellow		
S			
Ag I	He		
Physical State solid Physical	State gas		
Density 10.50 g/cm ³ Density	0.00018 g/cm ³		
Hardness somewhat soft Hardnes	s none		
Conductivity excellent Conduct	tivity very poor		
Solubility (H₂O) none Solubilit	y (H₂O) none		
Melting Point 961°C Melting	Point -272°C		
Color silver Color	colorless		
Cu	Na		
<u> </u>			
Physical State solid Physical			
Density 8.96 g/cm ³ Density	0.971 g/cm ³		
Hardness somewhat soft Hardnes			
Conductivity excellent Conduct			
Solubility (H ₂ O) none Solubilit			
Melting Point 1803°C Melting			
Color silver Color	silver		
C	Ca		
Physical State solid Physical	State solid		
Density 2.10 g/cm ³ Density	1.57 g/cm ³		
Hardness soft, yet brittle Hardnes	s medium		
Conductivity good Conduct	tivity good		
Solubility (H₂O) neglibible Solubilit	y (H₂O) reacts		
	0.4500		
Melting Point 3550°C Melting			
Melting Point 3550°C Melting Color black Color	silvery white		
Color black Color			
Color black Color	silvery white		
Unknown #8 Ur	silvery white		
Color black Color Unknown #8 Physical State solid Physical	silvery white nknown #9 State solid 11.85 g/cm³		
Color black Color Unknown #8 Physical State solid Physical Density 1.74 g/cm³ Density	silvery white nknown #9 State solid 11.85 g/cm³ s very soft		
Color black Color Unknown #8 Physical State solid Physical Density 1.74 g/cm³ Density Hardness medium Hardnes	silvery white nknown #9 State solid 11.85 g/cm³ ss very soft tivity medium		
Color black Color Unknown #8 Physical State solid Physical Density 1.74 g/cm³ Density Hardness medium Hardness Conductivity good Conduct	silvery white NKNOWN #9 State solid 11.85 g/cm³ very soft tivity medium (y (H ₂ O) none		
ColorblackColorUnknown #8UrPhysical StatesolidPhysicalDensity1.74 g/cm³DensityHardnessmediumHardnessConductivitygoodConductSolubility (H2O)reacts slowlySolubility	silvery white NKNOWN #9 State solid 11.85 g/cm³ very soft tivity medium (y (H ₂ O) none		
ColorblackColorUnknown #8UrPhysical StatesolidPhysicalDensity1.74 g/cm³DensityHardnessmediumHardnessConductivitygoodConductSolubility (H2O)reacts slowlySolubilityMelting Point651°CMelting	silvery white NKNOWN #9 State solid 11.85 g/cm³ Is very soft wedium Ity (H ₂ O) none Point 303°C		
ColorblackColorUnknown #8UrPhysical StatesolidPhysicalDensity1.74 g/cm³DensityHardnessmediumHardnessConductivitygoodConductSolubility (H2O)reacts slowlySolubilityMelting Point651°CMeltingColorsilvery whiteColor	silvery white nknown #9 State solid 11.85 g/cm³ very soft tivity medium (y (H ₂ O) none Point 303°C silvery white		
Color black Color Unknown #8 Physical State solid Physical Density 1.74 g/cm³ Density Hardness medium Hardness Conductivity good Conduct Solubility (H ₂ O) reacts slowly Melting Point 651°C Melting Color silvery white Color Be Physical State solid Physical	silvery white nknown #9 State solid 11.85 g/cm³ very soft tivity medium ty (H ₂ O) none Point 303°C silvery white Sn State solid		
Color black Color Unknown #8 Physical State solid Physical Density 1.74 g/cm³ Density Hardness medium Hardness Conductivity good Conduct Solubility (H ₂ O) reacts slowly Melting Point 651°C Melting Color silvery white Color Be Physical State solid Physical	silvery white nknown #9 State solid 11.85 g/cm³ very soft tivity medium by (H ₂ O) none Point 303°C silvery white Sn State solid 7.31 g/cm³		
ColorblackColorUnknown #8UrPhysical StatesolidPhysicalDensity1.74 g/cm³DensityHardnessmediumHardnessConductivitygoodConductSolubility (H2O)reacts slowlySolubilityMelting Point651°CMeltingColorsilvery whiteColorBePhysical StatesolidPhysicalDensity1.85 g/cm³Density	silvery white nknown #9 State solid 11.85 g/cm³ very soft tivity medium ry (H ₂ O) none Point 303°C silvery white Sn State solid 7.31 g/cm³ somewhat soft		
Color black Color Unknown #8 Ur Physical State solid Physical Density 1.74 g/cm³ Density Hardness medium Hardness Conductivity good Conduct Solubility (H2O) reacts slowly Solubility Melting Point 651°C Melting Color silvery white Color Be Physical State solid Physical Density 1.85 g/cm³ Density Hardness brittle Hardness Conductivity excellent Conduct	silvery white nknown #9 State solid 11.85 g/cm³ ss very soft tivity medium sy (H ₂ O) none Point 303°C silvery white Sn State solid 7.31 g/cm³ ss somewhat soft tivity good		
Color black Color Unknown #8 Ur Physical State solid Physical Density 1.74 g/cm³ Density Hardness medium Hardness Conductivity good Conduct Solubility (H2O) reacts slowly Solubility Melting Point 651°C Melting Color silvery white Color Be Physical Physical Density 1.85 g/cm³ Density Hardness brittle Hardness Conductivity excellent Conduct	silvery white nknown #9 State solid 11.85 g/cm³ very soft tivity medium y (H ₂ O) none Point 303°C silvery white Sn State solid 7.31 g/cm³ somewhat soft tivity good y (H ₂ O) none		

Ne Physical State		Br₂	
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 -7.2°C
Melting Point Color	-249°C colorless	Melting Point Color	reddish brown
	_		
K		Ba	
Physical State	solid	Physical State	solid
Density	0.86 g/cm³	Density	3.6 g/cm ³
Hardness	soft, claylike	Hardness	soft
Conductivity	good	Conductivity	good
Solubility (H ₂ O)	reacts strongly	Solubility (H₂O)	reacts strongly
Melting Point	961°C	Melting Point	710°C
Color	silver	Color	silvery white
X6	9	Ir	1
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 (H₂O)	none
Melting Point	-119.9°C	Melting Point	157°C
Color	colorless	Color	silvery white
		P	b
Physical State	solid	Physical State	b solid
Physical State Density		Physical State Density	solid 11.35 g/cm³
Physical State Density Hardness	solid	Physical State Density Hardness	solid
Physical State Density Hardness Conductivity	solid 4.93 g/cm³ soft very poor	Physical State Density Hardness Conductivity	solid 11.35 g/cm³
Physical State Density Hardness Conductivity Solubility (H ₂ O)	solid 4.93 g/cm³ soft very poor neglibible	Physical State Density Hardness Conductivity Solubility (H₂O)	solid 11.35 g/cm³ somewhat soft poor none
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point	solid 4.93 g/cm³ soft very poor neglibible 113.5°C	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point	solid 11.35 g/cm ³ somewhat soft poor none 327.5°C
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black	Physical State Density Hardness Conductivity Solubility (H₂O) Melting Point Color	solid 11.35 g/cm ³ somewhat soft poor none 327.5°C gray
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black	Physical State Density Hardness Conductivity Solubility (H₂O) Melting Point Color	solid 11.35 g/cm ³ somewhat soft poor none 327.5°C gray
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray solid
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray solid 5.904 g/cm³
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray solid 5.904 g/cm³ soft
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray Solid 5.904 g/cm³ soft medium
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O)	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O)	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray solid 5.904 g/cm³ soft medium none
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray solid 5.904 g/cm³ soft medium none 30°C
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray solid 5.904 g/cm³ soft medium none 30°C gray
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color A Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C:	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Unknown	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray a solid 5.904 g/cm³ soft medium none 30°C gray wn #1
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C: Physical State	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless solid	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Unknown	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray a solid 5.904 g/cm³ soft medium none 30°C gray wn #1 solid
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C: Physical State Density	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless solid 1.87 g/cm³	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Unknown	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray a solid 5.904 g/cm³ soft medium none 30°C gray wn #1 solid 2.33 g/cm³
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C: Physical State Density Hardness	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless solid 1.87 g/cm³ soft	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Unknow Physical State Density Hardness	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray a solid 5.904 g/cm³ soft medium none 30°C gray wn #1 solid 2.33 g/cm³ brittle
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color A Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C: Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C: Physical State Density Hardness Conductivity	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless solid 1.87 g/cm³ soft good	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Unknown Physical State Density Hardness Conductivity Color	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray a solid 5.904 g/cm³ soft medium none 30°C gray wn #1 solid 2.33 g/cm³ brittle intermediate
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C: Physical State Density Hardness Conductivity Solubility (H ₂ O)	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless solid 1.87 g/cm³ soft good reacts violently	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Unknow Physical State Density Hardness Conductivity Solubility (H ₂ O)	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray a solid 5.904 g/cm³ soft medium none 30°C gray wn #1 solid 2.33 g/cm³ brittle intermediate none
Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color A Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color C: Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color	solid 4.93 g/cm³ soft very poor neglibible 113.5°C bluish-black gas 0.00178 g/cm³ none very poor none -189°C colorless solid 1.87 g/cm³ soft good	Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color G Physical State Density Hardness Conductivity Solubility (H ₂ O) Melting Point Color Unknown Physical State Density Hardness Conductivity Color	solid 11.35 g/cm³ somewhat soft poor none 327.5°C gray a solid 5.904 g/cm³ soft medium none 30°C gray wn #1 solid 2.33 g/cm³ brittle intermediate

Unknown #2

gas

Physical State Density

Hardness Conductivity Solubility (H₂O) **Melting Point**

Color

0.00170 g/cm³ none very poor

slight -2-9.6°C pale yellow

Unknown #3

Physical State solid 1.53 g/cm³ Density Hardness soft

Conductivity good Solubility (H₂O) reacts violently **Melting Point** 39°C

Color silvery white

Unknown #4

Physical State Density **Hardness** Conductivity Solubility (H₂O) **Melting Point**

0.00374 g/cm³ none very poor none -156.6°C colorless

Unknown #5

Physical State solid Density 19.3 g/cm³ Hardness soft Conductivity excellent Solubility (H₂O) none **Melting Point** 1064°C Color gold

Unknown #6

Physical State Density **Hardness**

Color

Color

Conductivity Solubility (H₂O) **Melting Point**

solid 2.54 g/cm³ somewhat soft good

reacts rapidly 769°C silvery white

Unknown #7

Physical State Density Hardness Conductivity Solubility (H₂O) **Melting Point**

Color

solid 5.32 g/cm³ fairly brittle fair to poor none 937°C gray