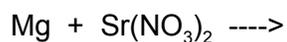


PRACTICE TEST

ChemCom Topic #3: Elements, Compounds, Mixtures and Batteries

Counting Atoms: Inventory the number of atoms in each of the possible single replacement reactions below.

1. How many atoms of each element are in the substances shown below?



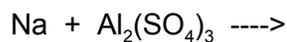
Mg=

Sr=

N=

O=

2. How many atoms of each element are in the substances shown below?



Na=

Al=

S=

O=

Classifying Element: Metals, Non-metals and Semi-metals

3. Circle all of the terms that can be used to describe the Luster of a material.

- Dull
- Earthy
- Metallic
- Shiny

4. Malleability

- How can you test a substance to see if it is malleable?

- What property is the opposite of malleability?

Use the data in the table below to answer questions below.

Physical Properties of Elements Lab: Data Table (Observations)

Atomic Structure of Elements

Element	Luster (metallic, pearly, or earthy)	Resistance (ohms)	Malleability (malleable or brittle)	Final Lab Classification (M-NM-SM)	Element Name
S	earthy	non-conductor	brittle		Sulfur
As	metallic	80	brittle		Arsenic
Rb	metallic	10	malleable		Rubidium
Sb	metallic	15	brittle		Antimony
P	earthy	Non-conductor	brittle		Phosphorus

5. Which element(s) would be considered non-metals?
6. Which element(s) would be considered metals?
7. Which element(s) would be considered semi-metals or metalloids?
8. Based on the data above, which element would be the best conductor to make electrical wire?

Metal Reactivities: Use the data in the table below to answer questions below.

Metal Reactivities: Observations of chemical reactions between metals and solutions

	$\text{Al}(\text{NO}_3)_3$	$\text{Cd}(\text{NO}_3)_2$	$\text{Ni}(\text{NO}_3)_2$	$\text{Pb}(\text{NO}_3)_2$
Al	X	Reaction	Reaction	Reaction
Cd	No Reaction	X	Reaction	Reaction
Ni	No Reaction	No Reaction	X	Reaction
Pb	No Reaction	No Reaction	No Reaction	X

9. Based on the data above, which metal would be the most reactive?

10. Based on the data above, which metal would be the least reactive?

11. What would be the best metal to use to build a car if you didn't want it to react with oxygen because that damages the car?

Use the table of reactivities to predict which single replacement reactions would happen.

12. Based on the activity series of metals and the chemical reaction below, would a chemical reaction take place if potassium was placed in a solution of Calcium Chloride?



- yes a reaction would occur
 - no a reaction would not occur
 - it is impossible to determine if a reaction would occur
13. Based on the activity series of metals above and the chemical reaction below, would a chemical reaction take place if lithium was placed in a solution of Aluminum Chloride?



- yes a reaction would occur
 - no a reaction would not occur
 - it is impossible to determine if a reaction would occur
14. Based on the activity series of metals above and the chemical reaction below, would a chemical reaction take place if Copper was placed in a solution of Calcium Chloride?



- yes a reaction would occur
- no a reaction would not occur
- it is impossible to determine if a reaction would occur

Activity Series	
← Decreasing activity	Li
	K
	Ba
	Sr
	Ca
	Na
	Mg
	Al
	Mn
	Zn
	Fe
	Cd
	Co
	Ni
	Sn
	Pb
	H
	Cu
	Ag
Hg	
Au	

Use the Potato Clock information below to answer battery analysis questions.

Battery	Metal #1	Metal #2	Voltage Measured
<i>Potato Clock</i>	<i>Copper</i>	<i>Zinc</i>	0.85 V

Battery Analysis:

15. When copper and zinc are used in the battery system, which element gains electrons?
- Copper
 - zinc
 - Both
 - Neither element gains electrons

16. What is the theoretical voltage for the potato clock battery? (show work)

17. What is the efficiency (%) for the potato clock battery? (show work)

18. Suppose that you had a chance to build a battery to push electron into your cell phone. Using table 5.3 what combination of the metals below would make a battery with the highest voltage?
- Mg & Li
 - Cu & Li
 - Ni & Zn

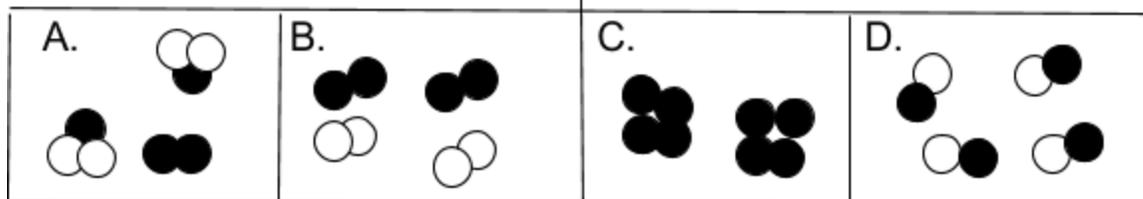
Table 5.3

Standard Reduction Potentials		
Species	Half-reaction	Standard Reduction Potential, E° (volts)
Au ⁺ /Au	$\text{Au}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Au}(\text{s})$	+1.61
Ag ⁺ /Ag	$\text{Ag}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Ag}(\text{s})$	+0.80
Cu ²⁺ /Cu	$\text{Cu}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Cu}(\text{s})$	+0.34
H ⁺ /H ₂	$2 \text{H}^+(\text{aq}) + 2 \text{e}^- \longrightarrow \text{H}_2(\text{g})$	0 (by definition)
Pb ²⁺ /Pb	$\text{Pb}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Pb}(\text{s})$	-0.13
Sn ²⁺ /Sn	$\text{Sn}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Sn}(\text{s})$	-0.14
Ni ²⁺ /Ni	$\text{Ni}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Ni}(\text{s})$	-0.23
Cd ²⁺ /Cd	$\text{Cd}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Cd}(\text{s})$	-0.40
Fe ²⁺ /Fe	$\text{Fe}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Fe}(\text{s})$	-0.44
Zn ²⁺ /Zn	$\text{Zn}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Zn}(\text{s})$	-0.76
Al ³⁺ /Al	$\text{Al}^{3+}(\text{aq}) + 3 \text{e}^- \longrightarrow \text{Al}(\text{s})$	-1.66
Mg ²⁺ /Mg	$\text{Mg}^{2+}(\text{aq}) + 2 \text{e}^- \longrightarrow \text{Mg}(\text{s})$	-2.36
Li ⁺ /Li	$\text{Li}^+(\text{aq}) + \text{e}^- \longrightarrow \text{Li}(\text{s})$	-3.05

Elements, compounds, mixtures:

Directions: Write formulas to represent each of the boxes below.

For example, the black and white atoms in box A can be shown as : $B_2 + 2BW_2$



19. Example-Box A: $B_2 + 2BW_2$

20. Box B

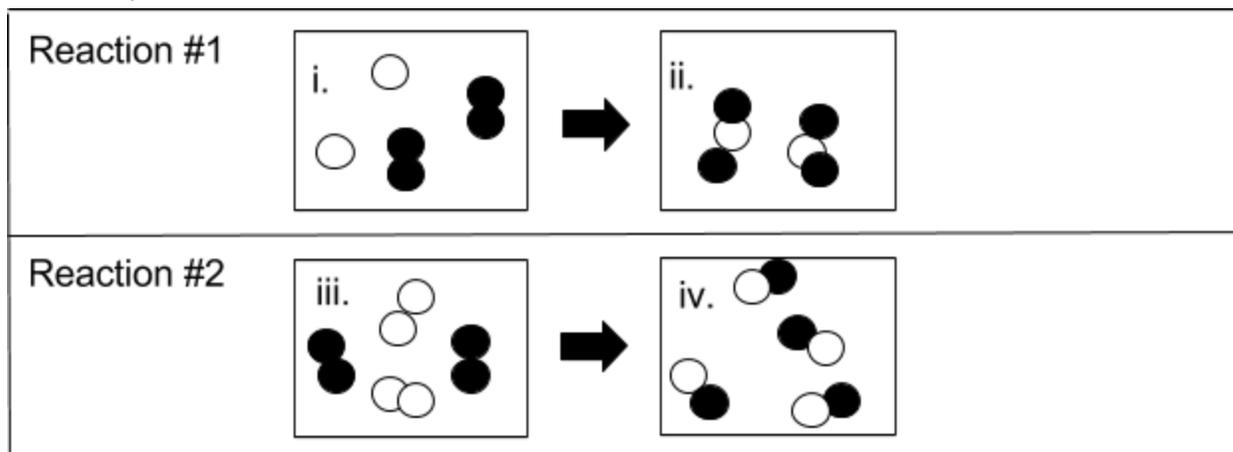
21. Box C

22. Box D

Questions 23 and 24: Directions:

Label each of the boxes above as containing elements, compounds, or both elements and compounds.

Directions: The boxes below show two reactions taking place. Use the pictures to answer the next two questions.



25. Which box or boxes represent **Reactants**?

- a. i only b. ii only c. i and iii d. ii and iv

26. Which chemical equation matches the pictures shown for **Reaction #2**?

- a. $2 Mg + 2 F_2 \rightarrow 2 MgF_2$
 b. $2 N_2 + 2 O_2 \rightarrow 4 NO$

Classify each of the following chemicals as elements or compounds.

27. Would H_2O be classified as an element, compound or mixture?

- a. Element
- b. Compound
- c. Mixture

28. Would O_2 be classified as an element, compound or mixture?

- a. Element
- b. Compound
- c. Mixture

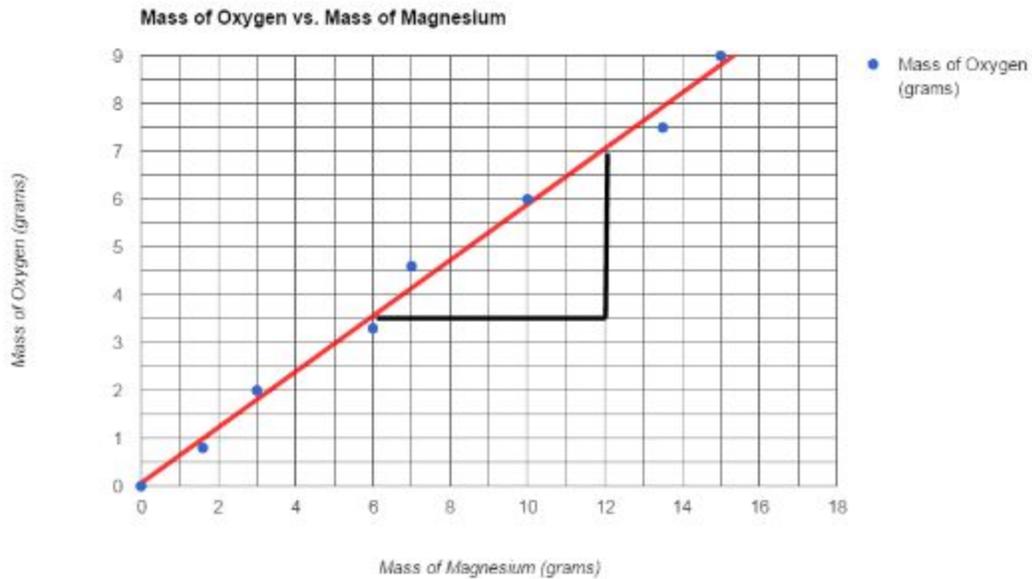
Atomic Structure of Elements

Element	Luster (metallic, pearly, or earthy)	Conductivity (ohms)	Malleability (malleable or brittle)	Final Lab Classification (M-NM-SM)	Element Name
S	earthy	non-conductor	brittle		Sulfur
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Rb	metallic	10	malleable		Rubidium
Sb	metallic	15	brittle		Antimony
P	earthy	Non-conductor	brittle		Phosphorus

29. Which element in the chart above has the fewest protons?

30. Which element in the chart above has the most electrons?

31. How many neutrons would be in an atom of Phosphorus-31?



Show your work on the graph above and below for questions 32-35.

32. Calculate the rise (change in Y) using the work the student did above.

33. Calculate the run (change in X) using the work the student did above.

34. Calculate the slope of the data in the graph above.

35. Write a “for every” story using the slope of the graph.