

metal + non-metal \Rightarrow ionic bond
 non-metal + non-metal \Rightarrow covalent bond

Unit 6 Activity Sheet

Dr. Scharberg

A. Compounds are formed from the following sets of elements. Indicate whether the compound would be ionic or covalent. I = ionic C = covalent

- | | | | |
|----------------|----------------|----------------|----------------|
| 1. Mg and O I | 2. F and Ca I | 3. Li and S I | 4. Br and Cl C |
| 5. Na and HI I | 6. S and H C | 7. Ba and Br I | 8. C and O C |
| 9. N and O C | 10. Rb and F I | | |

B. Draw the electron dot structures for the following atoms of these elements.

(does not matter what side of the atom the dots go on)

- | | | | |
|------------------------------|------------------------------|-------------------------------|-------------------------------|
| 1. Barium $\text{Ba} \cdot$ | 2. Carbon $\text{C} \cdot$ | 3. Xenon $\text{Xe} \cdot$ | 4. Nitrogen $\text{N} \cdot$ |
| 5. Silicon $\text{Si} \cdot$ | 6. Hydrogen $\text{H} \cdot$ | 7. Potassium $\text{K} \cdot$ | 8. Chlorine $\text{Cl} \cdot$ |
| 9. Sulfur $\text{S} \cdot$ | 10. Boron $\text{B} \cdot$ | | |

C. For the following elements, how many electron dots would you add to or remove from the electron dot symbols of the atoms to form the ions?

(here, metals lose electrons, non-metals gain electrons)

- | | | | |
|--------------------------------|--------------------------------|----------------------|----------------------|
| 1. Barium $\leftarrow 2e^-$ | 2. Chlorine $+ 1e^-$ | 3. Nitrogen $+ 3e^-$ | 4. Iodine $+ 1e^-$ |
| 5. Potassium $\leftarrow 1e^-$ | 6. Magnesium $\leftarrow 2e^-$ | 7. Sulfur $+ 2e^-$ | 8. Aluminum $- 3e^-$ |

D. Calculate the oxidation state of the underlined element. (review handouts & notes)

- | | |
|------------------------------------------------------|-----------------------------------------------------|
| 1. <u>K</u> Cl <u>-1</u> | 2. Ca <u>C</u> O ₃ <u>+4</u> |
| 3. <u>S</u> O ₃ <u>+6</u> | 4. H ₂ <u>S</u> O ₄ <u>+6</u> |
| 5. <u>Fe</u> ₂ O ₃ <u>+3</u> | 6. Na <u>N</u> O ₃ <u>+5</u> |
| 7. K ₂ <u>S</u> O ₃ <u>+4</u> | 8. Ca ₃ <u>P</u> ₂ <u>-3</u> |
| 9. Na ₃ <u>P</u> O ₄ <u>+5</u> | 10. <u>Zn</u> Br ₂ <u>+2</u> |

(see worked out solutions on following pages)

E. Practice Multiple Choice Problems.

- An oxide of nitrogen in which the oxidation number of nitrogen is +1 is:

a. NO **(b.) N₂O** c. N₂O₄ d. NO₂

$2N + 0 = 0$
 $2N + (-2) = 0; N = +1$
- Which element is the most electronegative?

a. Rb b. Sr c. Cu d. I **(e.) F** (most electronegative element)
- Which compound exhibits the greatest covalent character?

a. MgO b. NaCl c. HCl d. CsF **(e.) NCl₃** ² non-metal + non-metal close to F!
- An element in Group 1A (excluding hydrogen) is brought into contact with an element in Group VII. One expects:

(b.) An ionic compound to be formed.

Group 1A \rightarrow metal
 Group VII (non-metal)
- Elements whose atoms lose electrons in forming a compound are called:

(a.) metals c. noble gases

metals lose electrons to become ions

b. non-metals

d. metalloids

6. Which of the following elements would display the least tendency to form an ionic bond?

- a. K b. Cl **(c.) C** d. Li e. Ca ~~✗~~

7. Which of the following elements would display the greatest tendency to form a covalent bond?

- a. K b. Cl **(c.) Si** d. Li e. Ca

8. Which would have the least ionic character?

- a. KI b. MgO c. NaCl d. CsF **(e.) NO₂** (2 non-metals)

9. Which contains both covalent and ionic bonds?

- (a.) NaNO₃** b. CO₂ c. SO₃ d. HCl e. CH₄

10. Covalent bonding is common in all of the following except:

- ~~(a.) organic compounds~~ d. diatomic elements
 b. non-electrolytes e. water
(c.) salts

Correct Answer \Rightarrow

11. The type of bonding found in potassium chloride is

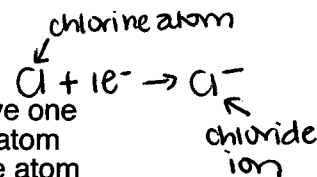
- (a.) ionic** d. non-polar
 b. covalent e. polar covalent
 c. coordinate-covalent

12. All ions of Group II-A in the Periodic Table have a charge of

- a. +1 **(b.) +2** c. +1 or +2 d. -1 e. -2

13. Chloride ions differ from chlorine atoms in that the chloride ions have one

- a. more proton than the atom b. less proton than the atom
(c.) more electron than the atom d. less electron than the atom



14. Which compound has nonpolar covalent bonds?

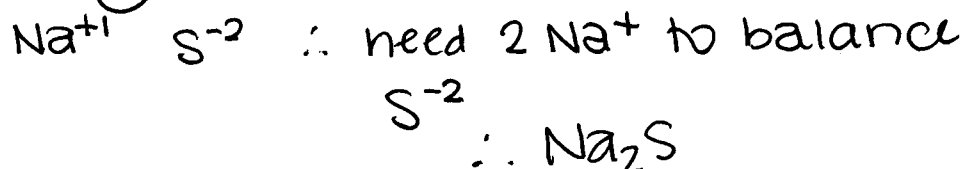
- (a.) F₂** b. HF c. OF₂ d. H₂O non-polar covalent \rightarrow
 2 of the same non-metals

15. The most likely charge on an aluminum (Al) ion is

- a. +1 b. +2 **(c.) +3** d. -3 loses 3 electrons to
 look like Ne (a noble gas)

16. Sodium (Na) reacts with sulfur (S) to form

- a. NaS **(b.) Na₂S** c. Na₃S d. NaS₂



Part D

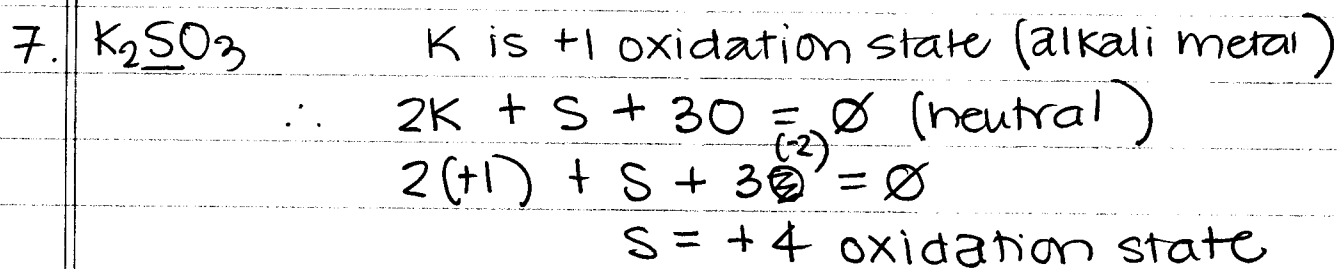
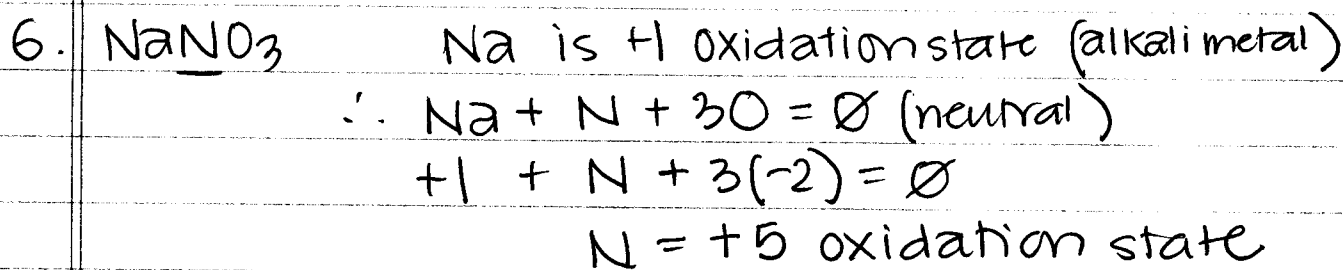
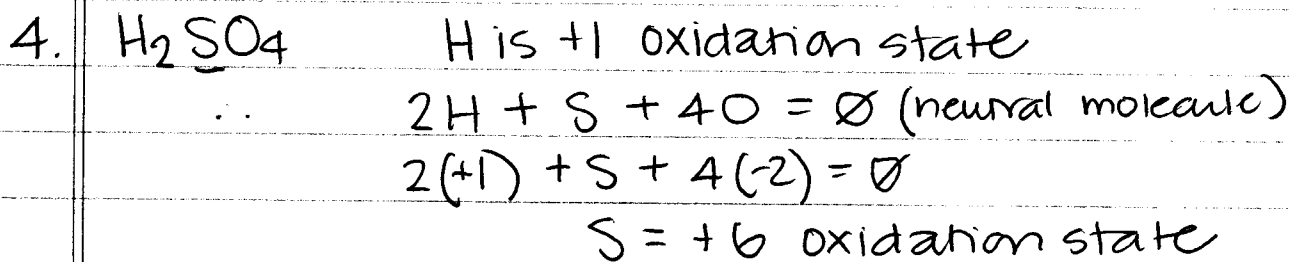
1. KCl K is +1 charge (K^+) because it is an alkali metal. Thus, to form a neutral molecule, Cl must be -1 charge (Cl^-).

32. SO₃ O has an oxidation state of -2; w/ 3 O atoms in SO₃, an overall -6 charge is produced by the O atoms. Since SO₃ is a neutral molecule, S must have an oxidation state of +6 to ~~create~~ neutralize the -6 charge from O atoms.

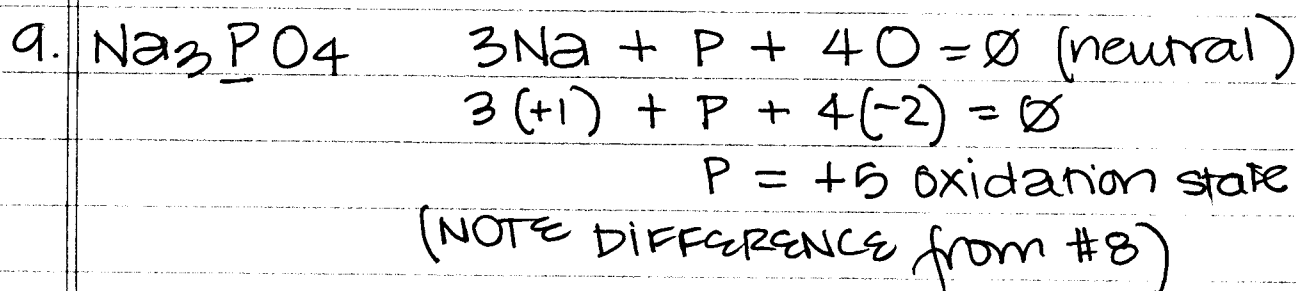
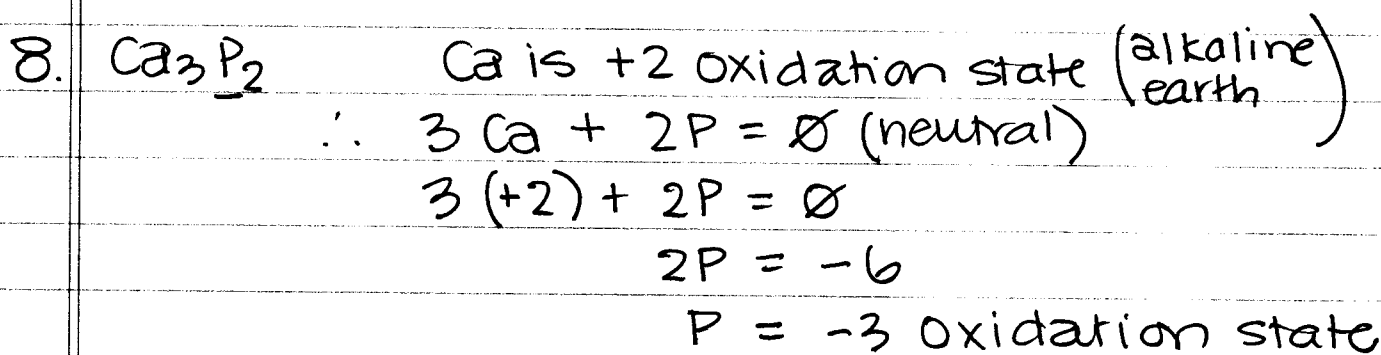
sorry about #cring

53. Fe₂O₃ same argument as above. ^{neutral molecule}
 another method: $2Fe + 3O = \emptyset$ charge
 (using algebra) $2Fe + 3(-2) = \emptyset$
 $2Fe = +6$; $Fe = \underline{+3}$

2. CaCO₃ Ca is an alkaline earth metal, so it is +2 oxidation state
 $\therefore Ca + C + 3O = \emptyset$ charge (neutral molecule)
 $+2 + C + 3(-2) = \emptyset$
 $C = +4$ oxidation state



[NOTE DIFFERENCE from #4!]



10. ZnBr₂

Br has a -1 oxidation state (halogen)

$$\text{Zn} + 2\text{Br} = 0 \text{ (neutral)}$$

$$\text{Zn} + 2(-1) = 0$$

$$\text{Zn} = +2 \text{ oxidation state}$$