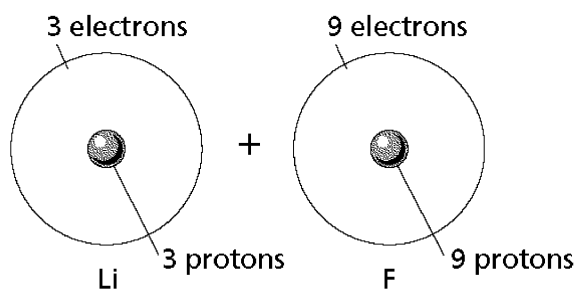


**Chem sem 1 midterm 2 review sheet 0809****Short Answer**

1. Write the noble gas form of the electron configuration and the electron dot structure of sodium and oxygen.
2. Write the noble gas form of the electron configuration and the electron dot structure of selenium and phosphorus.
3. Why do elements in the same group have similar properties?
4. Why is the size of a sodium ion ( $\text{Na}^+$ ) less than that of a sodium atom ( $\text{Na}$ )?
5. Define ionization energy.
6. The charge on the polyatomic ion,  $\text{NO}_2^-$ , is  $1^-$ . What will be the formula of one formula unit of a compound between  $\text{NO}_2^-$  and  $\text{Be}$ ?

The diagram below represents a lithium atom (group 1 of the periodic table) and a fluorine atom (group 17). Use the diagram to answer the questions that follow.



7. What is the electron configuration of the neutral lithium atom?
8. What is the electron configuration of the neutral fluorine atom?
9. What happens to the lithium atom when it reacts with the fluorine atom? What is the electron configuration of the lithium after the change?
10. In terms of the electron arrangement, why is this change favorable for the lithium atom?
11. What happens to the fluorine atom when it reacts with the lithium atom? What is the electron configuration of the fluorine after the change?
12. In terms of the electron arrangement, why is this change favorable for the fluorine atom?
13. What kind of compound is formed in the reaction?
14. What always happens to one or more electrons during a reaction that forms such a compound?
15. What are the formula and name of the product in this reaction?
16. What holds the atoms together in the compound?

For each of the following chemical formulas, write the correct name of the ionic compound represented. You may refer to the periodic table on pages 156–157 and Table 8.7 for help.

17. NaI
18. CaCl<sub>2</sub>
19. K<sub>2</sub>S
20. MgO
21. LiHSO<sub>4</sub>
22. NH<sub>4</sub>Br
23. Ca<sub>3</sub>N<sub>2</sub>
24. Fe(IO<sub>3</sub>)<sub>2</sub>

For each of the following ionic compounds, write the correct formula for the compound. You may refer to the periodic table on pages 156–157 and Table 8.7 for help.

25. copper(I) oxide
26. magnesium sulfite
27. ammonium sulfide
28. calcium iodate
29. iron(III) perchlorate
30. sodium nitride

### Problem

31. Complete the following table:

Element	Number of protons	Number of electrons	Number of neutrons	Atomic number	Mass number
Sodium		11	12		
Phosphorus	15				31
Cobalt	27		32		
Bromine		35			80
Silver			61	47	

32. An element X has two naturally occurring isotopes: X-79 (abundance = 50.69%, mass = 78.918 amu) and X-81 (abundance = 49.31%, mass = 80.917 amu). Calculate the weighted atomic mass of X. Also, identify the unknown element which exists as a reddish-brown gas and is a liquid at room temperature.
33. Calculate the number of protons, electrons, and neutrons in an atom of the element Pb with mass number 207 and atomic number 82.
34. Write the ground state electron configuration of sulfur and draw its electron-dot structure.

Name: \_\_\_\_\_

ID: A

35. An element has similar chemical properties as oxygen and selenium. It has an atomic number greater than krypton but less than iodine. Use the periodic table to identify the element.
36. Identify the element having the largest size and the element having the highest electronegativity from the list of electron configurations given below:
- a.  $[\text{Ne}] 3s^2 3p^3$
  - b.  $[\text{Ne}] 3s^2 3p^4$
  - c.  $[\text{Ne}] 3s^2 3p^5$
  - d.  $[\text{Ne}] 3s^2 3p^3 4s^2 3d^3$
37. A 50.00-g sample of hydrated manganese(II) chloride yields 31.75 g of the anhydrous compound after heating. Determine the chemical formula and name the hydrate.

## Chem sem 1 midterm 2 review sheet 0809

## Answer Section

## SHORT ANSWER

1. ANS:

a. The noble gas form of the electron configuration of sodium is  $[\text{Ne}]3s^1$ . Its electron dot structure is  $\text{Na} \cdot$ b. The noble gas form of electron configuration of oxygen is  $[\text{He}]2s^22p^4$ . Its electron dot structure is

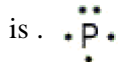
DIF: 2 REF: Page 138, Page 140

OBJ: 5.3.2 Define valence electrons and draw electron-dot structures representing an atom's valence electrons. STO: B.1, B.6

TOP: Define valence electrons and draw electron-dot structures representing an atom's valence electrons.

KEY: Electron configuration, Electron-dot structure MSC: 2

2. ANS:

a. The noble gas form of the electron configuration of selenium is  $[\text{Ar}]4s^24p^4$ . Its electron-dot structure isb. The noble gas form of the electron configuration of phosphorus is  $[\text{Ne}]3s^23p^5$ . Its electron-dot structure is

DIF: 2 REF: Page 138

OBJ: 5.3.2 Define valence electrons and draw electron-dot structures representing an atom's valence electrons. STO: B.1, B.6

TOP: Define valence electrons and draw electron-dot structures representing an atom's valence electrons.

KEY: Electron configuration, Electron-dot structure MSC: 2

3. ANS:

Elements in the same group have the same electron configuration and number of valence electrons. Valence electrons determine the properties of elements. Therefore, properties of elements in the same group are similar.

DIF: 1 REF: Page 159

OBJ: 6.2.1 Explain why elements in the same group have similar properties.

STO: UCP.1, B.1, B.2

TOP: Explain why elements in the same group have similar properties.

KEY: Groups, Electron configuration MSC: 2

4. ANS:  
The loss of an electron from a sodium atom results in a smaller radius. The electrostatic repulsion between the remaining number of electrons decreases thus allowing them to be pulled closer to the nucleus. Therefore, the size of a sodium ion ( $\text{Na}^+$ ) is less than that of a sodium atom ( $\text{Na}$ ).

DIF: 2                      REF: Page 165  
OBJ: 6.3.2 Relate period and group trends in atomic radii to electron configuration.  
STO: UCP.1, B.1, B.2  
TOP: Relate period and group trends in atomic radii to electron configuration.  
KEY: Atomic size, Ionic radius                      MSC: 2

5. ANS:  
Ionization energy of an atom is defined as the energy required to remove an electron from a gaseous atom.

DIF: 1                      REF: Page 167  
OBJ: 6.3.1 Compare period and group trends of several properties.  
STO: UCP.1, B.2    TOP: Compare period and group trends of several properties.  
KEY: Ionization energy                      MSC: 1

6. ANS:  
 $\text{Be}(\text{NO}_2)_2$

DIF: 1                      REF: Page 222                      OBJ: 8.3.1 Write formulas for ionic compounds and oxyanions.  
STO: B.1, UCP.1    TOP: Write formulas for ionic compounds and oxyanions.  
KEY: Polyatomic ions                      MSC: 1

7. ANS:  
 $1s^2 2s^1$

8. ANS:  
 $1s^2 2s^2 2p^5$

9. ANS:  
The lithium atom loses one electron, to form an  $\text{Li}^+$  ion. The configuration is  $1s^2$ .

10. ANS:  
The lithium has achieved the stable configuration of a noble gas.

11. ANS:  
The fluorine atom gains one electron, to form an  $\text{F}^-$  ion. The configuration is  $1s^2 2s^2 2p^6$ .

12. ANS:  
The fluorine has achieved a stable octet configuration, like that of a noble gas.

13. ANS:  
ionic

14. ANS:  
There is a transfer of electrons.

15. ANS:  
 $\text{LiF}$ ; lithium fluoride

16. ANS:  
electrostatic forces of attraction between the oppositely charged ions

17. ANS:  
sodium iodide

18. ANS:  
calcium chloride

19. ANS:  
potassium sulfide
20. ANS:  
magnesium oxide
21. ANS:  
lithium hydrogen sulfate
22. ANS:  
ammonium bromide
23. ANS:  
calcium nitride
24. ANS:  
iron(III) iodate
25. ANS:  
 $\text{Cu}_2\text{O}$
26. ANS:  
 $\text{MgSO}_3$
27. ANS:  
 $(\text{NH}_4)_2\text{S}$
28. ANS:  
 $\text{Ca}(\text{IO}_3)_2$
29. ANS:  
 $\text{Fe}(\text{ClO}_4)_3$
30. ANS:  
 $\text{Na}_3\text{N}$

**PROBLEM**

31. ANS:

Element	Number of protons	Number of electrons	Number of neutrons	Atomic number	Mass number
Sodium	11			11	23
Phosphorus		15	16	15	
Cobalt		27		27	59
Bromine	35		45	35	
Silver	47	47			108

DIF: 3

REF: Page 98, Page 99, Page 100

OBJ: 4.3.3 Calculate the number of electrons, protons, and neutrons in an atom given its mass number and atomic number. STO: B.1

TOP: Calculate the number of electrons, protons, and neutrons in an atom given its mass number and atomic number. KEY: Composition of elements MSC: 3

NOT: Atomic number = number of protons = number of electrons. Mass number = number of protons + number of neutrons.

32. ANS:  
79.904 amu  
Bromine
- DIF: 3 REF: Page 102, Page 103  
OBJ: 4.3.3 Calculate the number of electrons, protons, and neutrons in an atom given its mass number and atomic number. STO: B.1  
TOP: Calculate the number of electrons, protons, and neutrons in an atom given its mass number and atomic number. KEY: Atomic mass of isotopes MSC: 3  
NOT: Weighted atomic mass of element X = mass contribution of X-79 + mass contribution of X-81. Mass contribution of each isotope = (mass in amu of the isotope) \* (percent abundance).
33. ANS:  
Number of protons = atomic number = 82.  
Number of electrons = number of protons = 82.  
Number of neutrons = mass number – atomic number = 125.
- DIF: 2 REF: Page 98, Page 101  
OBJ: 4.3.1 Explain the role of atomic number in determining the identity of an atom.  
STO: B.1 TOP: Explain the role of atomic number in determining the identity of an atom.  
KEY: Atomic number MSC: 3  
NOT: Atomic number = number of protons = number of electrons.
34. ANS:  
The ground state electron configuration of sulfur is  $[\text{Ne}]3s^23p^4$ . Its electron dot structure is  $\cdot\ddot{\text{S}}\cdot$ .
- DIF: 2 REF: Page 138  
OBJ: 5.3.2 Define valence electrons and draw electron-dot structures representing an atom's valence electrons. STO: B.1, B.6  
TOP: Define valence electrons and draw electron-dot structures representing an atom's valence electrons.  
KEY: Electron-dot structure, Valence electrons MSC: 3
35. ANS:  
Tellurium
- DIF: 1 REF: Page 157  
OBJ: 6.1.1 Trace the development and identify key features of the periodic table.  
STO: G.3, B.1, UCP.1  
TOP: Trace the development and identify key features of the periodic table.  
KEY: Periodic table MSC: 2  
NOT: Elements are arranged in the increasing order of their atomic numbers. Elements in groups have similar properties.

36. ANS:

The element having the largest size has an electron configuration of  $[\text{Ne}] 3s^2 3p^3 4s^2 3d^3$ . The element having the highest electronegativity has an electron configuration of  $[\text{Ne}] 3s^2 3p^5$ .

DIF: 2

REF: Page 163, Page 168

OBJ: 6.3.2 Relate period and group trends in atomic radii to electron configuration.

STO: UCP.1, B.1, B.2

TOP: Relate period and group trends in atomic radii to electron configuration.

KEY: Electron configuration, Atomic size, Electronegativity MSC: 2

NOT: The size of the atom depends on the number of shells in an atom. Electronegativity increases across a period.

37. ANS:

50.00 g hydrate – 31.75 g anhydrous  
compound = 18.25 g water

$$1 \text{ mol MnCl}_2 \times \frac{1 \text{ mol Mn}}{1 \text{ mol MnCl}_2} \times \frac{54.94 \text{ g Mn}}{1 \text{ mol Mn}} = 54.94 \text{ g Mn}$$

$$1 \text{ mol MnCl}_2 \times \frac{2 \text{ mol Cl}}{1 \text{ mol MnCl}_2} \times \frac{35.45 \text{ g Cl}}{1 \text{ mol Cl}} = 70.90 \text{ g Cl}$$

$$(54.94 \text{ g} + 70.90 \text{ g}) = 125.84 \text{ g}$$

The molar mass of manganese(II) chloride is 125.84 g/mol.

$$31.75 \text{ g MnCl}_2 \times \frac{1 \text{ mol MnCl}_2}{125.84 \text{ g MnCl}_2} = 0.2523 \text{ mol MnCl}_2$$

$$18.25 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.02 \text{ g H}_2\text{O}} = 1.013 \text{ mol H}_2\text{O}$$

$$\frac{1.013 \text{ mol H}_2\text{O}}{0.2523 \text{ mol MnCl}_2} = \frac{4.015 \text{ mol H}_2\text{O}}{1.000 \text{ mol MnCl}_2} = \frac{4 \text{ mol H}_2\text{O}}{1 \text{ mol MnCl}_2}$$

The ratio of water to manganese dichloride is 4 : 1. The chemical formula of the hydrate is  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$  and its name is manganese(II) chloride tetrahydrate.