

1) (9 points, 1.5 each) Circle the one best answer.

(a) Which statement is false?

- a) One mole of liquid H_2 has a mass of 2.016 g.
- b) The mass of one mole of solid H_2 is equal to that of one mole of gaseous H_2 .
- c) A 1.008 g sample of H atoms has fewer particles than a 18.998 g sample of F atoms.
- d) 1.204×10^{24} hydrogen atoms makes up 1.000 mole of H_2 .
- e) I don't know. Please give me a half point.

(b) If Y (yttrium) and As (arsenic) combine to form an ionic compound. The formula unit is most likely

- a) YAs_3 . suggests Y^{+9}
- b) Y_3As . suggests Y^+ has an e^- config of $[Kr] 5s^2$, which is not stable
- c) YAs .
- d) Y_2As_3 . suggests $Y^{+9/2}$
- e) I don't know. Please give me a half point.

(c) Elements of one group have similar chemical properties because they

- a) contain the same number of core electrons.
- b) have the same physical appearance.
- c) have the same number of protons.
- d) have the same number of valence electrons.
- e) I don't know. Please give me a half point.

(d) A covalent bond forms between two atoms when

- a) the energy of the bonded atoms is higher than the energy of the un-bonded atoms.
- b) one atom completely transfers an electron to the other atom.
- c) the two nuclei fuse together.
- d) attractive forces just overcome repulsive forces.
- e) I don't know. Please give me a half point.

(e) Rank the following bonds by increasing polarity

- a) $Li-Cl < K-Cl < S-Cl < P-Cl < Si-Cl$
- b) $S-Cl < P-Cl < Si-Cl < K-Cl < Li-Cl$ this is the best choice, although $K-Cl$ and $Li-Cl$ could be switched
- c) $Si-Cl < S-Cl < P-Cl < Li-Cl < K-Cl$
- d) $K-Cl < Li-Cl < Si-Cl < P-Cl < S-Cl$
- e) I don't know. Please give me a half point.

(f) Which of the following name-formula pairs is/are incorrect?

- i) rhodium (III) nitride, RhN ✓
- ii) carbonate ion, CO_3^{2-}
- iii) hypochlorite, IO_3^-
- iv) hydrofluoric acid, $HF_{(aq)}$ ✓
- v) phosphorous acid, $H_3PO_3_{(aq)}$ ✓

- a) i and v
- b) ii and iv
- c) only i
- d) iii, iv, and v
- e) ii, iii
- f) I don't know. Please give me a half point.

2) (6 points) Give the formula for the name or the name for the formula.

- a) ammonium bromate NH_4BrO_3 d) $Ni(OH)_2$ nickel(II) hydroxide
 b) vanadium (V) selenide V_2Se_5 e) Ni_3 nitrogen triboride
 c) lithium nitrite $LiNO_2$ f) HFO_4 (aq) perfluoric acid
 if it existed, but it does not

3) (5 points) Complete the table

Chemical Formula	Total Number of Valence Electrons	Lewis Dot Structure Show all lone pair electrons	Are the bonds polar? If yes, identify the negative and positive ends by using δ^+ and δ^- , or a dipole moment arrow (\rightarrow)
NO_2^- 5 6 1 x 2	18		Yes Yes

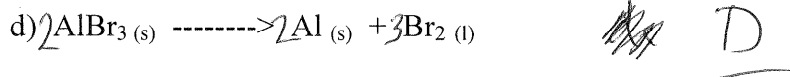
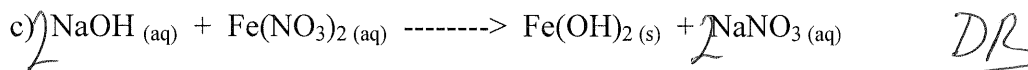
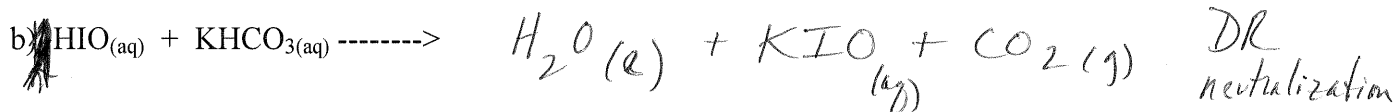
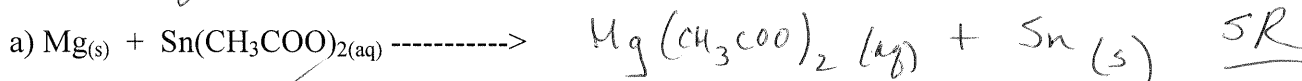
4) (10 points) For each set of reactants in parts a, b, c, & d

- i) Give the products of reaction if none is shown; be sure to include the states
 ii) Balance the resulting equation
 iii) Classify the reaction as one of the following six classes:

combination or synthesis (C) complete oxidation (O)

double replacement-precipitation (DR-PPT)

decomposition (D) single replacement (SR) double replacement-neutralization (DR-N)



5) (1 point) In an atom, how many electrons can have the following designation, 4d-spin up. 5

6) (6 points) For Se:

4d ↑ ↑ ↑ ↑ ↑
or 4d ↑↓ ↑↓ ↑↓ ↑↓

a) Write the ground state electron configuration (long form). $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$

b) How many valence electrons does it have? 6

c) Circle the type(s) of element that Se is:

halogen chalcogen pnictogen transition metal metalloid

non-metal metal noble gas

Don't worry about part c

7) (2 points) Which pairs are NOT isoelectronic:

a) Ne and Na^+

b) S^{2-} and Cl^+

c) Ba^{2+} and Te^{2-}

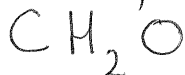
d) Mg^{2+} and Ar

8) (10 points) Fructose is a sugar that is found in honey and fruits. The percent composition of fructose is 40.0% C, 6.71% H, and the remainder is oxygen. Mass spectrometry shows the molar mass to be 180.16 g/mol.

a) Determine the empirical formula of the compound.

<u>% to mass</u>		<u>mass to mole</u>		<u>divide by small</u>
40.0% C	→ 40.0 g C	$\div 12.01 \text{ g/mol}$	3.33 ₀₅₆ mol C	$\div 3.33_{056} \text{ mol}$ 1.00 ₀₀ C
6.71% H	→ 6.71 g H	$\div 1.008 \text{ g/mol}$	6.65 ₆₇ mol H	$\div 3.33_{056} \text{ mol}$ 1.99 ₈₇ H
53.29% O	→ 53.29 g O	$\div 16.00 \text{ g/mol}$	3.33 ₀₆₂ mol O	$\div 3.33_{056} \text{ mol}$ 1.00 ₀₀ O

no need to multiply to whole



b) Determine the molecular formula of the compound.

Empirical Mass = $(12.01 + (1.008 \times 2) + 16.00) \text{ g/mol} = 30.026 \text{ g/mol}$ $\xrightarrow{6x}$

c) How many atoms of carbon are in 180.16 g of fructose?

Molecular Mass = 180.16 g/mol $\xrightarrow{CH_2O}$ $C_6H_{12}O_6$

180.16 g fructose	1 mol fructose	6.022×10^{23} $C_6H_{12}O_6$ molecules	6 atoms
180.16 g fructose	1 mol	1 molecule $C_6H_{12}O_6$	

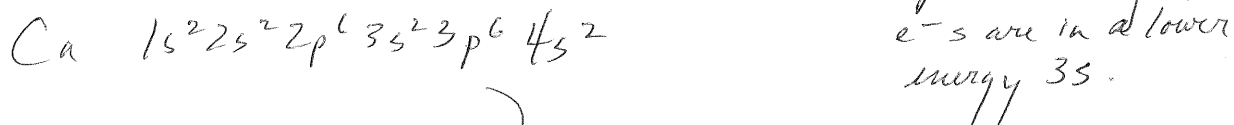
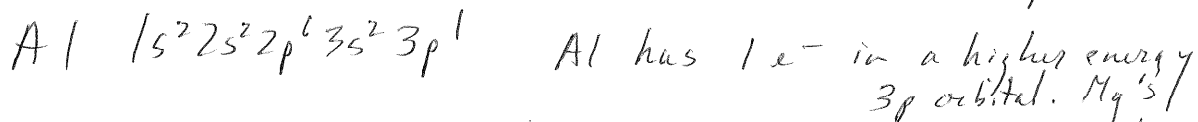
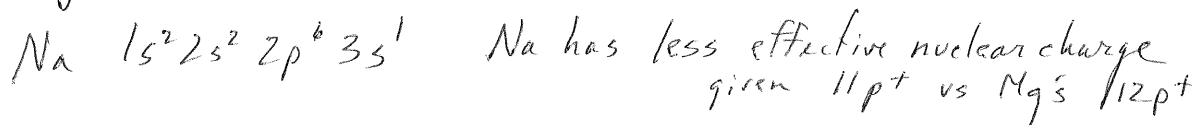
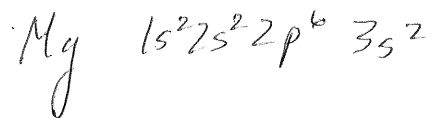
d) How many moles are in 720.64 g of fructose?

~~720.64~~ $\frac{720.64 \text{ g fructose}}{180.16 \text{ g fructose}} = 4.0000 \text{ mol fructose}$

$\rightarrow 3.613 \times 10^{24}$ atoms of C

Extra Credit (10 points)

Suggest reasons why the ionization energy of Mg is greater than those of Na, Al, and Ca. Be sure to incorporate electrostatics, electron configurations, and periodic trends in your discussion.



Ca has its val e^- s in a higher energy level $4s^2$ vs. Mg's $3s^2$