Exam 2

CHEM 111 – General Chemistry I

Fall 2017

Instructions: Read the instructions for each question carefully and answer the questions to the best of your ability. You may use the Periodic Table below and a calculator to answer the following questions.

Periodic Table of the Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.09	35 Br Bromine 79.904	36 Kr Krypton 84.80
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown

57 La Lanthanum 138.906	58 Ce Cerium 140.115	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.966	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

Good luck!

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(903) 813-2454

1. Periodic Trends:

   a. Identify the relationship between elements in the same group.

Elements in the same group have a similar valence configuration.

   b. Identify the relationship between elements in the same period.

Periods represent valence shells being filled

2. Classify the elements as metal, nonmetal, or metalloid:

   a. Mg metal

   b. S nonmetal

   c. Rb metal

   d. Cr metal (transition)

   e. Te metalloid

3. Describe effective nuclear charge.

Amount of charge valence electrons experience from the nucleus

4. Cations are smaller than anions (in relation to size).

5. Write the name of the following molecules:

   a. NF_3 Nitrogen trifluoride

   b. $CaCl_2$ Calcium chloride

   c. NH_3 Nitrogen trihydrogen

   d. $Zn_3(PO_4)_2$ Zinc phosphate

6. Write chemical formulas for each of the following:

   a. Iron(III) chloride

      $FeCl_3$

b. Carbon tetrafluoride

CF_4

c. Nitrate

NO_3

d. Potassium Dichromate

$K_2(Cr_2O_7)$

7. Identify all the intermolecular forces associated with the following:

a. Nitrite LDF, Dipole-Dipole (NO_2^-)

b. H_2O LDF, Dipole-Dipole, Hydrogen bonding

c. CF_4 LDF

d. KCN LDF, Dipole-Dipole

KCN:

8. Write the electron configuration for the following ions (short and long forms):

a. Ca^{2+}

$[Ar]4s^2$

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

b. Cl^- $[Ar]$

$1s^2 2s^2 2p^6 3s^2 3p^6$

c. Cr^{3+} $[Ar]3d^3$

$1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$

9. Identify the element from this electron configuration: [Ar] $3d^9$

Cu

10. Rank from highest to lowest:

a. Atomic Radius of: **Cl, Ni, Fr, Al, Kr**

Fr, Ni, Kr, Al, Cl

b. First Ionization Energy of: **Cd, O, B, Rb, Cs**

O, B, Cd, Rb, Cs

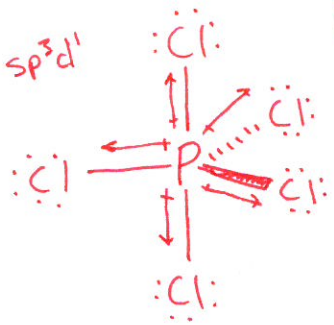
c. Electronegativity of: **Se, F, Ca, O, C**

F, O, C, S, Ca

11. Draw the Lewis structure for PCl_5. State the molecular geometry, formal charge of each atom, and the hybridization state. Show the dipoles with a vector arrow and indicate the net dipole moment.

geometry – see-saw

sp^3d^1

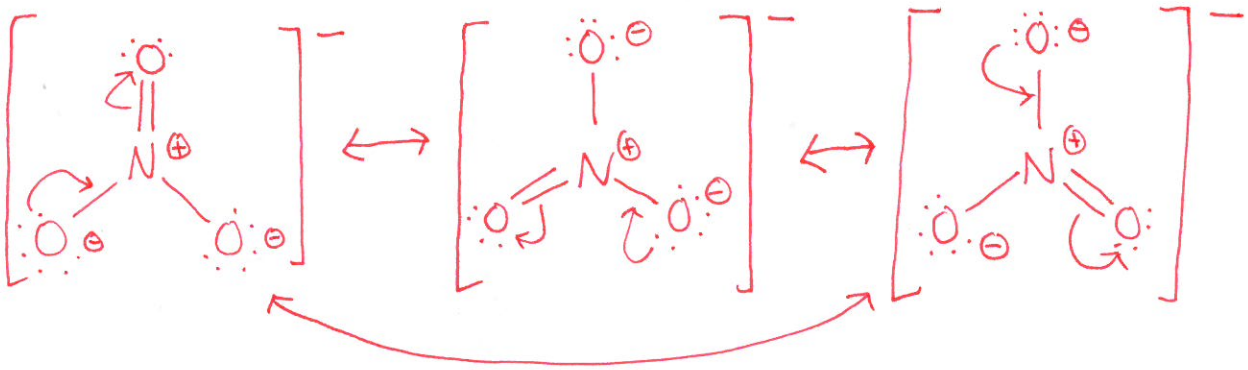


P is $\delta+$
all Cl are $\delta-$

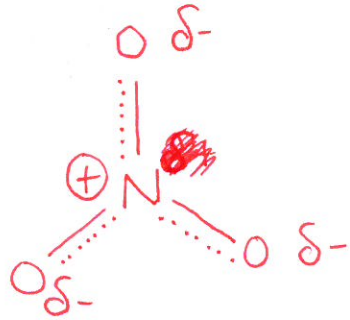
formal charges
all 0

NET:
No Net Dipole

12. Draw all of the resonance structures and the resonance hybrid for nitrate. State the molecular geometry, formal charge of each atom, and the hybridization state. Show the dipoles with a vector arrow and indicate the net dipole moment.



Hybrid:



13. Identify the percent composition of each of the elements present in $C_6H_{12}O_6$.

$(6 \times 12.011) = 72.066$

$(12 \times 1.008) = 12.096$

$(6 \times 15.999) = 95.994$

$C_6H_{12}O_6 = 180.156$

$(72.066/180.156) \times 100 = 40.0\%$ C

$(12.096/180.156) \times 100 = 6.7\%$ H

$(95.994/180.156) \times 100 = 53.3\%$ O

100%

14. What is the empirical formula of a compound containing 40.92% C, 4.58% H, and 54.50% O?

C $40.92/12.011 = 3.41/3.41 = 1.00 \times 3 = 3$

H $4.58/1.008 = 4.54/3.41 = 1.33 \times 3 = 4$

O $54.50/15.999 = 3.41/3.41 = 1.00 \times 3 = 3$

$C_3H_4O_3$

15. If the compound from the above question has a known molecular weight of 176.12 g/mol, what is the molecular formula?

$C_3H_4O_3 = 88.062$

$176.12/88.062 = 1.999$

$C_6H_8O_6$