Chem 110 **Fall 2016** **Exam I** **Whelan**

SID | | | | | | | | | Last Key First Answer

Question 1 (7 Points)

a) How many **significant figures** are there in each of the following numbers?

0.927790 6 0.060464 5 1.00×10^3 3

b) There are **12 eggs in a dozen**. A farm produces **747 dozen** eggs a month, how should the **number of eggs** per month be reported? 8.96×10^3

c) The number **447.496** rounded to **4 significant figures** is: 447.5

Question 2 (4 Points)

a) When **17.2** is **subtracted** from **45.58**, the result should be reported with **digit(s)** 1 after the decimal point.

b) When **85.49** is divided by **59.6**, the answer should be reported to significant 3 digit(s).

Question 3 (3 Points)

A copy of your chemistry textbook is found to have a volume of **2.81×10^3 mL**. Using unit analysis, show what the **volume** of this copy of your chemistry textbook is in **L**.

1 g = 1000 mg	1000 mL = 1 L	100 cm = 1 m
1000 mg = 1 g	1 mL = 1 cm^3	1000 mm = 1 m

No need to do the calculation – just set up the correct dimensional analysis conversions – **you may not need to fill in all the boxes**.

$$2.81 \times 10^3 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \_\_\_\_$$

Question 4 (6 Points)

Decide if the following statements are true (**T**) or false (**F**):

You must get all three correct to obtain credit - no partial credit awarded.

a) **Protons** and **neutrons** are **equal in mass**, but **opposite in charge**. F

b) The **mass of a proton** is **about the same** as the **mass of a neutron**. T

c) The **electron** acts as a **buffer zone** in the **nucleus** F

Question 5 (6 Points)

a) What is the **mass number** of an atom that contains **31 protons**, **36 neutrons**, and **31 electrons**? 67

b) How **many protons** and **neutrons** are in an atom that has an **atomic number of 39** and a **mass number of 90**? 51 **Neutrons** 39 **Protons**

c) What is the **symbol** of an atom that contains **27 protons**, **32 neutrons**, and **27 electrons**? Co

Question 6 (3 Points)

Lithium has two stable isotopes, **lithium-7**, atomic mass of **7.016 amu** and **lithium-6**, atomic mass of **6.015** amu. From the **atomic weight** of Li = **6.94** one can conclude that:

- ✓ **lithium-7** has the **highest percent natural abundance**
- ☐ **both isotopes** have the **same percent natural abundance**
- ☐ **lithium-6** has the **highest percent natural abundance**

Question 7 (10 Points)

The following questions pertain to the **periodic table** given at the **front of this exam**:

a. The **atomic number** for the element that is in **group 4A** and **period 2**? 6

b. The **atomic weight** for the element in **group 3A** and **period 4**? 69.72

c. **Check** the **elements** that would be expected to have **similar properties**?

☐ Pb ☑ Cl ☐ Be ☑ I ☐ Rn

d. What is the **symbol** of the **alkali metal** that is in **period 5**? Rb

e. **Check** any of the following that are **metals**? (Z = atomic number)

☑ Fe (Z=26) ☐ N (Z=7) ☐ Br (Z=35) ☑ Ba (Z=56) ☐ None of these

Question 8 (8 Points)

Give the correct **formula** for the following **polyatomic ions**:

a) **Phosphide** P^{3-}

b) **Phosphate** PO_4^{3-}

c) **Dihydrogen phosphate** $H_2PO_4^-$

d) **Ammonium** NH_4^+

Question 9 (8 Points)

a. **Name** the compound with the formula **MgS**? Magnesium sulfide

b. **Name** the compound with the formula **$Fe(NO_2)_2$**? Iron(II) nitrite

c. What is the **formula** for **sodium hydrogen carbonate**? $NaHCO_3$

d. What is the **formula** for **copper(II) sulfite**? $CuSO_3$

Question 10 (4 Points)

If a grain of sand weighs **46 mg**, what is the weight (**in grams**) of **610 grains**?

For full credit you must show work.

$$46\ mg \left| \frac{1\ g}{1000\ mg} \right. = 4.6 \times 10^{-2}\ g$$

$$4.6 \times 10^{-2}\ g\ (610) = 28.1\ g$$

28.1 grams

Question 11 (3 Points)

How many **moles** of **nitrite ions** are present in a sample that contains **1.88 moles** of $Mg(NO_2)_2$?

For full credit you must show work.

$$1.88\ mol\ Mg(NO_2)_2 \left| \frac{2\ NO_2^-}{1\ Mg(NO_2)_2} \right. = 3.76\ mol\ NO_2^-$$

3.76 moles

Question 12
4 Points

How many **grams** of **chromium(III) hydroxide** are present in **1.67 moles** of this compound?

For full credit you must show work.

$Cr(OH)_3$: $52.00 + 3(16.00 + 1.01) = 103.03\ g.mol^{-1}$

$$1.67\ mol\ Cr(OH)_3 \left| \frac{103.03\ g}{1\ mol} \right. = 172\ g$$

172 grams

Question 13
6 Points

Balance the following chemical equations using the **smallest possible integer coefficients**.

a. ___ Mg_3N_2 (s) + 6 H_2O (l) → 3 $Mg(OH)_2$ (aq) + 2 NH_3(aq)

b. Write a **balanced equation** for the **complete oxidation** reaction that occurs when **acetylene** (C_2H_2) burns in air..

2 C_2H_2 + 5 $O_2(g)$ → 4 CO_2 + 2 H_2O

c. When aqueous solutions of barium hydroxide, **$Ba(OH)_2$**, and nitric acid, **HNO_3** are combined, **barium nitrate** and **water** are formed.

___ $Ba(OH)_2$ (aq) + 2 HNO_3 (aq) → ___ $Ba(NO_3)_2$ + 2 H_2O

Question 14
10 Points

a) Write the **electron configuration** for the **sodium** atom: $1s^2 2s^2 2p^6 3s^1$

b) Write the **electronic configuration** for the **argon** atom: $1s^2 2s^2 2p^6 3s^2 3p^6$

c) Write the **noble gas configuration** for **vanadium** atom: $[Ar]\ 4s^2 3d^3$

d) The following Lewis diagram represents the **valence electron configuration** of a main-group element. X:. If this element is in **period 2**, its **valence electron configuration** is: $2s^2$

e) The element with an **electron configuration** of **$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$** is in **group** IVB and **period** 4 .

Question 15
6 Points

a) What is the **maximum number of electrons** possible in the shell with **n = 4** in an atom? 32

b) How many **types of orbitals** are there in the shell with **n = 2** in an atom? 2

c) How many **4d orbitals** are there in an atom? 5

Question 16
4 Points

Each of the orbitals depicted is from **the lowest energy shell possible** for its type. Which one has the **lowest shell number (n)**?

☐ ☑

Question 17 4 Points	Using only the periodic table **arrange** the following elements in order of **increasing atomic** radius: **S, Po, Te, O** O (Smallest) — S — Te — Po (Largest)
Question 18 4 Points	Using only the periodic table **arrange** the following elements in order of **decreasing ionization energy**: **Ca, As, K, Ge** As (Highest) — Ge — Ca — K (Smallest)

Exam I Score