Chemistry 1094 Spring 2018 Test 1

Wednesday, January 31, 2018 Time: 1 hour 50 minutes

Name: ANSWERS Student Number: _____

*This test consists of **seven** pages of questions, a periodic table, and a page containing additional information about the elements. Please ensure that you have a complete paper and, if you do not, obtain one from me immediately. There are **64** marks available. Good luck!*

1) **[4 marks]** Express the following numbers in scientific notation, to the correct number of significant figures:

a) 1,200,000 1.2×10^{6}

b) 0.000 000 641 0 6.410×10^{-7}

c) 450.0 4.500×10^{2}

d) 0.078 7.8×10^{-2}

2) **[4 marks]** Perform the following calculations. Round your answers to the correct number of significant figures.

a) **[0.5 marks]** 321.8 – 2.398 319.4

b) **[0.5 marks]** 851.3 x 0.0020 1.7

c) **[1 mark]** (421.2 – 0.002)/21.2 $\frac{421.198}{21.2} = 19.9$

d) **[2 marks]** (26.338 – 2.14)/(5.23 + 6.118) $\frac{24.198}{11.348} = 2.132$

3) **[10 marks total]** Perform the following unit conversions. You need not express your answers to the correct number of significant figures.

a) **[2 marks]** 4.58 cm to nm

$$4.58\,cm \times \frac{1\,m}{100\,cm} \times \frac{1\,nm}{1\times10^{-9}\,m} = \boxed{4.58\times10^{7}\,nm}$$

b) **[2 marks]** 6.3 ft to m, if 12 in = 1 ft, and 2.54 cm = 1 in

$$6.3\,ft \times \frac{12\,in}{1\,ft} \times \frac{2.54\,cm}{1\,in} \times \frac{1\,m}{100\,cm} = \boxed{1.92024\,m}$$

c) **[3 marks]** 12.6 m^2 to ft^2, if 2.54 cm = 1 in, and 12 in = 1 ft

$$12.6\,m^2 \times \left(\frac{100\,cm}{1\,m}\right)^2 \times \left(\frac{1\,in}{2.54\,cm}\right)^2 \times \left(\frac{1\,Ft}{12\,in}\right)^2$$

$$= \boxed{135.6\,ft^2}$$

d) **[3 marks]** 8.93 $\frac{g}{cm^3}$ to $\frac{lb}{in^3}$, if 50 lb = 22679.6 g, and 2.54 cm = 1 in

$$8.93\,\frac{g}{cm^3} \times \left(\frac{2.54\,cm}{1\,in}\right)^3 \times \left(\frac{50\,lb}{22679.6\,g}\right)$$

$$= \boxed{0.3226\,\frac{lb}{in^3}}$$

4) **[5 marks]** The silver medals at this year's Pyeongchang Olympics have a mass of 580 grams, and are 92.5 mm in diameter. Assuming the volume of the medals is given by $V = \pi \times \left(\frac{d}{2}\right)^2 \times t$ (d is diameter, and t is thickness), what should be the thickness of the silver medal? Give your answer in mm. The density of silver is 10.49 g/cm^3. You need not express your answer to the correct number of significant figures.

$$10.49\ \frac{g}{cm^3} \times \left(\frac{100\ cm}{1\ m}\right)^3 \times \left(\frac{1\times10^{-3}\ m}{1\ mm}\right)^3 = 0.01049\ \frac{g}{mm^3}$$

$$580\ g \times \frac{1\ mm^3}{0.01049\ g} = \pi \times \left(\frac{92.5}{2}\right) \times t$$

$$\Rightarrow \boxed{t = 8.22\ mm\ thick}$$

5) **[4 marks]** Suppose you wanted to determine the density of gold. You could do that by taking a 193.2-gram piece of gold and putting it into a can completely filled with ethanol (D = 0.789 g/mL). This, of course, would cause some of the ethanol to spill out. (Assume the volume of ethanol spilled out was equal to the volume of gold.) If the can and ethanol had a mass of 1218.31 grams before you added the gold, and 1403.62 grams after you added the gold, what is the density of the gold? Give your answer in g/cm^3. You need not express your answer to the correct number of significant figures.

If no ethanol spilled, mass is $1218.31 + 193.2 = 1411.51$ g

So ethanol spilled $= 1411.51 - 1403.62 = 7.89$ g

$$7.89\ g \times \frac{1\ cm^3}{0.789\ g} = 10\ mL\ eth.\ spilled = vol.\ gold.$$

$$\therefore D_{gold} = \frac{193.2\ g}{10\ cm^3} = \boxed{19.32\ \frac{g}{cm^3}}$$

6) **[4 marks]** Classify the following as **He**terogeneous mixtures, **Ho**mogeneous mixtures, **E**lements, or **C**ompounds. Circle your choice.

Brewed coffee	He	(Ho)	E	C
Gravel	(He)	Ho	E	C
Carbon dioxide	He	Ho	E	(C)
Silicon	He	Ho	(E)	C

7) **[4 marks]** Classify the following as **C**hemical **C**hanges, **C**hemical **P**roperties, **P**hysical **C**hanges, or **P**hysical **P**roperties. Circle your choice.

Magnesium is shiny and silver	CC	CP	PC	(PP)
Water is evaporating	CC	CP	(PC)	PP
Iron will react with oxygen to form rust	CC	(CP)	PC	PP
Methanol is burning	(CC)	CP	PC	PP

8) **[2 marks]** You are given a large sample of a solid and asked to determine whether that solid is a compound. You discover that a 0.500-gram sample of the solid contains 0.0500 grams of sodium, a 1.70-gram sample of the solid contained 0.200 grams of sodium, and a 0.750-gram sample of the solid contained 0.150 grams of sodium. Is the solid a compound? How do you know? (No marks for guessing. ☺)

sample 1: $\frac{0.05}{0.5} \times 100 = 10\%$ Na

sample 2: $\frac{0.2}{1.7} \times 100 = 11.8\%$ Na

sample 3: $\frac{0.15}{0.75} \times 100 = 20\%$ Na

% Na is different for all samples, so solid is NOT a compound

9) **[3 marks]** If you take a 2-gram sample of S_8 and convert it to SF_4, and a different 3-gram sample of S_8 and convert it to SF_6, what will be the ratio $\frac{mass\ of\ F\ in\ SF_4}{mass\ of\ F\ in\ SF_6}$?

$$\frac{2\,S_8 \times \frac{8S}{1S_8} \times \frac{4F}{1S}}{3S_8 \times \frac{8S}{1S_8} \times \frac{6F}{1S}} = \frac{8}{18} = \boxed{\frac{4}{9}}$$

10) **[6 marks]** Pick an element from the periodic table that matches the description given. Give the symbol for that element in the space provided.

A period 3 alkali metal	Na
A halogen that is liquid at room temperature	Br
A period 4 semiconductor	Ge
An actinoid used in nuclear weapons	U
A group VIA element that occurs naturally as a diatomic molecule	O
A period 4 metal that takes on more than one possible charge in ionic compounds	Fe

11) **[18 marks]** Fill in the missing information in the table below.

Formula	Name
NaCl	sodium chloride
CaS	calcium sulphide
$Al(NO_3)_3$	aluminum nitrate
$NaClO_3$	sodium chlorite
$Fe_2(SO_3)_3$	iron (III) sulphite
$Hg_2(C_2H_3O_2)_2$	mercury(I) acetate
$(NH_4)_2CO_3 \cdot 3H_2O$	ammonium carbonate
$Ti(IO_3)_2 \cdot 7H_2O$	titanium(II) iodate heptahydrate
$H_2S(g)$	hydrogen sulphide
$HBr(aq)$	hydrobromic acid
HNO_2	nitrous acid
H_2SO_3	sulphurous acid
HIO_4	periodic acid
H_3PO_4	Phosphoric acid
$Cr(OH)_3$	chromium (III) hydroxide
$Ca(OH)_2$	calcium hydroxide
NF_3	nitrogen trifluoride
Cl_2O_5	dichlorine pentoxide