Chem 1141
Fall 2014
Exam 1B

Name: KEY

Please write your full name, and which exam version (1B) you have on the scantron sheet.

Multiple Choice: _____ /30

Q11: _____ /10

Q12: _____ /10

Q13: _____ /10

Q14: _____ /10

Q15: _____ /10

Q16: _____ /10

Q17: _____ /10

BONUS: _____ /3

TOTAL: _____ /100

Multiple Choice. [3 points each.] Record your answers to the multiple choice questions on the scantron sheet.

Q1. How many significant figures are in the following measurement: 6.080×10^4 mL water?

a) 2 b) 3 c) 4 d) 5 e) 6

Q2. Which of the following is a mixture?

a) beer b) steam c) iron d) table sugar e) sodium chloride

Q3. Which of the following doesn't exist as a diatomic molecule (i.e. which is wrong as written)?

a) F_2 b) C_2 c) O_2 d) Cl_2 e) H_2

Q4. Which of the following elements is most likely to form an ion with a 2– charge?

a) O b) Mg c) Na d) Cl e) Li

Q5. Water has a boiling point of 100 °C. This is an example of a(n):

a) Chemical Property b) Physical Property c) Intensive Property
d) Extensive Property e) Both (b) and (c)

Q6. An irregularly shaped object was weighed by the following difference:

Watch glass + metal	= 56.7813 g
Watch glass	= 35.4725 g

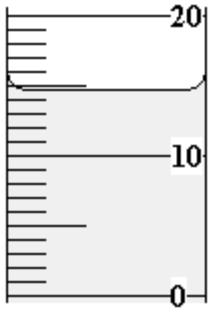
The volume of the metal was determined by placing the metal in a graduated cylinder that had water in it and measuring the volume difference.

Graduated cylinder + water + metal	= 14.15 mL
Graduated cylinder + water	= 11.24 mL

The density should be reported as:

a) 1.90 g/mL b) 19.5 g/mL c) 7.32 g/mL d) 7.3 g/mL e) 7.3226 g/mL

Q7. How much water is contained in the 20-mL measuring cylinder shown below:



a) 10.5 mL b) 15 mL c) 16.0 mL
d) 14.8 mL e) 10.48 mL

Q8. The nuclide symbol for the species that has the same number of electrons as $^{37}_{17}Cl^-$ is

a) $^{37}_{17}Cl$ b) $^{35}_{16}S^{2-}$ c) $^{32}_{16}S$ d) $^{31}_{15}P^{3+}$ e) $^{34}_{14}Si$

Q9. Isotopes are:

a) Atoms that only differ in the number of electrons they contain
b) Atoms that only differ in the number of neutrons they contain
c) Atoms that only differ in the number of protons they contain
d) Atoms that only differ in the number of nuclei they contain
e) Atoms that only differ in the number of electrons in the valence shell

Q10. The formulas of the nitrite, phosphide, and nitrate ions are represented, respectively, as:

a) NO_2^-, PO_4^{3-}, NO_4^- b) N^{3-}, PO_3^{3-}, NO_3^-
c) NO^-, P^{5-}, NO_3^- d) NO_2^-, P^{3-}, NO_3^- e) NO_3^-, PO_2^-, N^{3-}

Short Response.

Show all work to receive credit. You must use the factor-label (conversion-factor) method for all conversions. Be sure to show all units and write your answers using the correct number of significant figures or decimal places.

Q11. [10 pts.] a) Name an element in the second period of the periodic table: Lithium, beryllium, boron, ...

b) Give the name of group VIIA of the periodic table: Halogens

c) Give the name of group IIA of the periodic table: Alkaline Earth Metals

d) Name an element that is a metalloid: Silicon, germanium, ...

e) Name an element that is a transition metal: Scandium, titanium, vanadium, chromium, ...

Q12. [10 pts.] The world record for the 200-meter dash is 19.19 seconds, ran by Usain Bolt in 2009. Convert this to miles per hour. Note: 1.000 mile = 1.603 km.

$$\frac{200\text{m}}{19.19\text{s}} \times \frac{60\text{s}}{1\text{min}} \times \frac{60\text{min}}{1\text{hr}} \times \frac{1\text{km}}{10^3\text{m}} \times \frac{1\text{mi}}{1.603\text{km}} = 23.4\frac{\text{mi}}{\text{hr}} \text{ (3 s.f.)}$$

Q13. [10 pts.] Write formulas for the following compounds:

a) copper(I) nitride Cu_3N $Cu^{+}\ N^{3-}$

b) heptasulfur decoxide S_7O_{10}

c) ferric carbonate $Fe_2(CO_3)_3$ $Fe^{3+}\ CO_3^{2-}$

d) calcium cyanide $Ca(CN)_2$ $Ca^{2+}\ CN^{-}$

e) tetranitrogen hexabromide N_4Br_6

Q14. [10 pts.] One isotope of a metallic element has the mass number of 82, and 40 neutrons. The cation derived from this isotope has 39 electrons. Write the nuclide symbol for this isotope. Be sure to include the charge.
Hint: see one of the multiple choice questions for an example of a nuclide symbol.

$A = \#p^+ + \#n^0$

${}^{A}_{Z}X$ $Z = \#p^+ = 82 - 40 = 42$ $\boxed{{}^{42}_{}Mo}$

Atom: $42p^+ + 42e^-$ (neutral)

ion: $39e^-$? $\Rightarrow$ lost $3e^-$

$\Rightarrow$ 3+ charge

${}^{82}_{42}Mo^{3+}$

Q15. [10 pts.] Name the following compounds:

a) K_2SO_4 potassium sulfate

b) F_3Br_9 trifluorine nonabromide

c) $CuNO_2$ copper(I) nitrite (OR) cuprous nitrite

d) $SiCl_4$ silicon tetrachloride

e) $Na_3PO_4{\cdot}4H_2O$ sodium phosphate tetrahydrate

Q16. [10 pts.] The density of mercury is 13.6 g/cm^3. How many quarts (qt) does 301 g of Hg occupy? (1.000 L = 1.057 qt)

$d = m/V \Rightarrow V = m/d = \frac{301\,g}{13.6\,g/cm^3} = 22.1\,cm^3$ (3 s.f.)

$22.1\,cm^3 \times \frac{1\,L}{1000\,cm^3} \times \frac{1.057\,qt}{1.000\,L} = 0.0234\,qt$ (3 s.f.)

Q17. [10 pts.] Provide the results of the following calculations with the correct number of significant figures:

a) 80.321 – 79.783 = 0.538 (3 d.p.)

b) 0.0004760 × 0.27615 = 1.314×10^{-4} (4 s.f.)

c) (3.771 × 3.27) / 2.00 = 6.17 (3 s.f.)

d) 18.125 + 0.00213 + 71.9 = 90.0 (1 d.p.)

e) (1.230 + 2.17) / (34.0 – 13.0) = 0.612 (3 s.f.)

BONUS: The white blood cell concentration in normal blood is approximately 12,000 cells/mm^3 of blood. How many white blood cells does a normal adult with 5-L of blood have? Express the answer in scientific notation.

$5\,L \times \frac{10^3\,cm^3}{1\,L} \times \left(\frac{10\,mm}{1\,cm}\right)^3 \times \frac{12{,}000\,cells}{1\,mm^3} = 6 \times 10^{10}\,cells$

OR ... $\times \left(\frac{10^{-2}\,m}{cm}\right)^3 \times \left(\frac{mm}{10^{-3}\,m}\right)^3 \times$ ...