CHEM 1364
Test #1
Summer 2014 (Buckley)

Circle the letter corresponding to the one best answer for each of the following multiple choice questions. Each multiple choice question is worth two points.

1. Which one of the following statements is true about a gas?
   a. the particles in a gas are very close together  
   b. a gas occupies the volume of its container but has a flat top  
   c. a gas is not compressible  
   d. the particles of a gas move very rapidly compared to particles of liquids and solids  
   e. particles of a gas are fixed in position

2. Which one of the following statements refers to a physical property?
   a. benzene boils at 80.1 °C  
   b. water can be broken into hydrogen and oxygen by running electricity through it  
   c. gasoline can start on fire in the presence of air  
   d. copper does not react with water  
   e. silver metal reacts with copper in solution

3. Which one of the following is an example of an intensive property?
   a. boiling point  
   b. mass  
   c. volume  
   d. length of a sample of wire  
   e. weight

4. The nuclide symbol for a nucleus containing 24 protons and 29 neutrons is:
   a.²⁴Cu  
   b.²⁵Cu  
   c.²³Cu  
   d.²⁷Cr  
   e.²⁴Xe

5. An isotope of rubidium has a mass number of 87. What is its nuclide symbol?
   a.⁵⁰Rb  
   b.⁸⁷Rb  
   c.⁵⁰Rb  
   d.⁸⁷Rb  
   e.⁸⁶Rb

6. Which one of the following is NOT an SI unit?
   a. g  
   b. m  
   c. mol  
   d. K  
   e. s
7. (3 points) Use the letter before each name below to match the name with the contribution attributed to that person.

   A. JJ Thomson  C. Oil drop experiment
   B. John Dalton  A. Cathode Ray Tube
   C. Robert Millikan  D. Gold foil experiment
   D. Ernest Rutherford  B. Early atomic theory

8. (5 points) Place a mark in **ALL** of the boxes below that are examples of a chemical change.

   - [x] bread is toasted in a toaster
   - [ ] a piece of meat is cooked on the grill
   - [ ] sugar is dissolved in water
   - [ ] dry ice sublimes (goes from solid to vapor without any intervening liquid)
   - [x] food you eat helps your body function

   If you have concerns about any of your answers, please give a very brief description as to what those might be:

9. (5 points) Place a mark in all of the boxes below that are examples of homogeneous mixtures.

   - [ ] smoggy air in Los Angeles
   - [x] a pinch of sugar in a gallon of water
   - [x] clean air
   - [ ] asphalt
   - [ ] pure water **NOTICE THIS IS A COMPOUND, NOT A MIXTURE**

   If you have concerns about any of your answers, please give a very brief description as to what those might be:
Short answer questions and problems. Point totals are indicated in parentheses to the right of each problem number.

10. (5 points) An element has two naturally occurring isotopes as shown in the table below.

<table>
<thead>
<tr>
<th>Atomic mass (amu)</th>
<th>% natural abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>68.925580</td>
<td>60.108</td>
</tr>
<tr>
<td>69.926028</td>
<td>39.892</td>
</tr>
</tbody>
</table>

Find the average atomic mass of this element and SHOW YOUR WORK.

\[
\text{AV. ATOMIC MASS} = 68.925580 \times 0.60108 + 69.926028 \times 0.39892
\]

\[= 69.324679\]

11. (10 points) Conduct the following metric conversions. You can use the right hand side of the problem for scratch work.

\[6.75 \text{ mm} = \frac{6.75 \times 10^{-6}}{} \text{ km}\]

\[3.67 \times 10^{-4} \text{ g} = \frac{3.67 \times 10^{-1}}{} \text{ mg}\]

\[9.14 \times 10^8 \text{ kg} = \frac{9.14 \times 10^{17}}{} \text{ µg}\]

\[4.65 \text{ cs} = \frac{465}{98} \text{ ms}\]

\[6.55 \times 10^5 \text{ mmol} = \frac{6.55 \times 10^3}{3} \text{ dmol}\]

12. (5 points) Give the value of Avogadro’s number and describe what it means.

\[6.022 \times 10^{23}\]

It is the number of \(\text{item}\) in one \(\text{mole}\) of \(\text{anything}\).

\[\frac{5}{\text{atoms}}, \frac{4}{\text{molecules}}, \frac{3}{\text{ions}}, \frac{2}{\text{mole number}}\]
13. (10 points) Make the following conversions as indicated and show your work.

a. How many grams of Ca are in 14.6-mol of Ca?

\[
? \text{ g Ca} = \frac{14.6 \text{ mol Ca}}{1} \times \frac{40 \text{ g Ca}}{1 \text{ mol Ca}} = 584 \text{ g Ca}
\]

b. How many atoms of copper are in a sample with a mass of 96.5-g?

\[
? \text{ atoms} = \frac{96.5 \text{ g Cu}}{6.022 \times 10^{23} \text{ atoms}} = 9.05 \times 10^{23} \text{ atoms}
\]

c. The number of mol of Zr in a 8.65-g sample is

\[
? \text{ mol Zr} = \frac{8.65 \text{ g Zr}}{1} \times \frac{1 \text{ mol}}{91 \text{ g Zr}} = 9.50 \times 10^{-2} \text{ mol Zr}
\]

d. How many mol of In are in a sample with a mass of 150.6- g?

\[
? \text{ mol In} = \frac{150.6 \text{ g In}}{1} \times \frac{1 \text{ mol In}}{115 \text{ g In}} = 1.31 \text{ mol In}
\]

e. Which contains more atoms – 50.0-g of Rh or 50.0-g of W?

\[
? \text{ atoms} = \frac{50.0 \text{ g Rh}}{1} \times \frac{6.022 \times 10^{23} \text{ atoms}}{103 \text{ g Rh}} = 3.01 \times 10^{23} \text{ atoms Rh}
\]

\[
? \text{ atoms} = \frac{50.0 \text{ g W}}{1} \times \frac{6.022 \times 10^{23} \text{ atoms}}{184 \text{ g W}} = 1.64 \times 10^{23} \text{ atoms W}
\]
<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tera-</td>
<td>T</td>
<td>$1 \times 10^{12}$</td>
<td>1 teragram (Tg) = 1 \times 10^{12} g</td>
</tr>
<tr>
<td>Giga-</td>
<td>G</td>
<td>$1 \times 10^{9}$</td>
<td>1 gigawatt (GW) = 1 \times 10^9</td>
</tr>
<tr>
<td>Mega-</td>
<td>M</td>
<td>$1 \times 10^{6}$</td>
<td>1 megahertz (MHz) = 1 \times 10^6</td>
</tr>
<tr>
<td>Kilo-</td>
<td>k</td>
<td>$1 \times 10^{3}$</td>
<td>1 kilometer (km) = 1 \times 10^3 m</td>
</tr>
<tr>
<td>Deci-</td>
<td>d</td>
<td>$1 \times 10^{-1}$</td>
<td>1 deciliter (dL) = 1 \times 10^{-1} L</td>
</tr>
<tr>
<td>Centi-</td>
<td>c</td>
<td>$1 \times 10^{-2}$</td>
<td>1 centimeter (cm) = 1 \times 10^{-2} m</td>
</tr>
<tr>
<td>Milli-</td>
<td>m</td>
<td>$1 \times 10^{-3}$</td>
<td>1 millimeter (mm) = 1 \times 10^{-3} m</td>
</tr>
<tr>
<td>Micro-</td>
<td>\mu</td>
<td>$1 \times 10^{-6}$</td>
<td>1 microliter (\mu L) = 1 \times 10^{-6} L</td>
</tr>
<tr>
<td>Nano-</td>
<td>n</td>
<td>$1 \times 10^{-9}$</td>
<td>1 nanosecond (ns) = 1 \times 10^{-9} s</td>
</tr>
<tr>
<td>Pico-</td>
<td>p</td>
<td>$1 \times 10^{-12}$</td>
<td>1 picogram (pg) = 1 \times 10^{-12} g</td>
</tr>
</tbody>
</table>

TABLE 1.2  Prefixes Used with SI Units
<table>
<thead>
<tr>
<th></th>
<th>1A</th>
<th>2A</th>
<th>3A</th>
<th>4A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Na</td>
<td>Mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>K</td>
<td>Ca</td>
<td>Sc</td>
<td>Ti</td>
</tr>
<tr>
<td>6</td>
<td>Rb</td>
<td>Sr</td>
<td>Y</td>
<td>Zr</td>
</tr>
<tr>
<td>7</td>
<td>Cs</td>
<td>Ba</td>
<td>La</td>
<td>Hf</td>
</tr>
<tr>
<td>8</td>
<td>Fr</td>
<td>Ra</td>
<td>Ac</td>
<td>Sc</td>
</tr>
</tbody>
</table>

### Key
- Atomic number
- Element symbol
- Element name
- Average atomic mass

### Notes
- If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.

<table>
<thead>
<tr>
<th></th>
<th>5A</th>
<th>6A</th>
<th>7A</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Pa</td>
<td>U</td>
<td>Np</td>
</tr>
<tr>
<td>10</td>
<td>Th</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Periodic Table

- **Group 1 (IA)**: H, Li, Na, K, Rb, Cs
- **Group 2 (1A)**: Be, Mg, Ca, Sr, Ba, Ra
- **Group 3 (IIA)**: Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn
- **Group 4 (IIIA)**: Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd
- **Group 5 (IVA)**: Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg
- **Group 6 (VA)**: Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es

- **Group 7 (VIA)**: Rf, Db, Sb, B, As, Se, Br, At
- **Group 8 (VIIA)**: Ra, Ac, Tl, Bi, Po, At, W, Re, Os

- **Group 9 (VB)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm
- **Group 10 (VIB)**: Ra, Ac, Tl, Bi, Po, At, W, Re, Os

- **Group 11 (VIIIA)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm
- **Group 12 (VIIIA)**: Ra, Ac, Tl, Bi, Po, At, W, Re, Os

- **Group 13 (IB)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm
- **Group 14 (IIB)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm

- **Group 15 (IIIIB)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm
- **Group 16 (IIIB)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm

- **Group 17 (IIIC)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm
- **Group 18 (IIID)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm

- **Group 19 (IIIE)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm
- **Group 20 (IIIF)**: Fr, Ra, Th, Pa, U, Np, Pu, Am, Cm