

Chemistry 121  
Spring 2004  
Test 1  
FORM A

Name: KEY

Instructions: You have 75 minutes to complete this 100-point exam. You may use a simple scientific calculator. No programmable calculators allowed.

$$^{\circ}F = \left(\frac{9^{\circ}F}{5^{\circ}C}\right)(^{\circ}C) + 32^{\circ}F$$

$$^{\circ}C = \left(\frac{5^{\circ}C}{9^{\circ}F}\right)(^{\circ}F - 32^{\circ}F)$$

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1000\text{g} = 1\text{kg}$$

$$1000 \text{ mg} = 1 \text{ g}$$

**I. MULTIPLE CHOICE:** (30 pts, 3 points each) Carefully and clearly circle the best answer.

1. The correct elemental symbol for silicon is:

- a. S
- b. Se
- C  c. Si
- d. Sc

2. Which element has properties similar to arsenic, As?

- A  a. Sb
- b. Se
- c. Ge
- d. S

3. The melting point of sodium is  $98^{\circ}\text{C}$ , what is this in Kelvin?

- a. 175 K
- B  b. 371 K
- c.  $-175 \text{ K}$
- d.  $-371 \text{ K}$

$$98 + 273 = 371$$

4. Which of the following elements is an alkaline earth metal?

- a. Na
- b. F
- D  c. Cr
- d. Sr

5. A calcium atom has 20 neutrons. Its mass number is:

- a. 40.08
- b. 20
- C  c. 40
- d. 60

6. An atom of vanadium (V) loses 2 electrons. It is now called a(n)

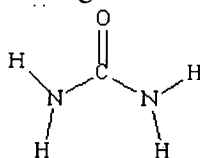
- a. Anion  
b. Element  
c. Isotope  
d. Cation
- D

7. What ion is likely to form from selenium (Se)?

- a.  $\text{Se}^+$   
b.  $\text{Se}^{2+}$   
c.  $\text{Se}^{-2}$  ← 6A  
d.  $\text{Se}^-$
- C

8. What is the chemical formula of the following molecule?

- a.  $\text{CN}_2\text{OH}_4$   
b.  $\text{H}_2\text{NCONH}_2$   
c.  $\text{ON}_2\text{CH}_4$   
d.  $\text{CH}_4\text{N}_2\text{O}$
- D



9. If sodium acetate,  $\text{NaCH}_3\text{CO}_2$ , breaks up, what ions will result?

- a.  $\text{Na}^+$ ,  $\text{CH}_3$ ,  $\text{CO}_2$   
b.  $\text{Na}$ ,  $\text{CH}_3\text{CO}_2$   
c.  $\text{Na}^+$ ,  $\text{CH}_3\text{CO}_2^-$   
d.  $\text{Na}^{2+}$ ,  $\text{CH}_3\text{CO}_2^{2-}$
- C

10. The smallest particle of an element that retains the chemical properties of the element is a(n):

- a. atom  
b. ion  
c. solid  
d. molecule
- A

**II. Short Answer and Calculations (80 pts):** Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. (10 pts) Name the following compounds:

a.  $\text{SCl}_2$

sulfur dichloride

b.  $\text{PF}_3$

phosphorous trifluoride

c.  $\text{CaSO}_4$

calcium sulfate

d.  $\text{Fe}_2\text{O}_3$

iron (III) oxide

e.  $\text{NH}_4\text{NO}_3$

ammonium nitrate

2. (10 pts) Give the correct formula for the following compounds:

a. Sulfur hexafluoride

$\text{SF}_6$

b. Sodium carbonate

$\text{Na}_2\text{CO}_3$

c. Magnesium hydroxide

$\text{Mg}(\text{OH})_2$

d. Chromium (II) chloride

$\text{CrCl}_2$

e. Copper (II) hydroxide hexahydrate

$\text{Cu}(\text{OH})_2 \cdot 6\text{H}_2\text{O}$

3. (10 pts) What is the volume of 3.00 g alcohol that has a density of 0.785 g/mL?

$$3.00 \text{ g} \times \frac{\text{mL}}{0.785 \text{ g}} = 3.82 \text{ mL}$$

4. (10 pts) What is the molar mass of ammonium sulfide,  $(\text{NH}_4)_2\text{S}$ ?

|     |                    |
|-----|--------------------|
| 2 N | $2(14.01) = 28.02$ |
| 8 H | $8(1.008) = 8.064$ |
| 1 S | $1(32.06) = 32.06$ |
|     | <hr/>              |
|     | 68.14 g/mol        |

5. (10 pts) How many molecules are there in 2.35 g of ammonium sulfide? (HINT: use molar mass from previous problem)

$$2.35 \text{ g } (\text{NH}_4)_2\text{S} \times \frac{\text{mol } (\text{NH}_4)_2\text{S}}{68.14 \text{ g } (\text{NH}_4)_2\text{S}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}}$$
$$= 2.08 \times 10^{22} \text{ molecules } (\text{NH}_4)_2\text{S}$$

6. (15 pts) Element Q on Planet Qurtok has 2 stable isotopes,  $^{49}\text{Q}$  (49.06885 g/mol) and  $^{52}\text{Q}$  (51.96590 g/mol). What is the percent abundance of each isotope if the molar mass of Q is 49.9576 g/mol?

$$\frac{49.06885(x) + 51.96590(1-x)}{49.9576} \quad 1-x = 1-0.6932 = 0.3068$$

$$49.06885x + 51.96590 - 51.96590x = 49.9576$$

$$-2.89705x = -2.0083$$

$$x = 0.6932$$

69.32%  $^{49}\text{Q}$  and 30.68%  $^{52}\text{Q}$

7. (15 pts) Vitamin C (also called Ascorbic Acid) can be found in citrus fruit, berries, broccoli, tomatoes, etc. It is composed of carbon (40.91%), hydrogen (4.55%) and oxygen (54.55%) and has a molar mass of 176 g/mol. What are Vitamin C's empirical and molecular formulas?

Assume 100. g

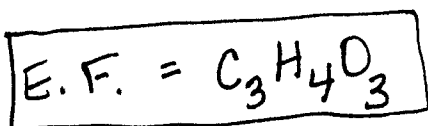
$$40.91 \text{ g C} \times \frac{\text{mol C}}{12.01 \text{ g C}} = 3.406 \text{ mol C}$$

$$4.55 \text{ g H} \times \frac{\text{mol H}}{1.008 \text{ g H}} = 4.51 \text{ mol H}$$

$$54.55 \text{ g O} \times \frac{\text{mol O}}{16.00 \text{ g O}} = 3.409 \text{ mol O}$$

$$\frac{\text{C}}{\text{O}} = \frac{3.406}{3.409} = \frac{1}{1}$$

$$\frac{\text{H}}{\text{C}} = \frac{4.51}{3.406} = \frac{1.32 \cdot 3}{1 \cdot 3} = \frac{4}{3}$$



$$\text{MM} = 88.06 \text{ g/mol}$$

$$\frac{\text{MM of MF}}{\text{MM of EF}} = \frac{176}{88.06} = \frac{2}{1}$$

