

Name: KEY

Chemistry 121
Fall 2003
Exam 1
75 minutes/100 pts

FORM A

Instructions: You have 75 minutes to complete this 100-point exam. Indicate your exam form on the line marked "SUBJECT" on the scantron. You may only use non-programmable scientific calculators. NO GRAPHING 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: (80 pts, 4 points each) Carefully indicate the best answers on the scantron provided using a #2 pencil.

1. The number of neutrons in the nucleus of a specific atom is equal to its

- a. atomic mass.
b. mass number.
c. atomic number.
D d. mass number minus the atomic number.

2. The species designated as ${}_{24}^{56}\text{X}$ is

- a. Fe
b. Ge
c. Ba
D d. Cr

3. An atom of strontium-90 (${}_{38}^{90}\text{Sr}$) contains:

- A a. 38 electrons, 38 protons, 52 neutrons.
b. 38 electrons, 38 protons, 90 neutrons.
c. 52 electrons, 52 protons, 38 neutrons.
d. 52 electrons, 38 protons, 38 neutrons.

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

- C a. Ni
b. Ge
c. Sr
d. K

5. Scientists theorize that all molecules stop moving at:

- C a. 0°C
b. 0°F
c. 0°K
d. Molecules never stop moving.

6. Convert 100 inches to meters. (see front of test for conversion factors)

- C a. 254. m
b. 25.4. m
c. 2.54. m
d. 0.254 m

$$100 \text{ in} \times \frac{2.54 \text{ cm}}{1 \text{ in}} \times \frac{1 \text{ m}}{100 \text{ cm}}$$

7. How many significant figures are in 0.0023005600

- C a. 4
b. 6
c. 8
d. 10

8. Which number below represents 2506.020 in correct scientific notation?

- D a. 2.5×10^3
b. 2.506×10^3
c. 2.50602×10^3
d. 2.506020×10^3

9. Which represents an ionic compound?

- B a. CCl_4
 b. CaCl_2
 c. SCl_4
 d. OCl_2

10. The correct name of N_2O_3 is:

- D a. nitrogen oxide.
 b. nitrogen(II) oxide.
 c. nitrous oxide.
 d. dinitrogen trioxide.

11. Substances that contain water incorporated in the crystal lattice are:

- D a. anhydrous.
 b. polymorphous.
 c. amorphous.
 d. hydrates

12. The mass of a metal cylinder was determined on an analytical balance and found to be 50.208 g. The volume of the metal cylinder was measured and determined to be 5.6 mL. The density of the metal cylinder is:

- D a. 280 g/mL
 b. 0.11 g/mL
 c. 31. g/mL
 d. 9.0 g/mL

$$\frac{50.208\text{g}}{5.6\text{mL}}$$

13. What is the molar mass (in g/mol) of iron(III) sulfate, $\text{Fe}_2(\text{SO}_4)_3$ to the nearest whole number?

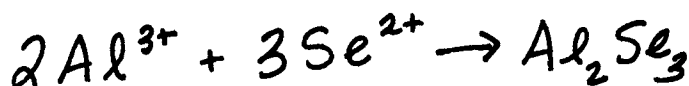
- D a. 104
 b. 152
 c. 308
 d. 400
- | | |
|------|-------------------|
| 2 Fe | 2 (55.85) = 111.7 |
| 3 S | 3 (32.06) = 96.18 |
| 12 O | 12 (16.00) = 192 |
| | <hr/> |
| | 399.88 g/mol |

14. The mass spectrograph may be used to

- A a. detect the presence of isotopes.
 b. increase the mass of atomic nuclei.
 c. electrolyze water.
 d. synthesize new elements.

15. From your knowledge of the periodic nature of the elements, what formula would be predicted for aluminum selenide?

- D a. AlSe
 b. AlSe_2
 c. Al_2Se
 d. Al_2Se_3



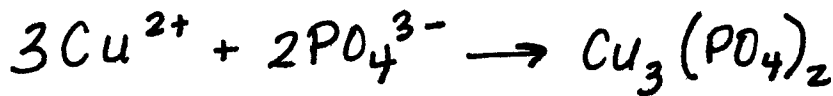
16. In which pair are the elements most similar in their chemical properties?

- A a. Ca and Ba
 b. Ag and Rb
 c. S and P
 d. Cs and Ba

17. What is the chemical formula of copper (II) phosphate

- a. Cu_2PO_4
- b. $\text{Cu}_2(\text{PO}_4)_3$
- c. $\text{Cu}_3(\text{PO}_4)_2$
- d. CuPO_4

C



18. Fluorine, the element of atomic weight 19 and atomic number 9, exists in most of its compounds as an ion of charge:

- a. +1.
- b. +2.
- c. -1.
- d. -2

C

19. The percent by mass of oxygen in $\text{Ca}(\text{NO}_3)_2$ is best represented by:

Atomic Molar Masses	
Ca	40.1 $\text{g}\cdot\text{mol}^{-1}$
N	14.0 $\text{g}\cdot\text{mol}^{-1}$
O	16.0 $\text{g}\cdot\text{mol}^{-1}$

C

(A) $\frac{16.0}{70.1} \times 100$

(D) $\frac{48.0}{102.1} \times 100$

(B) $\frac{96.0}{102.1} \times 100$

(E) $\frac{48.0}{164.1} \times 100$

(C) $\frac{96.0}{164.1} \times 100$

20. How many moles of potassium ions are in 25.0 g of K_2SO_4 ? (MM of $\text{K}_2\text{SO}_4 = 174.26 \text{ g/mol}$)

- a. 0.286 mol K^+
- b. 0.286 mol K
- c. 0.143 mol K^+
- d. 0.143 mol K

A

$$25.0 \text{ g } \text{K}_2\text{SO}_4 \times \frac{1 \text{ mol } \text{K}_2\text{SO}_4}{174.26 \text{ g } \text{K}_2\text{SO}_4} \times \frac{2 \text{ mol } \text{K}^+}{1 \text{ mol } \text{K}_2\text{SO}_4}$$

II. Calculations (30 pts, 10 pts each): 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. A compound is found to consist of 34.9% sodium, 16.4% boron and 48.6% oxygen. What is its empirical formula? (MM of Na = 22.99 g/mol, MM of B = 10.81 g/mol and MM of O = 16.00 g/mol)

Assume 100. g

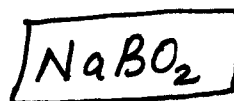
$$34.9 \text{ g Na} \times \frac{\text{mol Na}}{22.99 \text{ g Na}} = 1.52 \text{ mol Na}$$

$$\frac{\text{Na}}{\text{B}} = \frac{1.52}{1.52} = \frac{1}{1}$$

$$16.4 \text{ g B} \times \frac{\text{mol B}}{10.81 \text{ g B}} = 1.52 \text{ mol B}$$

$$\frac{\text{O}}{\text{Na}} = \frac{3.04}{1.52} = \frac{2}{1}$$

$$48.6 \text{ g O} \times \frac{\text{mol O}}{16.00 \text{ g O}} = 3.04 \text{ mol O}$$



2. An element, Q from planet Quark has a molar mass of 326.950 g/mol. This element has two isotopes, ^{320}Q (320.019 g/mol) and ^{328}Q (327.995 g/mol). What is the percent abundance of each isotope of element Q?

^{320}Q

$$320.019x$$

$$13.10\%$$

^{328}Q

$$327.995(1-x)$$

$$100 - 13.10 = 86.9\%$$

$$\frac{326.950}{326.950}$$

$$320.019x + 327.995 - 327.995x = 326.950$$

$$-7.976x = -1.045$$

$$x = 0.1310$$

3. How many caffeine molecules ($\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$) are there in 0.25 g of caffeine? (MM of caffeine = 194.1926 g/mol)

$$0.25 \text{ g C}_8\text{H}_{10}\text{N}_4\text{O}_2 \times \frac{\text{mol C}_8\text{H}_{10}\text{N}_4\text{O}_2}{194.1926 \text{ g C}_8\text{H}_{10}\text{N}_4\text{O}_2} \times \frac{6.02 \times 10^{23} \text{ molecules C}_8\text{H}_{10}\text{N}_4\text{O}_2}{\text{mol C}_8\text{H}_{10}\text{N}_4\text{O}_2}$$

$$= 7.75 \times 10^{20} \text{ molecules C}_8\text{H}_{10}\text{N}_4\text{O}_2$$