Chemistry C101 **Fall 2002 KA**

Examination 1—Form A

Directions:

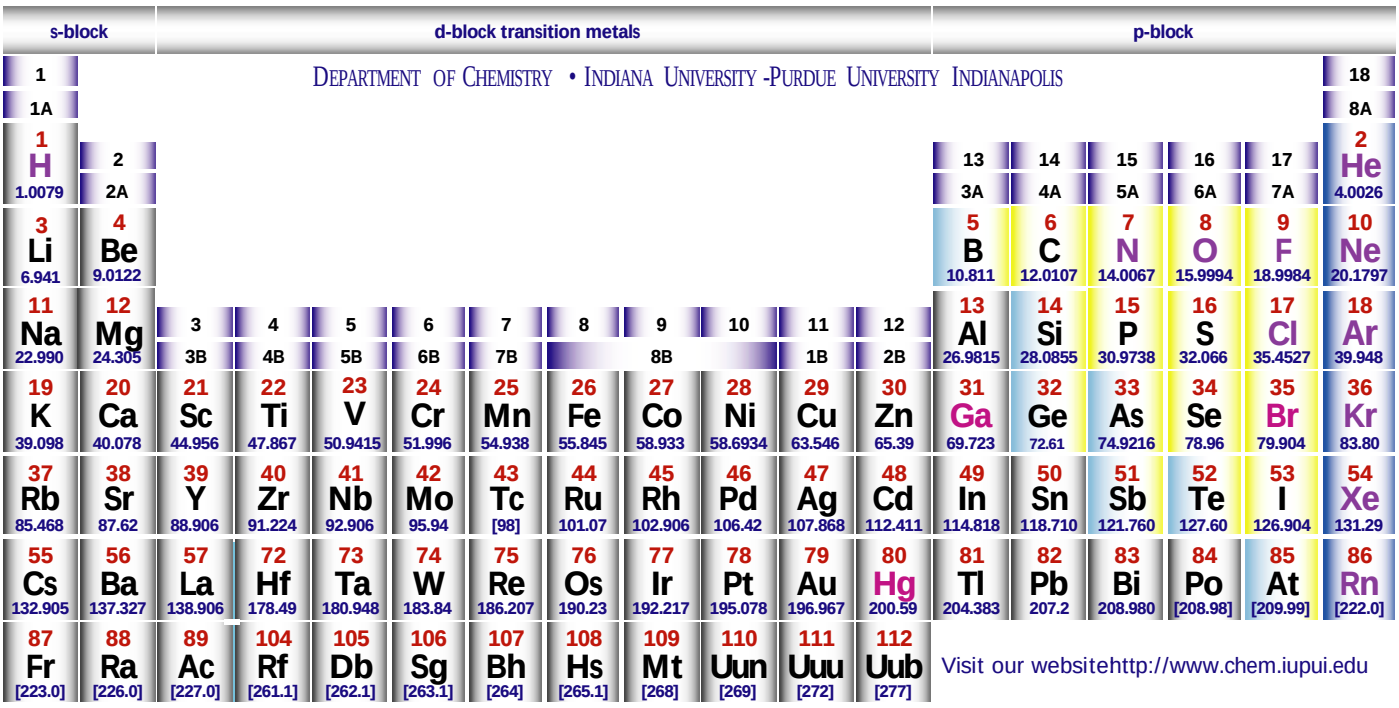
1. Both your **name** and **identification number** must be included and balloons properly darkened on the scan form. Any errors may result in a point penalty. Only the scan form will be graded.

2. Choose the **best** answer in each of the following questions. Using a #2 pencil, fill in the corresponding balloon on your scan form.

Potentially Useful Information

$q = mC\Delta T$	$°C = \frac{5}{9} \times (°F - 32°F)$
1 mile ≡ 5280 ft	$°C = K - 273$
1 inch ≡ 2.54 cm	1 amu = 1.6606×10^{-24} g
1 mL ≡ 1 cm^3	mass of proton: 1.6726×10^{-24} g
$c = 3.000 \times 10^8$ m / sec	mass of electron: 9.1094×10^{-28} g
1 cal = 4.184 J	mass of neutron: 1.6749×10^{-24} g

The symbol "≡" means "identical to", that is, with infinite precision (usually because it's a definition).



Each question is worth 4 points. Choose the BEST answer.

1. Carbon is a metal/nonmetal and has the symbol _____.
   a. metal, C
   b. metal, Ca
   c. nonmetal, C
   d. nonmetal, Ca
   e. nonmetal, Cl

2. Which of the following is a *physical* change or property?
   a. digestion of protein
   b. setting of concrete
   c. water vapor condenses
   d. natural gas burns
   e. iron corrodes

3. The symbols Ar, Sr and Zr are:
   a. argon, strontium and zinc
   b. aurum, silver and zirconium
   c. arsenic, sulfur and xenon
   d. argon, strontium and zirconium
   e. arsenic, sulfur and zirconia

4. Barium and beryllium are examples of
   a. alkaline earth metals.
   b. rare earth metals.
   c. transition metals.
   d. alkali metals.
   e. halogens.

5. Which of the following elements is misspelled?
   a. potassium
   b. fluorine
   c. silicon
   d. phosphorous
   e. **all are correctly spelled**

6. Which formula has the largest number of metal atoms represented in its formula?
   a. $Na_2Cr_2O_7$
   b. Ag_2SO_4
   c. $MgCO_3$
   d. C_6H_6
   e. $KMnO_4$

7. Which of the following has exactly two significant figures (digits)?

   a. 0.66
   b. 500
   c. 9020.
   d. 0.6600
   e. 2.10×10^{1}

8. Which digit is uncertain in the following mass? (Note: **BOLD** type specifies the digit.)

   0.12321 g

   a. 0.**1**2321
   b. 0.1**2**321
   c. 0.12**3**21
   d. 0.123**2**1
   e. 0.1232**1**

9. Which characteristics correctly describe a proton?

   a. mass approximately 1 amu, charge +1, located inside the nucleus
   b. mass approximately 1 amu, charge –1, located inside the nucleus
   c mass approximately 1 amu, charge +1, located outside the nucleus
   d. mass approximately $\frac{1}{1836}$ amu, charge +1, located inside the nucleus
   e. mass approximately $\frac{1}{1836}$ amu, charge –1, located outside the nucleus

10. An atom with mass number (A) 69 and atomic number (Z) 31 contains:

    a. 31 protons and 69 neutrons
    b. 69 protons and 31 neutrons
    c. 31 protons and 38 neutrons
    d. 38 protons and 31 neutrons
    e. 31 protons and 100 neutrons

11. Which of the following types of electromagnetic radiation has the highest energy?

    a. red light
    b. blue light
    c. yellow light
    d. infrared radiation
    e. ultraviolet radiation

12. Express 23400 in scientific notation.

    a. 2.34×10^{3}
    b. 2.34×10^{4}
    c. 2.34×10^{5}
    d. 2.34×10^{-2}
    e. 2.34×10^{-4}

13. Evaluate the following expression to the correct number of significant figures:

$$2.34 \times 10^{-2}\ \text{mL} + 1.002 \times 10^{-2}\ \text{mL} + 0.02\ \text{mL}$$

a. $5. \times 10^{-2}$ mL

b. 5.0×10^{-2} mL

c. 5.3×10^{-2} mL

d. 5.34×10^{-2} mL

e. 5.342×10^{-2} mL

14. What is the mass in grams of 135 atoms of bromine?

Note: 1 amu = 1.6606×10^{-24} grams

a. 1.5394×10^{-28} g

b. 9.8288×10^{-25} g

c. 2.8056×10^{-24} g

d. 7.8463×10^{-21} g

e. 1.7913×10^{-20} g

15. Which is the correct ground state electron configuration for aluminum ion, Al^{3+}?

a. $1s^2 2s^2 2p^2$

b. $1s^2 2s^2 2p^6$

c. $1s^2 2s^2 2p^2 3s^2$

d. $1s^2 2s^2 2p^6 3s^2 3p^1$

e. $1s^2 2s^2 2p^2 3s^2 3p^2$

16. *Isoelectronic* refers to species that

a. have the same charge.

b. have identical mass numbers, A.

c. have identical electron configurations.

d. reside in the same period in the periodic table.

e. have the same number of protons, but different numbers of neutrons.

17. The maximum number of electrons in any orbital is

a. 1

b. 2

c. 6

d. 10

e. 18

18. Which of the following represents a ground state electron configuration?

a. 1s ↑↓ 2s ↑↓ 2p ↑ ↑ ↑ 3s ↑

b. 1s ↑↓ 2s ↑↓ 2p ↑↓ ↑↓ ↑ 3s __

c. 1s ↑↓ 2s ↑ 2p ↑ ↑ ↑ 3s __

d. 1s ↑ 2s ↑ 2p ↑ ↑ ↑ 3s ↑

e. 1s ↑↓ 2s ↑↓ 2p ↑↓ ↑ ↑ 3s ↑

19. Convert 3.5 liters to milliliters.

a. 3.5×10^{-3} mL

b. 3.5×10^{3} mL

c. 3.5×10^{6} mL

d. 350000 mL

e. 0.00350 mL

20. Benzyl salicylate, a sunscreen, melts at 75°F and boils at 608°F. At which temperature would benzyl salicylate be a gas?

a. 0°F

b. 0°C

c. 100°C

d. 300°C

e. **none of the above**

21. How many distinct d-orbitals exist? Remember, the d-block is ten elements wide.

a. 3
b. 5
c. 6
d. 10
e. 18

22. The density of a solution is 1.293 g/mL. What is the mass of 3.0 mL of this solution (with proper attention to correct significant digits)?

a. 0.43 g
b. 4.0 g
c. 3.9 g
d. 3.879 g
e. 2.3 g

23. A sulfur atom that has gained two electrons has the same number of electrons as a neutral atom of:

a. C
b. Ne
c. Mg
d. Si
e. Ar

24. Suppose an equal amount of heat is absorbed by different masses of each of the following metals and you discover that the temperature of the magnesium sample changes the most. Which of the following could be a correct statement of the relative masses of the metal samples studied?

Au: 0.031 cal/g ℃ **Fe**: 0.106 cal/g ℃ **Mg**: 0.245 cal/g ℃

a. mass Au > mass Fe > mass Mg
b. mass Mg > mass Fe > mass Au
c. mass Mg > mass Au > mass Fe
d. mass Au > mass Mg > mass Fe
e. mass Fe > mass Mg > mass Au

25. Which of the following can be classified as a pure *compound* ?

a. glucose, $C_6H_{12}O_6$
b. mercury metal, Hg
c. chlorine gas, Cl_2
d. rubbing alcohol, C_3H_8O in H_2O
e. **all of the above**

26. An extra-strength aspirin tablet contains 0.500 grams of aspirin. How many grains is this? Note: 1 grain = 64.8 mg

a. 3.24×10^4 grains
b. 65.3 grains
c. 32.4 grains
d. 13.0 grains
e. 7.72 grains

27. How many millimeters are there in one kilometer?

a. 10^{-6}
b. 10^{-3}
c. 10^{-2}
d. 10^{3}
e. 10^{6}

28. What temperature is 75.0 °F on the Kelvin scale?

a. 24.0 K
b. 43.0 K
c. 215 K
d. 297 K
e. 348 K

29. An atom that contains 47 protons, 47 electrons and 60 neutrons is an isotope of:
    a. Ag
    b. Al
    c. Nd
    d. Bh
    e. **cannot be determined from the information given**

30. Which element is likely to have chemical properties similar to elemental potassium?
    a. Ar
    b. Ca
    c. Sc
    d. Rb
    e. Sr

31. How many electrons can occupy the shell having n = 2?
    a. 2
    b. 6
    c. 8
    d. 18
    e. 32

32. The neutral element with electron configuration $1s^2 2s^2 2p^4$ is:
    a. Be
    b. C
    c. O
    d. Si
    e. S

33. The neutral element that has exactly four valence electrons is:
    a. H
    b. Na
    c. Mg
    d. Si
    e. S

34. In terms of atomic structure, the common characteristic of elements in the same group is:
    a. number of electrons
    b. number of valence electrons
    c. number of neutrons
    d. number of protons
    e. mass number

35. What temperature change results if 10.0 g of iron absorbs 50.0 calories?
Note: The specific heat of iron is 0.106 cal/g ℃.

a. 47.2 °C
b. 0.530 °C
c. 0.0212 °C
d. 1.89 °C
e. 53.0 °C

36. What is the density if 58.41 g of a metal occupies a volume of 9.0 cubic centimeters (cm^3)? Make sure your answer has the correct number of significant figures.

a. 6.49 g/mL
b. 6.5 g/mL
c. 7 g/mL
d. 0.154 g/mL
e. 0.15 g/mL

37. The densities of ethylene glycol, water and wood alcohol are 1.11 g/mL, 1.00 g/mL and 0.79 g/mL respectively. Suppose an object floats in water and ethylene glycol but sinks when placed in wood alcohol. Which of the following could be the density of the object?

a. 1.22 g/mL
b. 1.11 g/mL
c. 1.05 g/mL
d. 0.92 g/mL
e. 0.75 g/mL

38. When an electrical current is used to make hydrogen gas and oxygen gas from water,

a. a simple change of state (physical change) has occurred.
b. a chemical change has occurred.
c. water is a reactant and hydrogen and oxygen are products.
d. ***a*** and ***c***
e. ***b*** and ***c***

39. The atomic weight listed for an element in the periodic table is

a. the same as the mass number (A) for the element.
b. a weighted average of the weights of naturally-occurring isotopes of the element.
c. the average of the mass number (A) and the atomic number (Z).
d. the mass of an atom with the weight adjusted to reflect loss or gain of electrons.
e. the weight of the predominant isotope found on earth.

40. $^{93}_{42}Mo$ is an isotope of molybdenum with _____ neutrons in its nucleus.

a. 96
b. 93
c. 84
d. 51
e. 42