July 3, 2001 Chemistry 117 Name_____
Summer 2002 Exam 1 NAID_____

**Part I:** Answer each question as completely as possible. Points are awarded on completeness.
**Turn this exam (parts I & II) with your opscan sheet from part II.**

1. Describe the methods of inquiry used in the science of chemistry. Use a flowchart and define each parameter of the flowchart. **(10 points)**

2. What is the group number, chemical symbol and name, atomic number Z, physical form at normal room temperature and 1 atmosphere of pressure, number of electrons in its outermost shell, and charge of the most common ion of the nonmetal chalcogen that constitutes 20% of our breathable atmosphere? **(4 points)**

3. If the diameter of a Na atom is 0.314 nanometers, how many sodium atoms would fit along a line exactly 1 inch long? (2.54 cm ≈ 1 inch)

   a. Show the setup with unit analysis in one complete step. **(5 points)**

   b. Complete the calculation using the given info and above unit analysis. **(5 points)**

4. The periodic table shows a relative atomic mass of each element's symbol. What does this number mean? Describe as completely as possible. **(6 points)**

5. Write the chemical formula or name of the following compounds. **(1 point each)** Identify whether the compound is ionic or covalent in the second column. **(1 point each)**

| | | | |
|---|---|---|---|
| a. | $N_2O_5$ | _____ | _____ |
| b. | boron trifluoride | _____ | _____ |
| c. | $FeSO_4$ | _____ | _____ |
| d. | $CS_2$ | _____ | _____ |
| e. | magnesium chloride | _____ | _____ |

6. Balance the chemical equation for the combustion of the welding gas, acetylene ($C_2H_2$), with oxygen ($O_2$). Show a balanced chemical equation and label correctly the reactant side and product side. **(10 points)**

Exam 1 **Chemistry 117** Summer 2002

**Part II: Multiple Choice Questions**

**Important Instructions:**

1) Use a soft (#2) graphite pencil only in filling out the answer sheet. **Make dark marks** in the correct circles on your answer sheet.

2) Print your name in the boxes on the upper left of Side 1 and blacken the respective circle under each letter of your name. Fill in **your last name first.**

3) Enter the first letter of the test color in the last box of the name grid and blacken the corresponding circle under the letter. **This is a White exam.**

4) You must enter a 10-digit identification code on your answer sheet as follows. The **left most digits** will be **117**, followed by the **7-digits of your NDSU NAID** number (the numbers before the dash). Next, blacken the respective circle under each digit of this identification code.

5) **Sign your name (do not print)** in the **upper left hand corner of the answer sheet and the exam**.

6) Answer each question by blackening the circle of the letter corresponding to the best or most correct answer to that question. **There is only one correct answer to each question**. If you blacken more than one circle for a question it will be scored as incorrect.

7) There should be **25 answers filled** in on the opscan when you are finished.

8) Be prepared to **show a picture I. D.** when you **turn in your exam and opscan sheet.**

1. All of the following elements are nonmetals **except**

   (a) He (b) O (c) Br (d) Ne (e) Si

2. Isotopes have the same number of _____but **different numbers** of _____.

   (a) neutrons, protons (b) protons, electrons (c) protons, neutrons (d) electrons, protons

3. In the modern periodic table, the elements are arranged by **increasing numbers** of

   (a) electrons (b) neutrons (c) protons (d) protons and neutrons

4. All of the following elements are good conductors of heat and electricity **except**:

   (a) Barium (Ba) (b) Titanium (Ti) (c) Lithium (Li) (d) Radon (Rn) (e) Copper (Cu)

5. The **correct name** for $FeCO_3$ is

   (a) Iron (III) carbonate
   (b) Iron carbon trioxygen
   (c) Iron (II) carbonate
   (d) Iron carboxide

6. Stoichiometric mole relationships can be developed from chemical equations. From the following equation, **which stoichiometric equivalent is incorrect** and could not be used in a quantitative calculation ?

$$\mathbf{4NH_3(}g\mathbf{)\ +\ 5O_2(}g\mathbf{)\longrightarrow 4NO(}g\mathbf{)\ +\ 6H_2O(}g\mathbf{)}$$

   (a) Four moles of ammonia react to produce four moles of nitrogen monoxide
   (b) Five moles of diatomic oxygen react with six moles of water
   (c) Four moles of ammonia react with five moles of diatomic oxygen
   (d) Four moles of nitrogen monoxide are produced with six moles of water

7. All of the following reactions are **decomposition reactions except**

   (a) $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$
   (b) $HCOOH(l) \rightarrow H_2O(l) + CO(g)$
   (c) $2HgO(s) \rightarrow 2Hg(l) + O_2(l)$
   (d) $Ni(CO)_4(l) \rightarrow Ni(s) + 4CO(g)$
   (e) $PCl_5(l) + 4H_2O(l) \rightarrow H_3PO_4(aq) + 5HCl(aq)$

8. A bond where electrons are **shared equally** by two atoms is called a(n) _____ bond.

   (a) ionic (b) polar covalent (c) nonpolar covalent (d) nonsense

9. Which atom in the group below is the most **electronegative** in the periodic table ?

   (a) Rb (b) F (c) Si (d) Cl (e) Ca

10. Aspirin has a density of 1.40 $g/cm^3$ (grams per cubic centimeter). Calculate the **volume (in $cm^3$)** occupied by an aspirin tablet that weighs 250 milligrams.

    (a) 350 (b) 0.179 (c) 0.350 (d) 1.79 (e) 179

11. What is the **correct formula** for Iron(III) phosphate?

    (a) $Fe_3(PO_4)_2$ (b) $FePO_4$ (c) $Fe(PO_4)_2$ (d) $Fe_2PO_4$ (e) $Fe_2(PO_4)_3$

12. The multiple 1 x $10^{-12}$ is represented by the **prefix**

(a) pico (b) micro (c) kilo (d) femto (e) nano

13. The coefficients in front of each formula required to **correctly balance** the reaction are:

$$Al(NO_3)_3 + Na_2S \longrightarrow Al_2S_3 + NaNO_3$$

(a) 2, 1 3, 2 (b) 2, 3, 1, 6 (c) 1, 1, 1, 1 (d) 4, 6, 3, 2 (e) none of these

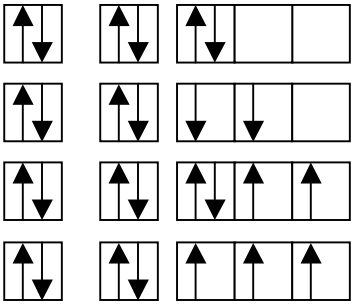
14. Which **orbital diagram correctly represents** the element, Nitrogen?

(a)

(b)

(c)

(d)



Subshells 1s 2s 2p

15. Valence electrons occur in:

(a) the atomic nucleus
(b) the neurons of an atom
(c) an atom's outermost electron shell
(d) an atom's innermost electron shell

16. The chemical symbol for fluorine is:

(a) F (b) Fl (c) Fe (d) Fr

17. The chemical combination reaction between calcium and sulfur produces an ionic compound whose chemical formula is:

(a) $CaS_2$ (b) $Ca_3S_2$ (c) $Ca_2S_3$ (d) CaS (e) $Ca_2S$

18. The value of Avogadro's number is:

(a) 6.02 X $10^{22}$ (b) 0.00001 (c) the atomic mass of carbon (d) 6.02 X $10^{23}$

19. How many moles of Ni are there in 128 grams of Ni (AW = 58.69 amu) ?

(a) 2.18 (b) 128 (c) 58.69 (d) 4.09

20. The number $1.05 \times 10^9$ has how many significant figures?

(a) 2 (b) 3 (c) 4 (d) 9 (e) 13

21. How many neutrons are there in an atom of lead whose mass number A is 208 and atomic number Z is 82?

(a) 82 (b) 126 (c) 208 (d) 290

22. What is the ratio of hydrogen atoms to sulfur atoms, H:S, in ammonium sulfate, $(NH_4)_2SO_4$?

(a) 2:1 (b) 6.4:1 (c) 8:1 (d) 1:4 (e) 2:8

23. The number of sodium ions ($Na^+$) contained in one mole of sodium chloride (NaCl) is:

(a) 1 (b) 2 (c) one mole (d) 23 (e) two moles

24. When one mole of lithium atoms reacts with one mole of bromine molecules, the molar mass of the product (in grams) is:

(a) 38 (b) 73 (c) 87 (d) 94 (e) 174

25. For the reaction: $C(s) + O_2(g) \rightarrow CO_2(g)$, the number of grams of C that must react in order to produce 8.8 grams of $CO_2$ is:

(a) 0.12 (b) 1.2 (c) 2.4 (d) 3.6 (e) 4.8