

Do not open the exam until you are told to do so.

Cell phones and other electronic devices must be turned off and stowed out of sight (your sight and mine). Calculator policy is in effect. Infractions will cost you points!

ALL outside paper must be stowed out of sight. Unauthorized materials will result in your exam being removed and a score of 0 assigned. If you reach a point where you need more scratch paper than the space available, ask a proctor.

Please clearly and legibly write your name, in ink, at the top of both pages of your answer sheet. Your score will not be recorded and your exam will not be returned if this is not done.

All answers should be rounded to the appropriate precision (correct significant figures.)

Atomic weights are provided in the Periodic Table. These values must be used.

Be certain your answers are clear. If an answer is not clear, it will probably be considered wrong.

Use your time effectively.

When authorized to open your exam, you may carefully remove this cover sheet. When you are finished with your exam, please turn in **the two answer sheets**. Make sure your name is clearly written on every page.

Time is up at 12:15!!

Potentially useful information:

$$6.022 \times 10^{23}$$

name _____

Scored grade (instructor use only!) _____

1. Write **balanced** chemical equations, with appropriate phase labels, for the following reactions. In both cases, you may use as much scratch space as you need, but write your final answer **legibly** in the box.

a. [10 pts] The **combustion of gaseous acetylene, C_2H_2** .

(remember to balance rxn and include phase labels.)

b. [10 pts] **Iron(III) oxide reacts with gaseous hydrogen chloride to form iron(III) chloride and water.**

(remember to balance rxn and include phase labels.)

2. (a) [3 pts] A general chemistry student is given a sample of a compound with empirical formula CH. She performs an experiment and finds the molar mass to be 77 g/mol. What is the molecular formula of the compound?

Answer: _____

(b) [3 pts] Another compound, in a different experiment, is found to consist of 85.6 % C and 14.4 % H. Which of the following formulae are consistent with this analysis? (Circle all that apply.)

CH

CH₂CH₆C₂H₁₂C₃H₆C₆HC₆H₁₂C₁₂H₂

3. [2 pts] Some elements have similar chemical properties and reactivity. Consider an atom with 8 protons and 8 neutrons in its nucleus. Rank the following atoms in order of how similar their chemical properties would be to this atom, from least to most similar:

(A) an atom with 7 p⁺ and 8 n⁰, (B) an atom with 8 p⁺ and 9 n⁰, (C) an atom with 16 p⁺ and 16 n⁰.

(Write the choices A, B and C in the appropriate spaces.)

least similar.....most similar

name _____

4. [3 pts] Chlorine has two major isotopes, ^{35}Cl and ^{37}Cl . Using the average mass from the periodic table, which of the following values is **closest** to the percent ^{35}Cl ? (Circle the best answer.)

1%

10%

25%

50%

75%

90%

99%

5. At high temperature, silver sulfate decomposes to form elemental silver, SO_3 , and O_2 . The reaction occurs in two steps:



(a) [2 pts] Identify the **intermediate** in the reaction. _____

(b) [3 pts] Give the balanced equation for the overall process, with the intermediate canceled out.

(c) [6 pts] (Calculate the following, and round your answers appropriately.) For a sample containing 0.032 mol of silver sulfate,

what is the mass of the sample? (Include appropriate unit.) _____

how many moles of oxygen are in the sample? _____

how many silver atoms are in the sample? _____

6. [10 pts] Fill in the blanks. In some cases there could be more than one acceptable answer; pick **one**.

_____ An element that forms covalent compounds, but does not form binary ionic compounds.

_____ The product formed in the combustion of magnesium metal.

_____ The Period 4 halogen.

_____ The number 312.096, rounded to 2 decimal places.

_____ An element that forms variable charge cations.

name _____

7. [18 pts] **Clearly** indicate whether each statement is TRUE or FALSE. If we can't tell which you mean, it's wrong.

_____ Allotropes of an element have different numbers of neutrons but the same number of protons.

_____ A balanced equation will have the same number of molecules on each side of the arrow.

_____ Different isotopes of an element have the same number of electrons.

_____ The sum of 55.54 and 63.47 should have 5 significant figures.

_____ The designation "transition elements" only includes metals.

_____ Chlorine dioxide is a binary covalent compound.

_____ Ionic compounds can contain covalent bonds.

_____ N_2O_3 is composed of N^{3-} and O^{2-} ions.

_____ Ru is an inner transition metal.

8. [5 pts] In the list below, circle all substances that are **covalent compounds**.

NaK

 IrCl_3 P_2O_5 N_2 ICl_3

9. [12 pts] Give a **correct systematic name** for each of the following. Spelling counts.

_____ $**\text{Li}_3\text{N}$

_____ $**\text{SiO}_2$

_____ $**\text{Cu}_2\text{SO}_3$

_____ $**\text{K}_3\text{PO}_4$

_____ $**\text{ClF}_3$

_____ SO_3

10. [14 pts] Give the correct **chemical formula** for each of the following.

_____ ammonium chlorite

_____ sodium perbromate

_____ nitrogen oxide

_____ butane

_____ silver oxalate

_____ elemental chlorine

_____ iron(III) sulfide