

Name: _____

Instructions: You will have the full class period to complete the exam (1:15). You may use your calculator, the attached periodic table, constants, and charts as needed. The exam must be handed in when you leave the room, which means you cannot leave the room unless you are prepared to hand in the test as complete. Use the proper number of significant figures and units wherever appropriate.

Section 1: Answer EACH of the questions in this section.

1. (10 points) A compound with the empirical formula of CH was placed into a 250.0mL flask at a temperature of 298.3K and 754.3 Torr. If the mass of the sample was 0.791g, what is the molecular formula of the compound?

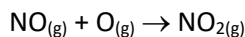
2. (8 points) Consider the following, regarding atomic orbitals:

- How many orbitals are available when $n = 5$? _____
- How many electrons are needed to fill all available orbitals when $n = 4$? _____
- How many types of orbitals are available when $n = 3$? _____
- Name the shapes of orbitals that are available when $n = 2$. _____

3. (12 points) Given the following information:



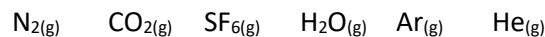
Determine the ΔH for the reaction below:



4. (10 points) What mass of solid silver bromide is made when 100.0mL of 0.150M silver nitrate is added to 20.0mL of 1.00M sodium bromide?

Section 2: Answer 3 of the following 4 questions. Draw an 'X' through the question that you will not be answering, or do not want graded.

5. (10 points) You have a mixture of gases in a 22.4L container at 0.0°C.



- Which of these gases would have the highest average velocity? Why?
- How do these gases compare in terms of kinetic energy?
- If you had 1.00 mole of each gas, what is the total pressure in the container?

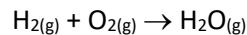
6. (10 points) An 80.0g piece of Aluminum ($C = 0.89 \text{ J/g}^\circ\text{C}$) at 385K is placed in 500.0g of water ($C = 4.184 \text{ J/g}^\circ\text{C}$) at 24.2°C. What is the final temperature when they reach thermal equilibrium?

7. (10 points) Make a plot that demonstrates Boyle's Law of gases. Under what circumstances would one expect a gas to show this behavior? Give a real-life example of Boyle's Law.

8. (10 points) What is the difference in energy between 780.0nm light and light with a frequency of 3.11×10^{14} Hz?

Section 3: Answer 3 of the following 4 questions. Draw an 'X' through the question that you will not be answering, or do not want graded.

9. (10 points) Consider the reaction



In a 11.2L container at 273.15K, what pressure of water can be made when 2.00atm of hydrogen and 2.00atm of oxygen are combined?

10. (10 points) In question 9, what is the pressure of each gas, and total pressure when the reaction is complete?

11. (10 points) Briefly describe the difference between electron orbits and electron orbitals.

12. (10 points) Briefly describe the difference between the ideal gas law and the Van der Waals equation for a gas (below). Be sure to mention the circumstances when each should be used.

$$P_{obs} = \frac{(n * R * T)}{(V - nb)} - a \left(\frac{n}{V} \right)^2$$

Constants:

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$c = 3.00 \times 10^8 \text{ m/s}$$

$$T_K = T_C + 273.15$$

$$760 \text{ Torr} = 760 \text{ mmHg} = 1 \text{ atm}$$

$$R = 0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

Solubility Rules

Ions	Statement	Exceptions
$\text{Li}^+, \text{Na}^+, \text{K}^+, \text{NH}_4^+$	Group 1A and ammonium compounds are soluble	N/A
NO_3^-	Nitrates are soluble	N/A
$\text{Cl}^-, \text{Br}^-, \text{I}^-$	Most chlorides, bromides, and iodides are soluble	$\text{Ag}^+, \text{Pb}^{2+}, \text{Hg}_2^{2+}$
SO_4^{2-}	Most sulfates are soluble	$\text{Ca}^{2+}, \text{Sr}^{2+}, \text{Ba}^{2+}, \text{Ag}^+, \text{Pb}^{2+}, \text{Hg}_2^{2+}$
$\text{S}^{2-}, \text{CO}_3^{2-}, \text{CrO}_4^{2-}, \text{PO}_4^{3-}$	Only slightly insoluble or insoluble	Group 1 Cations