

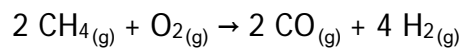
Practice Final Exam

1. Calculate the amount of *heat, in kJ*, needed to increase the temperature of 263.8 g of frozen phenol, $\text{C}_6\text{H}_6\text{OH}$, at -25.0°C (melting point is 40.5°C) to liquid at 65°C . $s_{\text{l}}=1.43 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$, $\Delta H_{\text{fus}}=11.51 \text{ kJ mol}^{-1}$, $s_{\text{s}}=0.306 \text{ cal g}^{-1} \text{ }^\circ\text{C}^{-1}$.

2. Quantum Chemistry:
a. Give the *electron configuration* and *orbital diagram* of molybdenum using the Noble gas shorthand.

b. Draw the *electron dot structure* of H_2CO_3 (hint: the hydrogens are attached to the oxygens). Give the electron *group* and *molecular geometries*. Give the *hybridization* on the central atom. Is the ion *polar*?

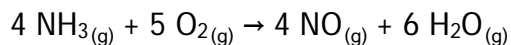
3. Hydrogen is prepared from natural gas (mainly methane, CH_4) by partial oxidation.



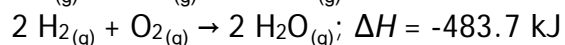
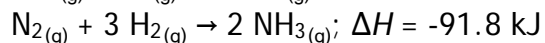
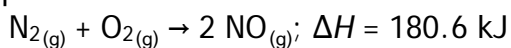
Calculate the enthalpy change ΔH° for this reaction, using standard enthalpies of formation.

4. A compound of carbon, hydrogen, and oxygen was burned in oxygen, and 1.000 g of the compound produced 1.434 g CO₂ and 0.783 g H₂O. In another experiment, 0.1107 g of the compound was dissolved in 25.0 g of water. This solution had a freezing point of -0.0894°C. What is the molecular formula of the compound? $K_f = 1.86^\circ\text{C m}^{-1}$
5. Polonium is the only metal that has a simple cubic unit cell structure. The density of polonium is 9.31 g cm⁻³. Calculate the *edge length* of the unit cell in pm. Calculate the *atomic radius* in pm.

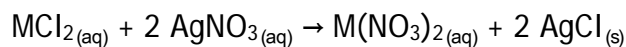
6. Ammonia will burn in the presence of a platinum catalyst to produce nitric oxide, NO.



What is the heat of reaction at constant pressure? Use the following thermochemical equations:



7. A metal, M, was converted to the chloride, MCl_2 . Then a solution of the chloride was treated with silver nitrate to give silver chloride crystals, which were filtered from the solution.



If 2.434 g of the metal gave 7.964 g of silver chloride, what is the atomic weight of the metal? What is the metal?

8. Lithium bromide and lithium chromate react in an oxidation-reduction reaction in nitric acid. Two of the products of the reaction are the molecular bromine and the chromium(II) ion. Write the *balanced complete chemical equation*. If 24.55 mL of 0.05214 M lithium bromide solution reacts with 54.33 mL of 0.1244 M lithium chromate solution, what *mass of bromine* can be obtained? If only 0.0996 g of bromine are produced, what is the *percent yield* of the reaction?