

## Chemistry 1100 Practice Exam 1

Show all of your work and reasoning to receive credit. Include units as well. You may not share calculators.

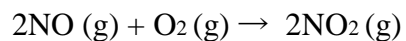
1. A 24.4 L volume of ethane gas is heated from  $19^{\circ}\text{C}$  to  $122^{\circ}\text{C}$  at constant pressure. What is the final volume of the gas?

2. A sample of nitrogen gas kept in a container of volume 0.24 L and at a temperature of  $12^{\circ}\text{C}$  exerts a pressure of 11.2 atm. Calculate the number of moles of gas present.

3. A gas at 450 mm Hg and  $14^{\circ}\text{C}$  occupies a volume of 2.85 L. Calculate its volume at STP.

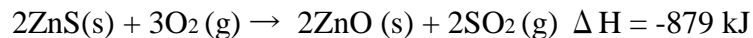
4. A 2.10 L vessel contains 4.44 g of a gas at 1.00 atm and 27.0 ° C. Calculate the density of the gas in grams per liter. Then calculate the molar mass of the gas.

5. Consider the formation of nitrogen dioxide from nitric oxide and oxygen:



If 4.5 L of NO are reacted with excess O<sub>2</sub> at STP, what is the volume in liters of the NO<sub>2</sub> produced?

6. The first step in the industrial recovery of zinc from the zinc sulfide ore is roasting, that is, conversion of ZnS to ZnO by heating:



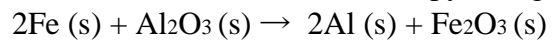
Calculate the heat released (in kJ) per gram of ZnS roasted.

7. A 4.25 kg piece of gold metal is heated from  $15.5^{\circ}\text{C}$  to  $197.0^{\circ}\text{C}$ . Calculate the heat absorbed (in kJ and kJ/mol) by the metal.

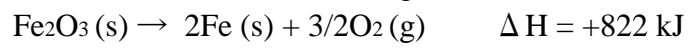
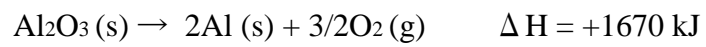
8. A quantity of 2.5000 g of methanol ( $\text{CH}_3\text{OH}$ ) was burned in a constant volume bomb calorimeter. Consequently, the temperature of the water rose by  $2.40^{\circ}\text{C}$ . If the heat capacity of the bomb plus water was  $10.4\text{ kJ}/^{\circ}\text{C}$ , calculate the molar heat of combustion of methanol.

9. Calculate the heat of decomposition for the process below at constant pressure and  $25^{\circ}\text{C}$ :  $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$   
Use the standard enthalpy of formation data given at the end of the exam.

10. Calculate the standard enthalpy change for the reaction:



given that:



$PV = nRT$  STP = 1 atm and  $0^\circ \text{C}$   $T_K = T_c + 273.15$   
 760 mm Hg = 1 atm 1 torr = 1 mm Hg 1.01 kPa = 1 atm  
 $R = 0.082057 \text{ Latm/Kmol} = 8.31 \text{ J/Kmol}$   $N_A = 6.022 \times 10^{23}/\text{mol}$   
 $MM = dRT/P$   $u_{rms} = \sqrt{3RT/MM}$   $r_1/r_2 = \sqrt{MM_2}/\sqrt{MM_1}$   
 $(P + an^2/V^2)(V-nb) = nRT$   $P_T = P_A + P_B + P_C + \dots$   
 $\Delta E = q + w$   $w = -P \Delta V$  1 Latm = 101.3 J  $\Delta H = \Delta E + P \Delta V$   
 $\Delta E = \Delta H - RT \Delta n$   $C = ms$   $q = ms \Delta T = C \Delta T$   
 $\Delta H_{rxn} = \sum n \Delta H_f(\text{products}) - \sum n \Delta H_f(\text{reactants})$

<b>substance</b>	<b>specific heat (J/g ° C)</b>
aluminum	0.900
gold	0.129
graphite	0.720
diamond	0.502
copper	0.385
iron	0.444
water (liquid)	4.184
ethanol	2.46

<b>substance</b>	<b><math>\Delta H_f</math> (kJ/mol)</b>
H <sub>2</sub> O (l)	-286
H <sub>2</sub> O (g)	-241.8
CaO (s)	-635.6
CaCO <sub>3</sub> (s)	-1206.9
CO <sub>2</sub> (g)	-393.5
HCl (g)	-92.3