

Chemistry 1105 Spring 2024 Test 3

Thursday, March 28, 2024

Time: 1 hour 50 minutes

Name: _____

Student #: _____

*This test consists of **eight** pages of questions, a page of useful constants and conversions, and a periodic table. Please ensure that you have a complete test and, if you do not, obtain one from me **immediately**. There are **35** marks available. Good luck!*

1) **[3 marks]** At 100 torr pressure and 90.46°C, the density of a gas of formula H_2O_n is 0.150 g/L. What is the number, n ?

2) **[4 marks]** A mixture of two gases (A and B) had a total pressure of 60 atm. There were three moles of gas A, and the mole fraction of gas B was found to be 0.75.

a) How many moles of gas B were in the mixture?

b) What were the partial pressures of each gas?

- 3) **[3 marks]** According to Apple, the iPhone 15 Pro Max can be submerged in 6 metres of water for up to half an hour. If the density of water is 0.9984 g/cm^3 , how many bars of pressure is exerted by water at this depth?

4) [4 marks] The following apparatus was assembled:

Flask 1:

Volume: 8 L

Filled with: HCN

At a pressure of: 5 atm

Flask 2:

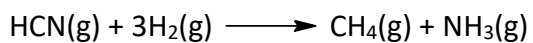
Volume: 12 L

Filled with: H₂

At a pressure of 7 atm

Both flasks were kept at a temperature of 336.18°C before, during, and after reaction.

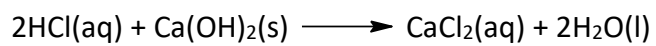
When the valve was opened, the following reaction occurred:



Calculate the partial pressures of all species **after** reaction.

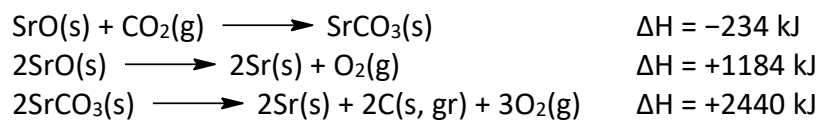
- 5) **[4 marks]** A 3-mole piece of iron ($\bar{C} = 25.07 \frac{J}{mol \cdot ^\circ C}$) at $89.35^\circ C$ was placed into 200 g of water ($S = 4.184 \frac{J}{(g \cdot ^\circ C)}$) at $15^\circ C$. The water was contained in a cup with $C = 20 \frac{J}{^\circ C}$. What was the final temperature of the water?

- 6) **[4 marks]** A 760.9-mg piece of Ca(OH)_2 (74.09 g/mol) was put into 100.0 mL of 0.300 M HCl (1.00 g/mL, $4.184 \frac{\text{J}}{\text{g}\cdot^\circ\text{C}}$) at 22.85°C :

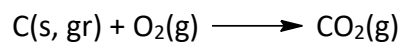


The temperature of the solution increased to 26.65°C . Calculate the molar enthalpy of the reaction.

7) **[3 marks]** Given the following reactions:

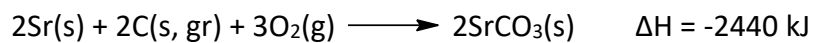


Find ΔH for the following reaction:



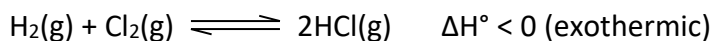
8) **[1 mark]** What is the molar enthalpy of formation of SrO(s)?

9) **[4 marks]** Given the reaction:



How many kJ of heat would be released by the reaction of 87.62 grams of Sr with 31.998 grams of oxygen and 12.011 grams of C(s, gr)?

10) [4 marks] Given the following equilibrium:



Predict the effect that each of the changes given below would have on the value of K and on the moles of Cl₂ present in a fresh system initially at equilibrium. Your choices are **Increase** from the starting value, **Decrease** from the starting value, or **Not Change** from the starting value. You may assume that, unless explicitly stated otherwise, the changes were carried out at constant temperature.

	Effect on:					
	K			Cl ₂		
Adding some H ₂	I	D	NC	I	D	NC
Cooling the reaction mixture	I	D	NC	I	D	NC
compressing the reaction mixture	I	D	NC	I	D	NC
Adding a non-reactive gas	I	D	NC	I	D	NC

11) [1 mark] Write a reaction for which the equilibrium expression is $K = [\text{O}_2]$.