

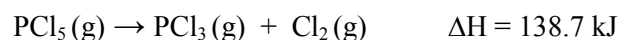
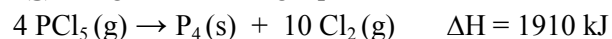
Exam 4 – Chapters 8, 9, 11

1. (6 pts) What is the molar mass of a gas with a density of 0.856 g/L at 30.0 °C and 761 mmHg?

MM = $dRT/P = 21.3$ g/mol

2. (6 pts) What is the partial pressure of nitrogen gas in a sample mixture of 0.400 mol H₂, 0.320 mol O₂, and 0.125 mol N₂ at 25.0 °C and 758 torr?
- 112 torr**
 - 359 torr
 - 287 torr
 - 5156 torr
3. (6 pts) What is the molality, *m*, of a glucose solution prepared by dissolving 18.0 g of glucose, C₆H₁₂O₆, in 125.9 g of water?
- 7.94 x 10⁻⁴ *m*
 - 0.143 *m*
 - 0.695 *m*
 - 0.794 *m***
4. (6 pts) What is the m/m% concentration of a glucose solution prepared by dissolving 18.0 g of glucose, C₆H₁₂O₆, in 125.9 g of water?
- 14.3 %
 - 12.6 %**
 - 7.93 %
 - 10.8 %
5. (6 pts) Stainless steel is an example of a _____ solution.
- solid/solid**
 - liquid/liquid
 - solid liquid
 - gas/solid
6. (6 pts) What does standard state refer to?
- 1 atm, 0°C, 1 M concentrations
 - 1 atm, 25°C, 0.1 M concentrations
 - 760 torr, 25°C, 1 M concentrations**
 - 760 torr, 0°C, 0.1 M concentrations
7. (6 pts) In a balloon with a small pinhole leak, which gas will escape the balloon the **fastest**?
- CH₄ (g)**
 - CO₂ (g)
 - Cl₂ (g)
 - SO₃ (g)

8. (8 pts) Calculate ΔH_{rxn} for $4 \text{ PCl}_3(\text{g}) \rightarrow \text{P}_4(\text{s}) + 6 \text{ Cl}_2(\text{g})$ using the following equations:



$$(-138.7 \times 4) + 1910 = 1360 \text{ kJ}$$

9. (6 pts) Which of the following changes will cause the volume of a gas in a closed container to double?

- The pressure of the gas is doubled.
- The temperature of the gas is doubled.**
- The moles of the gas in the container is decreased by half.
- The temperature of the gas decreased by half.

10. (6 pts) From the following reactions determine which one represents a standard enthalpy of formation, ΔH_f° ?

- $2 \text{ K}(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow 2 \text{ KCl}(\text{s})$
- $\text{Mg}(\text{s}) + \frac{1}{2} \text{ O}_2(\text{g}) \rightarrow \text{MgO}(\text{s})$**
- $\text{CO}(\text{g}) + \frac{1}{2} \text{ O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g})$
- $\text{C}(\text{s}) + \text{H}_2(\text{l}) \rightarrow \text{CH}_4(\text{g})$

11. (8 pts) A sample of gas occupies 2.67 L at 35°C and 789 torr. What is the **moles** of the gas?

$$PV=nRT \quad n = 0.110 \text{ moles}$$

12. (8 pts) How much heat is released from the fermentation of 3.00 g of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, to ethyl alcohol according to the following equation:

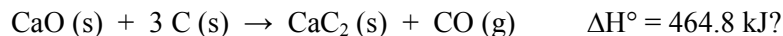


$$\text{heat transferred} = 1.37 \text{ kJ}$$

13. (6 pts) Using the like-dissolves-like rule, which of the following will be miscible with $\text{CCl}_4(\text{l})$?

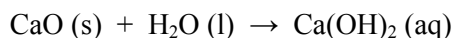
- $\text{CO}_2(\text{g})$
- $\text{I}_2(\text{s})$
- $\text{Br}_2(\text{l})$**
- $\text{CH}_3\text{CH}_2\text{OH}(\text{l})$

14. (6 pts) Which of the following statements is true for the reaction



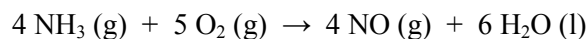
- Heat is absorbed by the system so it gains heat and the reaction is endothermic.**
- Heat is released by the system so it loses heat and the reaction is exothermic.
- Heat is absorbed by the system so it gains heat and the reaction is exothermic.
- Heat is released by the system so it loses heat and the reaction is endothermic.

15. (8 pts) When 2.579 g of calcium oxide is added to 50.00 mL of water at 25.0°C in a calorimeter, the temperature of the water increase to 43.2°C. Assuming the specific heat capacity of the solution is 4.18 J/g°C and the calorimeter itself absorbs a negligible amount of heat, calculate the heat of reaction (ΔH) in kJ/mol.



-87.0 kJ/mol

16. (8 pts) Calculate the heat of reaction when ammonia reacts with oxygen gas according to the following balanced equation:



moles x ΔH_f° products – moles x ΔH_f° reactants
-1169.6 kJ

| Substance | ΔH_f° (kJ/mol) |
|----------------------|-----------------------------|
| NH ₃ (g) | -46.1 |
| NO (g) | 90.2 |
| H ₂ O (l) | -285.8 |
| H ₂ O (g) | -241.8 |

Extra Credit: (6 pts)

One type of alcohol analysis determines the presence of ethanol (C₂H₅OH) by titration with K₂Cr₂O₇:



In Arizona, a driver is legally impaired if his/her blood alcohol level is 0.08% or higher. A driver suspected of DUI violation submitted a 7.00 g blood sample, which required 33.90 mL of 2.75×10^{-3} M K₂Cr₂O₇ (aq) for complete titration of the ethanol.

- a. Calculate the driver's blood alcohol content (mass/mass % of alcohol in the blood).

- b. Was the driver legally impaired? (Circle one) YES NO

**No credit for the answer if no work is shown!