

CHEM 3PC3**Quiz #5**

October 28, 2025

Name: _____

Student Number: _____

SUBMISSION INSTRUCTIONS — READ CAREFULLY

To receive full credit, you must follow these steps:

1. Answer all the questions.
2. Write your solutions on new, separate pages. Do not write your solutions in the margins of this paper.
3. At the top of each solution page, clearly write the corresponding question number (e.g., “**Question 5**”). If you use more than one page for a question, write the question number on each page (e.g., “**Question 5 (Page 1 of 2)**”).
4. **If you cannot solve a question, still attach a page with the question number and write “Blank” or “No Answer” to indicate you attempted it.**
5. **If you are unsure of a complete answer, still attempt the question:** attach a page with the question number and write down any relevant thoughts, formulas, or initial steps. Partial credit may be awarded for demonstrated effort and correct reasoning, whereas a blank answer will receive no credit.
6. Show all your work clearly and legibly. Unorganized or illegible work may not receive credit.

1 Problems

1. Compute the partial derivatives,

$$\frac{\partial f(x, y)}{\partial x}, \quad \frac{\partial f(x, y)}{\partial y}, \quad \frac{\partial^2 f(x, y)}{\partial x \partial y} \text{ and } \frac{\partial^2 f(x, y)}{\partial x^2},$$

where $f(x, y) = x^5 - y^2 + \exp(x^2 + y^2)$.

2. Answer these two questions. What two partial derivatives of enthalpy can be deduced directly from the following fundamental equation of thermodynamics?

$$dH = TdS + VdP \tag{1}$$

What additional thermodynamic identity can be deduced by equating the mixed partial second derivatives of H?

3. Determine an expression (i.e., evaluate the integral) for the work done by one mole of an ideal gas expanding reversibly and adiabatically from volume V_1 to V_2 :

$$w = -RT \int_{V_1}^{V_2} \frac{dV}{V^{5/3}}$$

4. Answer **a.**, **b.** and **c.**. It is possible that the equations are unsolvable for a given set of constants.

a. Write the augmented matrix for the system of equations,

$$-x + 2y - z = a$$

$$2x - 5y - 3z = b$$

$$2x - 3y + 7z = c$$

b. What values of x , y , and z solve these equations if $a = 3$, $b = 0$, and $c = -4$?

c. What values of x , y , and z solve these equations if $a = 1$, $b = 0$, and $c = -4$?

5. Compute the following operations.

a. Compute $A\mathbf{x}$ where $\mathbf{x} = (-2, 1, 0)$ and

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \\ 10 & 11 & 12 \end{bmatrix}$$

b. Compute $A\mathbf{y}$ where $\mathbf{y} = (-3, -2, -1, 0)$ and A is equal as in **a.**

c. Compute BC and CB , where

$$B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \quad \text{and} \quad C = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}.$$