

The exam of Principles of Physical Chemistry (CHEM-C1230) at 18.10.2023. has been corrected. There is an Excel file in the MyCourses which has all the points (also the exercises and quiz). Please check the points. The question 6 was a bit ambiguous. I took that into account in correcting it and took one point off from the total. I also reread all answers of the persons who did not pass the course.

I will add the marks to Sisu after few days. The next exam is 11.12. the registration is open in Sisu.

The exam weight was 70 %, the exercise 25 % and the quiz 5 %.

The point score is below.

	lowest points
1	50
2	60
3	70
4	80
5	90

Correction notes

- 1) Burning gasoline, methane and coal can be used as a heat source. Which of them in standard condition produce most heat per CO₂ molecule?
1 p. reaction equations and role of water
2 p. how to compute the reaction enthalpy (or combustion enthalpy), where you got the data
1 p. correct calculation of reaction enthalpy
1 p. calc of the heat per CO₂ and conclusion
1 p. general explanations of how the computations are done. Having only equations is not enough.
- 2) The van der Waals equation
2p. Why to use van der Waals equation. The equation and explanation of its components (parameters)
1 p. compression factor (it is NOT P_{vdw}/P_{id})
1 p. explanation of ideality from the table P and T dependencies
1 p. computations of $P_{vdw}(Vid)/P$ (Vid is NOT 22.4 L/mol)
1 p. general explanations of how the computations are done
- 3) Gibbs energy
1 p. gibbs energy and spontaneity of the reaction.

- 1 p. gibbs energy at non-1atm pressure
- 1 p. the difference of ΔG and ΔG°
- 1 p. compute the ΔG° where to get the data
- 1 p. compute the ΔG conclusions
- 1 p. general explanations of how the computations are done

The problem can be done also by using the equilibrium constant

4) Boiling, volume, enthalpy and entropy

- 1 p. volume will change a lot, from liquid to gas
- 1 p. numbers: liquid molar volume (OK at 25 C but 100 C is better) and ideal gas molar vol (at 100 C)
- 1 p. the boiling requires a lot of heat. The heat is = to enthalpy
- 1 p. numbers: the enthalpy change is mostly the evaporation enthalpy (Table 8.2.) it OK to compute the liquid and gas entalpies. If you use the values from Table 4.1 they are at 25 C, you should extrapolate them to 100 C with C_p
- 1 p. entropy increases since the disorder increase a lot liq vs gas.
- 1 p. $\Delta S = \frac{q}{T} = \Delta H_{vap} / T$

quite a few of you used equations that are valid in a single phase, like ideal gas law over the phase transition. That is not correct.

5) partial pressures of a mixture of two liquids

- 1 p. explain Raoult's law, what is x
- 1 p. the system in Fig. 1 is not ideal. explain why
- 1 p. at high concentration acetone and CS2 are close to ideal (how far)
- 1 p. at low concentrations they are not
- 1 p. Henry's law
- 1 p. Henrys law can be used at low concentrations.

6) reaction rate and rate constant

- 1 p. what is reaction rate
- 2 p. the unit of reaction rate and rate constant (here the question was not very clear and the points have been given quite easily). understanding the reaction order.
- 1 p. Arrhenius law
- 1 p. how to solve it from data
- 1 p. the numerical values of the parameters