Assignment 2

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on: 2020-03-12, 23:59 IST.

1) Which of the following laws is not a Maxwell’s relation for one mole of a pure substance?

- \( \frac{dL}{dV} \)  7 points

- \( \frac{dE}{dV} \)  7 points

- \( \frac{dS}{dV} \)  7 points

- \( \frac{dU}{dV} \)  7 points

No, the answer is incorrect.

2) Mammalian cells are stored for long time by cryopreservation using liquid nitrogen. The prepared cells are transferred to a vacuum vessel covered by a condenser and stored tightly to ensure temperature-free preservation by removing the seal in liquid nitrogen. Specialist cells are used to ensure safety. A researcher while making cryoparticles, followed the protocol but due to a manufacturing defect in the vessel, there was leakage of liquid nitrogen inside the vessel during storage. The cryoparticles, slowly warming, lead to the sealed rapidly to bring it to more temperatures. The researcher heated the vessel while being unaware of the entry of liquid nitrogen inside the vessel. The liquid nitrogen, slowly warming, leads to a quenching with rise in temperature and the vessel leads to pressure build up and explosion of the vessel. Considering that one mole of nitrogen has entered the vessel and that there is no interaction, physical or chemical, with the tissue contents, calculate the change in pressure per degree centigrade inside the vessel due to expansion of nitrogen given: \( \Delta V = 1524 \times 10^{-5} \text{ m}^3 \) and \( \Delta T = 1.273 \times 10^3 \text{ K} \). Choose the answer that is closest to your calculated result.

- \( 25.9 \text{ atm} \) 2 points

- \( 11.8 \text{ atm} \) 2 points

- \( 30.6 \text{ atm} \) 2 points

- \( 0.36 \text{ atm} \) 2 points

No, the answer is incorrect.

3) [Equations for a Closed System]

\[ \text{Chemical Potential} \]

\[ \Delta G = \mu \Delta n \]

\[ \Delta E = n \Delta U \]

\[ \Delta S = \frac{\Delta Q}{T} \]

No, the answer is incorrect.

4) [Equations for a Closed System]

\[ \text{Identify the equations that defines the chemical potential, } \mu \text{, the mole fraction } x_i \text{, and the number } n \text{. It is not equal to \( n \).} \]

\[ \mu \]

\[ x \]

\[ n \]

No, the answer is incorrect.

5) [Equations for a Closed System]

\[ \text{In a system, which is a mixture of more than one component, under constant temperature and pressure } \sum x_i \mu_i \text{.} \]

\[ n \]

\[ x \]

\[ \mu \]

No, the answer is incorrect.

6) [Equations for a Closed System]

\[ \text{The heat capacities of } \text{O}_2 \text{ and } \text{CO}_2 \text{ are given as } 29.98 \text{ kJ/mol} \text{ and } 25.90 \text{ kJ/mol} \text{, respectively. The initial temperature and pressure of the gaseous system are } 298 \text{ K} \text{ and } 1 \text{ bar pressure. Assuming that there is no pressure change in this process, calculate the change in enthalpy of the process if the final temperature of the system is } 450 \text{ K}. \]

\[ \Delta H \]

\[ \Delta T \]

\[ \text{Choose the answer closest to your calculated value.} \]

\[ 5200 \text{ kJ} \]

\[ 2519.1 \text{ kJ} \]

\[ 1018.2 \text{ kJ} \]

\[ 656.24 \text{ kJ} \]

No, the answer is incorrect.

7) [Equations for a Closed System]

\[ \text{In the above system, assuming that the system undergoes a constant volume process in reaching the final temperature, calculate the change in internal energy.} \]

\[ \Delta U \]

\[ \Delta T \]

\[ \text{Choose the answer closest to your calculated value.} \]

\[ 7623 \text{ kJ} \]

\[ 1895 \text{ kJ} \]

\[ 1023 \text{ kJ} \]

\[ 1250 \text{ kJ} \]

No, the answer is incorrect.

8) [Equations for a Closed System]

\[ \text{Estimate the work done by the system during the constant volume process.} \]

\[ \Delta W = \text{constant} \]

\[ \Delta V \]

\[ \text{Choose the answer closest to your calculated value.} \]

\[ 0 \text{ kJ} \]

\[ 1053 \text{ kJ} \]

\[ 125 \text{ kJ} \]

\[ 1250 \text{ kJ} \]

No, the answer is incorrect.