CARE PHYS 213 Review Session

Welcome and please sign in to the queue!
Welcome to the Center for Academic Resources in Engineering (CARE) PHYS 213 Exam 1 Review Session!

Tutors are available to answer questions, review problems, and help you feel prepared for your final during these times:

Sun, 4/3 2:00-4:00pm in 4035 CIF (Jay, Karan, Jonah)

Good luck!
Topic breakdown for the Exam

Unit 1: Equilibrium, Entropy, and Energy
Unit 2: Heat and Temperature
Unit 3: Ideal Gases
Unit 4: Equipartition and Molar Heat Capacity
Unit 1: Equilibrium, Entropy, Energy

- **Microstate vs. Macrostate**
  - Microstate: individual arrangement
  - Macrostate: properties that arise from the microstate
  - Many microstates can lead to same macrostate
    - Two people have same weight (macrostate), but the distribution of fat can be different (microstate)

- **Entropy**
  - The degree of disorder or randomness in the system
  - $S = k \ln(w)$ where $w$ is the number of microstates

- **Equilibrium**
  - Occurs when the macrostate of the system ceases to change.
  - Change in total $S$ is greater than or equal to 0
    - In other words, equilibrium is achieved when $S$, entropy, is maximized

- **Energy**
  - Always conserved
  - Must be transferred to a body in order to perform work or increase its temperature.
Unit 2: Heat and Temperature

- First law of thermodynamics:
  \[ \Delta U = Q - W \]

- Temperature:
  - Lower temperature = greater slope, more increase in entropy when increasing internal energy
  - Heat capacity (C) - the number of heat units needed to raise the temperature of a body by one degree
    - Specific heat capacity (lowercase c) - heat capacity per unit mass

  \[ Q = C \Delta T = m c \Delta T \]

- Where \( m \) is the mass of the object supplying or absorbing heat and \( \Delta T \) is the change in temperature of that object
Unit 3: Ideal gas and Equipartition

- Ideal Gas: Approximation of particles as points with no interactions:
  - Follows ideal gas law:
    \[ PV = nRT \]
    - Also \( pV = NkT \)

- Equipartition: each degree of freedom contributes \( \frac{1}{2} kT \) of energy
  - As you increase temperature, different parts of motion for particles are excited
Unit 4: Equipartition and Molar Heat Capacity

- Molar Heat Capacity: For an input of heat, how much does the temperature change?
  - \( C = \frac{dU}{dT} \)
- Because of equipartition, for certain particles, the higher the temperature, the higher the molar heat capacity
- \( c_m = \left( \frac{N_{\text{DOF}}}{2} \right) \times k \, N_A \)
Good Luck!!!

Feel free to ask any questions you may have!

You got this!!!