Exam 3 Review

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Other Reviews

- Monday Dec 1st 5:30-7pm in C295
- Friday Dec 5th **12**-3 in 108 MARB (weekly review)

Exam Information

- 28 questions
  - 3 do-overs from the last exam
  - 2 problems on pressure
  - 2 problems on static fluids
  - 3 problems on moving fluids
  - 1 problem on thermal expansion
  - 2 problems on calorimetry
  - 2 problems on heat transfer mechanisms
  - 2 problems specifically about the ideal gas law
  - 2 problems on kinetic theory
  - 6 problems on thermodynamic changes: PV diagrams, work, internal energy, heat, First Law of Thermodynamics, etc.
  - 3 problems on engines

General Equations to Know

- Power=Work/time
- Area Equations
  - Circle
  - Rectangle
  - Triangle (for PV diagrams)
- Volume Equations
  - Cube/rectangular prism
  - Sphere
- Temp Conversions (given on 1st page of Exam)

Pressure (2 problems) & Static Fluids (2 problems)

- P=F/A
- P=P0+pgh
- Archimedes' Principle (Buoyant force)
  - B=(m.displaced)*g=(p.fluid)(V.object)g

Moving fluids (2 problems)

- Volume Flow Rate=(Area)*(velocity)
  - Garden Hose equation: A1v1=A2v2
- Bernoulli's Equation- conservation of energy
  - Find lines of equal pressure.
  - Use multiple lines of equal pressure if you need to (u-tube question)

Thermal Expansion (1 problem)

- Linear expansion (alpha)
  - Change in length=(alpha)(L0)(change in temp)
- Volume expansion (beta)
  - Change in volume=(beta)(V0)(change in temp)
  - Beta=3(alpha)

Calorimetry (2 problems)

- Qlost1=Qgained2
  - Q=mcT
  - Q=mL
- If you're not sure what the final state of the object is (fluid, gas, etc.) guess! If you guessed wrong, your answer won't make sense.

Heat transfer mechanisms (2 problems)

- Thermal Conduction
- Radiation
  - With and without surroundings

Ideal Gas Law (2 problems)

- $PV=nRT$
- $PV=Nk_BT$

Kinetic Theory (2 problems)

- Transl.KE=(3/2)k_BT
  - (1/2)m(v.avg)^2=(3/2)k_BT
- Total KE for diatomic molecules=(5/2)k_BT
  - Includes rotational KE

thermodynamic changes: PV diagrams, work, internal energy, heat, First Law of Thermodynamics, etc. (6 problems)

- Work
  - W.on=area below the path on the PV diagram
  - W.on=P(change in Volume) for constant pressure
  - W.on=Pavg(change in V) for constant pressure change
  - W.on=nRTln(V2/V1) constant temp.
- First Law of Thermodynamics
  - Change in internal energy=Heat added + W.on
  - SIGNS!!!!
  - Adiabatic process=no heat is added or subtracted
  - Equipartition Theorem
    - $U=(3/2)Nk_BT=(3/2)nRT$ (monatomic)
    - $U=(5/2)Nk_BT=(5/2)nRT$ (diatomic near 300K)

thermodynamic changes: PV diagrams, work, internal energy, heat, First Law of Thermodynamics, etc. (6 problems)

- PV diagrams
  - Vertical line = no work; heat added/subtracted
  - Anything that isn't vertical = work being done
  - First look for the Work, is it + or -?
    - Work done? Or Work by?
  - Then look for a change in temp, is it + or -?
    - Change in temp = change in U
  - Use the First Law of Thermodynamics to find Q, is it + or -?
    - Heat added? Or Heat subtracted?
  - SIGNS!!!

Engines (3 problems)

- Qh=MAGNITUDE of heat absorbed from the hot reservoir
- Qc=MAGNITUDE of heat exhausted to the cold reservoir
- Wnet= net work done by the engine
- Qh=Wnet+Qc
- Thermal efficiency
  - e=Wnet/Qh
  - e=1-Qc/Qh
  - emax=1-Tc/Th (Carnot Theorem)