ENGG 201
TEST-WRITING STRATEGY

Overall points to remember for Midterm Exam:

- Read the question carefully (30 seconds of reading can save you 10 minutes of answering the wrong question or forgetting to answer part of the question)
- Draw a Diagram
- Answer what is asked in the question
- Answer should make sense
- UNITS, UNITS, UNITS!
- Show your work to get part marks
- **Budget your time (10% of test = 10% of time)**

Problem-Solving Strategy:

1. Read the question carefully
2. Write down given (known) information (use symbols, units)
3. Write down what is being asked (X=?)
4. Write down key equations (sum of mole or mass fractions for one stream or one phase equals 1)
5. When in doubt, write down definitions of important terms (i.e. Density = mass / volume, or Volumetric Flow = Volume / Time, etc.). These can be more key equations.
6. If you make assumptions, write them down (check at the end if possible). If you can't get a number in one part of the question that you need in the next part, make an assumption, state what it is and proceed with the calculations. Do what you need to do to solve the problem and be sure to show the process you used to solve it.
7. Circle or box or underline your final answer

2017 Midterm 1 Exam:

- Chapters 1,2, and 4
- Material– how much time did we spend in class?
  - Units / Dimensions / Material Balances / Phase Rule
  - Pure Components (PT, PV diagrams)
  - Binary Mixtures (T-x Diagrams)

Chapter 1/2 - Important Concepts

- Know basic formulas and the derived SI units
  - Heat ($Q=mC\Delta T$)
  - Force ($F=ma$); $N=kg\ m/s^2$
  - Work ($W=Fd$); $J=N\ m$
  - Pressure (F/A); $Pa=N/m^2$
  - Power; $W=J/s$
  - Balances (for heat and mass)
    - Input + Generation = Output + Accumulation
    - Each flow stream has a separate composition and total mass. For example, inlet stream: m_{in} (kg/s); $w_{1,in}$ (mass component 1 in the inlet stream/mass total in the inlet stream); $w_{2,in}$ (mass component 2 in the inlet stream/total mass in the inlet stream); the sum of the mass fractions (or mole fractions) for one stream or phase equals 1.
- Units / Dimensions
  - Know standard units (see Table A-2, A-4, A-5, and A-6), Base SI units (Table 2-1) and SI Prefixes (Table A-3)
  - Complex terms can be broken down into fundamental dimensions
    - [M],[L],[t],[T],[mol]
  - Each term in an equation must have the same dimensions
  - Dimensionless numbers have no units
  - Watch units in all calculations

Chapter 4 – Important Concepts

- Phase Rule
  - $F+P=C+2$
  - Degrees of freedom (F) = Intensive variables needed to fix the system (variables that do not depend on size of system); if one or more intensive variables are already specified in a problem (e.g., pressure held at 1 atm), then it must be subtracted from the degrees of freedom.

  - Most important intensive variables are T, P, density, molar volume, composition (i.e. mass or mole fraction of a specific component)
  - Phases (P) = must be homogeneous and have a definite boundary
  - Components (C) = number of independent species (Compounds when no reaction, elements when reaction present)
- C=1 = Pure Component Systems
  - Described by P-V and P-T diagrams
  - Know phase regions and boundaries
  - P-T Diagram:
    - Identify phase regions: S,L,V,G
    - Identify Triple point, Critical point- the critical point is where two phases are indistinguishable-they have the same density; triple point is where 3 phases exist simultaneously
    - Vapor-Liquid line = pressure is vapor pressure, temperature is boiling/condensing point
  - P-V Diagram:
    - Identify Phase regions: usually L,V, L+V, G (Sometimes S, S+L, S+V)
    - Identify Triple point, Critical point
    - Specific volume = 1 / density of a phase
    - Know isotherms (shape); if you need to find the temperature, use your best guess
    - Lever rule in 2-phase regions only
    - Lever rule = for amounts of phases, relative amounts
- C=2 = Binary Systems
  - Described by T-x diagrams; pressure is fixed which removes one degree of freedom; which leaves two degrees of freedom in the one phase region (can specify T and composition) and one degree of freedom in the two-phase region (can specify either T or composition); at the azeotrope, one degree of freedom will be set by the requirement that the composition of the vapour phase equals the composition of the liquid phase (leaving 0 degrees of freedom).
  - Know azeotrope and eutectic points: azeotrope means no change in composition with boiling and can occur in V-L or S-V systems; eutectic means easily melted and is the lowest freezing point for a mixture (L cools to S1 + S2)
  - Liquid/Vapor and Solid/Liquid have same shape/form
  - Only have one vapor phase
  - Vapor-Liquid = 3 different systems
    - Completely Miscible Liquids
    - Partially Miscible Liquids
    - Completely Immiscible Liquids
  - Liquid-Solid = 3 different systems
    - Completely Miscible Solids
    - Partially Miscible Solids
    - Completely Immiscible Solids
  - Important concepts:
    - Identify pure component melting or boiling points
    - Identify phase regions and boundaries
    - Composition = what is in the phase (i.e. mole or mass fraction of a specific component)
      - Each single phase will have a certain composition and the overall mixture of 2 phases may have different compositions
    - Amounts of each phase – need the lever rule to calculate
    - Manipulation of amounts of components or phases such as amount of one component that needs to be added to get to a certain point on the diagram (e.g., to obtain one homogeneous phase).
    - Conversions between mass fractions and mole fractions