Set up the equations to describe:
a. the wet bulb thermometer
b. an iceberg being towed in the ocean
c. a burning carbon particle

Will heat transfer affect the friction factor?
In what way?

What is the difference between diffusivity and a mass transferee coefficient? $N = -D\frac{dc}{dx} = k(c-c$

Why is the Prandtl number greater for liquids than for gases?

What is the Sherwood number?

Do Neon and Argon have the same atomic radius?
If not, which is larger?
Which one has a larger diffusivity; viscosity; heat capacity; Prandtl number?

Consider the problem of pumping oil down the Alaskan pipeline. Given the pipe diameter and length and the properties of oil, how would you calculate the (a) pump size; (b) heat loss and (c) the temperature profile?

Describe and give the governing equations for (a) and orifice meter; (b) a venturi meter; and (c) the pitot tube.

Give the following:
a. Bernoulli's equation
b. Hagen-Poiseuille law;
c. Stokes law;
d. Continuity equation;
e. Navier stokes equation.

What is an NTU and how do you calculate it?

Describe the use of a McCabe-Thiele diagram.

How do the following vary with temperature and pressure?
a. diffusivity;
b. dynamic viscosity;
c. thermal conductivity;
d. heat capacity;
e. heat transfer coefficient;
f. kinematic viscosity.

What is the Reynolds analogy?
What is the Chilton-Colburn analogy?

What is the friction factor?
What is the coefficient of friction?

Derive the boundary layer equations.

Sketch the operating diagrams for a stripper and an absorber.

Sketch the shear stress profile for a pipe.

Define the most commonly used dimensionless parameters and describe their significance.

Given a pool of organic liquid (such as from a spill), how would you estimate its evaporation rate?

How are the diffusivity and viscosity of a mixture determined?

Sketch the temperature profile in a heat exchanger.

Consider a drop falling down a tower, initial temperature and tower temperature are given. How does the drop temperature change as it falls?

What is the angular dependence for the Nusselt number for a falling drop?

Draw the boiling curve and describe the physical phenomena responsible for the observed behavior. Draw and explain the similar curve for condensation.

given the free stream velocity and particle diameter, calculate the boundary layer thickness at a 45 degree angle. What is the pressure at the forward and backward stagnation points? What causes the difference?

Derive the steady-state momentum balance for fully developed, laminar flow in a pipe.

How is the overall heat transfer coefficient for a heat exchanger found?

There are several analogies between mass, heat, and momentum transfer. How do they arise? Why are those between mass and heat transfer easier to use than mass and momentum?

Is the mass flux from a liquid into a gas higher or lower if the gas is soluble in the liquid (as compared to as insoluble gas)?

Derive the mass transfer boundary layer equation.

How does upstream pressure relate to velocity of the jet in a discharging gas cylinder? (assume μ_{JT} = zero)

Derive an equation describing;
a. losses in a sudden expansion;
b. pressure drop across a jet ejector pump;
c. flow rate through an orifice;
d. pitot tube velocity measurement;
e. diameter of a free jet (laminar flow)

A sphere of ice is inserted into a bath of 50 F water of infinite dimensions.
a. How far will the sphere travel before it melts and how long will it take?
b.What is the terminal velocity?
c. How does friction factor depend on Renolds number?
d. Draw a temperature profile from the sphere center in the radial direction.
e. What does the heat transfer coefficient depend on?
f. Construct an energy balance for the system.

Determine the time required for a liquid to drain from a tank.

Upon pricking a soap film with a pin, the film breaks and retracts. Calculate the velocity of the receding film boundary.

Draw the transient velocity profiles associated with laminar flow down a pipe. What is important in determining how far down the pipe a fully developed profile will occur (both laminar and turbulent)?

Draw a plot of friction factor vs Reynolds number.
What is k/D?
Why do such small values of k/D greatly affect *f*?

Draw the boiling curve.

A hot metal sphere falls through the air. How would you calculate the sphere's temperature after it has fallen a given distance?