Possible questions
Gas velocity distributions
Question one show a plot of a Maxwellian and make them determine the temperature and drift velocity (The whole distribution function)

Give an overview of plasma theory and describe how the models fit together

Low density of ions and electrons - is it a plasma?

Derive the average velocity of a three-dimensional drifting Maxwellian distribution.

Derive the mean-free path for collisions?

How does a turbo pump work?
How does a thermocouple or ion gauge work?
Derive the equation for the Debye length?

Show that if a Force is at right angles to an applied magnetic field, the particle will drift at a certain velocity FxB/B^2
Give a magnetic field with a gradient - determine the drift velocity
Give an electric field and a magnetic field – determine the drift velocity

Determine the differential scattering cross section as a function of the impact parameter

During the landing of the Applo moon rockets there was a period of blackout.
Describe the physical reason for blackout.
Given that the AM band of radio runs from 0.550 to 1.60 MHz, what can you say about the plasma?
Why do blackouts not occur on the space shuttle landings?

Derive the ambipolar diffusion coefficient from the fluid energy equation.

What is the physical significance of the ambipolar diffusion?

Describe the differences between the kinetic equation and the fluid equations

Determine the electric potential at which an insulated object will float in a plasma.

Assume that a plasma initially has a density of thus (add figure). After it is turned off what shape does the density become and why?

Over view
A plasma is a soup of charged and uncharged particle that interact and as such have collective properties that individual particles would not have. This means that we must have the particles interacting often enough to produce this collective behavior.

If we were to try to model the plasma precisely, we would have to follow the "10^{23}" particles and all of their interactions. Each of the particles can be represented as delta functions in velocity and position space. While we can follow the motion of individual particles, which we have done in class, it is simply impossible, even with the most powerful computer, to follow all of the particles. Thus, we at first assume that instead of discrete points in our 6-D space we will assume that the particles can be modeled as a continuous function in the 6-D space. This is known as kinetic theory. Kinetic theory can be employed in computer models of plasmas, as has been done successfully for many high energy plasmas. However, it is very difficult to use kinetic theory to derive analytic equations describing plasmas. To do this we must go to a simpler model, Fluid Theory. We get fluid theory by integrating over all velocities. There are several moments of the kinetic equations that we can obtain. The first two are the most important – giving us conservation of particles and conservation of momentum (energy). This is what we did in class.
We can picture what we have studied in the following manner:

Single particle motion	⇒	Kinetic Theory	⇒	Fluid Theory
This is the 'true' theory of plasmas. Individual particles act as if they are delta functions in velocity and position space. NOTE To be a plasma collective motion must occur.		This is the most complex model that can be fully handled via computer. Arrived at by assuming continuous distribution in velocity and position space		This model is arrived at by integrating over all velocity space to obtain a number of the moments of the Kinetic model.
⇓		⇓		⇓
Single particle motion Analytic: **E, v^B, E^B drift etc** **Collisions** Numerical/simulation: Monte Carlo – looks at single particle motion through a background 'gas' (partial model) Particle-in-cell – looks at limited number of particles interacting with each other – usually assumes 'light' ions		Kinetic Theory Analytic: Boltzmann Equation Numerical/simulation: Full fledge computer simulations following full velocity/position distributions. Often requires massive parallel processing or similar.		Fluid Theory Analytic: Most plasma phenomena can be described via fluid equations. This includes diffusion, sheaths, bulk plasma waves, electromagnetic waves and electrostatic waves. Numerical/simulation: Full fledge computer simulations following position distributions, average velocity (r) and energy (r). Often can be done on a standard PC.

From this we can get 'global' models (0-D!) that give overall or averaged processes across the system.