1. The energy released during an explosion, E, is a function of time after detonation t, the blast radius R, at time t, and the ambient air pressure, p, and density. Determine by dimensional analysis the general form of expression for E in terms of the other variables.

2. Small droplets of liquid are formed when a liquid jet breaks up in spray and fuel injection processes. The resulting droplet diameter, d, is thought to depend on liquid density, viscosity, and surface tension, jet speed, and jet diameter. Determine the dimensionless groups.

3. The equilibrium height of a sphere placed in the jet is found to depend on D, d, V, rho, mu, and W. W is the weight of the sphere. Determine the pi groups that characterize the phenomena. Replace the sphere by a plate and determine the force on the plate. Make appropriate assumptions.

4. The rate dT/dt at which the temperature T at the center of a rice kernel falls during a food technology process is critical, too high a value leads to cracking of the kernel and too low a value makes the process slow and costly. The rate depends on the rice specific heat capacity, C, thermal conductivity k, and the size L. It also depends on the air specific heat capacity, density, viscosity, and velocity. Determine the Pi group.

5. The power required to drive a fan depends on the impeller diameter, angular speed, volumetric flow rate, the pressure difference, and density of the fluid. Determine the dimensionless groups.