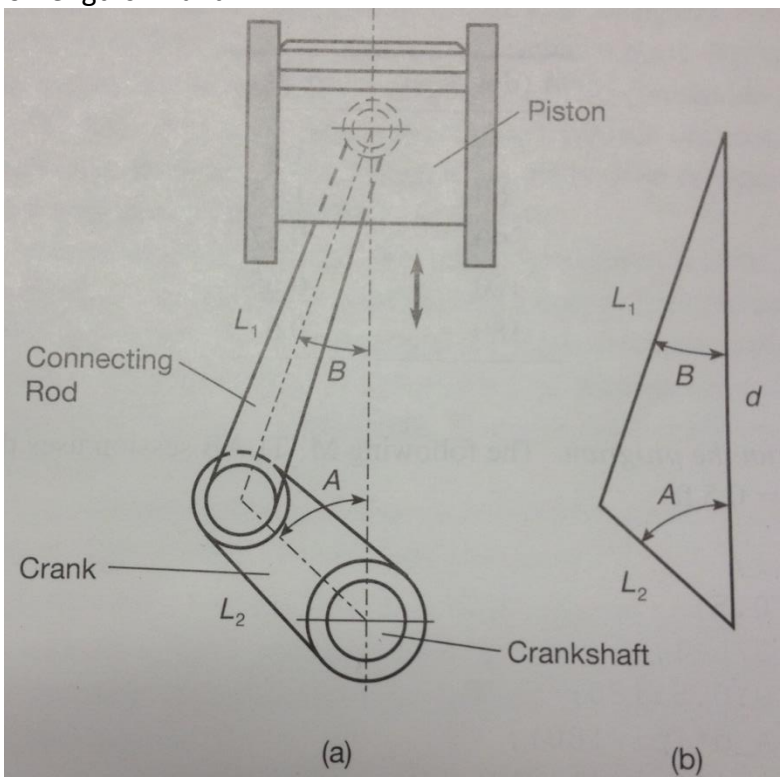
1. Identify the variable to solve for in the following problem statements:
    a. The air pressure and density at a point on the wing of a Boeing 747 are 1.10×10^5 N/m and 1.2 kg/m^3, respectively. What is the temperature at that point?
    b. An ordinary, helium-filled party balloon has a volume of 2.2 ft^3. The lifting force on the balloon due to the outside air is the net result of the pressure distribution exerted on the exterior surface of the balloon. Assuming the balloon is at sea level, can a pencil tied to the string be lifted?
2. A piston, connecting rod, and crank for an internal combustion engine is shown in the figure below. When combustion occurs, it pushes the piston down. This motion causes the connecting rod to turn the crank shaft. Use the Problem Solving Method to develop the equations that will allow us to compute the distance from the crankshaft center, d, traveled by the piston as a function of the angle A, for given values of lengths L1 and L2. Such equations would help engineers when designing the engine to select appropriate values for lengths L1 and L2.



3. Draw a flowchart for the following problem: A planetary lander controls its engine thrust. It tilts to control its horizontal position, which is provided as a function of time (t, θ). The thrust remains aligned with the vehicle (no rocket gimbal). Plot the thrust required to maintain a constant descent rate (no vertical acceleration) at each time point t_i. If the instantaneous thrust exceeds T_{max}, display a warning and stop. The landing could happen on the moon (g=0.16G) or Mars (g=0.38G)