

Use the Direct Format for all five problems. Problems 1, 2, 3 and 4 are individual problems and your solutions to those problems must be submitted individually. Problem 5 is completed by a team of two.

1. Draw the pump body and face plate of your pump using SolidWorks based on the PowerPoint presentation for constructing the pump as your source for dimensions. Print out views from both sides of the final part for the pump body; you only need to print out one view of the faceplate since it is symmetric.
2. A pump is connected to an electric motor. The motor is supplied with 1 A of current from a 12 VDC source. The apparatus is run steadily for 30 seconds, and the following measurements are recorded:

Mass of Fluid Collected: 500 grams
 Diameter of Exit Tube: 3/16 inch
 Density of Water: 1000 kg/m³
 Height of fluid exit above reservoir: 30 inches

Manually compute mass flow rate, volumetric flow rate, velocity of fluid in the tubing, and the efficiency of the pump. Show your work and include units in all calculations. It would be very helpful to convert any US Customary units to SI units before beginning the solution to avoid complexity.

3. Create a spreadsheet for data reduction using the following table as a suggested guide. The values of head h (in), accumulated mass Δm (kg), time of mass accumulation Δt (s), pump voltage V_p (V), and pump current $I_p(V)$ are measured. The head h (m), mass flow rate \dot{m} (kg/s), volumetric flow rate Q (m³/s), water velocity v (m/s) and efficiency η are computed from the measured data. Use the sample calculation from the preceding problem to fill in the first row. (Note: when you use the spreadsheet for your own data, you will delete that row).

h (in)	Δm (kg)	Δt (s)	V_p (V)	I_p (A)

h (m)	\dot{m} (kg/s)	Q (m ³ /s)	v (m/s)	η

4. Complete the SolidWorks tutorial entitled “Lesson 2 – Assemblies.” Capture three screen shots steps from the assembly tutorial and include the screen shots in your solution sheet. (Paste these into a neatly formatted MS Word document). One of the screen shots should be your final assembly. You may need to modify some of the dimensions given in the tutorials to make the parts come together as shown on the assembly tutorial (like using a fillet radius of 10 instead of 5 when making the first part in Lesson 1 and by using an extrude depth of 25 instead of 30 for the part drawn in Lesson 2). The main thing here is that you play around with the assembly. You may need to add more mating constraints to make the assembly come together correctly. Also, you may need to turn on some toolbars when you enter SolidWorks assembly for the first time (such as View > Toolbars > Assembly).

5. Draw the DC motor, a barbed fitting and a screw for the pump assembly. You will need to measure these parts with your dial indicator. As shown in the assembly drawings below, you do not need to include the threads on the barbed fittings and the screws. Combine your parts into an assembly (using what you learned from the assembly tutorial). Provide both assembled and exploded views of your pump (print views like the ones below but from different viewpoints).

