q== ==q

v== Please check your responses with <https://qrproblems.org/prob> or scan the QR code. You will need to put in your Problem Number and index number (given above) to check your responses. When you are finished checking, click the “get rtn Code” button at the bottom of the sheet - **Write the score and the rtn Code in the space provided above**. No credit for the computer graded part of problem if a clear rtn Code is not provided. Documenting your work is important – please return this sheet along with your work. If you run into problems, see if you can get the answers to the base-case problem and use the problem hints.==v

s== Directions for contributors: The QRP solve BringMN macro will delete these direction (and anything between s double equal and double equal s markup tags like those around this section).

1. Compose the problem in this template. Any variable parameters should be put in the form ##varname,[var type],[Base case value]##. var type can have value of num, txt, or arr. Repeated instances of the variable should be exactly the same as the first occurrence (use copy/paste). Denote different parts of the problem that will be computer checked with p==a==p, p==b==p…p==j== p (these will be replaced with a) b) later by a macro in QRP solve)

If you have variable images - put all the images in the document where you want one image to appear. Right click on the first image and Insert Caption then New Label in the New Label dialog box type ##varname,img## where varname is the name you want to call the images. Leave the default numbering alone. Add captions to all of the images in the set with this same label. Note the caption will be removed from the figure during the rendering.

**2) Edit the higher level, short answer, human graded, qualitative questions at the end of the problem (between w== and ==w).** The “Reflect” portion asked students to think about their methods when problem solving. The “Explore” question should ask to change things about the specific problem (e.g. What direction the temperature would move if the pressure were increased…). The “Connect” question should ask them to connect the question to something in the outside world (e.g. Research on the web three different ways to measure flow rate of a liquid in a pipe and …). The “Safety & Society” should tie the problem back to safety, health, codes, environment or society (e.g. Could the temperature of the fluid calculated be contained with carbon steel pipe….) Hints –not all portions are appropriate for all problems and It will help the graders if you put in some numerical specifications. (e.g. List three ways is better than list some ways. Write at least 100 words is better than write a short paragraph…) For times you want the students to do external research, make sure to explicitly request they cite their resources.

**3) Make sure to replace all red font items to black**

4) Save and close this document then open the QRPSolve template. –This bring the variable names into the solution template.

5) solve the problem – see QRPsolve template for directions on this.

6) Upload required files to QRPproblems web site and provide metadata. A simple example is shown below, and this can be deleted or replaced:

- Note anything included between the t== and ==t will be included with the base case values in the area denoted by x== and ==x in the final version. w== ==w denotes the written response area that must be graded by a human. q== ==q denotes where the quote goes – delete this markup if you do not want the random quotes to show up.

==s

t== The disc was made of ##material,txt,iron##, had a diameter of ##diam,num,1.0## meters and a thickness of ##thick,num,10## mm. If the ##material,txt,iron## costs $##price,num,2.14## per pound, determine the

p==a==p volume of the disc in cubic centimeters

p==b==p specific gravity of the disc

p==c==p mass of the disc in kg

p==d==p the material cost (in $) for one of these discs

==t

s== The base case will go in the base case input tags below (please do not remove them) ==s

x== **Base Case Index = 1**

==x

u==

==u

w== The following short answer / reflection questions are available with this problem

i) Reflect – Expert problem solvers reflect on the process. Describe in words your problem-solving methodology and your ability to solve this problem. Some questions you may want to consider include:

* Did you get the answer to all parts on the first try? If not, what was your most serious mistake and how could you minimize that type of mistake in the future.
* What part of your solution strategy went well? What part could use improvement?
* Were you stuck on one part? What process was effective in getting unstuck?
* Did you use a well-defined problem-solving algorithm? If not, why not?
* Did you start early enough to give yourself time to step away from the problem and “incubate the problem”?
* If you could give advice to your former self regarding this problem, or homework set, what would it be?

ii) Explore – Write a concluding statement for this problem. Also, can ask more specific questions such as: If the diameter of the discs were increased by 20% with everything else the same, would the cost increase by 20%, more than 20% or less than 20%? Please back your conclusion up with mathematical / logical reasoning.

iii) Connect – Relate this problem to something that you are familiar with. Can the concepts used to solve this problem be applied to other systems? Can also ask specific questions such as: Would it be safe for one person to pick up one of these discs or would you recommend a group of people lift them? Back up your conclusion with logical reasoning.

iv) Safety & Society – This can include safety, environment, social impart, history … These questions often involve the student looking up external information. Suppose there are many these discs that your town could obtain for free. Someone suggest that they be used for street covers in an upcoming road addition. What do you think of this idea? Why? List at least three other things you would need to know about the discs before you could make an informed decision. What would be an efficient way of gathering this information.

==w