q== ==q

v==

==v

s== Directions for contributors: The Excel file 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. **Variable names** - 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) when rendered to the student)

**Variable images** - If you have variable images (*rare*) 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 the images in the set with this same label. Note the caption will be removed from the figure during the rendering.

**Personalizing Problems** – If you would like to add the students full name, first name, university, city or state to the problem statement you can do so with the following notation !!stu\_name!! , !!stu\_first!! , !!stu\_university!! , !!stu\_city!! or !!stu\_state!! These could be useful in setting up scenarios.

**2) Edit the Reflection questions -** edit 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 …or “is this volume bigger than your house”). The “Safety & Society” should tie the problem back to safety, health, codes, environment, history or society (e.g. Could the temperature of the fluid calculated be contained with carbon steel pipe….) Hints on writing these –It will help the graders if you put in some numerical specifications. (e.g. List at least 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. Think about these as small group and discussion questions

**3) Make sure to replace all red font items to black in the problem statement and reflections below**

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) After the Excel has generated the required input and answer csv files and write the problem number on this word template (i.e. you have run the rocket ship macro).

- Note anything included between the t== and ==t will be included in the problem statement. The basecase will be rendered when the student pulls up the problem and will appear in the area denoted by x== and ==x in the final version. w== ==w denotes the written response area. 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?

s== \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ==s

ii) Explore – If the temperature were increased, how would the answer to each part of the problem change (increase, decrease or not change)?

Or

List three ways you could increase the value obtained in the final part of this problem. Which would be the easiest and / or most effective and/or most cost effective?

Or

Write a problem like the one above but switching the type of value that is given and the solution variable.

And/or any other way to use logical reasoning and draw some conclusion about this problem.

s== \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ==s

iii) Connect – Pick a course you have previously taken. Pick a **type** of problem most like (in some way) the one presented above. Compare and contrast solving the problem presented above, to the one from the previous class (or pick one of their previous classes).

Or

Besides the system presented in this problem, list two other types of problems that could be solved using the concepts required in this problem.

Or

Compare the mass obtained in part c to that of a human. Or (Energy to a sports car, or flow rate to a garden hose, length to the width of a human hair…..) anything that the students would be familiar with in their everyday life.

Or

Explain the concepts presented in this problem in language a 5th grader could understand.

s== \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ==s

iv) Safety & Society – Write a short paragraph on what impact understanding the concept(s) presented in this problem has had on human society. Cite at least one reference.

Or if the equation or concept has a person associated with it (e.g. Bernoulli, Reynolds, Newton…)

Write 100 to 200 words describing the life and contributions of Osborne Reynolds. What was the most interesting thing you found in your research? Cite at least one reference.

Or if the problem involves a device or system that has an impact either on the local, regional or global environment

Briefly research and describe in 100 to 200 words, how the impact airplanes have had on the environment around airports. Cite at least one reference.

Or if the system or device involves aspects of safety

What are some of the most hazardous components of in the problem given above? What steps could be taken to eliminate or reduce those hazards?

Or if the system or device involves any type of equipment of device

Briefly research and describe in 100 to 200 words, the history of the wind tunnel. Cite at least one reference.

==w