**Worksheet 7 Equation of Continuity & fluid dynamics**  **Name:**

Relevant textbook sections covered: 15.5

**1) How do ALL these variables fit together?**

We have been learning about the relationship of pressure to force and area; and now we have the continuity equation relating area and velocity.

Let us now look at all the relationships between the variables:

**Force (F), pressure (p), area (A), volume (V), velocity (v), and acceleration (a)**

 **\*\* BE CAREFUL with the upper and lower case letters for variables.**

A1

A2

flow

The drawing shows a section

of a long round pipe in which

the diameter of the pipe changes.

Section 1 has a cross sectional

area A1 and section 2 has area A2.

Assume that water flows through

the pipe with a certain flow rate

m/t (=V/t).

What can you say about…

a) the **flow rate** as the fluid moves from the wide to the narrow section?

(increases, decreases, stays the same.)

b) the **velocity** of the fluid as it moves from the wide to the narrow section?

(increases, decreases, stays the same.)

c) If the diameters of the container are D1 = 2 D2, what is the relationship between the liquid’s velocity in the two sections? (write this as a ratio)

d) the **acceleration** of the fluid as it moves from the wide to the narrow section? (increases, decreases, stays the same.) hint: a = v/t

e) the **force** of the fluid as it moves from the wide to the narrow section?

(increases, decreases, stays the same.) hint: F = ma

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**2) Conservation of energy in a flowing fluid**

In high school, you learned about

* potential energy, PE = mgh
* kinetic energy, KE = 1/2mv2
* work: the external force needed to move an object some distance, W = Fs



A fluid flows through a pipe that increases in height and changes in diameter (like in the figure).

(a) Write down the expression for the K and U at each opening of the pipe (1) and (2); substitute in *m =* ***ρ****V* wherever possible

(b) Work on a flowing liquid can be written as W = K + U. Using the expressions from above, write the equation for work in a fluid.

(c) Does the total amount of energy change from point (1) to point (2)?

**Explain your answer.**