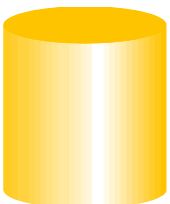
Name: ____ Date: ________________

Why Does a Liquid Jet Form Droplets?

The inkjet printer is one of the most widely-used printer types for home and office printing. The fundamental principle in the operation of inkjet printers is the tendency of a continuous stream of liquid to break apart and form droplets, just like water falling from a faucet. In this activity, we are going to explore why this happens.

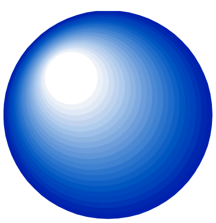
1. Turn on a faucet so that just a small stream of water emerges. Describe what you see:
   Turn off the faucet when you are done.



2. **Cylindrical Column:** Imagine that the water from the faucet **did not** break up, but remained in a cylindrical stream all the way down.
   Use a radius r of the cylinder is 0.75 cm and the height is 16 cm.

   a. What is volume of the water? $V = \pi r^2 h$ (Show all work.)

b. What is the surface area of the column of water? $A_C = 2\pi(r^2 + rh)$ (Show all work.)

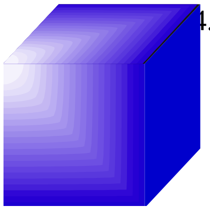


3. **Spheres:** When a jet of water breaks up into droplets, their radii are about twice the radius of the original water column. Use a spherical radius R of 1.0 cm.

   a. What is the volume of a single spherical droplet? $V_S = \frac{4}{3}\pi R^3$ (Show all work.)

b. When water breaks into spherical droplets, the *volume* of the water does not change.
How many spherical droplets will be formed from the total volume found in # 2a? $n = \frac{V}{V_S}$ (Show all work.)

c. What is the total surface area of the spherical water droplets? $A_S = n\, 4\pi R^2$ (Show all work.)



4. **Cubes:** Why does the water form spherical droplets instead of cubical droplets? Use a cube droplet with a side length 1.0 cm.

   a. What is the volume of a single cubical droplet? $V_{Cu} = l^3$ (Show all work.)

b. How many cubical droplets would be formed from the total volume found in # 2a? $n = \frac{V}{V_{Cu}}$ (Show all work. Round to the nearest whole number.)

c. What would be the total surface area of the cubical droplets? $A_{Cu} = n\,(6\,l^2)$ (Show all work.)

5. **Summary:** Fill in the table below.

Shape	Total Surface Area (cm^2)
cylindrical column	
spherical droplets	
cubical droplets	

6. **Questions:** For all three shapes, the volume used was the same. Looking at the table above, why does a liquid jet form spherical droplets? How is this related to the surface tension activities done in class?