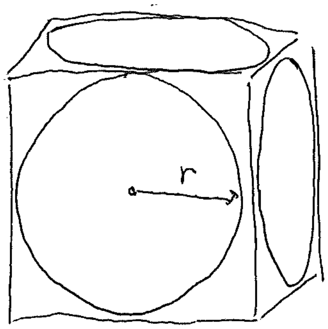
Porosity and Grain Packing

A. Determine the porosity of the cubic aquifer with single spherical grain.



$$n = \frac{V_{void}}{V_{total}}$$

1. Determine the volume of the cube.
   - Assume each side is 1 cm long

$$V = L \times W \times H$$

$$V = 1\ cm^3$$

2. Determine the volume of the grain

$$V = \frac{4}{3}\pi r^3$$

   - If the grain fills the cube then the diameter of the grain will be 1 cm. Thus the radius will be 0.5 cm

$$V_g = \frac{4}{3}\pi(0.5)^3$$

$$V_g = 0.52$$

3. Determin Volume of voids

$$V_{total} = V_{void} + V_{grain}$$

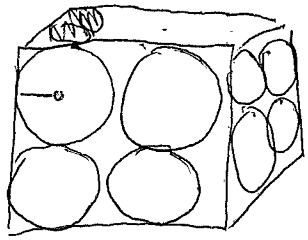
$$V_{voids} = V_{Total} - V_{grain} = 1cm^3 - 0.52cm^3$$

$$V_{oids} = 0.48\ cm^3$$

4. Porosity:

$$n = \frac{V_{void}}{V_{total}} = \frac{0.48cm^3}{1\ cm^3} = 0.48 \text{ or } 48\%$$

B. Determine the Porosity of an aquifer with Cubic Packing



* Same Size cube as Part A. ($1 cm^3$)

Radius of one grain is now

$$r = \frac{1 cm}{4} = 0.25$$

$$n = \frac{V_{void}}{V_{total}}$$

- Volume of one grain is

$$V_g = \frac{4}{3}\pi(r)^3 = 0.065 \ cm^3$$

- Total volume of the grains (there are 8 of them)

$$V_{g\,total} = 8V_g = 0.52 cm^3$$

- $V_{void} = V_{total} - V_{g\,total} = 1 cm^3 - 0.52 cm^3 = 0.48 cm^3$

Porosity: $n = \frac{0.48 cm^3}{1 cm^3} = 0.48$ or 48%

C. Explain the relationship between the Porosity of the Single spherical grain model and the cubic pack model with ~~four~~ 8 grains.

- The two models turn out to be exactly the same. They have the exact same porosity as you see from the calculation. If you where to take the eight grain model and cut it down to 1/8 you would have the one grain model. It does not matter how you scale it, you will get the same porosity for cubic packing (independent of the grain size)