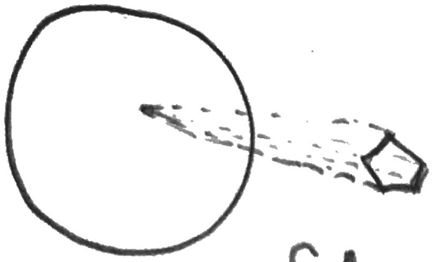
SURFACE AREA OF A SPHERE



IMAGINE WE BROKE UP THE SPHERE INTO MANY SMALL PYRAMIDS, EACH WITH A BASE ON THE SURFACE.

$$S.A._{sphere} = B_1 + B_2 + \ldots + B_n$$

We can find surface area by using volume

$$V_{\text{each pyramid}} = \frac{1}{3} \underbrace{B}_{\text{Base on surface}} \overbrace{r}^{\text{height of pyramid = radius of sphere}}$$

$$V_{sphere} = \frac{1}{3} B_1 r + \frac{1}{3} B_2 r + \ldots + \frac{1}{3} B_n r$$

$$= \frac{1}{3} r \underbrace{(B_1 + B_2 + \ldots + B_r)}_{S.A_{sphere}}$$

$$V_{sphere} = \frac{1}{3} r (SA_{sphere})$$

Now, we plug in the volume of a sphere & solve for S.A.

$$V_{sphere} = \frac{\frac{4}{3}\pi r^3}{1/3\, r} = \frac{\frac{1}{3} r (SA_{sphere})}{\frac{1}{3} r}$$

$$\boxed{SA_{sphere} = 4\pi r^2}$$

Ex. $\approx 70\%$ of the earth is covered by water. Find the area not covered by water if the diameter is $\approx 12{,}750$ km.

$$A = 0.3\, S.A._{sphere}$$

$$= 0.3 (4 \cdot \pi \cdot 6375^2) \approx 153{,}200{,}000 \text{ km}^2$$

SIMILARITY AND AREA/VOLUME

* IF corresponding edge lengths, radii, or heights of 2 similar solids are in a ratio of $\frac{m}{n}$, then the volumes compare in a ratio of $\frac{m^3}{n^3}$

* FOR POLYHEDRONS:

  SIMILAR IF CORRESPONDING FACES ARE SIMILAR AND CORRESPONDING EDGES ARE PROPORTIONAL

* FOR CYLINDERS/CONES:

  SIMILAR IF RADII AND HEIGHTS ARE PROPORTIONAL

$\boxed{\text{RECALL}}$

AREA SCALES BY THE SQUARE OF THE RATIO

$\frac{m}{n} \rightarrow \frac{m^2}{n^2}$

Think two similar circles with radii in a ratio of a/b. The ratio of areas would be $\pi a^2 / \pi b^2 = a^2/b^2$