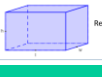
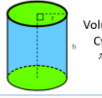



Volume of a cube = s^3



Volume of a Rectangular Prism = lwh

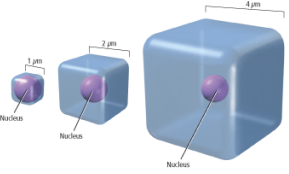


Volume of a Cylinder = $\pi r^2 h$

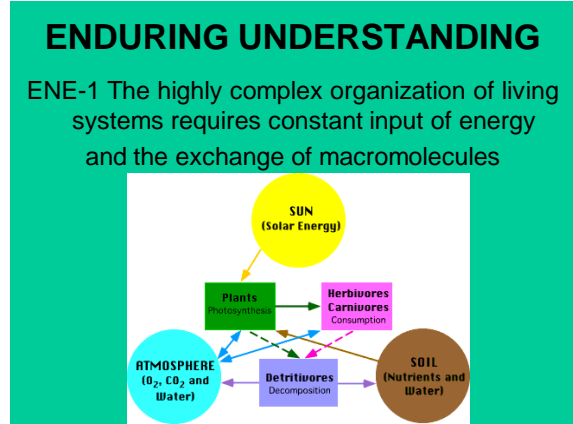


Volume of Sphere = $\frac{4}{3}\pi r^3$

2.3 Cell Size



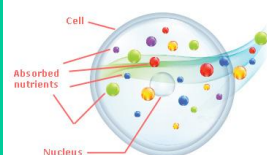
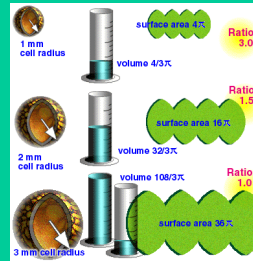
Cell Radius	Volume	Surface Area	Ratio
1 mm	4/3π	4π	3.0
2 mm	32/3π	16π	1.5
3 mm	108/3π	36π	1.0



ENE-1.B Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.

□ Surface area-to-volume ratios affect the ability of a biological system to:

- obtain necessary resources
- eliminate waste products
- acquire or dissipate thermal energy
- exchange chemicals and energy with the environment.

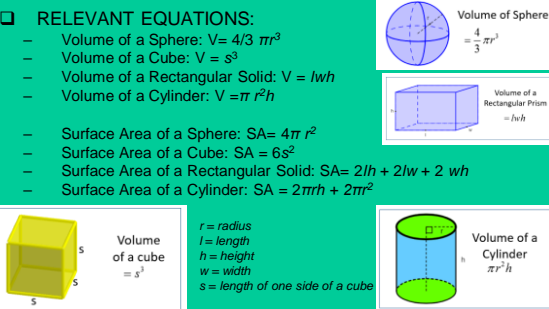



ENE-1.B Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.

□ RELEVANT EQUATIONS:

- Volume of a Sphere: $V = \frac{4}{3}\pi r^3$
- Volume of a Cube: $V = s^3$
- Volume of a Rectangular Solid: $V = lwh$
- Volume of a Cylinder: $V = \pi r^2 h$

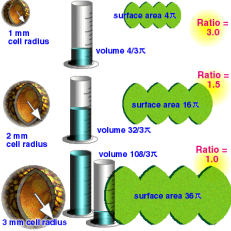
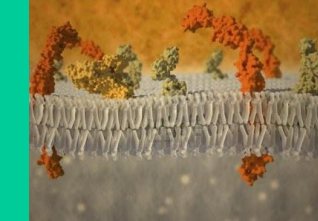
- Surface Area of a Sphere: $SA = 4\pi r^2$
- Surface Area of a Cube: $SA = 6s^2$
- Surface Area of a Rectangular Solid: $SA = 2lh + 2lw + 2wh$
- Surface Area of a Cylinder: $SA = 2\pi rh + 2\pi r^2$



ENE-1.B Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.

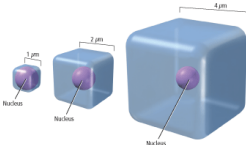
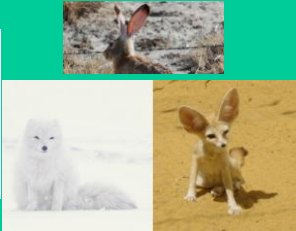
□ The surface area of the plasma membrane must be large enough to adequately exchange materials

- Smaller cells
 - higher surface area-to-volume ratio
 - more efficient exchange of materials with the environment

ENE-1.B Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.

- As cells increase in volume
 - relative surface area decreases
 - demand for internal resources increases.
- As organisms increase in size, their surface area-to-volume ratio decreases, affecting properties like rate of heat exchange with the environment.

ENE-1.C Explain how specialized structures and strategies are used for the efficient exchange of molecules to the environment.

□ Organisms have evolved highly efficient strategies to obtain nutrients and eliminate wastes. Cells and organisms use specialized exchange surfaces to obtain and release molecules from or into the surrounding environment.

- Root hairs
- Cells of the alveoli
- Cells of the villi
- Microvilli
- Internal Membranes

