

Quantitative Methods

Volume, Mass & Density

Module No. Cons 1012

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Volume, Mass and Density

- Mass refers to the weight of an object and is measured in Kilogram's(kg)
- Density is mass per unit volume and is measured in Kg/m³
- If the volume and density of a material is known, the mass(weight) can be calculated:
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 - **Mass = Density x Volume**
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- (This formula can also be expressed for Mass or Volume through transposition)

Volume, Mass and Density

- To get the Weight or Mass of something you multiply the volume by its Density
- Example:
- Calculate the weight of the plank size 2.4m x 200mm x 75mm if the density is 470 kg/m³
- Volume: $2.4 \times 0.2 \times 0.075 = 0.036\text{m}^3$
- Weight: $0.036 \times 470 = 16.92\text{Kg}$

Volume, Mass and Density

- To get the Density of something you divide the Weight by the Volume
- Example:
- A clay brick measuring 215mm x 100mm x 65mm weighs 2.7Kg
- Calculate the density of the brick.
- Volume: $0.215 \times 0.10 \times 0.065 = 0.00139\text{m}^3$
- Density: $2.7 \div 0.00139 = 1942.446\text{kg/m}^3$

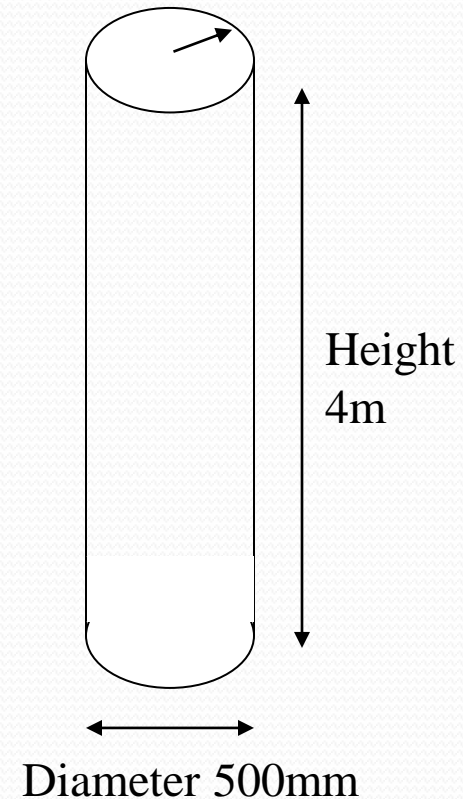
Volume, Mass and Density

- **Q 1** A concrete block measures 440mm x 215mm x 100mm .
- Calculate the weight of the block if the density of the concrete is 2300kg/m³
- $(0.44 \times 0.215 \times 0.10) \times 2300 = 21.76\text{kg}$

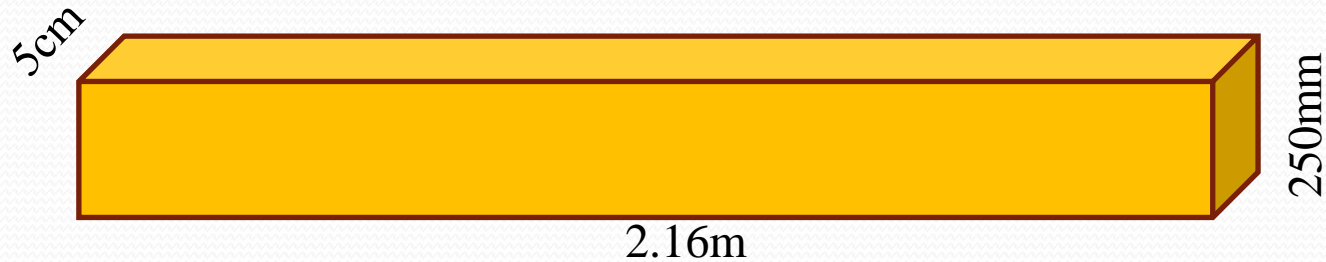
- **Q 2** Calculate the weight of a wall 4.5m long x 2.5m high where blocks are laid flat. Density of the concrete is 2300kg/m³
- $(4.5 \times 2.5 \times 0.215) \times 2300 = 5563.12\text{kg}$

Volume, Mass and Density

- **Mass = Density x Volume**
- **Example**: Calculate the volume of concrete required for the cylindrical column shown, and from this, calculate the weight of the column if the density concrete is 2400 kg/m^3
- (Vol. of cylinder = $\pi r^2 h$)
- **Answer**: Volume = $\pi r^2 h$
- $= \pi \times 0.25^2 \times 4 = 0.785\text{m}^3$
- Mass = Density x Volume
- $= 2400 \times 0.785 = \mathbf{1884\text{kg}}$



Volume, Mass and Density



- Q.3 Calculate the mass (weight) of the timbers listed below:
- Norway Spruce (white deal) Density = 470 kg/m^3
- European Redwood (red deal) Density = 515 kg/m^3
- American Red Oak Density = 790 kg/m^3
- Greenheart Density = 1040 kg/m^3
- **Mass = Density x Volume**

Volume, Mass and Density

- First find volume of plank $L \times B \times W$
- Volume of plank = $2.16\text{m} \times 0.250\text{mm} \times 0.050\text{mm} = 0.027\text{m}^3$
- ***(Mass = Density x Volume)***

- Norway Spruce = $0.027 \times 470 = 12.69 \text{ kg}$
- European Redwood = $0.027 \times 515 = 13.905\text{kg}$
- American Red Oak = $0.027 \times 790 = 21.33\text{kg}$
- Greenheart = $0.027 \times 1040 = 28.08 \text{ kg}$