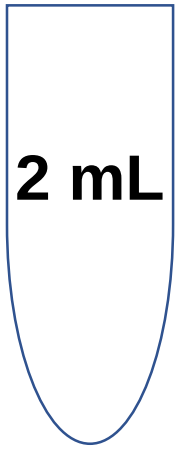
Calculations for suppositories to ensure dose accuracy

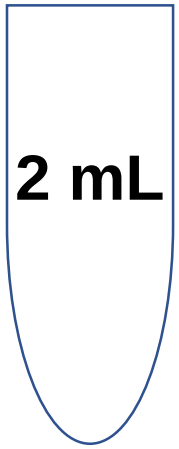


Drug volume	Base volume
0.2 mL	2-0.2=1.8 mL
0.4 mL	2-0.4=1.6 mL
0.1 mL	2-0.1=1.9 mL

Total volume 2 mL

Total weight ?

Calculations for suppositories



Drug Amount
0.2 grams

Base volume
2-?? =?? mL

$$Density(\rho) = \frac{m}{v} \qquad v = \frac{m}{\rho}$$

Base volume

If ρ=1, V of 0.2 gram is mL

2-0.2 =1.8 mL

If ρ=2, V of 0.2 gram is mL

2-0.1 =1.9 mL

Total volume 2 mL

Total weight ?

Amount
0.2 grams

Base volume
2-?? =?? mL

Base amount (grams)

$$Density(\rho) = \frac{m}{v} \qquad m = \rho \times v$$

$$Density(\rho) = \frac{m}{v}$$

Base volume

Base amount

If ρ=1, V 0.2 gram is 0.2 mL

2-0.2 =1.8 mL

1.8 mL × ρ=??

If ρ=2, V 0.2 gram is 0.1 mL

2-0.1 =1.9 mL

1.9 mL × ρ=??

If ρ=3, V 0.2 gram is 0.067 mL

2-0.067 =1.933 mL

Base amount

1.8 mL × 1 g/mL= 1.8 g

1.9 mL × 1 g/mL= 1.9 g

1.933 × 1 =1.933 g

If base density is 2

1.933 × 2 =3.866 g

Calculations for suppositories

The base has a density of 1.0 g/mL, what will be the total volume for 2 grams?

Volume vs Weight

$$Density(\rho) = \frac{m}{v}$$

Prepare a suppository containing 0.18 g of the active drug with a density of 1.8 g/mL. The base has a density of 1.0 g/mL. What will be the total volume if I mix 0.18 grams of the drug with 2 grams of the base?

$$v_{drug} = \frac{m}{\rho} = \frac{0.18}{1.8} = 0.1\ mL$$

$$v_{base} = \frac{m}{\rho} = \frac{2}{1} = 2\ mL$$

$$v_{total} = 0.1 + 2 = 2.1\ mL$$

$$v_{total\ base} = 2 - 0.1 = 1.9\ mL$$

$$m_{base\ removed} = v_{base\ removed} \times \rho_{bas}$$

$$m_{base\ removed} = 0.1 \times \rho_{base} = 0.1 \times 1$$

=0.1 grams

Calculations for suppositories

- Dose accuracy

Drug $\quad Density(\rho) = \frac{m}{v}$ $\quad$ Base ρ : 1 g/mL

Density (g/mL)	Weight (g)	Volume (ml)	Replaced volume (mL)	Replaced weight (g)
2	0.1	0.05	0.05	0.05
1	0.1	0.1	0.1	0.1
4	0.1	0.025	0.025	0.025

Base ρ : 1.5 g/mL

Replaced weight (g)

Calculations for suppositories

Example:

Prepare a suppository containing 200 mg of the active drug with a density of 3.0. The base has a density of 1.0. The weight of the blank base using the same mold is 2.0 g. How many grams of the base do you need?

Volume of the mold: 2.0/1.0=2 mL

Drug $Density(\rho) = \frac{m}{v}$ Base ρ : 1 g/mL

Density (g/mL)	Weight (g)	Volume (ml)	Replaced volume (mL)	Replaced weight (g)
3	0.2	0.2/3=0.067	0.067	0.067 ×1
4	0.2	0.2/4=0.05	0.05	0.05 × 1
5	0.2	0.2/5=0.04	0.04	0.04 × 1

Calculations for suppositories

Drug $\qquad Density(\rho) = \frac{m}{v}$ $\qquad$ Base ρ : 1 g/mL

Density (g/mL)	Weight (g)	Volume (ml)	Replaced volume (mL)	Replaced weight (g)
3	0.2	0.2/3=0.067	0.067	0.067 × 2
4	0.2	0.2/4=0.05	0.05	0.05 × 2
5	0.2	0.2/5=0.04	0.04	0.04 × 2

Base ρ : 2 g/mL

$$Replaced\ weight = 0.067(replaced\ volume) \times \rho(base) \ldots\ldots (E1)$$

$$Replaced\ weight = 0.067(drug\ volume) \times \rho(base) \ldots\ldots (E2)$$

$$\frac{0.2}{3} = 0.067 \qquad \frac{0.2\ (API\ Amount)}{3\ \rho(drug)} = 0.067(\text{drug volume})$$

$$Replaced\ weight = \frac{API\ amount}{\rho(drug)} \times \rho(base)$$

Calculations for suppositories

$$Replaced\ weight = \frac{API\ amount}{\rho(drug)} \times \rho(base) = \frac{API\ amount}{\frac{\rho(drug)}{\rho(base)}}$$

- Determine the occupied volume
  1. Calculated the total amount of the APIs required for the total number of suppositories.
  2. Estimate the average and total weight of the base
  3. Divide the density of APIs by the density of the base
  4. Divide the total weight of the APIs for the total number of suppositories by the ratio obtained in step 3 to afford the amount of base displaced by the APIs
  5. Subtract the base amount displaced by the APIs to obtain the weight of the base required.

Calculations for suppositories

Q: Prepare 10 suppositories, each containing 200 mg of the active drug with a density of 3.0. The base has a density of 1.0. The weight of the blank base using the same mold is 2.0 g. How many grams of the base do you need?

1. Total API: 10 ×0.2=2 grams
2. Average blank base per suppository: 2.0 gam. Estimated total base 10 ×2=20 grams
3. Density ratio=3.0/1.0=3
4. Amount of the base to be replaced by APIs: 2/3=0.67
5. Total base needed: 20-0.67=19.33 gram