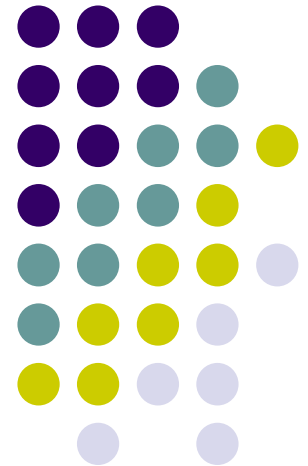
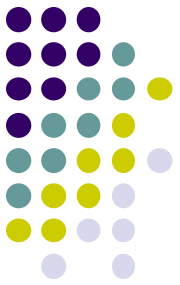


General Principles of Calculations

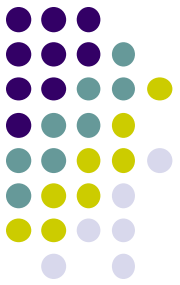
Dimensional Analysis,
Estimation, Errors



Objectives



- Properly use units, units conversion and **dimensional analysis method**
- Apply **estimation to predict and confirm pharmaceutical calculations**
- Calculate **significance figures and ranges of accepted limits**



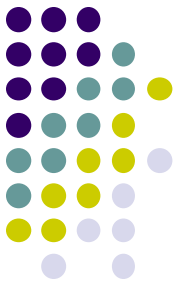
Units

- The magnitude of each pharmaceutical quantity is made of **number** and **unit**.
- $1 \neq 1(1 \text{ mg} \neq 1 \text{ } \mu\text{g})$
- $1 = 2.2 (1 \text{ kg} = 2.2 \text{ lb})$
- Units must be indicated during calculation.
- Indicating the units facilitates the use of **dimensional analysis**.



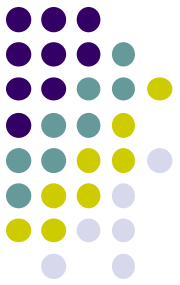
Dimensional Analysis

- A method that manipulates units and ratios between units in calculating desired quantity with the required unit.
- You have to know the relations between different units to use this method:
- $\text{Kg} = 2.2 \text{ lb}$, $1 \text{ ft} = 12 \text{ inches}$, $1 \text{ kg} = 1000 \text{ grams}$, $1 \text{ day} = 24 \text{ hours}$...



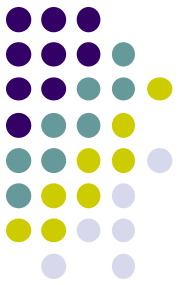
Problem 1

- The recommended amoxicillin dose is 20 mg/kg/day orally divided into 3 doses (every 8 hours). How many milligrams of amoxicillin can be given to an adult 165 lb patient per day?



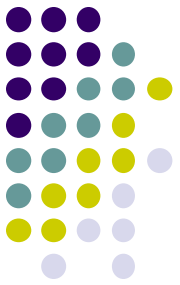
Problem 2

- A child dose of medicated syrup is 0.1 mL /kg once a day. How many teaspoonfuls should be given to a 55 lb child/day?
- 1 kg = lb
- 1 tsp =mL



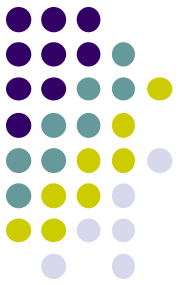
Estimation

- Before solving a problem estimate the answer
 - Round your numbers to one digit.
 - Perform the calculation without calculator.
 - Do the exact calculation and compare the results.



Result Estimation

- Example : 2025 grams of cream are used to fill 45 cream vials. How many grams does each vial contain?
 - Round 2025g to 2000g
 - Round 45 vials to 50 vials



Result Estimation

- Rx

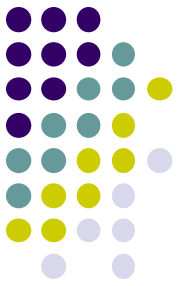
Zinc Oxide 7.5 g

Calamine 7.5 g

Starch 15 g

White petrolatum 30 g

Estimate how many prescriptions you can fill if you have 98 grams of calamine

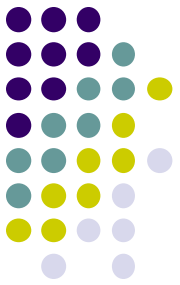


Tolerance

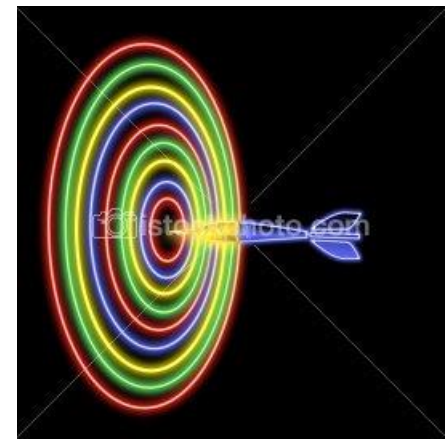
- 1- Amount and Percentage (USP)
- 2- Compounding & Manufacturing
- 3- Based on the number of figures

Tolerance

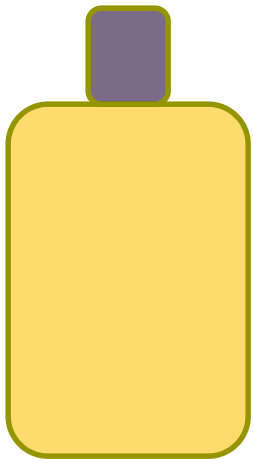
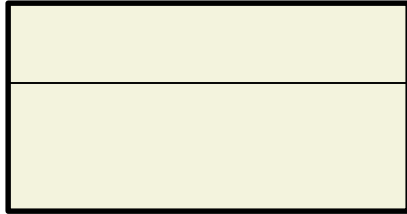
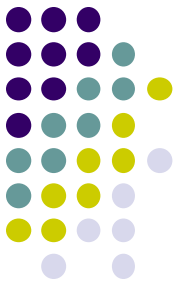
1-Amount and Percentage (USP)



- Accepted amount and percentage
- Errors can be expressed in the following forms
 - Exact value $\pm$ accepted error (150 mg tablet $\pm$ 15 mg)
 - Exact range 150 mg tablet accepted range is (135mg-165mg)
 - Exact value $\pm$ % accepted error (true value $\pm$ 10%)
 - Range of accepted % error (90 %- 110%)



Express the tolerance in mean (median) value $\pm$ %error



- A cream batch with a weight range of 35- 50 grams of cream/jar.
- A syrup batch with total volume range of 180-220 mL/ bottle.
- A total tablet weight range of 470- 520 mg.



Tolerance

2- Compounding & Manufacturing



What if the % error is not indicated?

A- For compounding prescription

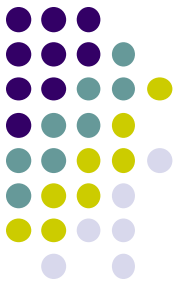
- 5% is the maximum accepted error.

In weighing and
measuring

B- In pharmaceutical manufacturing

- Tolerance in measurement should be less than 1%.

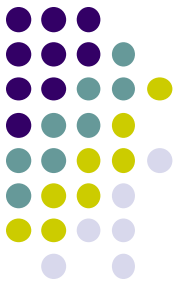
Accepted Tolerance



3- Based on the number of figures

- How many significant figures are the following numbers?
 - 23
 - 3298
 - 2787
 - 9
- Initial zeros to the left of the first digit are never significant. They indicate the location of the decimal point.
- 0.09, 0.008, 0.0071

Accepted Tolerance

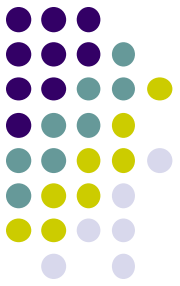


3- Based on the number of figures

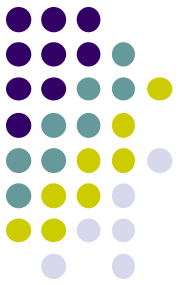
- Significant figures are the number of consecutive figures that express the value of a number accurately enough for a given purpose.
- The last figure is always approximate.

Accepted Tolerance

3- Based on the number of figures

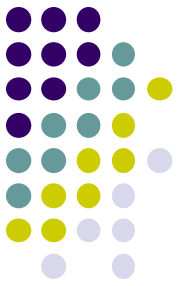


- Zeros to the right of the decimal point are significant.
- 20.0, 15.0, 14.00
- Zeros to the left of the decimal point do not indicate the right significance.
- 2000 may be 1, 2, 3 or 4 figures.



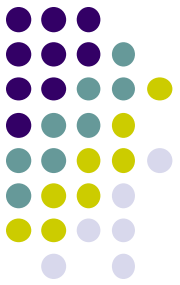
Question

- Which zeros indicate significant figure?
 - 0.339
 - 0.0037
 - 34.0
 - 45.90
 - 6500



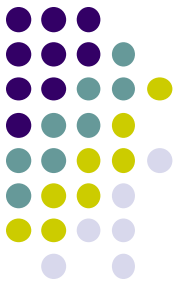
Accepted Tolerance

- 345 cm (345cm $\pm$ cm)
- 345.0 cm (345.0 cm $\pm$ cm)



Accepted Tolerance

- 345 cm ($345\text{cm} \pm 0.5\text{ cm}$)
- 345.0 cm ($345.0\text{ cm} \pm \text{cm}$)



Accepted Tolerance

- 345 cm ($345\text{cm} \pm 0.5 \text{ cm}$)
- 345.0 cm ($345.0 \text{ cm} \pm 0.05 \text{ cm}$)

Extra problems

- What is the accepted tolerance of 5.56 mL?
- What is the accepted tolerance of 3.3×10^2 mg?

