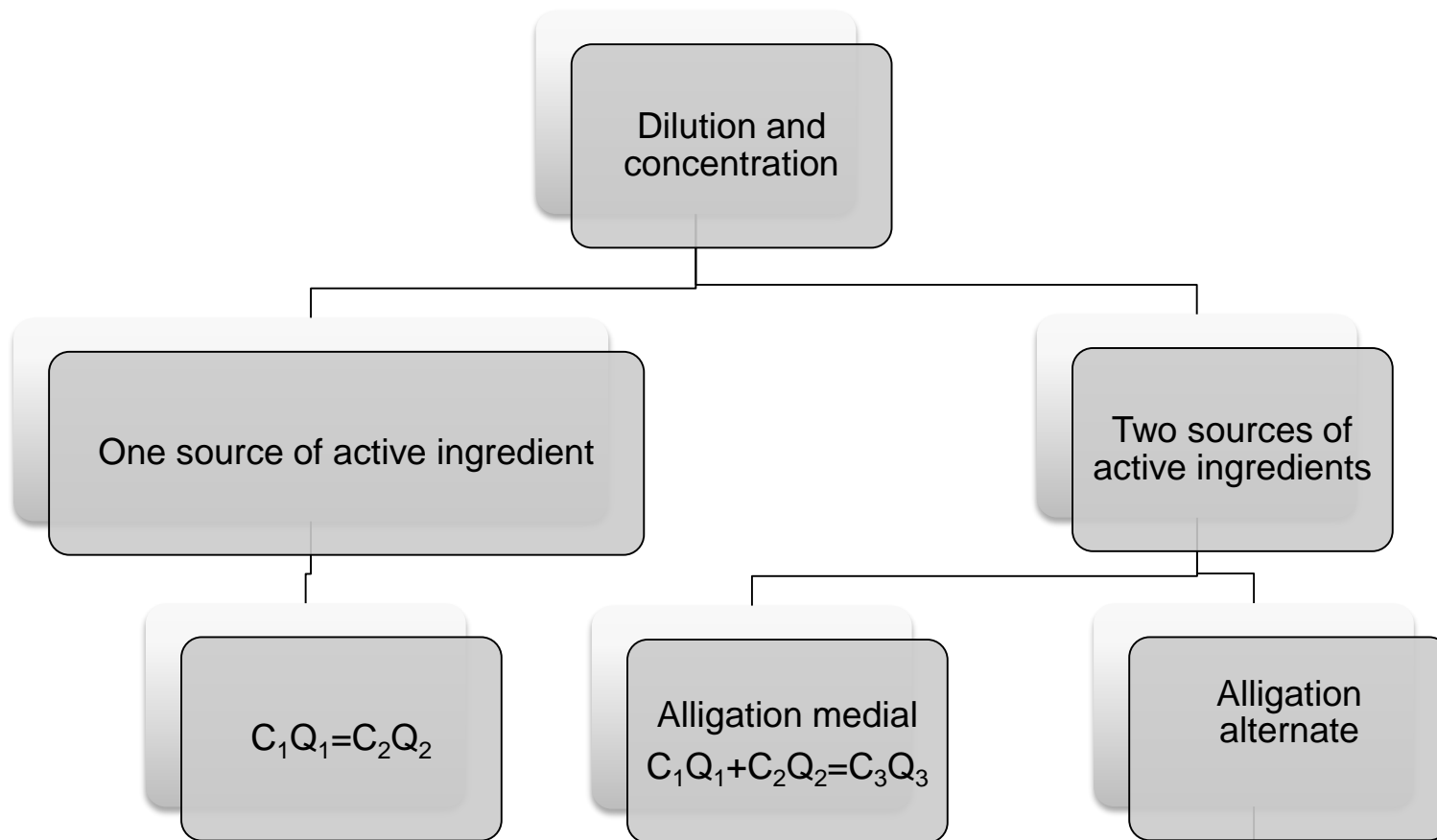# Alligation
Dilution and Concentration

Objectives

Students should be able to calculate the necessary quantities needed from different concentrated solutions or preparations in order to prepare a final dosage form with a required concentration.

Why dilution and concentration?

- Preparation of individualized doses (to fulfill the need of different dosage forms &/or strengths from an available product.

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                    ┌─────────────────┐
                    │   Dilution and  │
                    │  concentration  │
                    └────────┬────────┘
              ┌──────────────┴──────────────┐
    ┌─────────────────────────┐   ┌──────────────────┐
    │ One source of active     │   │ Two sources of   │
    │ ingredient               │   │ active ingredients│
    └────────┬─────────────────┘   └────────┬─────────┘
             │              ┌───────────────┴────────┐
    ┌────────────────┐  ┌──────────────────┐  ┌──────────────┐
    │                │  │ Alligation medial│  │ Alligation   │
    │  C₁Q₁=C₂Q₂     │  │ C₁Q₁+C₂Q₂=C₃Q₃   │  │ alternate    │
    └────────────────┘  └──────────────────┘  └──────────────┘
```

$C_1Q_1=C_2Q_2$

Alligation medial
$C_1Q_1+C_2Q_2=C_3Q_3$

Alligation alternate

High conc preparation		# of parts of the high conc preparation
	Required conc	
Low conc preparation		# of parts of the low conc preparation

Amount of Drug

Quantity of solute = Concentration x quantity of the preparation

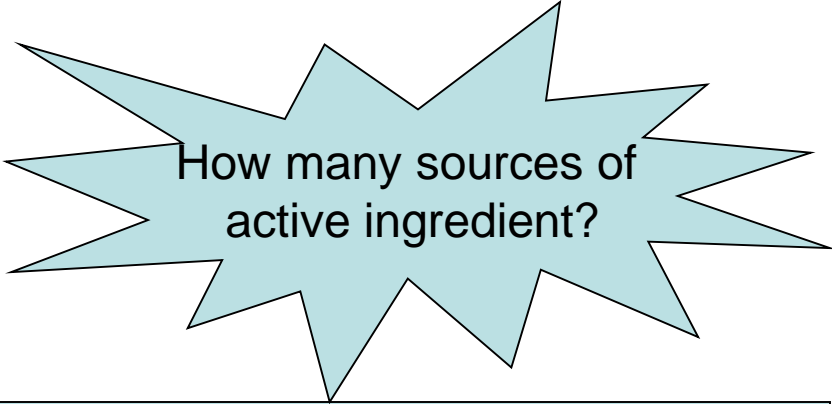How many milliliters of solute are in

1- 6.6 L of 1:3000 v/v solution?

2- 400 mL of 6% v/v solution?

Dilution

- Prepare a 30 grams 5% ZnO cream using 20% ZnO cream and white ointment CQ equation:

How many sources of active ingredient?

Concentration 1 x quantity 1 = Concentration 2 x quantity 2

Dilution

- A pharmacist needs to prepare 45 grams 10% sulfur in petrolatum using 1: 5 w/w sulfur in petrolatum. How much of each (the medicated and non-medicated creams) does the pharmacist need?

Concentration 1 x quantity 1 = Concentration 2 x quantity 2

Dilution

- How much alcohol 95% should be added to 30 mL of 15% w/v solution of drug A, to create a solution of 5% w/v strength of drug A?

Dilution

- A surgeon needs 15 mL of diluted solution of H_2O_2 1:40 v/v. How many mL of water and 20% H_2O_2 should be used?

Combining dosage forms with different concentrations

- Alligation medial (also called Mass Balance Equation),

  "thinking in terms of amount of active ingredient"

- Alligation Alternate method

  " thinking in terms of parts"

Alligation medial
Mass Balance Equation

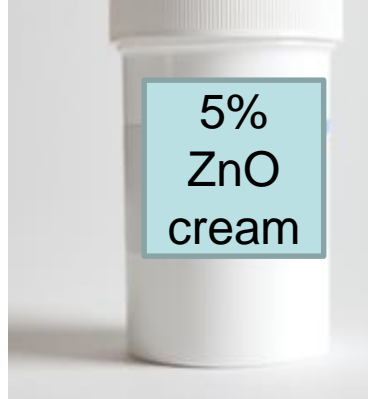Concentration &
quantity of the final
solution or dosage form

$$C_1Q_1 + C_2Q_2 = C_fQ_f$$

Concentration and quantity of
solution or dosage form 1

Concentration and quantity of
solution or dosage form 2

Remember

$$Q_1 + Q_2 = Q_f$$

Can also be used if you are mixing more than 2 sources of the active ingredient

5%
ZnO
cream

Diluent
cream

HELPS TREAT & PREVENT DIAPER RASH

Activ Guard™

Balmex®

DIAPER RASH CREAM ZINC OXIDE 11.3%

Crema Para Rozaduras De Pañal con OXIDO DE CINC 11.3%

Reduces redness in ❶ diaper change

• Gentle On, Easy Off • Soothing Vitamins B5 and E
• Forms a Protective Barrier to Help Seal Out Wetness

NET WT 16 OZ (453 g) PESO NETO 16 OZ (453 g)

7%

15%

Zinc Oxide Powder

20%
ZnO
cream

Alligation Medial
Mass Balance Equation

- A pharmacist needs to prepare 28 grams of 10% ZnO cream using 2% , 20% ZnO creams. How much of each cream should be used?

Alligation Medial / Mass Balance Equation

- How many mL of 15% w/v boric acid and 2.5% w/v boric acid solutions are required to prepare 200 mL of 5% w/v boric acid solution?

- Q1 + Q2= 200 mL

Alligation Medial / Mass Balance Equation

- How many mL of syrup 80% w/v sucrose should be mixed with 300 mL of syrup 50% w/v sucrose to prepare 70% w/v syrup ?

Alligation Medial / Mass Balance Equation

- Example

Belladonna tincture 20 mL (67% alcohol)

Elixir phenobarbital 70 mL (15% alcohol)

Alcohol USP   qs

Simple Syrup qs ad 180 mL

- How much alcohol is needed, so the final solution has 20% alcohol?

Alligation Alternate method

- Use 5% and 15 % of drug A creams to prepare 12 % of drug A cream

Strength to be used

Absolute value of the differences

15%

7 part of 15%

Desired strength

12%

3 parts of 5%

5%

Make sure you have the same unit then think parts

17

Alligation Alternate method

15

12

5

Absolute value of the differences

7 part of 15%

3 parts of 5%
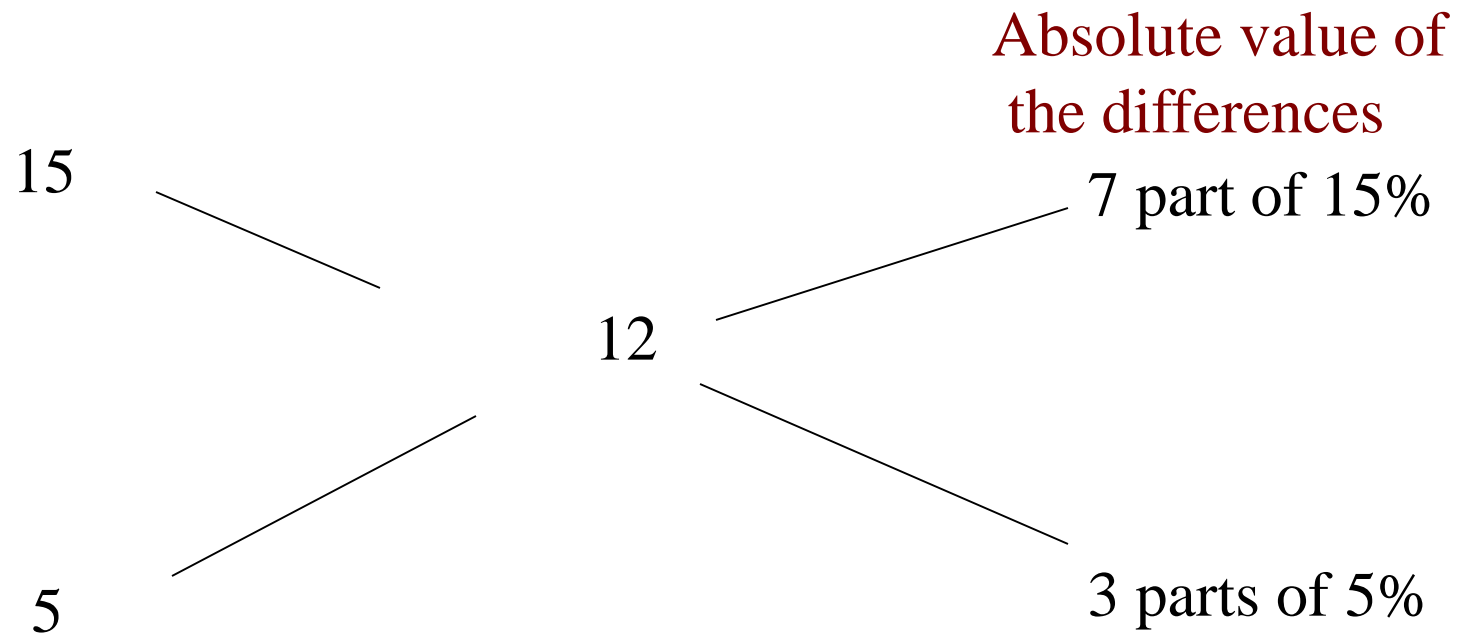
Application

- How many mL of 2% solution should we mixed with water to prepare 500 mL of solution contains 4 mg/ mL?

- Use Alligation Alternate

- Rx
  - Hydrocortisone 0.1%
  - Zinc oxide 5%
  - Hydrophilic Base qsad 100 gram
  - Dispense 30 g
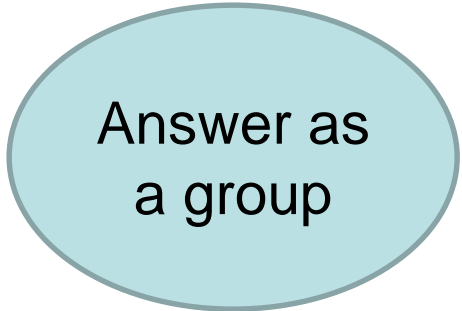- How would you prepare this prescription using the following creams?
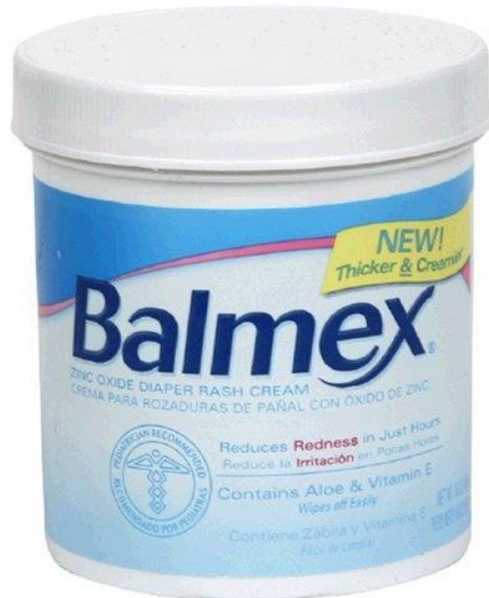
11% ZnO cream

How much of alcohol 50% should be mixed with alcohol 10 % to prepare 40 mL of alcohol 5%?
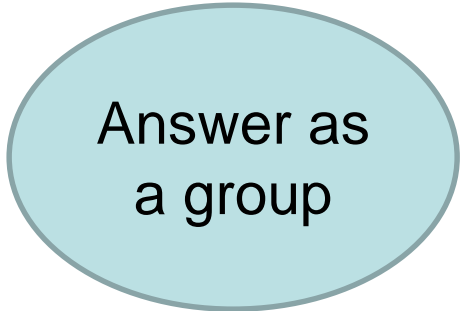
Answer as a group

A. 5 parts of alcohol 50% and 45 parts of alcohol 10%.

B. 5 parts of alcohol 50% and 40 parts of alcohol 5%.

C. This concentration cannot be achieved

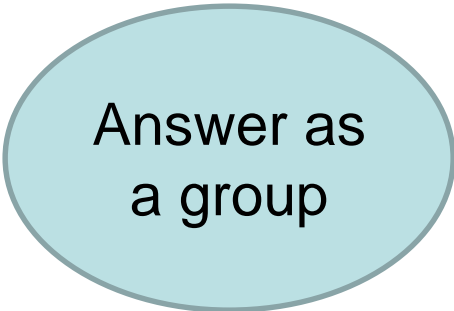What is the **ratio** of alcohol 90% : alcohol 25% needed to prepare alcohol 60%?

A. 7:6

B. 54%

C. 35:65

D. 6:7

Answer as a group

Application

- How many mL of Phenytoin elixir containing 25mg/tsp and 35 mg/tsp should be used to prepare 100 ml of elixir containing 6.2 mg/mL?

Answer as a group