THE OBJECTIVES INCLUDE THE FOLLOWING:

• Discuss importance of calculations in a pharmacy practice.
• Outline steps to avoid calculation errors
• Explain importance of reading the prescription carefully then performing calculations
• Explain importance of calculations in determining days supply
• Describe consequences of calculation errors.
• Perform calculations during the presentation

ADDITIONAL LEARNING OBJECTIVES

• Understand how the concentration of electrolyte solutions are expressed and calculations of m.Eq.
• Understand the importance of iso-tonicity in ophthalmic solutions.
• Perform calculations, using a prescription, to determine the quantity of a liquid product required to fill the prescription accurately.

ADDITIONAL LEARNING OBJECTIVES

• Perform calculations, using a prescription, to determine the # of day supply for a specific product.
• Perform calculations to determine m.Eq strength of an electrolyte solution.
• Perform calculations to prepare an isotonic ophthalmic solution.
IMPORTANCE OF CALCULATIONS IN THE PHARMACY PRACTICE:

• It is consistent with the practice and philosophy of pharmaceutical care.
• Patient safety is of utmost importance.
• Your pharmacy is the last check point for the prescription written by a physician. Therefore, pharmacy team is responsible for all the final checks.

The final check points will include
• accuracy of the dose and dosage regimen;
• the quantity prescribed or required;
• # of refills; and # of days supply.
• Your Pharmacists depend on you to input the prescription accurately to avoid editing and save time.

The internal and external audit is another good reason for maintaining accuracy of the prescription.
• Federal and state regulations will also play an important role.
• When there is a reimbursement issue, accuracy in the quantity of the medication dispensed becomes an important matter.

Electrolytes Concentration

Its solution contains ions. Examples include, sodium chloride, calcium chloride, potassium chloride, zinc sulfate, magnesium sulfate, and many more. Electrolytes dissociate into particles known as ions. For example,

NaCl ------ Na⁺ (cation) + Cl⁻ (anion)

These ions carry electric charge

Electrolyte ions (cations) commonly present in the blood include:
• sodium (Na⁺), potassium (K⁺), calcium (Ca²⁺), magnesium (Mg²⁺), etc.

The anions commonly found in the blood are Chloride (Cl⁻), bicarbonate (HCO₃⁻), phosphate (HPO₄²⁻), and sulfate (SO₄²⁻).

These ions maintain acid-base balance in the body.
Electrolyte solutions are, therefore, used in the treatment of disturbances in the electrolytes.

- The concentrations of these solutions can be expressed as % W/V or mg %; however, these expressions do not take into consideration chemical equivalence and, hence, they do not give any direct information as to the number ions or charges they carry.
- A chemical unit, milli-equivalent (m.Eq.) is almost exclusively used to express the concentration of an electrolyte in solution.

A chemical unit, mili-equivalent (m.Eq.) is almost exclusively used to express the concentration of an electrolyte in solution.

- This unit is related to the number of ionic charges in solution and the valence of ions or m.Eq unit is a measurement of the amount of chemical activity of an electrolyte.
- Under normal conditions, blood plasma contains 155 m.Eq of cations and same number of anions.
- The total concentration of cations always equals the total concentration of anions.

The expression mEq represents the amount of solute in mg equal to 1/1000 th gram of the equivalent weight of the substance.

\[
1 \text{ mEq} = \frac{\text{Equivalent weight (grams)}}{1000}
\]

Two Tables in your handout provide values for some important cations and anions.
### Ions Valence At. weight mEq. (mg)

<table>
<thead>
<tr>
<th>Ions</th>
<th>Valence</th>
<th>At. weight</th>
<th>mEq. (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na⁺</td>
<td>1</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>K⁺</td>
<td>1</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Ca²⁺</td>
<td>2</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Mg²⁺</td>
<td>2</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>NH₄⁺</td>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Li⁺</td>
<td>1</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

### POTASSIUM CHLORIDE PRESCRIPTION

**Potassium chloride liquid**

Sig: 15 mEq; po; bid; for 3 weeks

**Dis; QS**  **Refill x2**

Potassium chloride is available as 10% w/v solution

Molecular weight of potassium chloride is 74.5 grams

Therefore 74.5 mg (Molecular weight in milligrams is equal to 1 mEq. for monovalent compounds)

### Isotonic Solution

A solution that has same osmotic pressure as body fluids.

### Hypotonic Solution

A solution that has lower osmotic pressure than the body fluid.

### Hypertonic Solution

A solution that has higher osmotic pressure than that of body fluids.

### Patient will need 74.5 mg/mEq. x 15 mEq. X 2/day = 2235 mg of potassium chloride daily

Potassium chloride is available as 10% w/v (i.e., 10 g/100 ml or 10,000 mg/100 mL) or **100 mg/mL**

100 mg of KCl is provided by 1 mL of 10% w/v potassium chloride solution

1117.5 mg (15 mEq.) will be provided by X mL of solution

### 1117.5 mg/100 mg/mL = 11.175 mL of 10% w/v solution will provide 15 mEq. of potassium chloride

11.175 mL x 2/day = 22.35 mL per day x 21 days = **469.35 ml quantity for 3 weeks**

Sig: 11.175 ml by mouth twice a day for three weeks
• It has been determined that 0.9% w/v solution of sodium chloride exhibits the same osmotic pressure as the human body fluids.

• Therefore, while preparing solution to be administered in the body (ophthalmic solution and intravenous solutions), it is imperative that these solutions have the same osmotic pressure as body fluid or as 0.9% sodium chloride solution.

• Therefore, most frequently, sodium chloride is used to make the solution isotonic. Boric acid and dextrose may also be used when it is necessary.