Electrolytes

- Chemical equivalent
- a formal fraction of a molecule, atom or ion that, in a given reaction, is equivalent to one hydrogen atom, one electron or an elementary charge carried by an ion
- Older type of expression

- mEq = amount of substance (n; mmol) x valence
- For example: 1 mmol Ca^{2+} = 2mEq (valence = 2)

Valence and atomic weights

Element	Valence	At. weight	Rounded
H	1	1.008 g	1 g
C	2, 4	12.011 g	12 g
N	3, 5	14.007 g	14 g
O	2	15.999 g	16 g
Na	1	22.9898 g	23 g
S	2, 4, 6	32.064 g	32.1 g
Cl	1, 3, 5, 7	35.453 g	35.5 g
K	1	39.102 g	39.1 g
Ca	2	40.08 g	40.1 g

For pharmaceutical calculations, atomic weights are most often rounded to one tenth

Electrolytes

- Osmolality (osmol/kg)
- Virtually all solutes that contribute to the osmotic pressure of a solution are determined by osmolality; the amount of osmotically active substances dissolved per unit mass of solvent.

$$\xi_m = \upsilon m \Phi$$

- υ - is the total number of ions per molecule of solute
- *m* – solution molality
- Φ - molal osmotic coefficient

Electrolytes

- Osmolality
- Osmometer uses relation between osmolality and decrease of solidification temperature ΔT:
- ξ_m = ΔT /1,86 * 1000 (mosmol/kg)
- Real vs. Ideal (theoretical) osmolality
- **Ideal osmolality**
  - Simplified; in ideal solution:
  - 1 mol/kg NaCl is equal to osmolality 2 osmol/kg. (NaCl full disociation = 2 ions)
  - 1 mol/kg $CaCl_2$ is equal to osmolality 3 osmol/kg (Ca^{2+} and 2 Cl^- = 3 ions)

Electrolytes

- Osmolarity (osmol/L)
- The pharmacopoeia requires designation of infusions by osmolarity value
- Osmolarity cannot be measured
- Osmolarity can be calculated from osmolality
- Some pharmacopoeias do not state how to calculate osmolarity
- USP 34

$$c_{os} = \frac{1000.m_{os}}{(\frac{1000}{\varrho} + \sum M.V_m)}$$

M = weight

V_m = specific volume of the substance

Electrolytes

- Osmolarity
  - Simplified; in ideal solution:
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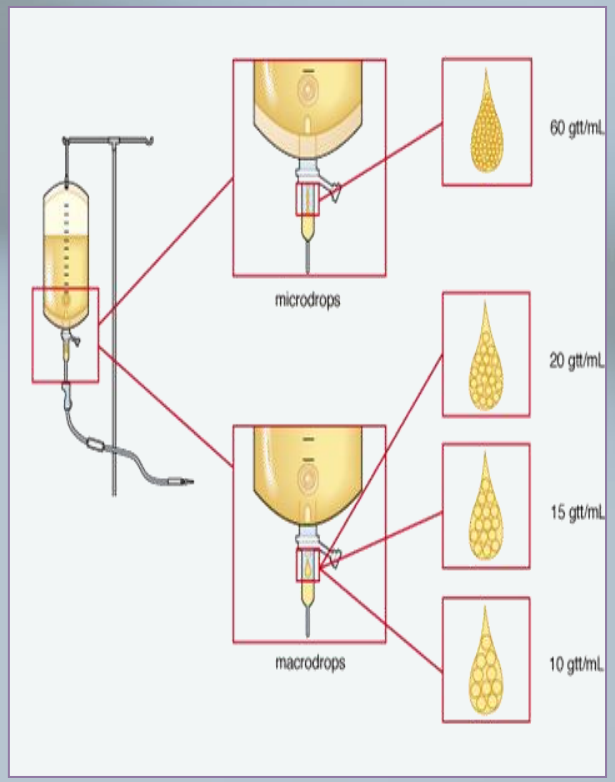
Drip chamber



- 10 (10 gtt/mL)
- 15 (15 gtt/mL)
- 20 (20 gtt/mL)
- 60 (60 gtt/mL)

Exercise 1

The patient on the infusion pump should receive 500 ml of R / L solution intravenously for 12 hours. What will be the flow in ml per hour?

Exercise 2

The patient on the infusion pump should receive 50 ml of intravenous antibiotic solution for 30 minutes. What will be the flow in ml per hour?

Exercise 3

The doctor prescribed 150 ml of D5W solution intravenously for 45 minutes every 4 hours. The drip chamber is 20 drops per ml. What is the flow rate in drops per minute?

Exercise 4

The doctor ordered to add 1,000,000 units of penicillin to 100 ml of saline in IV bag for infusion over 45 minutes every 6 hours. The storage bottle of penicillin contains 2,000,000 units of the drug. The instructions for use say to reconstitute the powder with 9.8 ml of water to obtain 10 ml of total volume. The drip chamber used is designated as 15 drops / ml. How many ml of penicillin solution do you add to the IV bag to meet the required dose? What is the flow in drops per minute? What is the flow in ml / h? (density = 1)

Exercise 5

The patient was prescribed 2 mcg / kg / min of dopamine. The pharmacy has an IV bag designated: Dopamine 400mg / 250 ml D5W. The patient weighs 68 kg. What will be the flow in ml / hour?

Exercise 6

One liter of IV solution is dispensed at a rate of 125 mL / hour. At what time intervals will the bag have to be changed?

Exercise 7

Doctor will prescribe 4000 mL of 5% glucose in saline (D5NS) IV for 36 hours. If the IV set drip rate is 15 gtt / mL, how many drops will be delivered in one minute?

Exercise 8

Calculate the osmolality of 9.463 grams of NaCl in 1 kg of solution. (Mw = 58.44)

Exercise 9

What is the mEq of sodium in one liter of NaCl physiological solution? What will be the osmolarity of this solution?

Exercise 10

What is the mEq value of calcium in one liter of $CaCl_2$ solution with a concentration of 5 g/100 ml? What is the osmolarity of this solution? Mr $CaCl_2$ = 110.98 g / mol

Exercise 11

Calculate the osmolarity of the Ringer's solution.

- 1000 ml of solution for infusion contains:

natrii chloridum	8,60 g
kalii chloridum	0,30 g
calcii chloridum	0,25 g

M_r NaCl = 58,44 g/mol

M_r KCl = 74,55 g/mol

M_r $CaCl_2$ = 110,98 g/mol