

Fluid Compartments Homework - Key  
 BI-374, Spring '06, Dr. C. S. Tritt  
 Due: 4/13 (Thursday)

In the following problems, calculate the “final” ICF and ECF volumes and osmolarity given the following initial conditions:

ICF volume      28.0 l  
 ECF volume      14.0 l  
 Osmolarity      290 mOsm/kg H<sub>2</sub>O

Assume a constant density of 1.00 kg/l for the solution and neglect the mass of the solute so values of molality (moles/kg H<sub>2</sub>O) and molarity (moles/l of solution) are the same. Assume a period long enough for establishment of osmotic equilibrium but short enough that renal and other compensatory responses do not occur.

Initial osmoles:

IC osmoles = (28.0 l)(290 mOsm/l) = 8120 mOsm

EC osmoles = (14.0 l)(290 mOsm/l) = 4060 mOsm

1. Addition of 2.0 l of 145 mOsm/l saline (NaCl).

		Initial	Final
Volumes	IC	28.0	28.6
	EC	14.0	15.4
	TB	42.0	44.0
Osmoles	IC	8120	8120 (n.c.)
	EC	4060	4350
	TB	12180	12470
Osm/l		290	283

Added volume: 2.0 l

Added osmoles: (2.0 l)(145 mOsm/l) = 290 mOsm all of which stays in the ECF.

2. Addition of 1.0 l of 580 mOsm/l of KCl.

		Initial	Final
Volumes	IC	28.0	29.3
	EC	14.0	13.7
	TB	42.0	43.0
Osmoles	IC	8120	8700
	EC	4060	4060 (n.c.)
	TB	12180	12760
Osm/l		290	297

Added volume: 1.0 l

Added osmoles:  $(1.0 \text{ l})(580 \text{ mOsm/l}) = 580 \text{ mOsm}$  all of which enters the cells.

3. Addition of 4.0 grams of NaCl.

		Initial	Final
Volumes	IC	28.0	27.6
	EC	14.0	14.4
	TB	42.0	42.0 (n.c.)
Osmoles	IC	8120	8120 (n.c.)
	EC	4060	4228
	TB	12180	12348
Osm/l		290	294

Added volume: None.

Added osmoles:  $(4.0 \text{ g}) / (47.5 \text{ g/mole}) (2 \text{ osmoles/mole}) (1000 \text{ mOsm/osmole}) = 168 \text{ mOsm}$  all of which remains in the ECF.