

# Koeppen: Berne and Levy Physiology, 6<sup>th</sup> Edition

## Chapter 1: Principles of Cell Function

### Test Bank

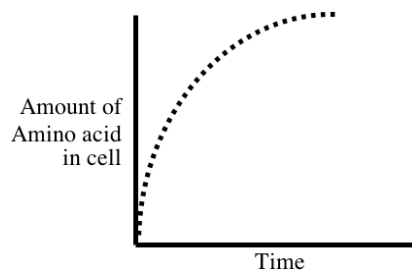
#### Multiple Choice

1. The subcellular structure that degrades proteins is called the:

- A. tight junction
- B. mitochondria
- C. lysosome
- D. plasma membrane
- E. ribosome

ANS: C

2. An experiment is done to measure the uptake of an amino acid into a cell. The following data are obtained.

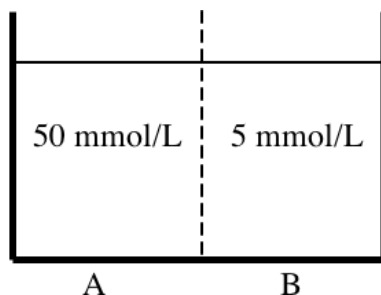


If  $\text{Na}^+$  is removed from the extracellular bathing solution, or a drug is added that prevents the cell from making ATP, the uptake of amino acid into the cell is markedly reduced. Based on this information which of the following mechanisms is likely responsible for the transport of the amino acid into the cell?

- A. passive diffusion through the lipid bilayer
- B. uniporter
- C. transport ATPase
- D.  $\text{Na}^+$  symporter
- E.  $\text{Na}^+$  antiporter

ANS: D

3. A membrane permeable only to  $\text{Na}^+$  separates two compartments containing  $\text{Na}_2\text{SO}_4$  as shown below.



Electrodes are placed in both compartments and a voltage applied (compartment A is held at 0 mV). What voltage applied to compartment B would result in NO net movement of  $\text{Na}^+$  across the membrane separating the compartments?

- A. -60 mV
- B. -30 mV
- C. 0 mV
- D. +30 mV
- E. +60 mV

ANS: E

4. The resting membrane potential of a cell is -85 mV. The intracellular and extracellular concentrations of several ions are indicated below, as is the calculated Nernst equilibrium potentials (E) for these ions.

Ion	[ ] Inside Cell	[ ] Outside Cell	E <sub>i</sub> , mV
$\text{Na}^+$	12 mEq/L	145 mEq/L	66
$\text{K}^+$	150 mEq/L	4 mEq/L	-96
$\text{Cl}^-$	30 mEq/L	105 mEq/L	-33
$\text{Ca}^{2+}$	0.0001 mM	1 mM	122

The membrane has channels for  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$  and  $\text{Ca}^{++}$ . The conductance of the membrane is the greatest for which ion?

- A.  $\text{Na}^+$
- B.  $\text{K}^+$
- C.  $\text{Cl}^-$
- D.  $\text{Ca}^{++}$

ANS: B

5. A cell contains the following membrane transporters:

$\text{Na}^+$  channel

$\text{K}^+$  channel

$\text{Na}^+, \text{K}^+$ -ATPase

The resting membrane voltage of the cell is  $-80$  mV and the intracellular and extracellular ion concentrations are:

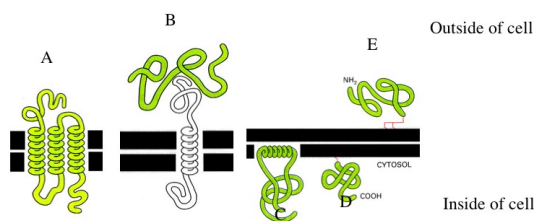
	Intracellular (mEq/L)	Extracellular (mEq/L)
$\text{Na}^+$	10	145
$\text{K}^+$	120	4

The cell is treated with a drug to inhibit the  $\text{Na}^+, \text{K}^+$ -ATPase. What would be the effect of this drug on the following parameters?

	Intracellular $[\text{Na}^+]$	Intracellular $[\text{K}^+]$	Cell volume	Membrane voltage
A.	decrease	decrease	decrease	depolarize
B.	increase	decrease	increase	depolarize
C.	increase	increase	increase	no change
D.	decrease	increase	decrease	hyperpolarize
E.	increase	increase	decrease	hyperpolarize

ANS: B

6. Which of the labeled proteins (shaded) is attached to the membrane by a glycosylphosphatidylinositol (GPI) anchor?



ANS: E

7. A cell has channels for  $\text{Na}^+$ ,  $\text{K}^+$ , and  $\text{Cl}^-$  in its plasma membrane. The resting membrane potential is  $-60$  mV (cell interior negative). The intracellular and extracellular concentrations for these ions are given below, as is the calculated Nernst potential.

	Intracellular [ ]	Extracellular [ ]	$E_i$
$\text{Na}^+$	14 mEq/L	140 mEq/L	60 mV
$\text{K}^+$	150 mEq/L	5 mEq/L	-89 mV
$\text{Cl}^-$	10 mEq/L	100 mEq/L	-60 mV

A drug is applied to the cell that increases the permeability of the cell to  $\text{Cl}^-$  (i.e., it opens  $\text{Cl}^-$  channels). What effect will this drug have on the net movement of  $\text{Cl}^-$  across the plasma membrane?

- A. Net  $\text{Cl}^-$  movement out of the cell will be increased.
- B. Net  $\text{Cl}^-$  movement into the cell will be increased.
- C. There will be no change in the net movement of  $\text{Cl}^-$ .

ANS: C

8. Reducing the extracellular  $[\text{K}^+]$  would be expected to have which of the following effects on the resting membrane potential, and excitability of ventricular myocytes?

	Membrane potential	Excitability
A.	unchanged	unchanged
B.	hyperpolarized	decreased
C.	hyperpolarized	increased
D.	depolarized	decreased
E.	depolarized	increased

ANS: B

9. A cell is bathed in a solution that contains 5 mmol/L of glucose. The intracellular concentration of glucose is 10 mmol/L. What is the most likely mechanism for the transport of glucose across the plasma membrane of this cell?

- A. glucose uniporter
- B.  $\text{Na}^+$ -glucose symporter
- C.  $\text{Na}^+$ -glucose antiporter
- D. diffusion of glucose through the lipid bilayer of the membrane

ANS: A

10. A blood sample is taken from an individual whose blood osmolality is 295 mOsm/kg  $\text{H}_2\text{O}$ . Red blood cells from this sample are then placed in the following solutions.

	Osmolality (mOsm/kg $\text{H}_2\text{O}$ )	$\sigma$ of solute
1. NaCl	300	1
2. fructose	300	0.5
3. urea	300	0
4. $\text{CaCl}_2$	100	1
5. KCl	150	1

The red blood cells in which of these solutions will swell to the greatest degree?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

ANS: C

11. A solution that causes a cell to shrink is:

- A. isotonic
- B. hypotonic
- C. hypertonic

ANS: C

12. Osmosis is the:

- A. active transport of water
- B. number of solute particles in 1 kg of water
- C. diffusion of water across cell membranes
- D. defined as the weight of a volume of a solution divided by the weight of an equivalent volume of distilled water
- E. amount of a substance relative to its molecular weight

ANS: C