NAME [redacted] (Please Print CLEARLY)

1,5 Corrected

Voluntary quiz 1. Friday April 26 2002
Instructions: Circle the one best answer. You can use your calculator.

Remember that: mM = millimoles per liter = millimolar

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1 A normal red blood cell is placed in each of the following solutions. In which solution will the cell **shrink**?

a. pure water ×
b. 200 millimolar NaCl
c. 100 millimolar NaCl
d. 290 millimolar urea

Normal level = 142mM NaCl outside

142 mM NaCl

2. A hydrophobic solute in the extracellular fluid is most likely to enter a cell by which of these mechanisms?

a. by dissolving in the phospholipid bilayer and diffusing across the membrane
b. by passing through a voltage-dependent sodium channel
c. by passing through a water channel formed by aquaporin proteins
d. via the Cl^-/HCO_3^- exchanger on the cell membrane

3. Calculate the **resting membrane potential** of a cell that is only permeable to K^+ and Na^+ and has the following conductances and equilibrium potentials:

g_K = 300 microSiemens = 300×10^{-6} S
g_{Na} = 100 microSiemens = 100×10^{-6}
E_K = - 90 mV = -90×10^{-3}
E_{Na} = + 60 mV = 60×10^{-3}

$E = ET + ET$
$= (100 \times 10^{-6})(60 \times 10^{-3}) + (300 \times 10^{-6})(-90 \times 10^{-3})$
$= 6 \times 10^{-6} + (-2.7 \times 10^{-5})$

a. The resting membrane potential is +22.5 mV
b. The resting membrane potential is about -80 mV
c. The resting membrane potential is about -75 mV
d. The resting membrane potential is -52.5 mV

$E_m = E_{Na} T_{Na} + E_K T_K$
$= (60)\left(\frac{100}{400}\right) + (-90)\left(\frac{300}{400}\right)$
$= 15 +$

4. Which describes the status of the sodium and potassium channels in the **upstroke** phase of a nerve action potential? $i_{Na} > i_K$

a. Most of the sodium channels are open but most of the potassium channels are closed.
b. Most of the potassium channels are open but most of the sodium channels are closed.
c. Nearly all of the sodium channels are open and nearly all of the potassium channels are open
d. Most of the sodium channels are open but most of the potassium channels are inactivated.

5. All other things being equal, how will the action potential conduction velocity of a myelinated nerve that is 10 microns in diameter compare to the action potential conduction velocity of a myelinated nerve that is 5 microns in diameter?

a. There is no relationship between nerve action potential conduction velocity and nerve diameter.
b. The conduction velocity of the thicker nerve and the thinner nerve will be the same.
c. The conduction velocity of the thicker nerve will be faster.
d. The conduction velocity of the thicker nerve will be slower.

6. Which **best** describes the role of the sodium pump (the Na^+/K^+ pump) in the action potential of a myelinated nerve?

a. The Na^+/K^+ pump is responsible for the upstroke of the action potential.
b. The Na^+/K^+ pump is responsible for bringing the nerve to threshold for the action potential.
c. The Na^+/K^+ pump has no direct role in the action potential but makes action potentials possible because it creates and maintains the concentration gradients of Na^+ and K^+ across the cell membrane.
d. The Na^+/K^+ pump is responsible for the downstroke phase of the action potential.