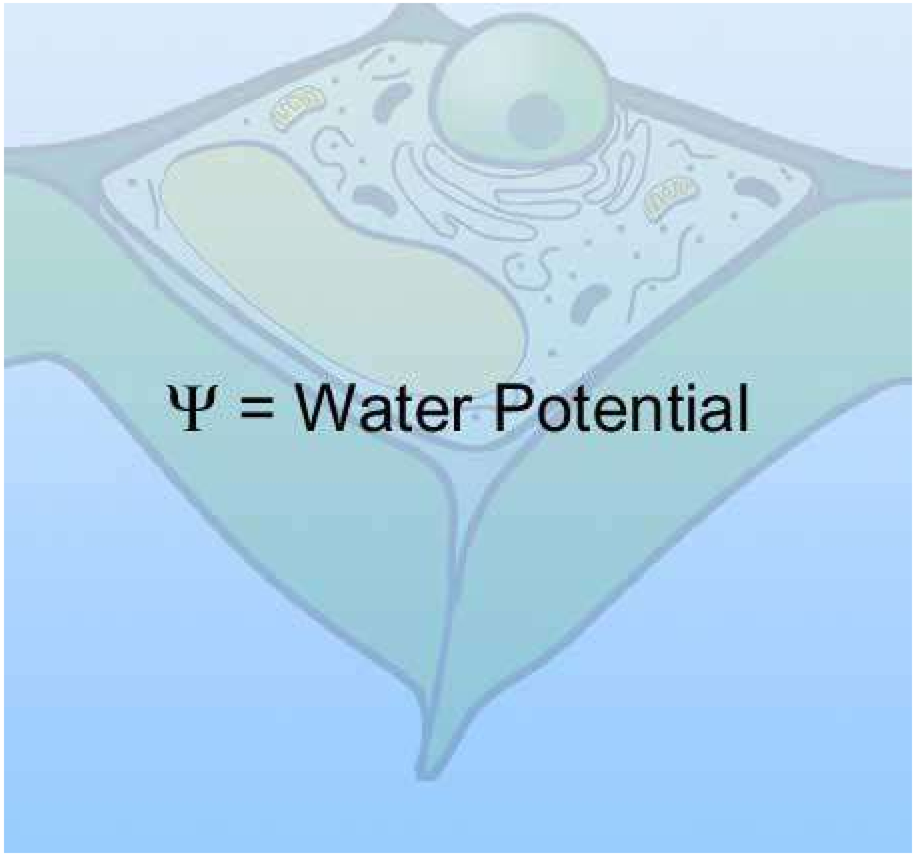
http://www.neosci.com/demos/10-1041_cell%20processes/Presentation%20Images/tutorials/3.01.jpg



WATER POTENTIAL

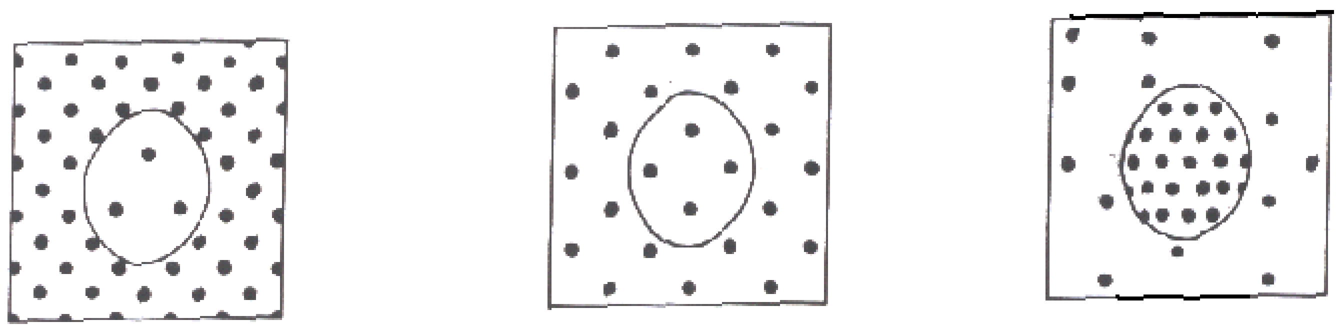
Kelly Riedell
Brookings Biology

SEARCH YOUR "BIO BRAIN"

You learned about HYPERTONIC, HYPOTONIC, ISOTONIC solutions and how water will move as a result of differences in solute concentration

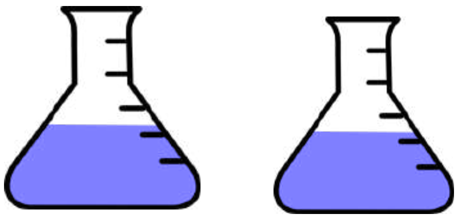
Dots in the diagrams below represent solute.

This cell is sitting in a _______________ solution.



SOLUTE SUCKS!
Which direction will the water move?

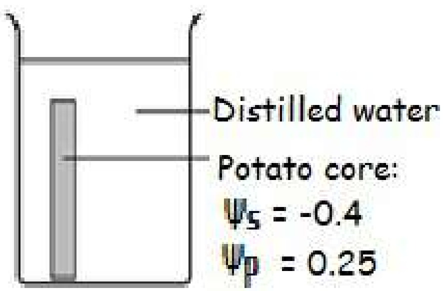
Types of water potential problems you may see



A
0.2 M

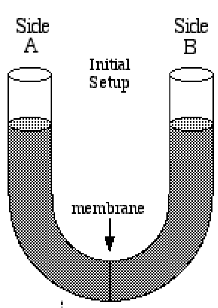
B
0.4 M

Comparing solutions in containers



Comparing a cell with the solution outside

0.5 M glucose
0 3 M starch



0.2 M glucose
0.2 M starch

Comparing solutions across a semi-permeable membrane in a U tube

Water potential is a way add some math to explain where and why water will move.

<u>Equations on AP Formula sheet:</u>

Ψ = pressure potential (Ψ_p) + solute potential (Ψ_s)

Ψ_s = - iCRT

i = # of particles molecule makes in water

glucose = 1 (no ionization)

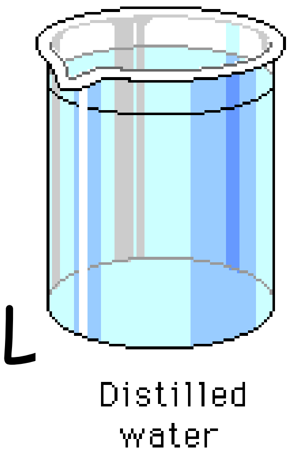
NaCl = 2 (makes 2 ions Na^+ and Cl^-)

C = molar concentration

R = pressure constant 0.0831 liter bar/mole °K

T = temperature in °K = 273 + ° C

Solute potential (Ψ_s)



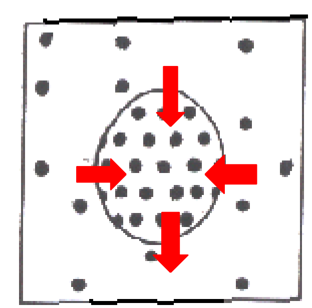
DISTILLED WATER has a $\Psi s = 0$

- Adding solute lowers SOLUTE POTENTIAL (ALSO CALLED OSMOTIC POTENTIAL)

- Makes it more ______________

Since $\Psi = (\Psi_p) + (\Psi_s)$
Overall WATER POTENTIAL decreases too

Water = more likely to flow toward areas with low water potential



Solute potential (Ψ_s) = -iCRT

Calculate the (Ψ_s) following for a solution of 0.2 M glucose at 20 °C

Ψ_s = - i C R T

Ψs =

=

https://www.labsource.com/media/catalog/product/cache/1/small_image/250x/17f82f742ffe127f42dca9de82fb58b1/Kimble-Chase/kimble-chase-14000-10.jpg

Solute potential (Ψ_s) = -iCRT

Calculate the (Ψ_s) following for a solution of 0.5 M NaCl at 22 °C

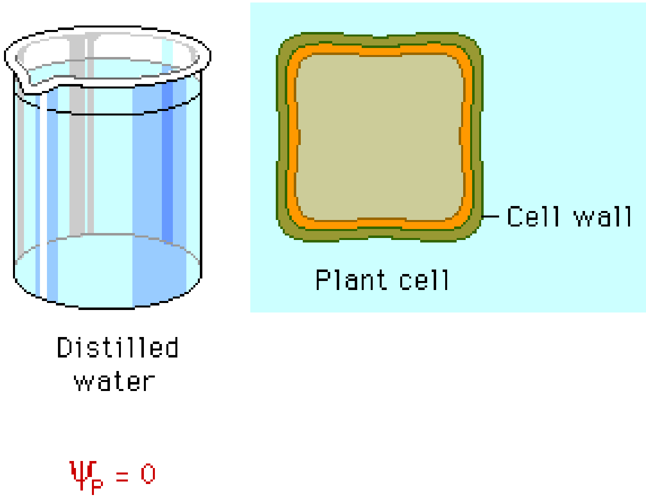
Ψ_s = - i C R T

Ψs =

=

Images from: http://www.phschool.com/science/biology_place/labbench/lab1/watpot.html

PRESSURE POTENTIAL Ψp

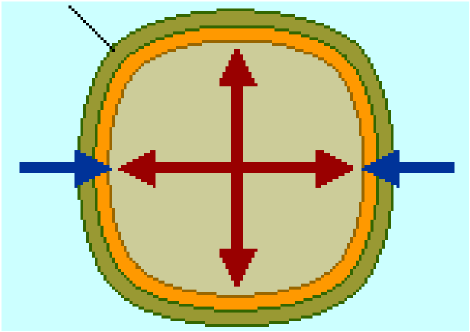


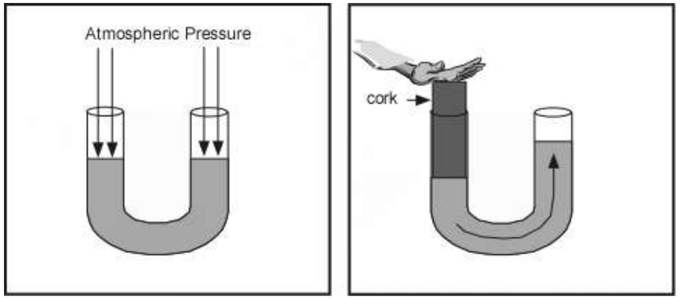
In open system (like beaker or cell in isotonic conditions) pressure potential Ψ_p = O

In closed system

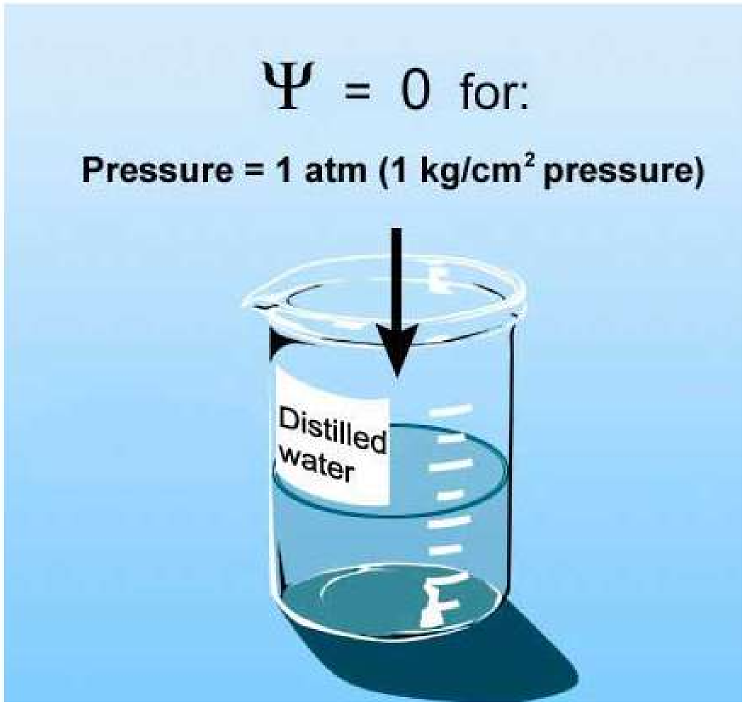
(like plant cell with rigid cell wall or a container with a plunger)

Ψ_p can be a positive or negative number, or zero.





SI UNITS

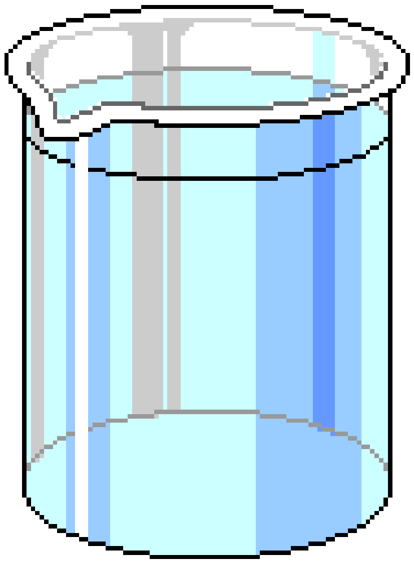


1 Bar = 1 Atm

1 Bar = 0.1 Megapascals (Mpa)

http://www.neosci.com/demos/10-1041_cell%20processes/Presentation_4.html

Ψ = pressure potential (Ψ_p) + solute potential (Ψ_s)



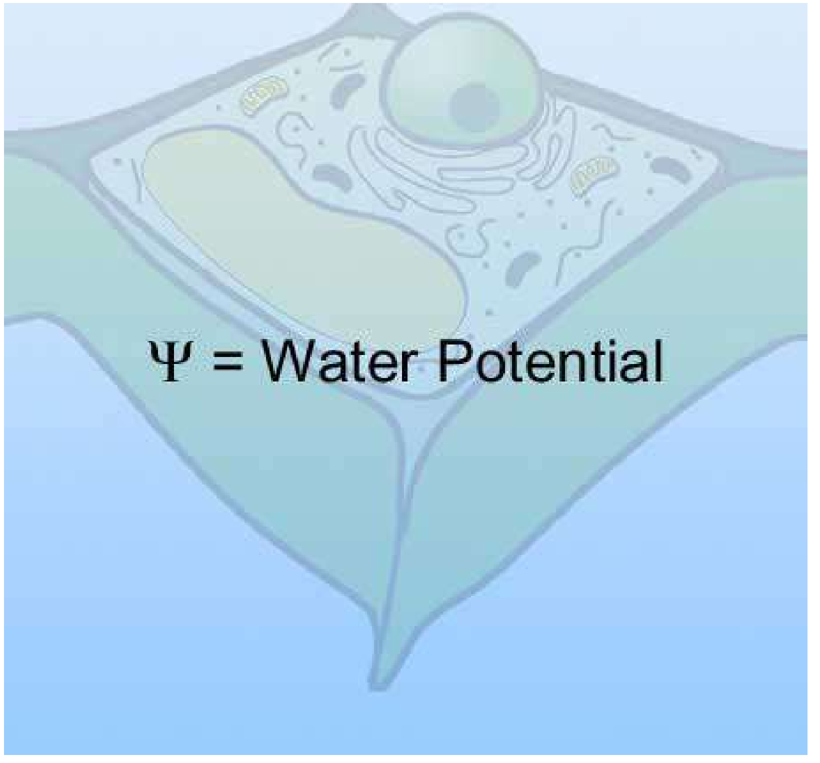
Calculate the following for an OPEN CONTAINER filled with PURE WATER

(Ψ_p) = ________

(Ψ_s) = ________

(Ψ_s) + (Ψ_p) = Ψ

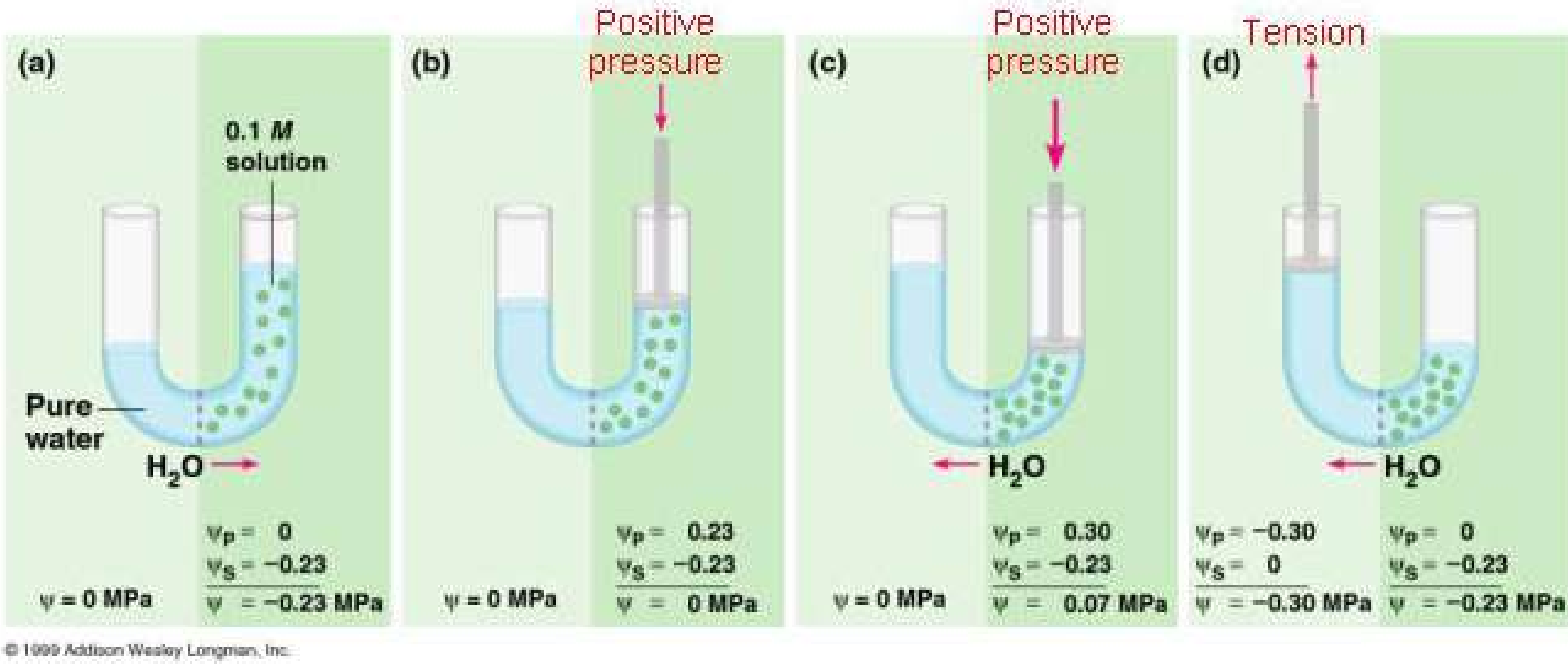
Ψ = ____________



Water moves from a region of HIGHER WATER POTENTIAL to a region of LOWER WATER POTENTIAL

http://www.neosci.com/demos/10-1041_cell%20processes/Presentation%20Images/tutorials/3.01.jpg

Water Flows from Regions of High Water Potential to Regions of Low Water Potential



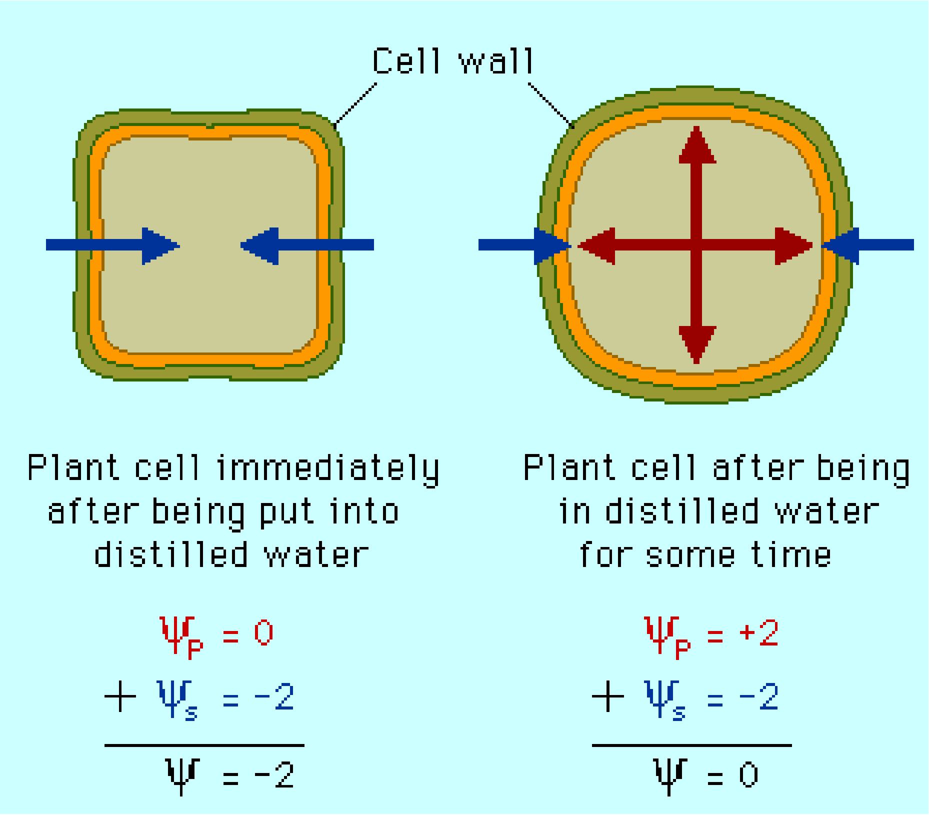
Changes in water potential (Ψ_w) can be brought about by changes in pressure potential (Ψ_p) or changes in solute potential (Ψ_s).

http://www.cetbiology.com/biology-photographs/waterpotential.jpg

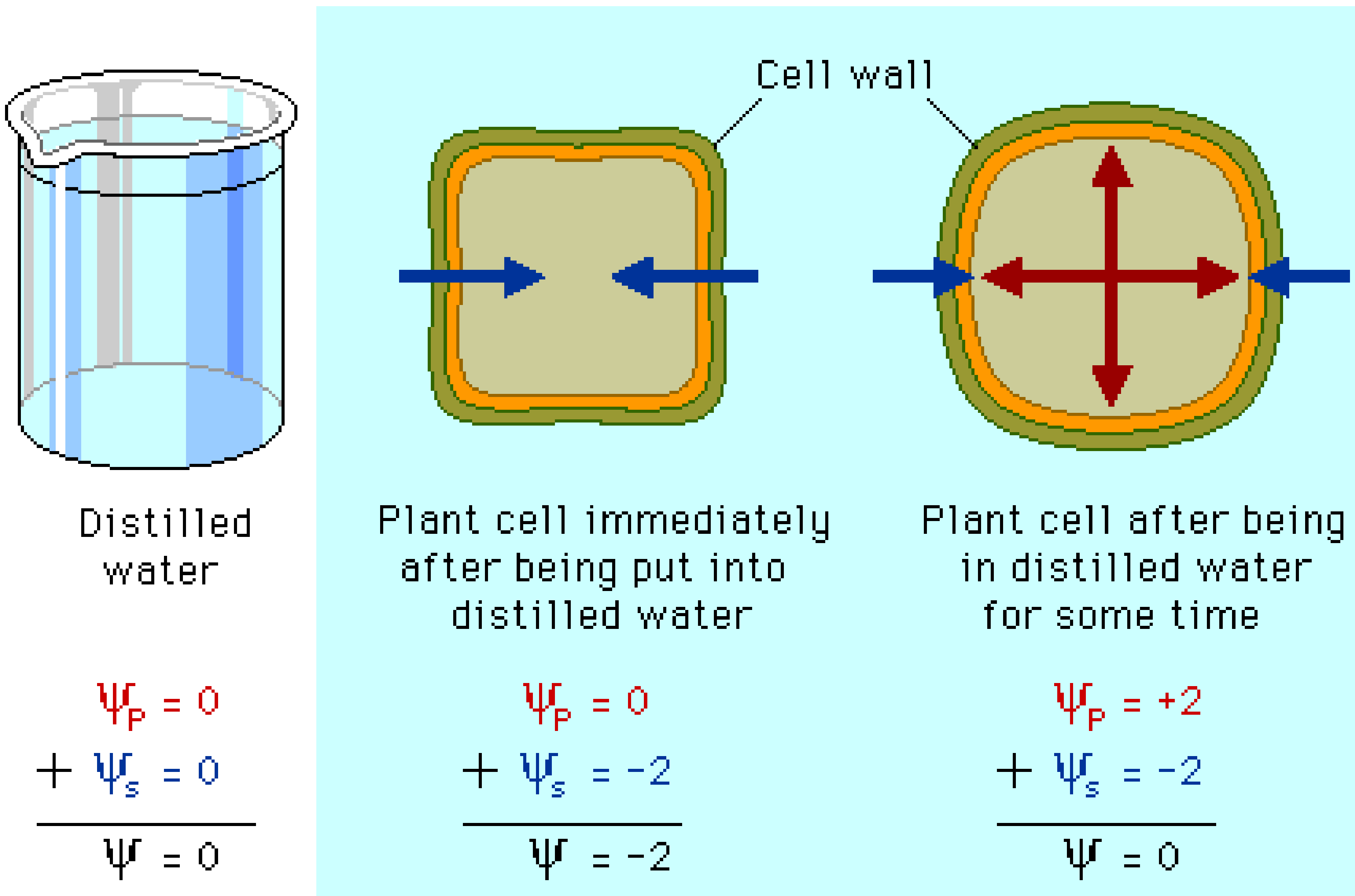
Ψ = pressure potential (Ψ_p) + solute potential (Ψ_s)

PLANT CELL
Water moving into a plant cell puts pressure on the cell wall.

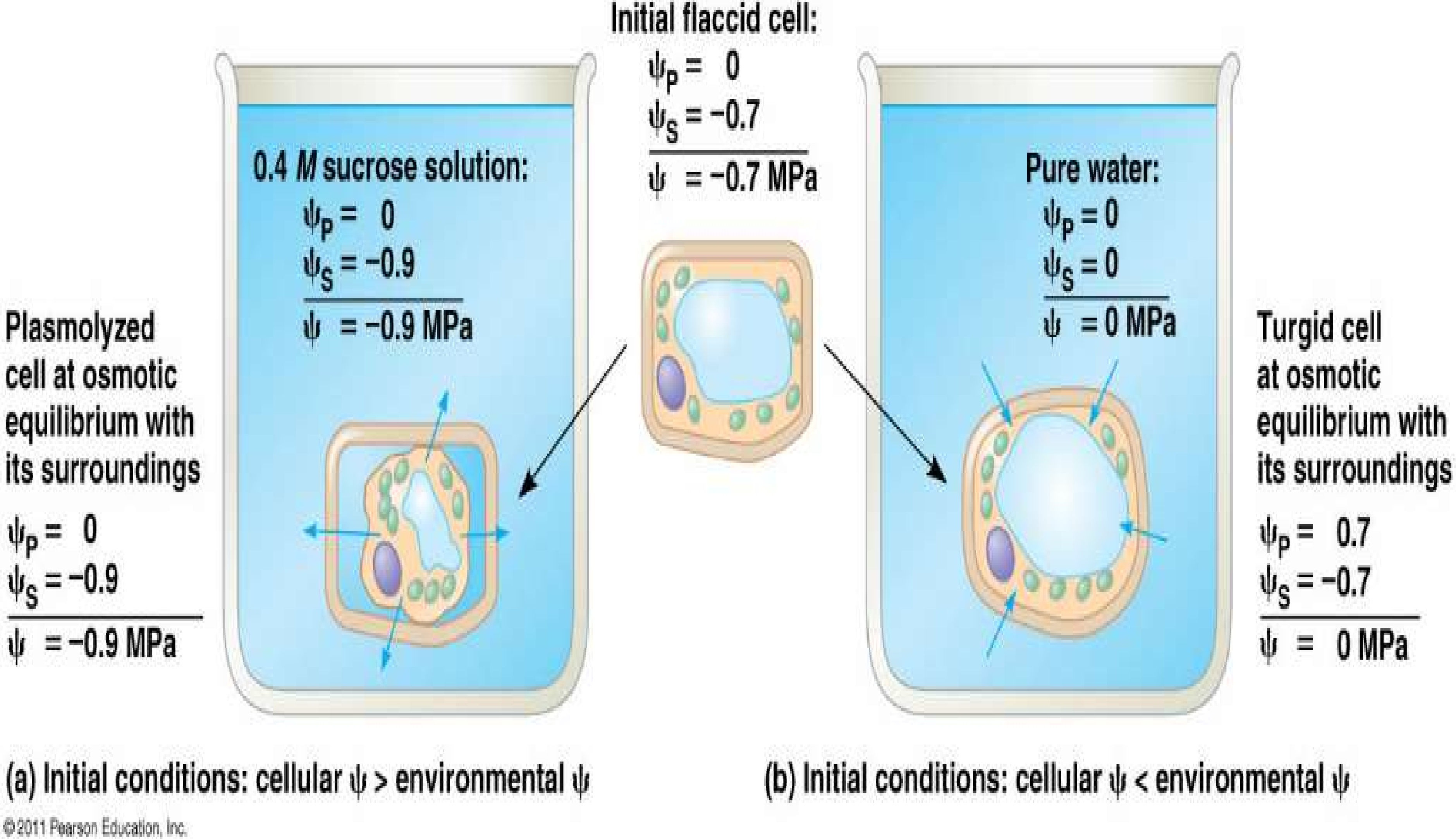
INCREASING THE PRESSURE POTENTIAL ALSO INCREASES THE WATER POTENTIAL



http://www.phschool.com/science/biology_place/labbench/lab1/watpot.html



Water enters cell until the Ψ inside cell = Ψ outside cell



Water enters cell until the Ψ inside cell = Ψ outside cell

Solute potential (Ψ_s) = –iCRT

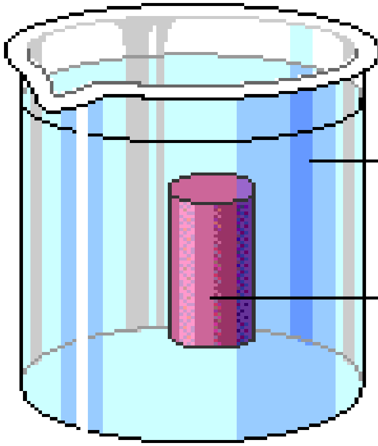
i =	The number of particles the molecule will make in water; for NaCl this would be 2; for sucrose or glucose, this number is 1
C =	Molar concentration (from your experimental data)
R =	Pressure constant = 0.0831 liter bar/mole K
T =	Temperature in degrees Kelvin = 273 + °C of solution

The molar concentration of a sugar solution in an open beaker has been determined to be 0.3M. Calculate the solute potential at 22 degrees. Round your answer to the nearest hundredth.

Now that you know the Ψ_s you can calculate the water potential Ψ of this beaker of liquid.

Ψ = pressure potential (Ψ_p) + solute potential (Ψ_s)

http://www.phschool.com/science/biology_place/labbench/lab1/quiz.html

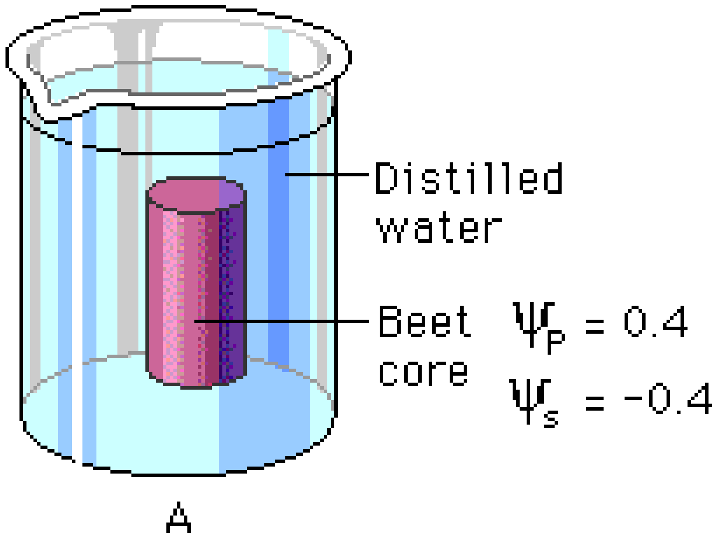


What is the water potential of the distilled water?

What is the water potential of the beet core?

Which way will water move?

5. Which of the following statements is true for the diagrams?



a. The beet core in beaker A is at equilibrium with the surrounding water.

b. The beet core in beaker B will lose water to the surrounding environment.

c. The beet core in beaker B would be more turgid than the beet core in beaker A.

d. The beet core in beaker A is likely to gain so much water that its cells will rupture.

e. The cells in beet core B are likely to undergo plasmolysis.

http://www.phschool.com/science/biology_place/labbench/lab1/quiz.html