Name:_____ Due Date:_____

Regents Review #4: Cellular Transport and Diffusion Through a Membrane State Lab

The Big Ideas:

- Each cell is covered by a membrane that performs a number of important functions for the cell. These include: separation from its outside environment, controlling which molecules enter and leave the cell, and recognition of chemical signals. The processes of diffusion and active transport are important in the movement of materials in and out of cells.
- Many organic and inorganic substances dissolved in cells allow necessary chemical reactions to take place in order to maintain life. Large organic food molecules such as proteins and starches must initially be broken down (digested to amino acids and simple sugars respectively), in order to enter cells. Once nutrients enter a cell, the cell will use them as building blocks in the synthesis of compounds necessary for life.

State Lab Review:

Important Terms

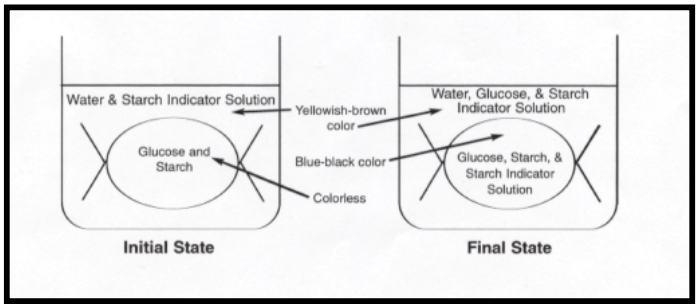
Diffusion	Selectively permeable
Indicators	Dialysis tubing
Starch	Glucose
Starch indicator	Glucose indicator
Controls	Cytoplasm
Cell membrane	Cell wall
Osmosis	Wet mount
Cover slip	

Key Points Part I

1. Molecules tend to move from high to low concentration without the use of energy (*diffusion*).
2. Membranes may allow some molecules to pass through while not allowing others (*selectively permeable*).
3. *Indicators* are chemicals that change color in the presence of certain kinds of molecules.

Procedure Part I

1. A model cell is made using a plastic membrane (*dialysis tubing*) containing *starch* and *glucose*. The bag is sealed with string.
2. *Starch indicator* (iodine) is placed in solution outside the 'cell'.
3. Because of the differences in concentration, starch indicator diffuses in and glucose diffuses out.
4. Starch 'wants' to diffuse out, but cannot because the molecule is too large to pass through the membrane.



5. Starch (milky white) + starch indicator (brown) = blue-black color
6. The inside of the bag turns blue-black while the outside stays brown, proving that indicator went in, but starch did not leave.
7. *Glucose indicator* (blue) + glucose (clear) + HEAT = green, brown, red, or orange
8. Testing the fluid outside the 'cell' shows glucose has diffused out of the cell. This is tested by placing fluid from outside into a test tube, adding indicator solution, and heating the mixture.
9. You may prove that #6 is true by testing (heating) indicator alone and also testing indicator + starch. Both of these *controls* result in a blue color (no change).

Analysis Part I

1. Glucose and starch indicator may pass through the membrane. Starch may not. This is because starch is a much larger molecule than glucose or starch indicator.
2. This shows the importance of breaking down large molecules inside the digestive system in order for nutrients to enter the bloodstream.

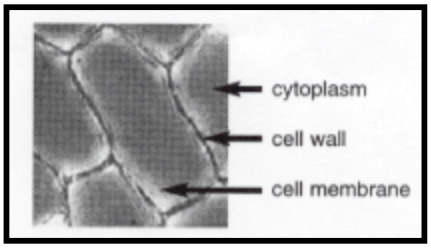
Key Points Part II

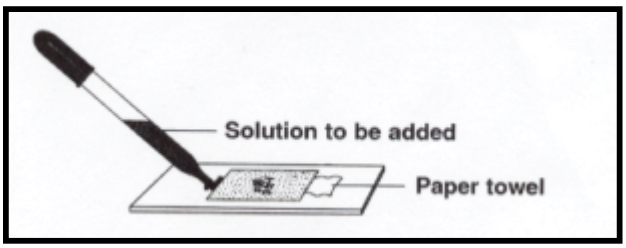
1. Basic parts of the cell that are easily seen under the microscope are the *cytoplasm*, *cell membrane*, and *cell wall* (in plants).
2. Molecules tend to move from high to low concentration without the use of energy (*diffusion*).
3. Diffusion of water molecules is particularly important and has the special name of *osmosis*.
4. The balance of water molecules inside and outside the cell is extremely important for the survival of all organisms, including humans.

Procedure Part II

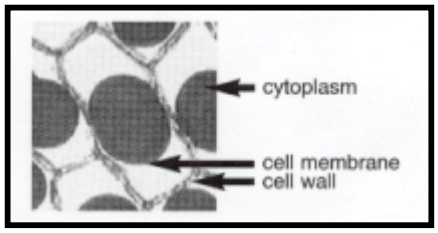
1. Make a *wet mount* slide of a thin section of red onion cells. The cells are taken from the outer 'skin' of the onion bulb and a small piece is placed in a drop of water on a microscope slide. A *cover slip* is placed on top by touching it to the water at an angle, and then carefully placing it on the specimen, trying not to get air bubbles underneath.

2. The cells are examined under the light (compound) microscope. You should be able to identify the cytoplasm, cell membrane, and cell wall.
3. It is important to see that the cell membrane and cytoplasm completely fill the space within the cell wall.

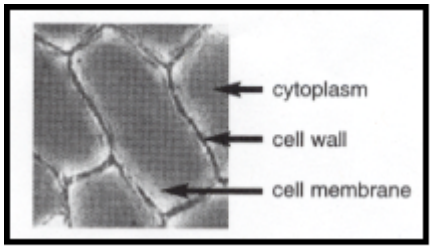




4. Place a 10% salt solution under the cover slip. This is done by putting a drop of salt solution next to one edge of the cover slip, then absorbing water from the opposite side of the slip using a paper towel.
5. Observe the cells in the salt solution. It is important to see that the cytoplasm and cell membrane have shriveled up inside the cell wall. This is due to water molecules leaving the cell and entering the salty (low water) solution.



6. Place distilled water under the cover slip using the technique described in #4 above.
7. Observe the cells in distilled water. It is important to see that the cytoplasm and cell membrane have swollen back to fill the entire space available within the cell wall.



Analysis Part II

1. Cells placed in very salty solutions will lose water, causing them to collapse and possibly lose the ability to complete life functions.
2. Cells placed in very watery solutions will tend to gain water, which causes them to swell and might cause them to burst/break open, destroying the cell. Note that this did not happen in the plant cells because the cell wall prevents the cell membrane from easily expanding.
3. Freshwater creatures, particularly single-celled organisms, must cope with too much water entering the cells. Saltwater organisms tend to have the opposite problem and must try to reclaim lost water.

Name_____date_____pd_____

RLE Regents review #4 Cellular Transport and NYS Diffusion Lab

1. Which set of functions is directly controlled by the cell membrane?

   A) protein synthesis, respiration, digestion of food molecules
   B) active transport, recognition of chemical messages, protection
   C) enzyme production, elimination of large molecules, duplication of DNA codes
   D) release of ATP molecules, regulation of cell reproduction, food production

2. The ameba represented in the diagram below is a single-celled organism.

   Which two processes are most closely associated with structure *A*?

   A) insertion and deletion
   B) nervous regulation and circulation
   C) active transport and diffusion
   D) replication and photosynthesis

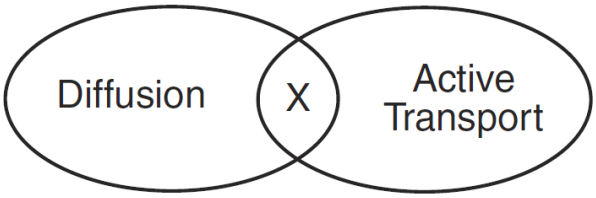
3. Which statement regarding the functioning of the cell membrane of all organisms is *not* correct?

   A) The cell membrane forms a boundary that separates the cellular contents from the outside environment.
   B) The cell membrane is capable of receiving and recognizing chemical signals.
   C) The cell membrane forms a barrier that keeps all substances that might harm the cell from entering the cell.
   D) The cell membrane controls the movement of molecules into and out of the cell.

4. If the concentration of sodium is greater outside a cell than inside the cell, which process could move sodium out of the cell?

   A) diffusion
   B) carbohydrate synthesis
   C) active transport
   D) digestion

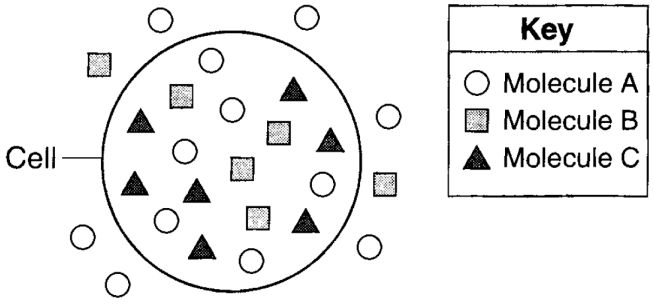
5. The diagram below represents two processes that occur in organisms. A characteristic represented by *X* is common to both of these processes.



   A characteristic that the two processes have in common is that each process

   A) uses ATP
   B) requires enzymes
   C) uses oxygen
   D) moves molecules

6. The diagram below represents a cell and several molecules. The number of molecules shown represents the relative concentration of the molecules inside and outside of the cell.



   Molecule *B* could enter the cell as a direct result of

   A) digestion
   B) diffusion
   C) active transport
   D) enzyme production

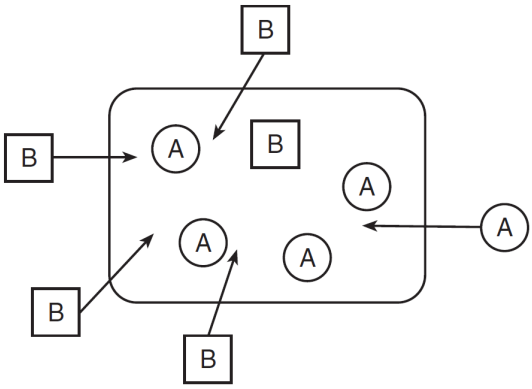
7. Which substance can enter a cell by diffusion without having to be digested?

   A) water
   B) protein
   C) starch
   D) fat

8. A substance is most likely to diffuse into a cell when

A) it is a large organic food molecule such as protein or starch
B) it is enclosed in an organelle such as a vacuole
C) the concentration of the substance is greater outside the cell than inside
D) the pH of the substance is greater than the pH of the cell

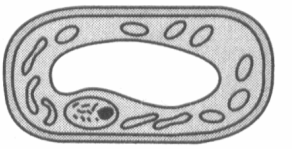
9. The diagram below shows two different kinds of substances, *A* and *B*, entering a cell.



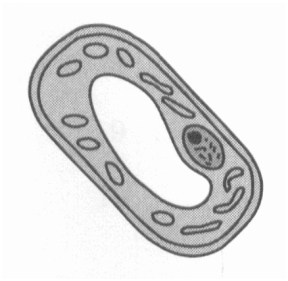
ATP is most likely being used for

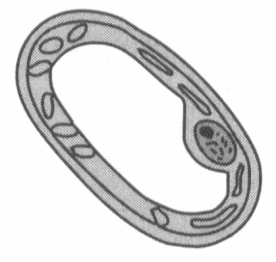
A) substance *A* to enter the cell
B) substance *B* to enter the cell
C) both substances to enter the cell
D) neither substance to enter the cell

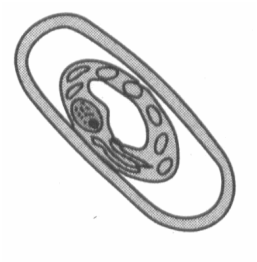
10. The diagram below represents a plant cell in tap water as seen with a compound light microscope.

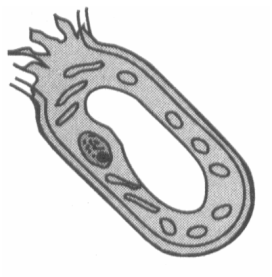


Which diagram best represents the appearance of the cell after it has been placed in a 15% salt solution for two minutes?

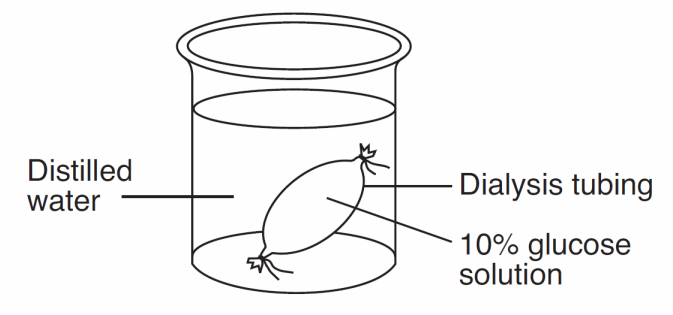
A) 

B) 

C) 

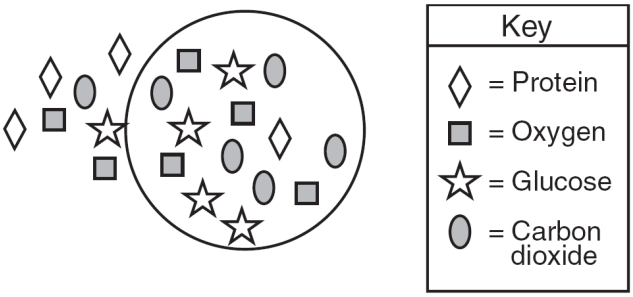
D) 

11. A laboratory setup using an artificial cell made from dialysis tubing is shown in the diagram below.



Identify the process that would most likely be responsible for the movement of glucose from inside the artificial cell to the solution outside of the cell.

12. The diagram below shows the relative concentration of molecules inside and outside of a cell.



Which statement *best* describes the general direction of diffusion across the membrane of this cell?

A) Glucose would diffuse into the cell.
B) Protein would diffuse out of the cell.
C) Carbon dioxide would diffuse out of the cell.
D) Oxygen would diffuse into the cell.

13. Molecule X moves across a cell membrane by diffusion. Which row in the chart below best indicates the relationship between the relative concentrations of molecule X and the use of ATP for diffusion?

Row	Movement of Molecule X	Use of ATP
(1)	high concentration → low concentration	used
(2)	high concentration → low concentration	not used
(3)	low concentration → high concentration	used
(4)	low concentration → high concentration	not used

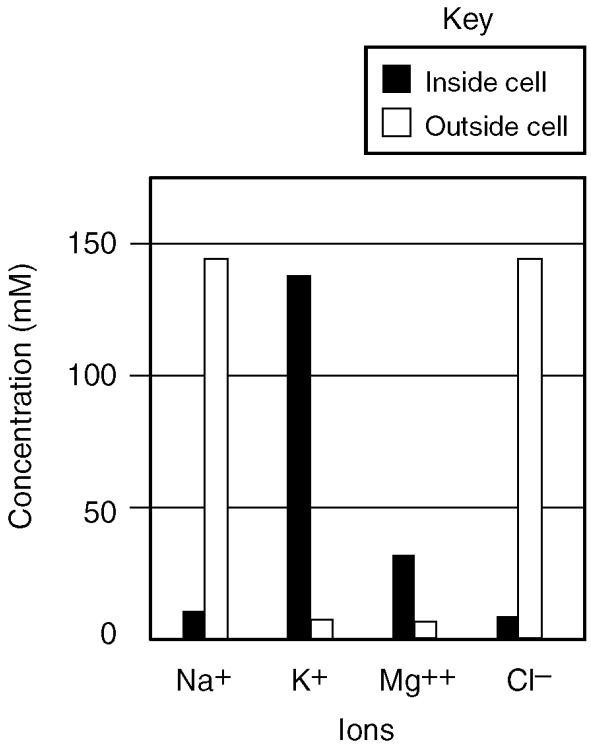
A) 1 B) 2 C) 3 D) 4

14. Which row in the chart below best describes the active transport of molecule *X* through a cell membrane?

Row	Movement of Molecule X	ATP
(1)	high concentration → low concentration	used
(2)	high concentration → low concentration	not used
(3)	low concentration → high concentration	used
(4)	low concentration → high concentration	not used

A) 1 B) 2 C) 3 D) 4

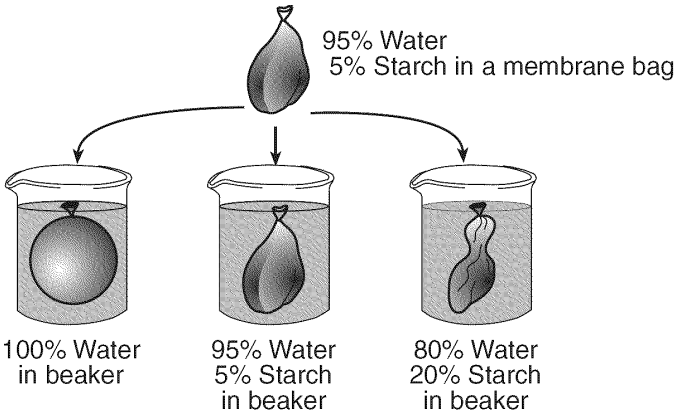
15. The graph below shows the relative concentrations of different ions inside and outside of an animal cell.



Which process is directly responsible for the net movement of K^+ and Mg^{++} into the animal cell?

A) electrophoresis
B) diffusion
C) active transport
D) circulation

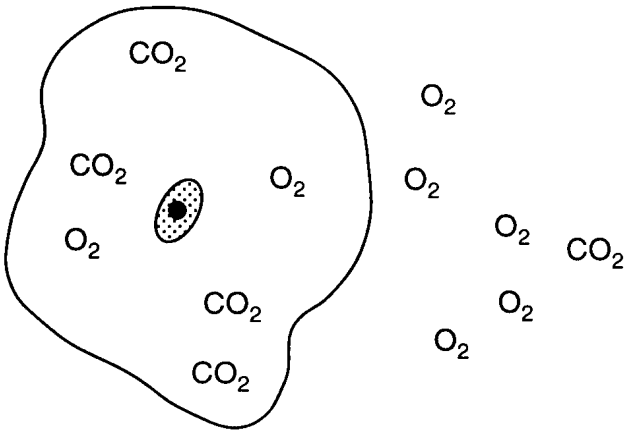
16. An investigation was set up to study the movement of water through a membrane. The results are shown in the diagram below.



Based on these results, which statement correctly predicts what will happen to red blood cells when they are placed in a beaker containing a water solution in which the salt concentration is much higher than the salt concentration in the red blood cells?

A) The red blood cells will absorb water and increase in size.
B) The red blood cells will lose water and decrease in size.
C) The red blood cells will first absorb water, then lose water and maintain their normal size.
D) The red blood cells will first lose water, then absorb water, and finally double in size.

17. The diagram below represents a cell in water. Formulas of molecules that can move freely across the cell membrane are shown. Some molecules are located inside the cell and others are in the water outside the cell.



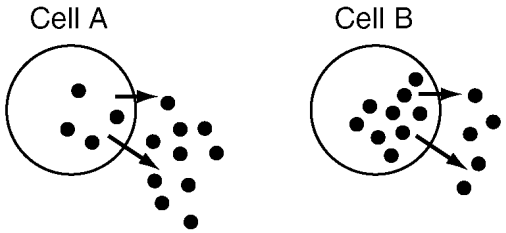
Based on the distribution of these molecules, what would most likely happen after a period of time?

A) The concentration of O_2 will increase inside the cell.
B) The concentration of CO_2 will remain the same inside the cell.
C) The concentration of O_2 will remain the same outside the cell.
D) The concentration of CO_2 will decrease outside the cell.

18. Which process would include a net movement of sugar molecules through a membrane from a region of lower concentration to a region of higher concentration?

A) osmosis
B) cyclosis
C) active transport
D) passive transport

19. In the diagram below, the dark dots indicate small molecules. These molecules are moving out of the cells, as indicated by the arrows. The number of dots inside and outside of the two cells represents the relative concentrations of the molecules inside and outside of the cells.

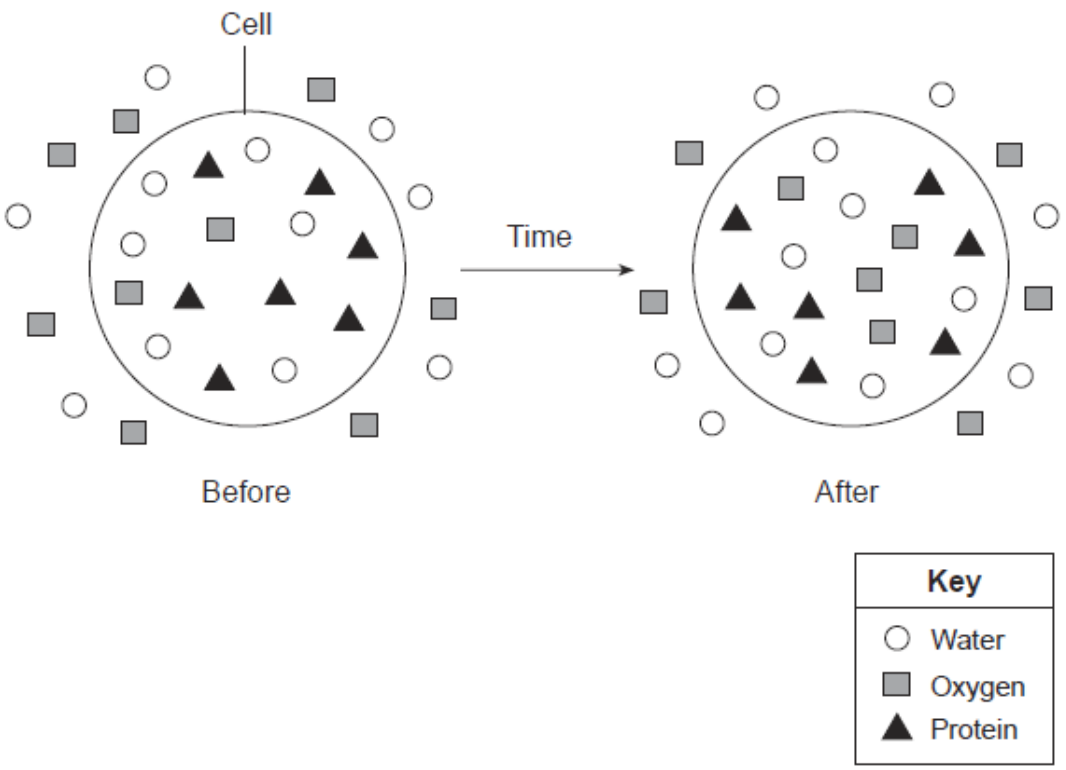


ATP is being used to move the molecules out of the cell by

A) cell *A*, only
B) cell *B*, only
C) both cell *A* and cell *B*
D) neither cell *A* nor cell *B*

20. State *one* reason that most foods must be digested before they can enter a cell.

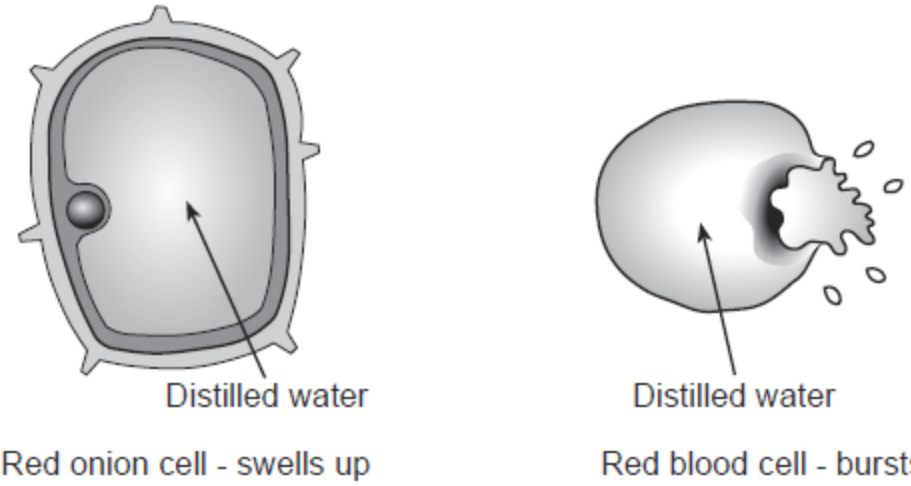
21. The diagram below represents the distribution of some molecules inside and outside of an artificial cell over a period of time.



Which statement is best supported by the diagram?

A) Oxygen molecules entered the cell over time by active transport.
B) Water molecules are too large to enter or leave the cell, so they remained where they were at the start of the investigation.
C) Protein molecules are kept inside of the cell because the cell needs them.
D) The protein molecules are too large to diffuse out of the cell.

22. The diagram below represents what occurred when an onion cell and a red blood cell were placed in distilled water.

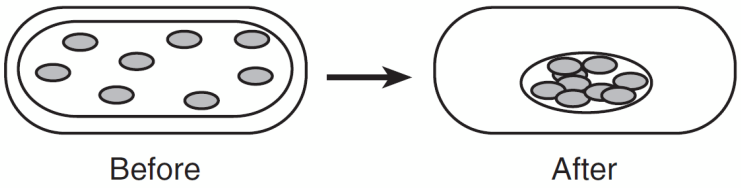


The best explanation for why the onion cells do not burst, while red blood cells often do, is that

A) the red blood cells have only a cell membrane, which does not protect them from bursting
B) the onion cells do not have a cell wall that could protect them from bursting
C) the onion cells have a cell membrane, which can protect them from bursting
D) the red blood cells have a cell wall, which does not protect them from bursting

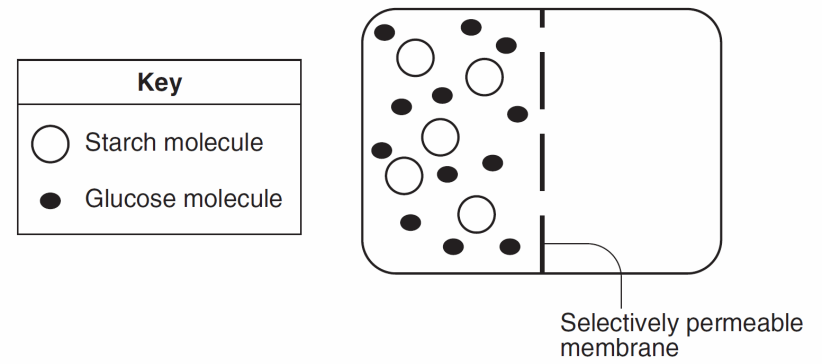
23. Some roads are salted heavily in winter. Describe *one* way plants growing near these roads could be harmed by the salt.

24. The diagram below represents a green plant cell viewed with the high power of a compound light microscope before and after a particular substance was added.

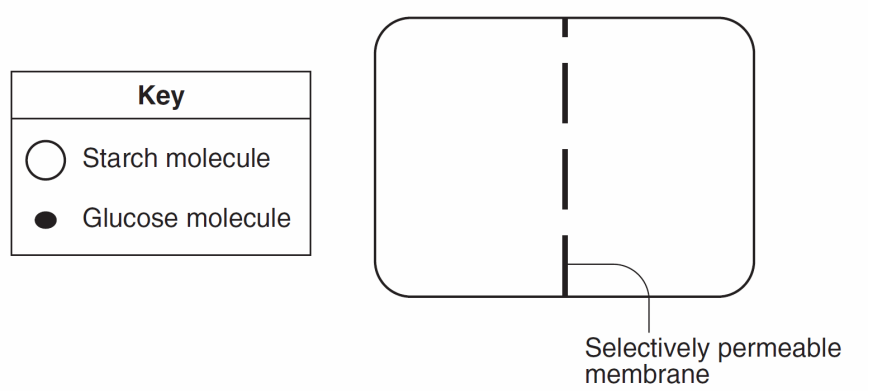


Identify a substance that could have been added to the slide to bring about the change shown.

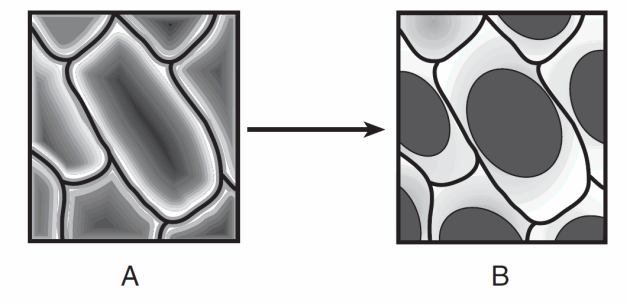
25. The diagram below represents a laboratory setup used to demonstrate the movement of molecules across a selectively permeable membrane.



In the diagram below, draw the 5 starch and the 12 glucose molecules to show where they would most likely be located after 15 minutes.



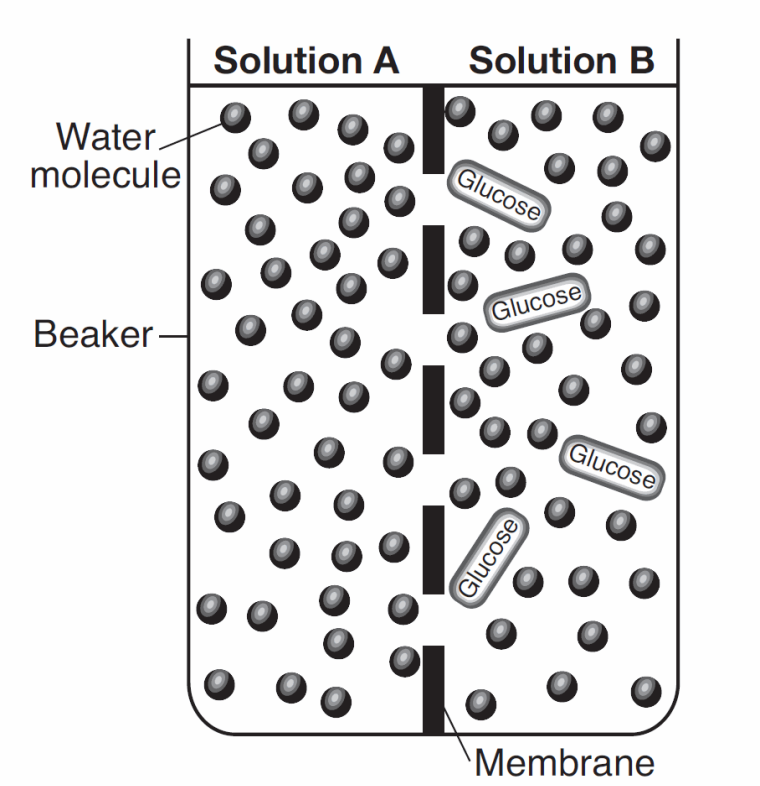
26. Red onion cells undergo the change represented in the diagram below.



This change is most likely caused by the cell being transferred from

A) distilled water to starch indicator
B) distilled water to salt water
C) salt water to tap water
D) salt water to distilled water

Base your answers to questions **27** and **28** on the diagram below and on your knowledge of biology. The diagram represents two solutions, *A* and *B,* separated by a selectively permeable membrane.



27. Which statement best describes the outcome after 20 minutes?

A) Solution *A* will contain approximately the same number of glucose molecules as solution *B.*
B) Solution *A* will contain all of the water molecules.
C) Solution *B* will remain unchanged.
D) Solution *B* will lose all of the glucose molecules to solution *A.*

28. A sample from solution *A* and solution *B* were each tested with blue-colored glucose indicator solution before the solutions were placed in the beaker. Which row represents the results?

Row	Solution A	Solution B
(1)	red or orange	blue
(2)	blue black	amber
(3)	blue	red or orange
(4)	amber	blue black

A) 1 B) 2 C) 3 D) 4

29. Cell membranes are said to be selectively permeable. Which statement best explains what selectively permeable means?

A) The cell membrane prevents any harmful substance from entering the cell.

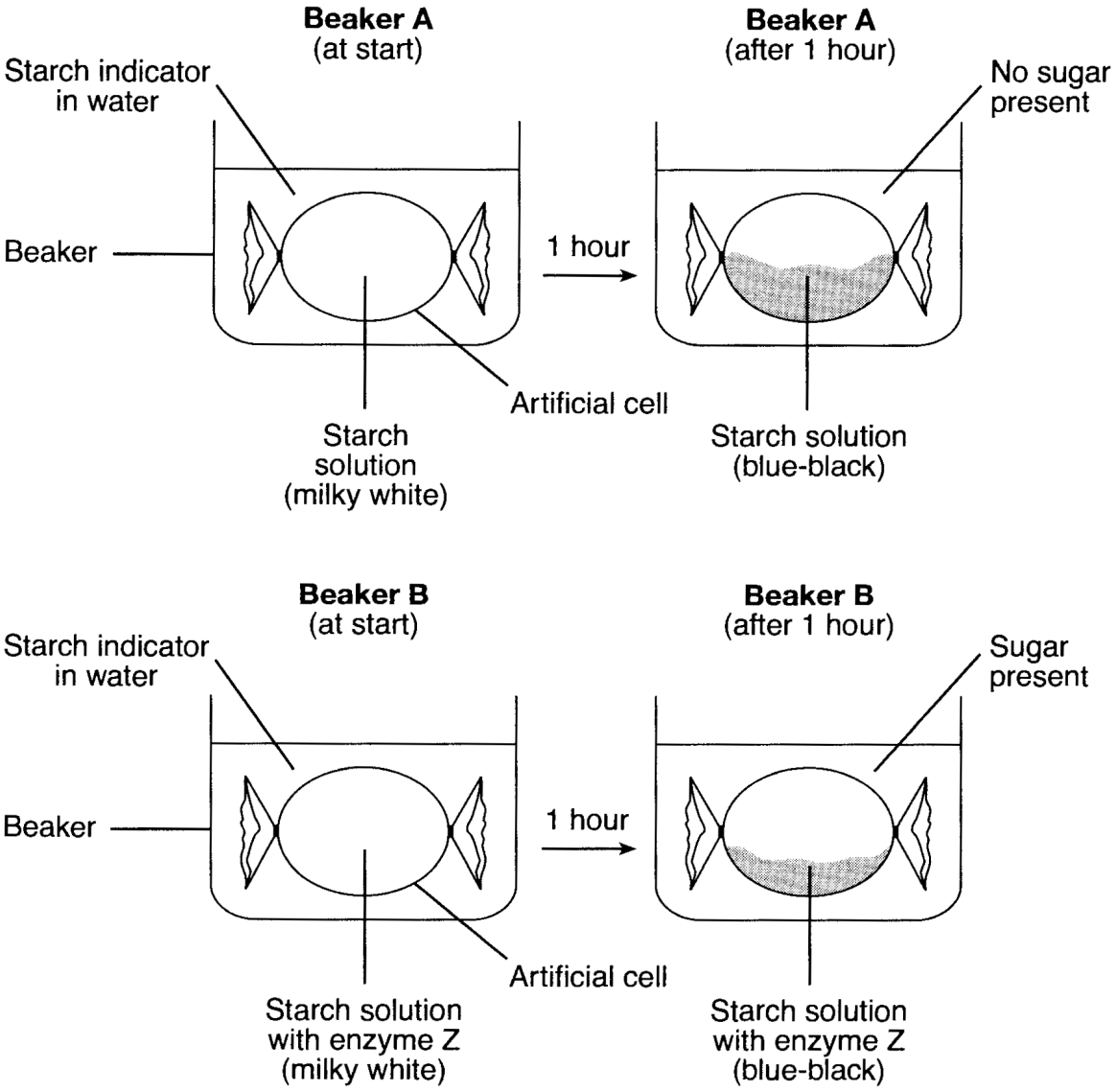
B) The cell membrane lets certain substances enter the cell and keeps certain substances out of the cell.

C) The cell membrane allows only large molecules to diffuse into the cell.

D) The cell membrane has pores that let only water and glucose into the cell and carbon dioxide out.

Base your answers to questions **30** and **31** on the information and diagram below and on your knowledge of biology.

Two models of a cell were made with dialysis tubing and placed in two beakers of fluid, *A* and *B,* each containing starch indicator solution, as represented in the diagram below. Enzyme Z was added to the artificial cell in beaker *B.* The solution outside each cell was tested for the presence of sugar. Initially, no sugar was present in the solution outside each cell. The results after one hour are represented below.



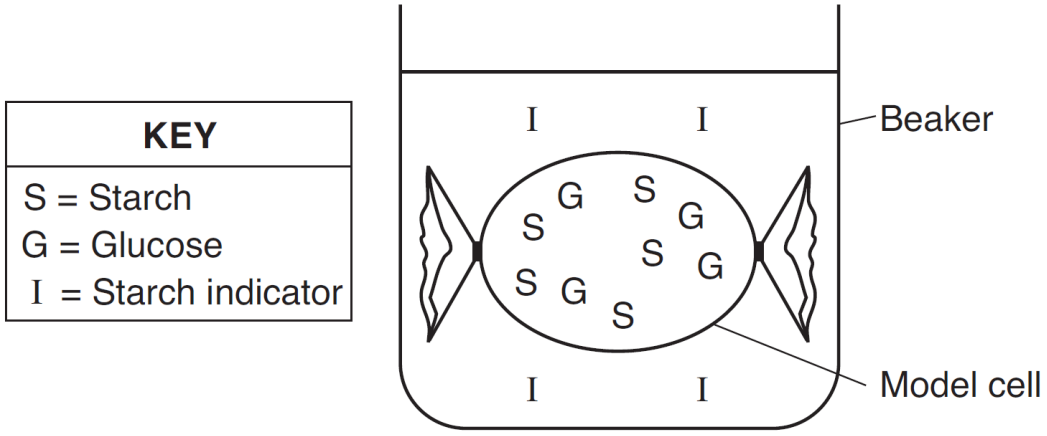
30. State *one* reason for the color change in beaker *A* after one hour.

31. How would the results have been different in beaker *B* if an enzyme that digests protein was used instead of enzyme Z?

32. Hospital patients are often given intravenous fluids (IVs) to maintain proper levels of water and salts in the body. Great care is used in preparing these solutions. If a manufacturer accidentally prepared a batch of IV fluid that contained much more than the usual amount of salt, harm to the patient if this incorrectly prepared IV fluid was used is that

A) water would move into body cells and cause them to burst
B) water would move out of body cells and cause them to dehydrate
C) salt and water would both move out of body cells and disrupt homeostasis
D) salt and water would both move into body cells and preserve homeostasis

Base your answers to questions **33** and **34** on the diagram below and on your knowledge of biology. The diagram represents a model cell setup. The locations of three different substances are indicated in the diagram.



33. Which row in the chart below best explains the movement of some molecules between the model cell and the solution in the beaker?

Row	Direction of Flow of Molecules	Energy Use
(1)	from high to low concentration	without using cellular energy
(2)	from high to low concentration	using cellular energy
(3)	from low to high concentration	without using cellular energy
(4)	from low to high concentration	using cellular energy

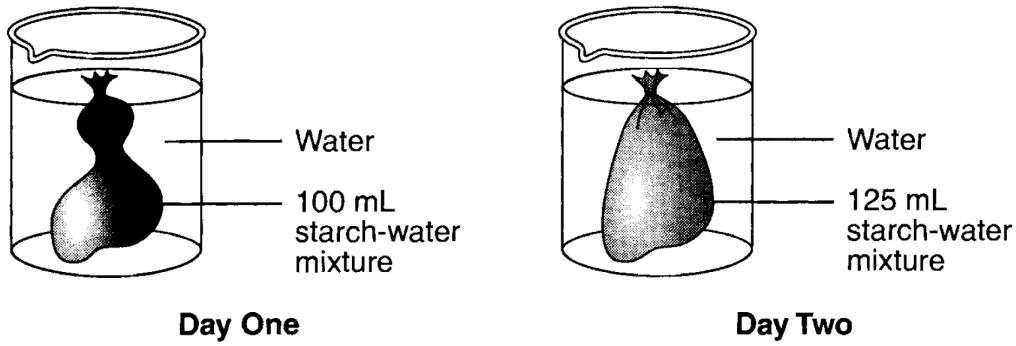
A) 1 B) 2 C) 3 D) 4

34. Which statement best describes what will most likely happen after several minutes?

A) The contents of the model cell will change color.
B) The liquid outside the model cell will change color.
C) The model cell will shrink.
D) The model cell will rupture.

Base your answers to questions **35** and **36** on information and diagram below and on your knowledge of biology.

In an experiment, students placed a dialysis bag containing 100 mL of a starch-water mixture in a beaker of water, as shown below. They left the setup until class the next day, when they removed the dialysis bag and measured the volume of the contents. They found that there were now 125 mL of the starch-water mixture.



Day One **Day Two**

35. Identify *one* organ in the human body where this process occurs and identify *one* substance that moves into the blood at that location.

Organ: _____

Substance: _____

36. Identify the process that caused the increase in volume.

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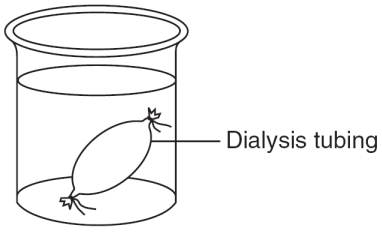
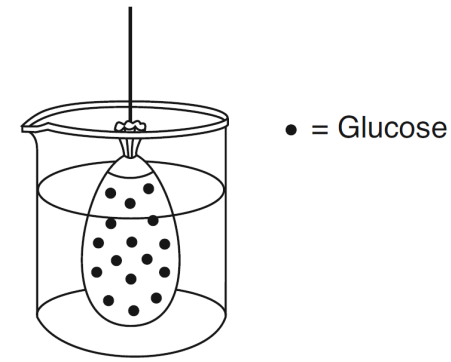
37. An experimental setup using a model cell is shown in the diagram below.



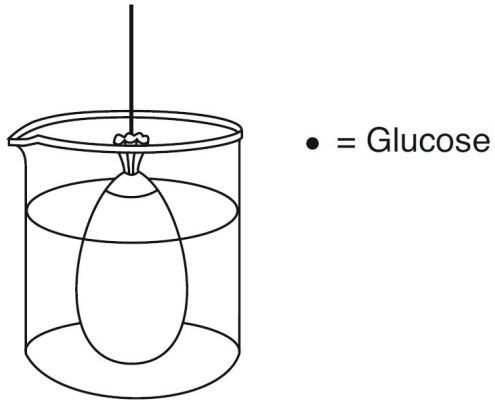
State what cell structure the dialysis tubing represents.

Base your answers to questions **38** and **39** on the information below and on your knowledge of biology.

An artificial cell filled with a glucose solution was placed in a beaker of water, as represented below. The beaker was left undisturbed for 20 minutes.



38. In the diagram below, draw in the expected location of the glucose molecules after 20 minutes.



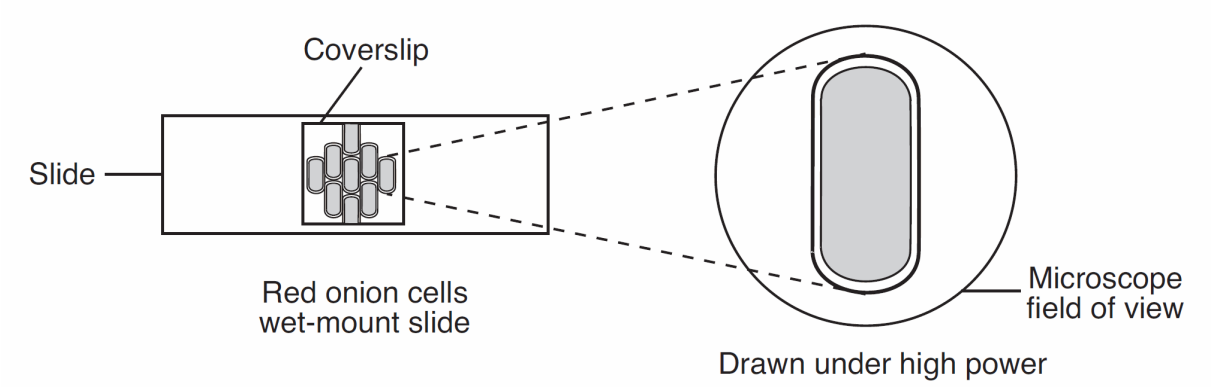
39. If both glucose and starch were added to the artificial cell, where would the starch be located after 20 minutes?

_____

40. Some of the pain from a sore throat is caused by swelling of moist throat tissue. A common remedy for a sore throat is to gargle (rinse the throat tissue) with salt water. Explain why gargling with salt water would be expected to relieve the pain of a sore throat.

Base your answers to questions **41** and **42** on the information below and on your knowledge of biology.

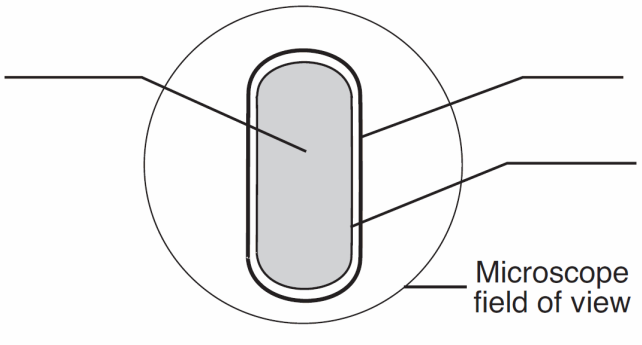
A wet-mount slide of red onion cells is studied using a compound light microscope. A drawing of one of the cells as seen under high power is shown below.



41. Describe the proper way to add a saltwater solution to the cells without removing the coverslip.

42. On the diagram below, label the location of each of the cell structures listed.

cell wall
cytoplasm
cell membrane



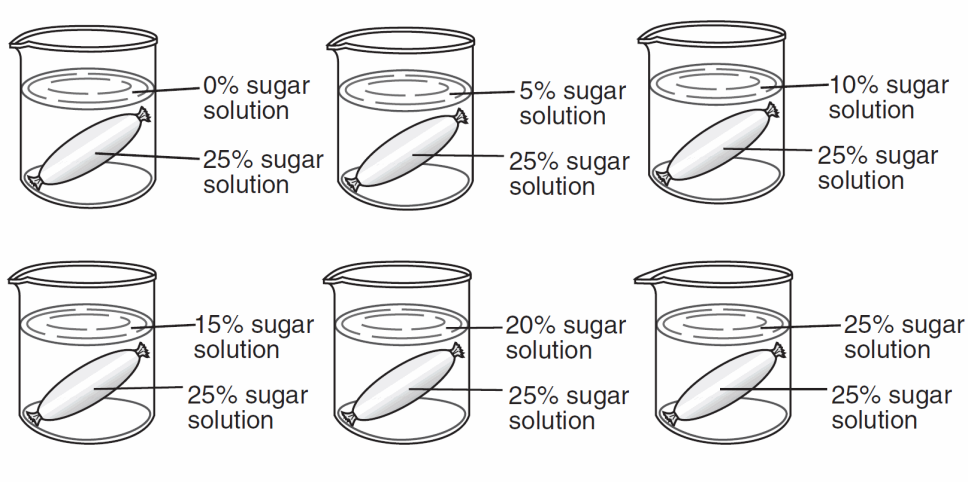
43. A student observes some cells with a compound light microscope as shown in view *A* below.

What did the student most likely do to obtain view *B*?

A) applied a biological stain to the slide
B) applied distilled water to the slide
C) used electrophoresis
D) used a higher magnification

Base your answers to questions **44** and **45** on the information below and on your knowledge of biology.

The masses of six sections of dialysis tubing, each containing 20 mL of a 25% sugar solution, were recorded. They were then placed in beakers each containing 100-mL solutions of varying sugar concentrations, as shown in the diagrams below.



The sections of tubing remained in the beakers for 30 minutes. They were then removed and the outside of each section of tubing was blotted dry. Following this, the mass of each section of tubing was measured again. The mass change of each section of tubing in the different sugar solutions is indicated in the data table below.

Mass Change of Dialysis Tubing Sections in Different Sugar Solutions

Sugar Concentration in the Beaker (%)	**Mass Change of the Tubing** (g)
0	5.1
5	4.7
10	4.4
15	2.5
20	1.4
25	0.0

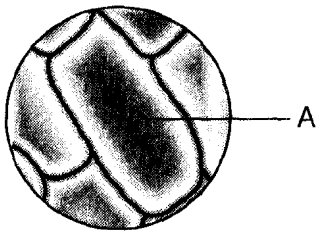
44. Identify the process responsible for the change in mass of the dialysis tubing in the beakers.

45. If another dialysis tube containing a 25% sugar solution were placed in a beaker containing a 12% sugar solution for 30 minutes, the change in the mass of the tubing would most likely be closest to

A) 1.2 g B) 1.9 g C) 2.6 g D) 3.8 g

46. Base your answer to the following question on the information and diagram below and on your knowledge of biology.

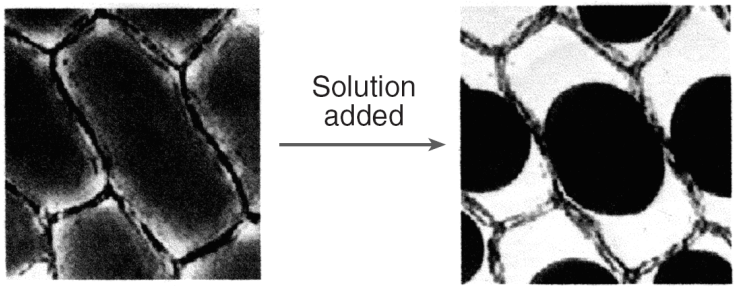
A wet mount of red onion cells as seen with a compound light microscope is shown below.



Which substance would most likely be used to return the cells to their original condition?

A) starch indicator
B) dialysis tubing
C) glucose indicator solution
D) distilled water

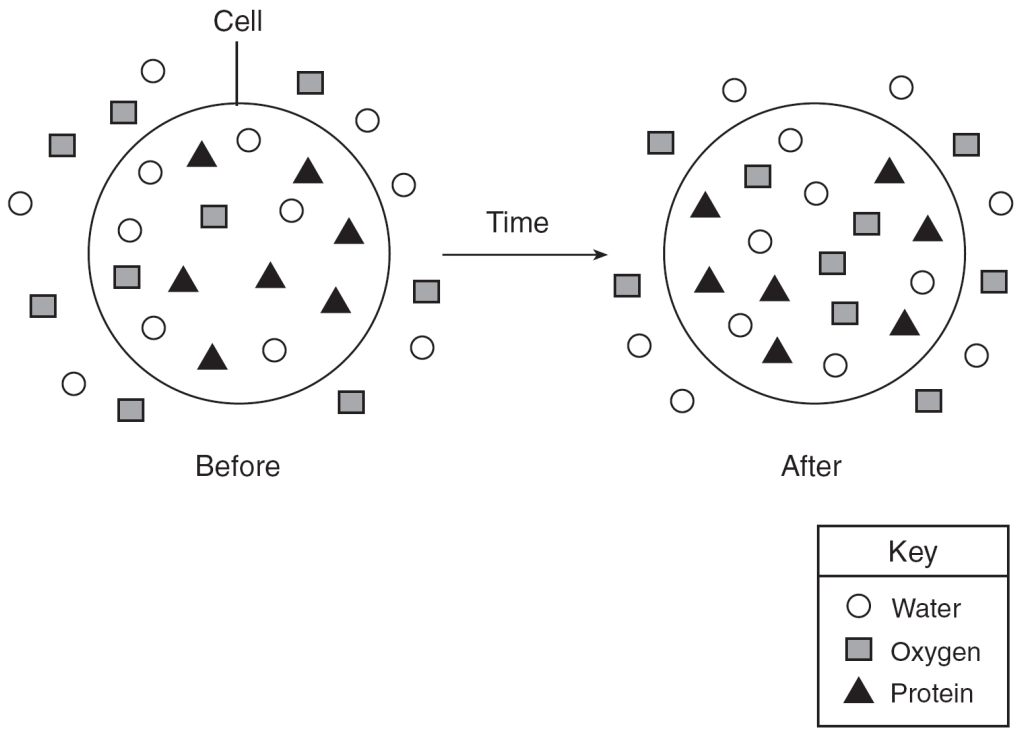
47. Base your answer to the following question on the diagram below and on your knowledge of biology. The diagram illustrates what happens when a particular solution is added to a wet-mount slide containing red onion cells being observed using a compound light microscope.



To observe the cells on this slide it is best to start out using the

A) high-power objective and focus using the coarse adjustment, only
B) low-power objective and focus using the fine adjustment, only
C) high-power objective and focus using the fine adjustment
D) low-power objective and focus using the coarse adjustment

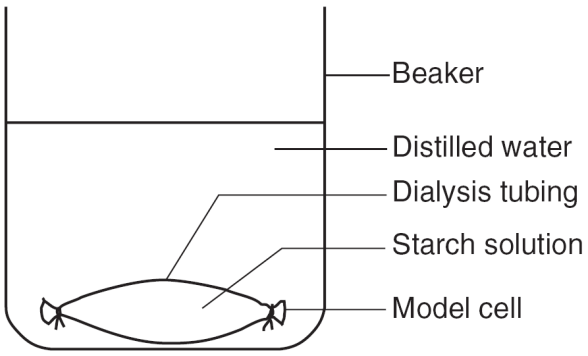
48. The diagram below represents the distribution of some molecules inside and outside of a cell over time.



Which factor prevented the protein molecules from moving out of the cell?

A) temperature
B) pH
C) molecule size
D) molecule concentration

49. A laboratory setup of a model cell is shown in the diagram below.



Which observation would most likely be made 24 hours later?

A) The contents of the model cell have changed color.
B) The diameter of the model cell has increased.
C) The model cell has become smaller.
D) The amount of distilled water in the beaker has increased.

50. Glucose indicator was added to a beaker of an unknown liquid. Starch indicator was added to a different beaker containing the same unknown liquid. The color of the indicator solutions before they were added to the beakers and the color of the contents of the beakers after adding the indicator solution are recorded in the chart below.

Beaker	Solution	Color of Indicator Solution Before Adding to Beaker	Color of Contents of Beaker After Adding Indicator Solution
1	unknown liquid + glucose indicator	blue	blue (after heating)
2	unknown liquid + starch indicator	amber	blue black

Which carbohydrate is present in the unknown liquid? Support your answer.

51. Base your answer to the following question on the information and data table below and on your knowledge of biology.

A student cut three identical slices from a potato. She determined the mass of each slice. She then placed them in labeled beakers and added a different solution to each beaker. After 30 minutes, she removed each potato slice from its solution, removed the excess liquid with a paper towel, and determined the mass of each slice. The change in mass was calculated and the results are shown in the data table below.

Change in Mass of Potato in Different Solutions

Beaker	Solution	Change in Mass
1	distilled water	gained 4.0 grams
2	6% salt solution	lost 0.4 gram
3	16% salt solution	lost 4.7 grams

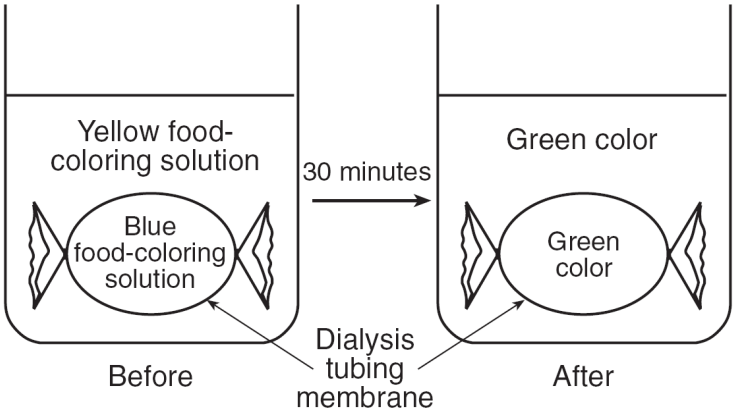
Explain why the potato slice in beaker 1 increased in mass.

52. If frog eggs taken from a freshwater pond are placed in a saltwater aquarium, what will most likely happen?

A) Water will leave the eggs.
B) Salt will leave the eggs.
C) Water will neither enter nor leave the eggs.
D) The eggs will burst

Base your answers to questions **53** and **54** on the diagram below and on your knowledge of biology.

The diagram shows the changes that occurred in a beaker after 30 minutes. The beaker contained water, food coloring, and a bag made from dialysis tubing membrane.



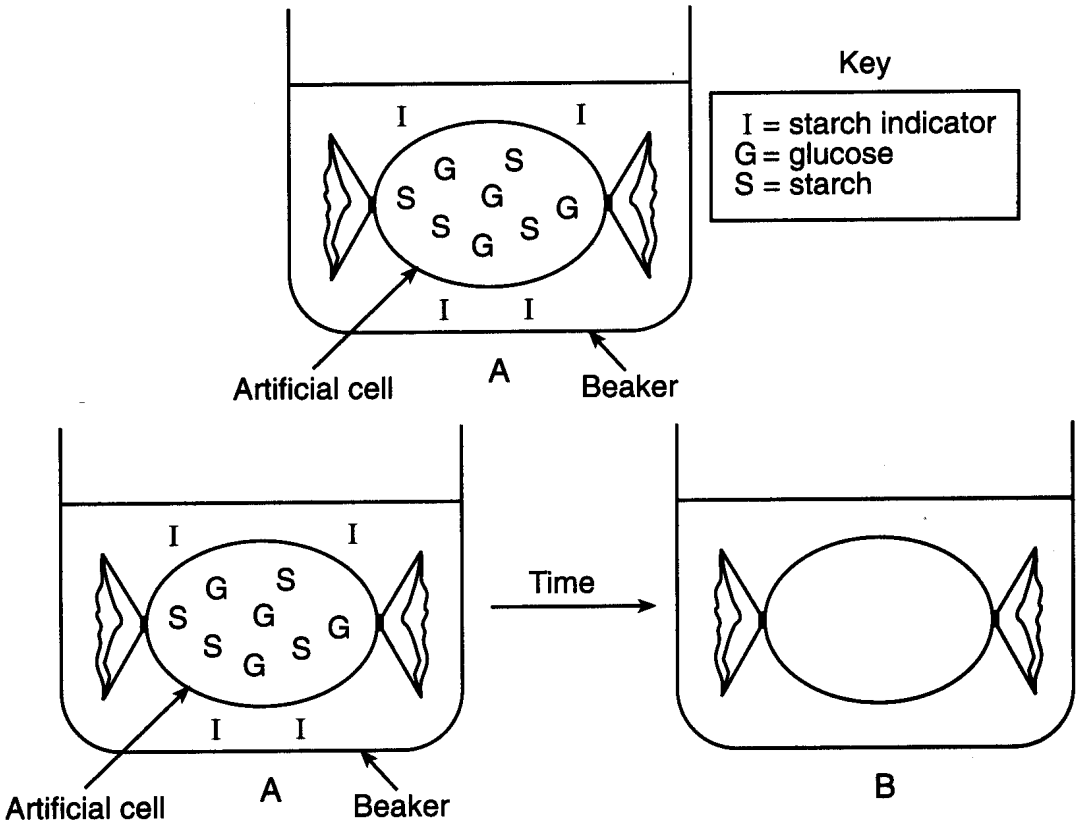
53. When the colors yellow and blue are combined, they produce a green color. Which statement most likely describes the relative sizes of the yellow and blue food-coloring molecules in the diagram?

A) The yellow food-coloring molecules are small, while the blue food-coloring molecules are large.
B) The yellow food-coloring molecules are large, while the blue food-coloring molecules are small.
C) Both the yellow food-coloring molecules and the blue food-coloring molecules are large.
D) Both the yellow food-coloring molecules and the blue food-coloring molecules are small.

54. Which statement best explains the changes shown?

A) Molecular movement was aided by the presence of specific carbohydrate molecules on the surface of the membrane.
B) Molecular movement was aided by the presence of specific enzyme molecules on the surface of the membrane.
C) Molecules moved across the membrane without additional energy being supplied.
D) Molecules moved across the membrane only when additional energy was supplied.

Base your answers to questions **55** and **56** on the information and diagram below and on your knowledge of biology. The diagram illustrates an investigation carried out in a laboratory activity on diffusion. The beaker and the artificial cell also contain water.



55. Predict what would happen over time by showing the location of molecules *I*, *G*, and *S* in diagram *B* above.

56. State what is observed when there is a positive test for starch using the starch indicator.

Base your answers to questions **57** and **58** on the information below and on your knowledge of biology.

Students prepared four models of cells by using dialysis tubing containing the same blue solution. Each of the model cells originally weighed 10 grams. They then placed each model cell in a beaker containing a different concentration of water. After 24 hours, they recorded the mass of the model cells as shown in the data table below.

Data Table

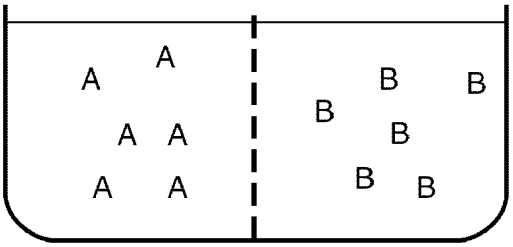
Concentration of Water Surrounding the Model Cell	Mass of Model Cell
100%	12 grams
90%	11 grams
80%	10 grams
70%	9 grams

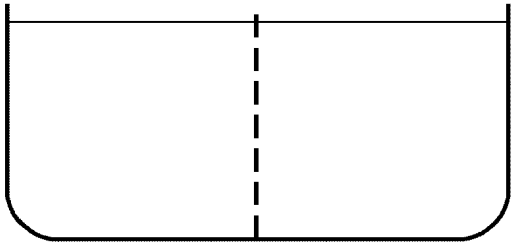
57. What was the concentration of water in the original blue solution? State evidence in support of your answer.

58. Why did the model cell that was placed in 100% water increase in mass?

_____

59. The diagram below represents a container of water and two different kinds of molecules, *A* and *B*, separated into two chambers by a membrane through which only water and molecule *A* can pass.





On the diagram of the container above, indicate the distribution of molecules *A* and *B* after the net movement of these molecules stops.