

Activity 1: simple diffusion



**ASSIGN
BUSTER**

Activity 1: Simple diffusion Introduction: Simple diffusion is the net movement of substances from a region of high concentration to a region of low concentration so its overall net movement is along the concentration gradient, simple diffusion does not require energy therefore it is 'passive', substances are diffused across the membrane between the phospholipids.

Materials and methods: * 20 mwco dialysis membrane * 50 mwco dialysis membrane * 100 mwco dialysis membrane * 200 mwco dialysis membrane * Membrane holder * NaCl concentration * Urea * Albumin * Glucose *

Deionized water * Beakers The experiment wasn't done in an actual lab, but rather using a computer simulation in order to achieve precision and save time. Results: At 20 MWCO , NaCl (9.00 mM) no diffusion occurred . At 50 MWCO, NaCl(9.00 mM) diffusion occurred from the left beaker to the right until reached equilibrium was reached. Equilibrium occurred in 10 minutes as NaCl decreases from 9.00 mM to 4.50 mM. Whereas glucose, urea and albumin at 20 and 50 MWCO , didn't undergo diffusion. This implies diffusion occurs only in NaCl, which means that the membrane is permeable to NaCl at 50 MWCO. Below is a table showing whether or not diffusion occurred using each dialysis membrane: (+ for diffusion, - for no diffusion) Chart 1 |

Dialysis Results (average diffusion rate in mM/min)	Membrane(MWCO)
Solute 20 50 100 250	NaCl - +
Urea - -	Albumin - -
Glucose - -	

Discussion: While undergoing this study , It shows us that NaCl diffuse into the right beaker from the left when it was 50 MWCO . Thus , NaCl at 20 MWCO didn't diffuse while all of urea , albumin and glucose didn't diffuse at either beakers. Urea diffused in 16 minutes to the right beaker using the 100 MWCO . We conclude that the 100 MWCO is permeable to urea. On the other hand, we set up NaCl in the left and right beaker in order

to make a balance and equilibrium, and to unchange the NaCl solution. Thus, urea had diffused in 100 MWCO at 16 minutes. Activity 2: Facilitated diffusion Introduction: Facilitated diffusion is when a molecule cannot just passively diffuse across a membrane; however, it requires a protein "carrier" and energy in the form of ATP to move across the membrane. Materials and methods: * Membrane holder * NaCl concentration * Glucose * Deionized water * Beakers * Membrane builder The experiment wasn't done in an actual lab, but rather using a computer simulation in order to achieve precision and save time. Results: When glucose at left beaker was set to 2.00 mM: * When the membrane contained 500 glucose carrier proteins, diffusion of NaCl occurred in 43 minutes. NaCl diffused into the second beaker until equilibrium was reached. * When we built a membrane with 700 glucose carrier proteins, diffusion was faster and ended in 33 minutes. * And when the membrane had 900 glucose carrier proteins, it took 27 minutes. When glucose at left beaker was set to 8.00mM: * When we placed the membrane with 500 glucose carrier proteins, the glucose diffused in 58 minutes. * When we placed membrane with 700 glucose carrier proteins, glucose diffuses in 43 minutes. * Finally when we placed a membrane with 900 glucose carrier proteins, glucose diffuses in 35 minutes. . Below is a table showing the facilitated diffusion results: (+ for diffusion, - for no diffusion)

Glucose concentration(mM)	500	700	900	2.00	8.00
Diffusion rate (mM/min)	+(in 43 minutes)	+(in 33 minutes)	+(in 27 minutes)	+(58 minutes)	+(43 minutes)
Diffusion rate (mM/min)	+(35 minutes)				

Discussion: We conclude from the experiment that as the number of protein carriers increased, the rate of diffusion increased. Thus NaCl is a control and at equilibrium, so no diffusion

occurs. Furthermore, glucose concentration also affects the rate of diffusion, as concentration increases, rate of diffusion decreases. We also notice that NaCl doesn't affect glucose diffusion, since it undergoes diffusion itself.

Activity 3: Osmosis Introduction: Osmosis is the diffusion of the movement of water from a region of higher concentration to a region of lower concentration through a cell membrane or other semi-permeable membrane until an equilibrium is reached. It is a special case of diffusion (passive transport). In the following experiment, we will learn about osmosis.

Materials and methods: * 20 mwco dialysis membrane * 50 mwco dialysis membrane * 100 mwco dialysis membrane * 200 mwco dialysis membrane * Membrane holder * NaCl concentration * Albumin * Glucose * Deionized water * Beakers The experiment wasn't done in an actual lab, but rather using a computer simulation in order to achieve precision and save time.

Results: * When we added 8.00 mM NaCl in one of the beakers and placed a 20 mwco membrane dialysis on the membrane holder, no diffusion occurred as the left beaker reported 8.00 mM NaCl and the right beaker reported 0 mM. However it is important to note that osmotic equilibrium was reached.

Furthermore, the pressure at the left beaker increased to 272 mmHg. * When we placed a 50 mwco dialysis membrane between the beakers, NaCl diffused into the right beaker in 10 minutes until equilibrium was reached and both beakers reported 4.00 mM of NaCl. However the reported osmotic pressure was 0 mmHg for both beakers. * When we placed a 100 mwco dialysis membrane, NaCl also diffused in 10 minutes causing equilibrium. And osmosis pressure recorded also was 0 mmHg. * When we placed a 200 mwco dialysis membrane, NaCl also diffused in 10 minutes causing equilibrium.

And osmosis pressure recorded also was 0 mmHg. * We do similar

<https://assignbuster.com/activity-1-simple-diffusion/>

procedures using 9.00 mM albumin, no diffusion occurred using all 4 dialysis membranes. And reported pressure reached 153 mmHg on all beakers. In addition, osmotic equilibrium was reported for all 4 beakers. * We do similar procedures but using 10.00 mM of glucose this time. The 20, 50, 100 mwco dialysis membranes recorded same results: No diffusion occurred and pressure rose to reach 170 mmHg and osmotic equilibrium was reported using the 3 dialysis membranes. However, when we used the 200 mwco membrane, glucose diffused from left beaker to right until equilibrium was reached. And recorded pressure was 0 mmHg. Below is a table showing the osmosis results using the 4 dialysis membranes for all 3 solutes:

Solute	20 mwco	50 mwco	100 mwco	200 mwco
Na/CL	272 mmHg	0 mmHg	0 mmHg	0 mmHg
Albumin	153 mmHg	153 mmHg	153 mmHg	153 mmHg
Glucose	170 mmHg	170 mmHg	170 mmHg	0 mmHg

Discussion: Many observations were recorded: NaCl diffusion occurred using the 50, 100, and 200 mwco dialysis membranes. No pressure was recorded in the beakers using those membranes. However when diffusion didn't occur in using the 20 mwco membrane, pressure rose to 272mmHg. Albumin did not diffuse using any of the membranes. Which means it may need another membrane with a mwco greater than 200. In all the beakers, pressure rose at the left beaker to reach 153 mmHg. Glucose diffused using only the 200 mwco dialysis membrane and no pressure was recorded in either beaker. However using the 20, 50, and 100 mwco membranes, no diffusion of glucose happened, and pressure at left beaker reached 170mmHg. We can conclude from the results above that when diffusion of solutes occurs, dialysis membranes of certain mwco are required depending on the solute. Furthermore, when diffusion happens, no pressure is recorded within the

beakers containing the solutes. On the other hand, when no diffusion occurs, pressure in the beaker containing the solute rises and osmotic equilibrium is reached.

Activity 4: Filtration Introduction: Filtration is mainly used for like separating things. When chemicals are mixed together without any chemical change, they form a mixture since there is no chemical change the substances in the mixture can be separated. Solutions are an example of a mixture.

Materials and methods: * NaCl (mg/ml) * Urea (mg/ml) * Glucose(mg/ml) * Powdered charcoal (mg/ml) * Deionized water * 20 mwco dialysis membrane * 50 mwco dialysis membrane * 100 mwco dialysis membrane * 200 mwco dialysis membrane * Membrane holder * Beakers * Membrane residue analysis machine

The experiment wasn't done in an actual lab, but rather using a computer simulation in order to achieve precision and save time.

Results: * We added 5.00 mg/ml of NaCl, urea, glucose, and powdered charcoal on the top beaker, and placed the 20 mwco dialysis membrane in the membrane holder. The filtration was completed in 100 minutes, and the filtration rate was a recorded 1 ml/min. However none of the 4 solutions filtrated into the second beaker even though residue of all solutes was present in the membrane. * Using the 50 mwco membrane, filtration ended in 40 minutes. The filtration rate was 2.5 ml/min. But only NaCl diffused to the second beaker and was recorded to be 4.81 mg/ml in the second beaker. Residue of all solutes was also found in the membrane. * Using the 100 mwco membrane, filtration was completed in 20 minutes, with a filtration rate of 5 ml/min. Both NaCl and Urea diffused into the second beaker. The concentration of NaCl was 4.81 mg/ml, and that of urea was 4.74 mg/ml. Residue of all 4 solutes was found in the membrane. * Finally using the 200 mwco membrane, filtration was completed in 10 minutes with

<https://assignbuster.com/activity-1-simple-diffusion/>

a rate of 10 ml/min. NaCl, urea, and glucose were filtrated into the second beaker recording 4. 81, 4. 74, 4. 39 mg/ml repectivley. Residue of all solutes was also present in the membrane. Below is a table showing the filtration results and also shows presence of residue in each dialysis membrane:

Solute	20 mwco	50 mwco	100 mwco	200 mwco	Filtration rate
NaCl	0 mg/ml +	4. 81 mg/ml +	4. 81 mg/ml +	4. 81 mg/ml +	1 ml/min
Urea	0 mg/ml +	0 mg/ml +	4. 74 mg/ml +	4. 74 mg/ml +	2. 5 ml/min
Glucose	0 mg/ml +	0 mg/ml +	0 mg/ml +	0 mg/ml +	5 ml/min
powder charcoal	0 mg/ml +	0 mg/ml +	0 mg/ml +	0 mg/ml +	10 ml/min

Discussion: In this experiment, when we changed the dialysis membrane, the rate of filtration changed. Furthermore, the solutes that filtrated into the second beaker varied from one membrane to another. And when we changed the driving pressure applied to the beaker, the filtration rate also varied. We also notice that of all the solutes present, powder charcoal did not filtrate using any of the membranes. We can conclude that as the mwco of dialysis membrane increases, the rate of filtration increases. Pressure also affects filtration rate, as pressure increases, filtration rate increases. Finally it is essential to point out that the molecular weight of glucose must be greater than urea but less than powder charcoal.

Activity 5: Active Transport Introduction: Active transport describes what happens when a cell uses energy to transport something. Active transport usually happens across the cell membrane.

Materials and methods: * NaCl (mM) * KCl (mM) * Glucose (mM) * Deionized water * Membrane holder * Membrane builder * Beakers * ATP dispenser The experiment wasn't done in an actual lab, but rather using a computer

simulation in order to achieve precision and save time. Results: For the first experiment, we adjust the membrane to have 500 glucose carriers, and 500 sodium-potassium pumps. We then dispense 9.00 mM NaCl to the left beaker and 6.00 mM KCl to the right beaker. We also dispense 1 mM ATP to both sides of membrane. We notice that Na⁺ concentration dropped in the left beaker from 9.00 to 5.613 mM and increased in right beaker from 0 to 3.3871 mM. while the K⁺ concentration decreased in the right beaker from 6 to 3.742 mM and increased in left beaker from 0 to 2.258 mM. We performed the same experiment but with dispensing 1 mM ATP. No change was reported. In another experiment, we adjusted the ATP to 3mM to be dispensed. And the amount of Na⁺ was completely transported to the right beaker in 60 minutes. In another experiment, we decreased the sodium-potassium pumps in the membrane. And the recorded transported Na⁺ and K⁺ decreased. In another experiment we dispensed 9.00 mM in the left beaker, and 10.00 mM in the right. It is obvious that Na⁺ transport was not affected by this change. In another experiment we increased the number of sodium-potassium pump proteins, and we noticed that it took less time for transport to occur. Finally upon added glucose solution, Na⁺ and K⁺ transport change was not affected. Discussion: In the experiments done, we notice the importance of ATP in active transport, as no ATP implies no Na⁺/K⁺ transport through the membrane. Furthermore, we can conclude that the higher the ATP, the more the transported Na⁺ concentration. Another experiment proves that the number of sodium-potassium pumps is proportional to the number of transported Na⁺/K⁺ in the beakers. As we increase sodium-potassium pumps transported Na⁺/K⁺ increase. As we decrease sodium-potassium pumps transported Na⁺/K⁺ decrease. Finally

<https://assignbuster.com/activity-1-simple-diffusion/>

the introduction of glucose solution does not affect the transport of Na^+ and K^+ in any way. It is also important to know that facilitated is not considered simple diffusion, because facilitated diffusion requires use of ATP, and the concentration of Na^+ and K^+ in both beakers are not equal.