Osmosis is Serious Business! Case Study – Hospital Group

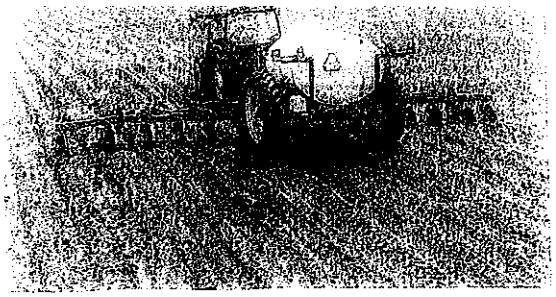
Case Study: *Read the following story about a mix up at the hospital with very serious consequences.*

In Habersham County, Tom was feeling slightly nervous as he exited the staff lounge and entered the hustle and bustle of County Hospital's ER to begin his first shift as an RN. The first few hours of his shift passed slowly as Tom mostly checked vital signs and listened to patients complain about various aches, pains, coughs, and sniffles. He realized that the attending physician, Dr. Greene, who was rather "old school" in general about how he interacted with nursing staff, wanted to start him out slowly. Tom knew, though, that the paramedics could bring in a trauma patient at any time. After his lunch break, Tom didn't have long to wait before the paramedics burst in through the swinging double-doors of the ambulance bay wheeling in a young man on a gurney. Edward, a veteran EMT, recited the vital signs to Tom and Dr. Greene as they helped push the gurney into the trauma room, "18 year-old male, GSW (Gun Shot Wound) to the right abdomen, heart rate 92, respiratory rate 22, blood pressure 95/65, no loss of consciousness."

Once inside the trauma room, Dr. Greene began his initial assessment of the patient while Tom got busy organizing the things he knew would be needed. He attached a pulse-ox monitor to the patient's index finger so Dr. Greene could keep an eye on the O2 levels in the patient's blood and he inserted a Foley catheter so the patient's urine output could be monitored. After finishing his initial duties, Tom heard Dr. Greene saying, "It looks like the bullet missed the liver and kidney, but it may have severed an artery. That's probably why his BP is a bit low. Tom, grab a liter of saline and start a fast IV drip ... we need to increase his blood volume." Tom grabbed one of the fluid-filled bags from the nearby shelf, attached a 12-gauge IV needle to the plastic tubing, and gently slipped the needle into the patient's antecubital vein. He then hung the plastic bag on the IV stand and let the fluid quickly start to flow down the tubing and into the patient's vein. The reaction was quick and violent. The patient's heart rate began to skyrocket and Tom heard Dr. Greene shouting, "His O2 saturation is falling! Pulse is quickening! What is going on with this guy?!" Tom stood frozen in place by the fear. He heard Dr. Greene continuing, "Flat line! We've lost a pulse ... Tom, get the crash cart, we need to shock this guy to get his heart going again!" Tom broke free from his initial shock and did as Dr. Greene had ordered. He then started CPR as Dr. Greene readied the cardiac defibrillator to shock the patient. They continued to alternate between CPR and defibrillation for almost an hour, but to no avail. As Dr. Greene announced the time of death, Tom felt a sickening feeling in the pit of his stomach. He couldn't believe that he had lost his first trauma patient! Then Tom noticed that the fluid in the Foley catheter bag was bright red. "Dr. Greene, there's hemoglobin in the Foley bag," he said. "How could that be?" responded Dr. Greene. Tom began to trace back over his steps in the trauma, trying to think of anything that could have caused the hemoglobinuria. His mounting fear turned to outright terror as he looked at the now empty bag on the IV stand. Its label didn't read "Saline," but rather "Distilled Water." He looked at Dr. Greene, his heart quickly sinking, and said, "I think I may have killed the patient."

Part A: Recognize and Recall.

1. What problem did the distilled water in the patient's bloodstream create? (hypertonic, isotonic, or hypotonic?) What happed to the patient's blood cells as a result? (Shrink, swell, or burst?)
2. Considering the function of red blood cells, why did the patient's oxygen levels fall?
3. After Tom made his error, could he have done anything to save the patient's life?



Osmosis is Serious Business! Case Study – Fertilizer Group

Times were difficult in Habersham County. The skyrocketing prices of fuel and food were threatening to bankrupt the Johnson family's small farm, which was no match for the multi-million-dollar mega-farms that had been popping up all over the southeast. They knew that this year's corn crop was his best chance to save the farm, and his distress was evident to his family as they sat around the dinner table. "Michael, I'm going to need your help tomorrow," Joseph said to his eldest son. "I have to go into town to pick up a part for the combine so I can fix it before it's time to harvest in a few months. I need you to spread the potash and phosphate on the corn because we're expecting some rain by the end of the week."

The following afternoon, Michael was loading heavy bags of fertilizer into the drop spreader on the farm tractor. His father's cheerless demeanor the previous evening weighed heavily on him. Michael knew that 25 bags of the potassium and phosphorous-based fertilizer was the normal load to cover the 40 acres of corn the family had planted that spring. But as he was emptying the 25th bag into the spreader, an idea flashed through his mind: "If we need a good corn crop to make it, maybe I should add a little extra fertilizer." Michael decided that some extra fertilizer couldn't hurt, so he quickly loaded 15 extra bags. He was certain that adding the extra fertilizer would produce a massive crop when it came time to harvest in a few months.

Michael hadn't told his father about the extra fertilizer he'd added to the corn, wanting to see his father's surprise over the size of the harvest in a few months. As expected, the rain started Friday afternoon; Michael was certain it would start an incredible growth spurt in the newly fertilized, young corn plants and that his family would hit pay dirt in a few months. He was out of bed early on Saturday morning, taking his four-wheeler down to the cornfields. He expected to see a vibrant green sea of young corn, extra healthy due to the fertilizer "boost" he had given them. His stomach dropped a bit as he stared out at a field of sickly looking corn plants, their leaves pale green and slightly wilting. "Maybe it rained too hard and that beat the plants up a little," thought Michael, trying to be optimistic. "I'll check on them again in a few days. I'm sure they'll have perked up by then!"

The next few days didn't bring the results Michael was hoping for. The corn plants looked even worse! The leaves were beginning to yellow significantly and were continuing to wilt. Having watched his father grow corn for most of his 14 years, Michael knew this crop wasn't going to make it. A lump was forming in his throat as he made his way back to the house, not sure how to tell his father about the corn.

Part B: Interpret, Classify, Infer and Explain.

4. What problem did the extra fertilizer in the soil create? (hypertonic, isotonic, or hypotonic?) What happed to the corn plants cells as a result? (Shrink, swell, or burst?)
5. Generally, people water their plants with 100% H_2O—no solutes added. What sort of environment does this create around the roots of the plant? Briefly explain why plants generally thrive in this sort of environment.
6. If Michael's mistake had been caught earlier, could he have done anything to prevent the corn from dying?

Name_____ Date_____

Osmosis is Serious Business! Activity Sheet

Part I-Read the following Case Study about Tom, a new nurse at Habersham County Hospital and answer the following questions.

1. What was the cause of death for the patient?

2. What was an indicator to Tom that something wasn't right? Why did this occur?

3. How are distilled water and saline different? (Research your answer)

Part II-Pre Lab/Brainstorming

1. Observe the eggs you have been given. How are the eggs similar to cells? How are the eggs different?

2. What are some qualitative and quantitative observations we can make about the eggs?

3. Follow the directions and set up your egg experiment.

4. Make a prediction about what will happen to the egg when placed in each solution.

   Distilled H_2O-

   Saline Solution-

   Salt H_2O-

5. Complete the data table below.

Part III-Data Collection

	Qualitative Observations	Initial Mass	Final Mass	Mass Difference
Egg #1(Distilled H_2O)				
Egg #2 (Saline Solution)				
Egg #3 (Salt H_2O Solution)				

Part IV-Analysis

1. What appears to be happening? What evidence do you have?

2. What causes the egg to gain mass? What evidence do you have to support your answer?

3. What causes the egg to lose mass? What evidence do you have to support your answer?

4. Carefully pop each egg with the point of your pencil and record your observations below.

5. Draw a diagram showing what is happening to the eggs in each solution.

Part V-Class Consensus and New Vocabulary

Part V-Conclusion

Using evidence from your lab and our class discussion explain why Tom's patient did not survive. Be sure to include specific evidence from the activity and the term osmosis to support your answer.