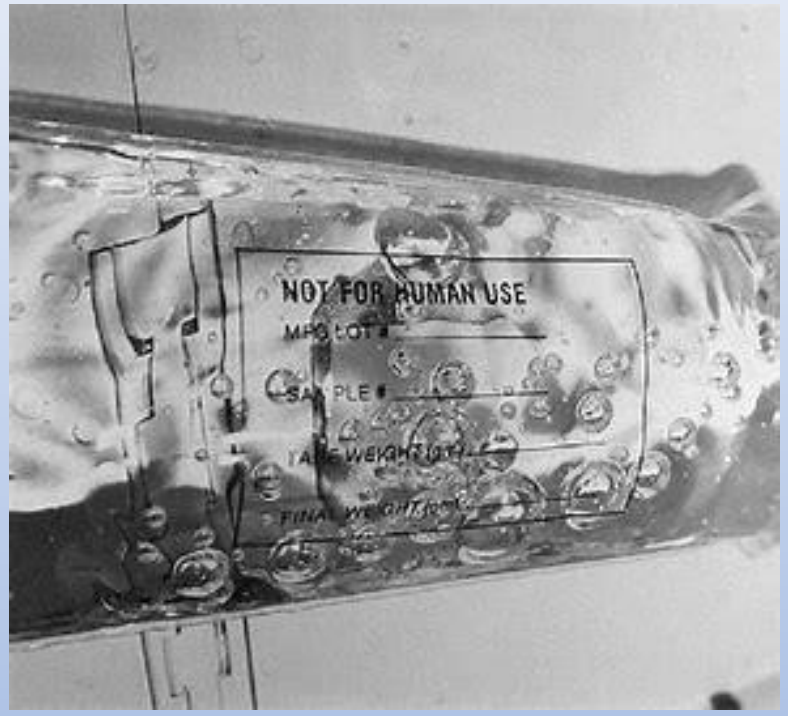
IV Fluid Administration on Long Duration Space Flight

Problem:

IV fluids use the force of gravity to deliver fluids to a patient. In a microgravity environment what method or device assistance would be needed to accomplish fluid delivery?

How does microgravity affect an IV fluid bag?

Normal bag on Earth



In a microgravity environment, air bubbles will come out of solution and create many bubbles to deal with.

IV fluids won't "drip" naturally in space. Water will move all around the drip tube space and due to surface tension water will ball up in the corners

How do we want IV fluids to work?

- ❑ Ability to preset the drip rate (deliver a certain amount over a certain amount of time.
- ❑Eliminate the possibility of air bubbles getting in the IV line.
- ❑ An air removal filter system to be used at the point of IV fluid administration into the patient that would allow for higher flow rates (~1L/15 min)
- ❑ The current filter that most IV delivery use is flow rate limiting. It would be beneficial to have a design that could have both a limited flow rate and a larger flow rate (for an emergency situation). A system could be designed in parallel to accomplish both aspects.
- ❑ Constant and consistent delivery.

IV Fluids that are delivered by pump system

- IV Fluids in hospitals are sometimes delivered by a pre-set pump to deliver a certain volume of fluid over a certain amount of time.
- Pumps don’t work the same way in a microgravity environment and tend to have issues with fluid balling up.
- STEMonstrations: Surface Tension – YouTube
- Space Coffee Cup: Capillary Flow Driven Fluids in Space - YouTube
- Make sure if you are looking at a pump mechanism that you are considering the physics of fluid in a microgravity environment and what kind of forces you would need to produce a desirable result.

TIPS for working this problem

- ❑ Different Types of filters may aid in getting rid of bubble issue
- ❑Controlled, Consistent pressure may be needed for delivery.
- ❑Consider the physics of capillary action
- ❑Amazon has cheap IV bags for purchase with tubing
- ❑You can contact any number of IV manufacturers and let them know you are working on a NASA Student project. You may get some free samples
- ❑*** safety!!: DO NOT INJECT anything into your own body!!!***