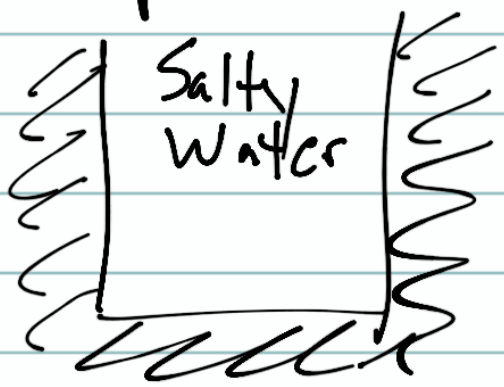
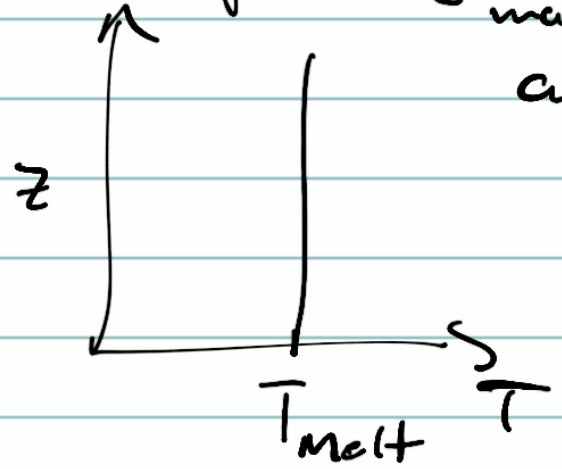
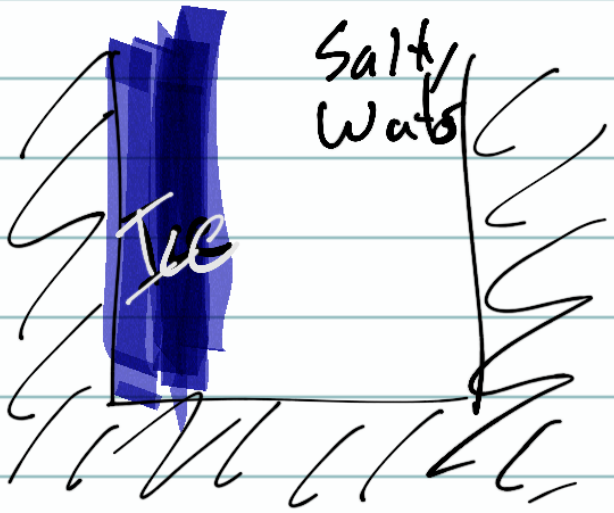
The Ice Pump

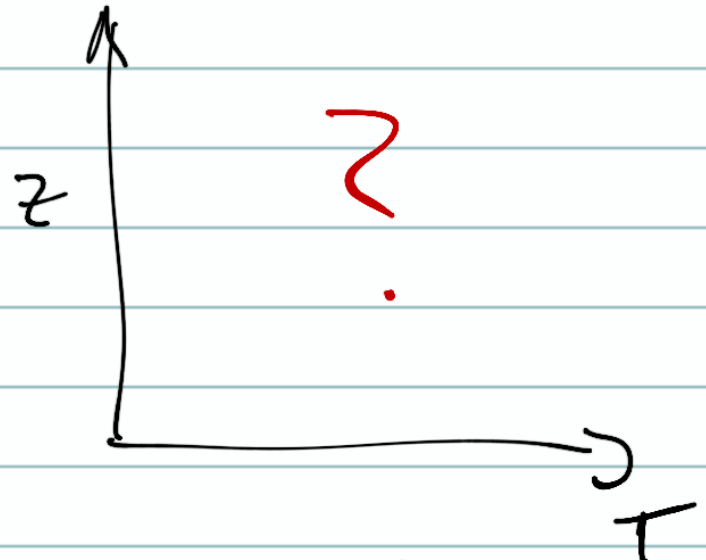
→ Consider a tank of water at uniform temperature (the melting point) and salinity → maintained at sfc



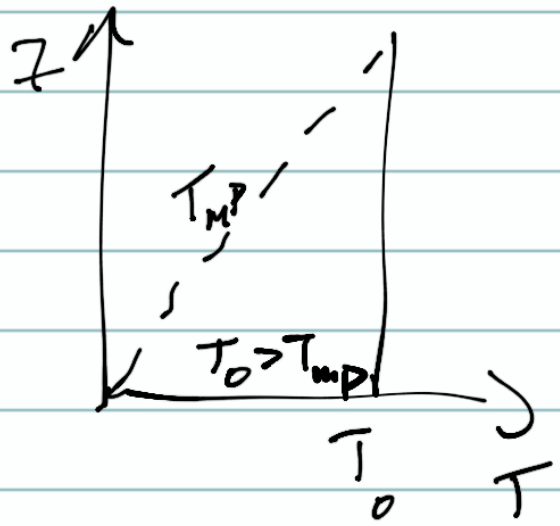


3 min - Add a vertical slab of ice to the tank - what happens to temp?

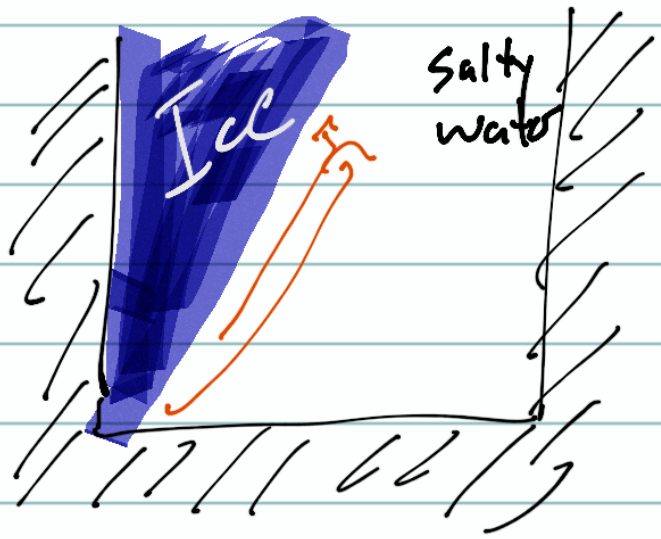


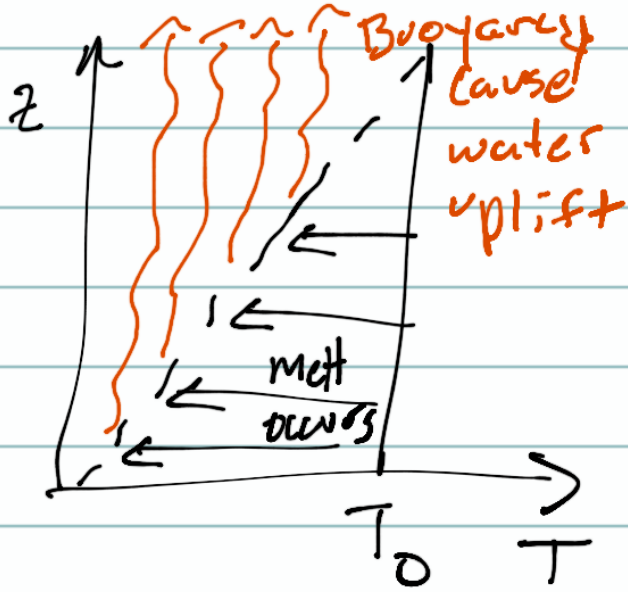


Ans: At sfc of tank water is at T_{melt}, nothing happens. At depth, pressure decreases the MP → ice melts more w/depth

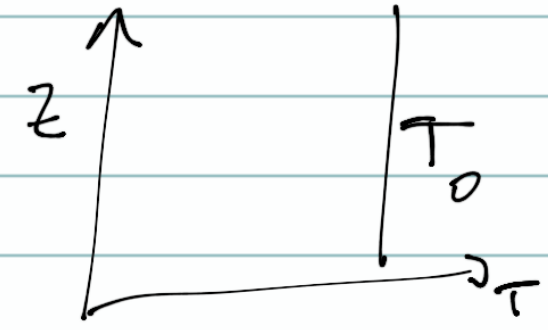


Melting starts - what happens to the water next? (3 mins)





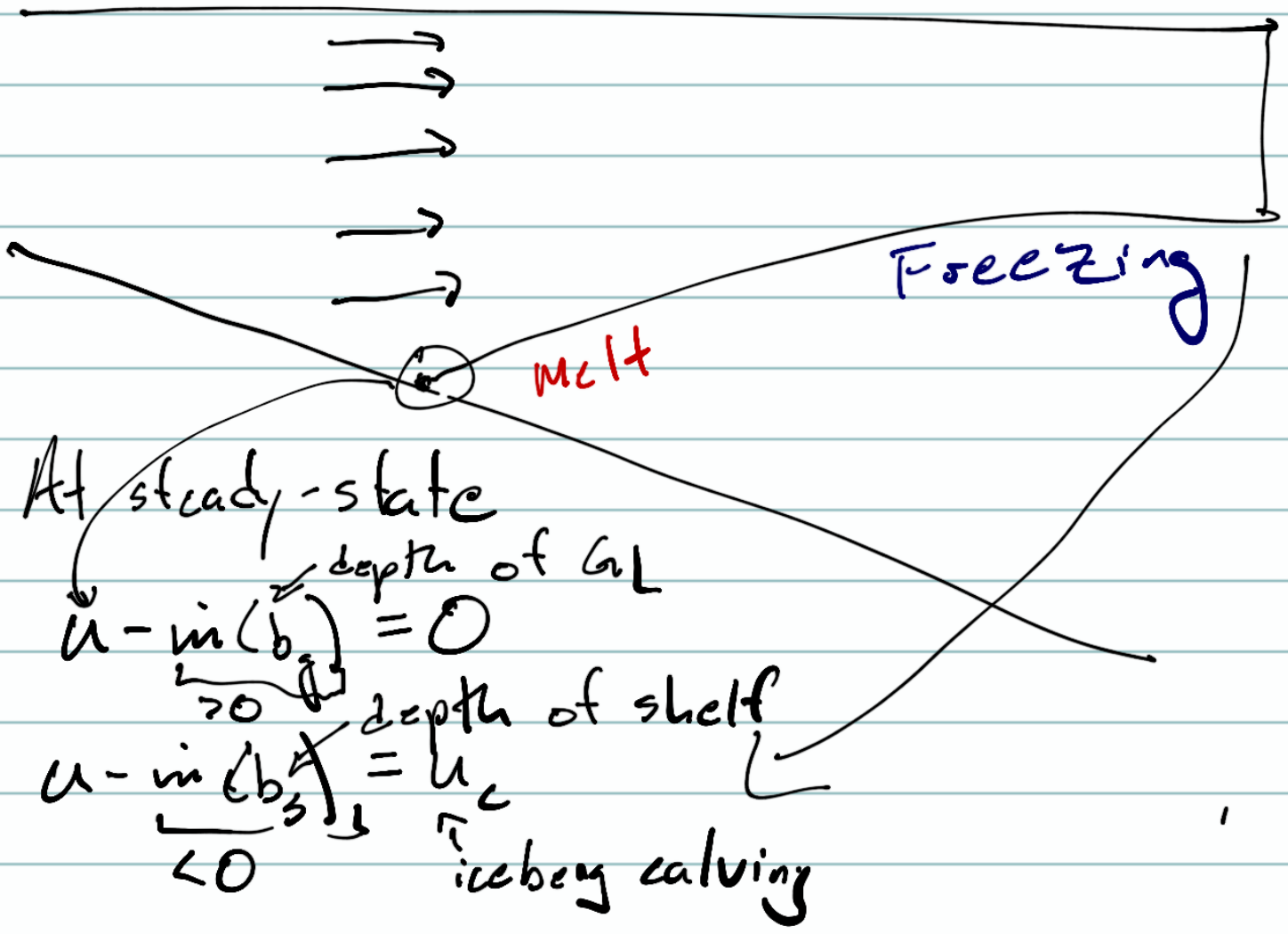
3 min - What is the final equilibrium?



Ans: All ice is at the surface

→ The ice pump lowers the overall energy of the system by moving all the ice to the state with the lowest potential energy (floating)

The steady state shape of an ice shelf given vertically uniform inflow of ice



At steady-state

$u - \dot{m}(b_g) = 0$ (depth of GL)

> 0

$u - \dot{m}(b_s) = u_c$ (depth of shelf)

< 0

↑ iceberg calving