**US420**

**Problem statement** - For this user story, we aimed to know, for a specific ship, how much the vessel sank with the cargo of the containers.

**Problem resolution** - To solve this problem, our group followed some steps to achieve the objective of the question. The development steps were:

* Calculation of ship pressure with and without load.
* Calculation of the height which the ship sank with the cargo of containers.

**Calculation of ship pressure**

To calculate the pressure, we took into account some values ​​of old problems, already solved, more precisely US418 and US419 to obtain the total mass of the ship of containers with and without cargo. In the example of the ship with cargo, an example was used in which the vessel only contains 2000 containers.

Regarding the calculations, we use the following formula to calculate the pressure:

**P =**  where,

P = pressure that the ship exerts on the sea water, measured in Pascals.

F = Ship's strength, which in the present case corresponds to the weight of the ship, which is given by the formula:

**p = m x g**

A = Ship area.

**Pressure for the ship without the cargo**

**p = m x g => (**7020 + 3861000 + 7020 + 39000) x 10 ⬄ p = 39140400 N

**A = c x l =>** 390 x 50 ⬄ A = 19500 m²

**P1 = =>** 39140400 / 19500 ⬄ P = 2007,2 Pa

**Pressure for the ship with the cargo**

**p = m x g => (**7020 + 3861000 + 7020 + 39000 + 500 + 500) x 10 ⬄ p = 40140400 N

**A = c x l =>** 390 x 50 ⬄ A = 19500 m²

**P2 = =>** 40140400 / 19500 ⬄ P = 2520,02 Pa

**Calculation of the height which the ship sank**

To calculate the height that our ship sank with the cargo, we had to take some points into consideration, such as:

density of sea water.= 1,03 x 10³ kg/m³

Draft = 15 m

After taking these values ​​into account, we apply the following formula (given by Stevin's

theorem):

**= d(liquid) x g x (h2 – h1)** where,

P2 and P1 are the previously calculated pressures.

d = density of sea water.

g = gravity acceleration.

h2 and h1 are equivalent to vessel heights pre and post loading of containers.

Given this,

2520,02 - 2007,2 = 1030 x 10 x (h2 – 15) => 30,64 = 10,3 x (h2 -15) ⬄ h2 = 15,05 m

To know for sure how many meters the vessel sank, we just calculated the height differences.

h2 – h1 => 15,05 – 15 => 0,05 m

**Conclusion**

Finally, after carrying out all the calculations, we can see that for our container ship, when we place 2000 containers it will sink 0,05 m.