**Q1 - Suggested solution**

Retention time 3.5min i.e. 210s. Water production 40 000 bbl/d \* 0.159m3/bbl / 24h/d = 265m3/h = 0.07361 m3/s

Water flow area (cross sectional area of separator for water), inner radius 1m, water level 0.8m

From the exercise given during the semester, the area up to level, *h*, for a vessel of inner diameter r is,

$$A\left(h\right)=r^{2}cos^{-1}\left(\frac{r-h}{r}\right)-\left(r-h\right)\sqrt{2hr-h^{2}}$$

$$A\_{water}=A\left(0.8\right)=1.17m^{2};r=1$$

Thus, the horizontal plug flow velocity for water is

Water plug flow velocity = $\frac{Water flow rate}{Water flow area}=\frac{0.0.07361m^{3}/s}{1.17m^{2}}=0.0627m/s$

Separator length, *L*, to weir plate:

$$L=u^{h}t^{s}=\frac{0.0627m}{s}∙210s=13.17m$$

L/D = 6.6

6.6 a bit high, it is often selected between 3 and 5. The diameter and water level should be increased.