3. Calculate the inlet concentration if the outlet concentration is 80 mg/l and the process removal efficiency is 60%

In
$$\frac{Xmg/l}{100mg/l}$$
 Process $\frac{80\text{mg/l}}{40\text{mg/l}}$ Out

Removal Efficiency = 60%

$$\frac{In}{Out}: \frac{Actual \ inlet \ (X)}{80} = \frac{100}{100-60} \Longrightarrow \frac{Actual \ inlet \ (X)}{80} = 2.5$$
Rearranging the equation: $Actual \ inlet(X) = 2.5*80 = \boxed{200mg/l}$

4. If a plant removes 35% of the influent BOD in the primary treatment and 85% of the remaining BOD in the secondary system, what is the BOD of the raw wastewater if the BOD of the final effluent is 20mg/l Solution:

Influent BOD
$$\xrightarrow{X \ mg/l}$$
 Primary $\xrightarrow{0.65X \ mg/l}$ Primary BOD Out Removal $Efficiency = 35\%$

Primary BOD Out
$$0.65X \ mg/l$$
 Secondary $0.65X \ mg/l$ Secondary $0.65X \ mg/l$ Secondary $0.65X \ mg/l$ Secondary Secondary BOD Out $0.65X \ mg/l$ Secondary $0.65X \ mg/l$ Secondary BOD Out $0.65X \ mg/l$ Secondary $0.$

For the Secondary process:
$$\frac{In}{Out}: \frac{0.65X}{20} = \frac{100}{15} \implies X \quad mg/l = \frac{100*20}{15*0.65} = \boxed{205 \quad mg/l}$$
Alternate Solution #1
$$\frac{\text{Influent BOD}}{X \frac{mg}{l}} \xrightarrow{Primary} \frac{\text{Primary Effluent BOD}}{X-0.35X=X*(1-0.35)=0.65X} \xrightarrow{Rg} \boxed{Secondary} \xrightarrow{Secondary} \frac{\text{Secondary Effluent BOD}}{0.65X-0.5525X=(0.65-0.5525)X=0.65X} \xrightarrow{U} = 0.0975X = 20 \implies X = \frac{20}{0.0975} = \boxed{205 \frac{mg}{l}}$$

Alternate Solution #2:

$$\frac{Influent BOD}{X \frac{mg}{l}} \xrightarrow{Primary} \frac{Primary Effluent BOD}{0.65X} \xrightarrow{Secondary} \frac{Secondary Effluent BOD}{(0.65*0.15)X}$$

$$\downarrow (0.35X)BOD Removed$$

$$\downarrow (0.65X*0.85)BOD Removed$$

Primary Effluent BOD = Influent BOD * (1-Primary BOD Removal), and Secondary Effluent BOD=[Primary Effluent BOD]*(1-Secondary BOD Removal)