1. You are setting up a laboratory experiment that requires 1 kg of seawater. Since you have no access to the real thing here in MSB, you need to prepare artificial seawater. Only include major ions ([C] > 1 mmol/kg). The following data is from table 1.4 of Emerson and Hedges for seawater with a salinity of 35:

Ion	**Concentration (mmol / kg)**
Na^+	469.09
Mg^{2+}	52.82
Ca^{2+}	10.28
K^+	10.21
Cl^-	545.86
SO_4^{2-}	28.34

You have the following salts on hand:

NaCl(s)
MgSO4(s)
$CaCl_2$(s)
KOH(s)
$Mg(OH)_2$(s)
HCl (we will assume this exists as a pure solid)

Assume all ions dissociate completely.

a. **How many grams of each solid will you measure out for a 1 kg solution?**

2. Sea level is known to vary significantly from glacial to interglacial episodes. Assume the modern global ocean is a big rectangular bathtub (i.e. no continental shelves) 3790 m deep. In a hypothetical glacial ocean, sea level is 100 m lower than it is today due to the expansion of continental glaciers and ice sheets. Assume that the average salinity in the modern ocean is 35 g kg^{-1} and the density of the modern ocean is 1.025 g ml^{-1}. Assume the amount of salts in the ocean remains the same.

a. **What is the *molar* concentration of K^+ in the modern ocean?**
b. **Calculate the salt content of the modern and glacial ocean in grams of salt per liter of solution.**

3. There has been a mercury spill into a stream which drains into an urban lake. The contaminated stream is the only waterway draining into the lake and it has a volume flux of 50 m^3/s. The concentration of mercury in the stream during the spill is 10 µmol/L and the spill duration is 5 days after which the mercury concentration in the stream abruptly falls to 1 µmol

/L and remains constant. The initial concentration of mercury in the lake is negligible. The lake has a surface area of 1 km^2 and an average depth of 30 m.

a. **Find the residence time of water in the lake in days with respect to stream inflow.**
b. **What is the concentration of mercury in the lake after 5 days?**
c. **What is the concentration of mercury in the lake 10 days after the start of the spill?**
d. **Plot the mercury concentration over time (from 0 to 20 days) in the lake, highlighting the concentration at 5 and 10 days after the spill.**

Note: for all plots / figures generated in this class (and in life) make sure to label axes, include a title, a legend if necessary, etc. Someone who doesn't know what you are plotting should be able to look at your figure and understand the salient information.