13. An oil spill, with the appearance of black to dark brown, is sighted by a commercial airliner flying over the Great Barrier Reef. The spill is estimated to be 1.5 kilometers long and 50 meters wide. How much oil (in liters) would there be in the spill? (Remember that to produce a black to dark brown color, the oil would have to be at least 100 microns thick.)

You are asked for the volume of oil (in liters).

Volumes are 3-dimensional: \( \text{Volume (V)} = \text{Length (L)} \times \text{Width (W)} \times \text{Height (H)} \)

Here, the Length and Width are given, and the Height is the thickness of the oil.

Convert L, W, and H to meters (so you can multiply them all together to get cubic meters, \( \text{m}^3 \)).

One kilometer = 1000 meters \( \text{(Use this to convert L from km to m)} \)

One micron = 1 micrometer = 1 \( \times \) \( 10^{-6} \) meters = 0.000001 meter \( \text{(Use this to convert H from microns to meters)} \)

Now multiply: \( V = L \times W \times H \)

Now convert to liters – Per the table on page 4 of the lab handout, 1 cubic meter is 1000 liters. \( \text{(Use this to convert V from m}^3 \text{ to liters)} \)

\( \text{Hint: Your final answer should be 7500 liters.} \)

14. A Coastwatch surveillance aircraft photographs a ship trailing a silvery oil discharge from its stern. The discharge is 13.5 nautical miles and at least the width of the vessel which is 37.5 meters. An oil spill on the water that gives a silvery sheen is approximately 1 micron in thickness. How much oil (in liters) has the ship discharged into the sea?

Do the same thing as in Q#13 above, with one additional conversion step:

Per lab page 4: Nautical miles \( \times \) 1.852 = metric conversion from nautical miles to kilometers

\( \text{Hint: Your final answer should be a little less than 1000 liters.} \)

15. A fishing boat reports an oil spill near a ship to the local maritime authority. The ship is radioed and asked whether oil was being discharged from its vessel. The captain reports that the ship has discharged only 10 liters of heavy fuel waste oil during a bilge pump-out which is mixed with 100 tonnes of sea water. Has the ship exceeded the legal limit of oil discharge of 15 parts per million (15 parts of oil to 1 million parts of water)? Assume oil and sea water have the same density for the calculation (but see the tables in the lab background for closer estimates).

Try this one on your own. You’ll need to know (lab page 4) that 1 metric tonne of water = 1000 liters of water. Also, 15 ppm = 15 parts oil to 1,000,000 parts water. Likewise, a concentration of 1 ppm equals 1 liter oil in 1,000,000 liters seawater.

\( \text{Hint: Your final answer should be YES – The concentration you calculate should vastly exceed the legal limit of 15 ppm.} \)