1. For your school field trip, you take a diesel-powered school bus to a local museum. You and your friends travel 12 km in order to reach your destination. Calculate (one way only):

   **Known:** Fuel consumption for a diesel school bus = 0.22 L/km, distance = 12 km, energy content of diesel fuel = 38.3 MJ/L, N\textsubscript{2}O emitted by diesel fuel = 2.2 \times 10^{-4} \text{ kg/L}

   a. The total amount of fuel consumed (in litres)
      \[
      \text{Total fuel} = \text{Fuel consumption} \times \text{distance travelled} = 0.22 \text{ L/km} \times 12 \text{ km} = 2.64 \text{ L}
      \]

   b. The total amount of energy used (in MJ)
      \[
      \text{Total energy} = \text{Litres of fuel} \times \text{energy content for fuel} = 2.64 \text{ L} \times 38.3 \text{ MJ/L} \\
      = 101.11 \text{ MJ}
      \]

   c. The total amount of N\textsubscript{2}O (nitrous oxide) emitted by the bus (in kg and g)
      \[
      \text{Total N\textsubscript{2}O} = \text{Litres of fuel} \times N\textsubscript{2}O \text{ emission value for diesel} = 2.64 \text{ L} \times 0.00022 \text{ kg/L} \\
      = 5.81 \times 10^{-4} \text{ kg} = 0.581 \text{ g}
      \]

2. You and your family take a cruise on a long-distance ferryboat from North Sydney, NS to Port aux Basques, NL, a 178 km round trip. Including you, there were 225 people on board. Calculate (round trip):

   **Known:** Fuel consumption for a long-distance ferry = 43.97 L/km, distance = 178 km, energy content of heavy fuel oil = 42.5 MJ/L, CO\textsubscript{2} emitted by heavy fuel oil = 3.12 kg/L

   a. The fuel consumed per person (in litres)
      \[
      \text{Fuel per person} = (\text{Fuel consumption} \times \text{distance travelled})/\text{number of people} = (43.97 \text{ L/km} \times 178 \text{ km})/225 = 7826.66 \text{ L}/225 \text{ people} = 34.78 \text{ L/person}
      \]

   b. The energy used per person (in MJ)
      \[
      \text{Energy per person} = \text{Litres of fuel per person} \times \text{energy content for fuel} = 34.78 \text{ L} \times 42.5 \text{ MJ/L} = 1478.15 \text{ MJ/person}
      \]

   c. The CO\textsubscript{2} (carbon dioxide) emitted per person (in kg)
      \[
      \text{CO\textsubscript{2} per person} = \text{Litres of fuel per person} \times \text{CO\textsubscript{2} emission value for heavy fuel oil} = 34.78 \text{ L} \times 3.12 \text{ kg/L} = 108.51 \text{ kg/person}
      \]
3. You, your dad and two friends take your family’s SUV to go to and from a hockey game, a one-way distance of 6.5 km. On the way, your dad stops at the gas station and puts in some gasoline.

*Calculate (round trip):*

**Known:** Fuel consumption for an SUV using gasoline = 0.12 L/km, distance =13 km, energy content of gasoline = 35 MJ/L, CO\(_2\) emitted by gasoline = 2.29 kg/L, CH\(_4\) emitted by gasoline = 1.4 \times 10^{-4} \text{ kg/L}

a. The fuel consumed **per person** (in litres)

\[
\text{Fuel per person} = \frac{\text{Fuel consumption} \times \text{distance travelled}}{\text{number of people}} = \frac{0.12 \text{ L/km} \times 13 \text{ km}}{4 \text{ people}} = 0.39 \text{ L/person}
\]

b. The energy used **per person** (in MJ)

\[
\text{Energy per person} = \text{Litres of fuel per person} \times \text{energy content for fuel} = 0.39 \text{ L} \times 35 \text{ MJ/L} = 13.65 \text{ MJ/person}
\]

c. The CO\(_2\) (carbon dioxide) emitted **per person** (in kg)

\[
\text{CO}_2 \text{ per person} = \text{Litres of fuel per person} \times \text{CO}_2 \text{ emission value for gasoline} = 0.39 \text{ L} \times 2.29 \text{ kg/L} = 0.89 \text{ kg/person}
\]

d. The CH\(_4\) (methane) emitted **per person** (in kg)

\[
\text{CH}_4 \text{ per person} = \text{Litres of fuel per person} \times \text{CO}_2 \text{ emission value for gasoline} = 0.39 \text{ L} \times 0.00014 \text{ kg/L} = 5.46 \times 10^{-5} \text{ kg/person}
\]

4. While in Montréal, you hop aboard the Métro to go and visit a friend. Your stop is 9 km from where you start. There are six cars on your train and you can see 35 people in your car (assume same number of people in each train car).

*Calculate (one way only):*

**Known:** Fuel consumption (litre equivalent) for a subway = 0.38 L\text{e}/km, distance = 9 km, energy content of gasoline = 35 MJ/L, CO\(_2\) emitted by electric vehicle = 0 kg/L, CH\(_4\) emitted by electric vehicle = 0 kg/L, N\(_2\)O emitted by electric vehicle = 0 kg/L, six cars with 35 people on each car (210 people total)

a. The energy used by the train **per person** (in MJ)

\[
\text{Fuel equivalent per person} = \frac{\text{Fuel equivalent} \times \text{distance travelled}}{\text{number of people}} = \frac{0.38 \text{ L\text{e}/km} \times 9 \text{ km}}{210} = 0.016 \text{ L\text{e}/person}, \text{energy per person} = \text{L\text{e} per person} \times \text{energy content for gasoline} = 0.016 \text{ L} \times 35 \text{ MJ/L} = 0.67 \text{ MJ/person}
\]

b. The amount of CO\(_2\) emitted **per person** (in kg)

\[
\text{The amount of CO}_2 \text{ emitted per person} = 0 \text{ kg/L}
\]

c. The amount of CH\(_4\) emitted **per person** (in kg)

\[
\text{The amount of CH}_4 \text{ emitted per person} = 0 \text{ kg/L}
\]

d. The amount of N\(_2\)O emitted **per person** (in kg)

\[
\text{The amount of N}_2\text{O emitted per person} = 0 \text{ kg/L}
\]