1. A particular brand of gasohol contains 10% (v/v) ethanol. (MW = 46, d = 0.789)
   a. What is the % (w/v) of ethanol?
   b. What is the molarity of ethanol?

2. a. How would you make a 10% solution of sodium formate? (NaCOOH, MW= 68)
   b. What is the molarity of the solution?

3. a. How would you make a 25 mM solution of propionic acid (H\textsubscript{3}CCH\textsubscript{2}COOH, MW = 74.08, d = 0.99)?
   b. What would the %(w/v) and %(v/v) be?

4. a. How would you make one liter of a 12% NaCl solution? (MW = 58.44)
   b. What would the molarity of the solution be?

5. Eighteen grams of soil was added to 30 ml of water. After mixing, the suspension was serially diluted and used to inoculate spread plates. The inocula from the three highest dilutions, 10\textsuperscript{-4}, 10\textsuperscript{-5}, and 10\textsuperscript{-6}, produced 272, 33, and 2 colonies, respectively.
   a. What is the total dilution? The dilution factor?
   b. What was the bacterial concentration in the soil?

6. Twenty grams of soil was added to 50 ml of water. After mixing, the suspension was serially diluted and used to inoculate spread plates. The inocula from the three highest dilutions, 10\textsuperscript{-4}, 10\textsuperscript{-5}, and 10\textsuperscript{-6}, produced 210, 31, and 2 colonies, respectively. What was the bacterial concentration in the soil?

7. A disinfectant was tested by adding it to a culture of \textit{Pseudomonas aeruginosa}. After one minute of exposure, the culture was neutralized, serially diluted, and used to inoculate pour plates. The plates inoculated with aliquots from the 10\textsuperscript{-2}, 10\textsuperscript{-3}, 10\textsuperscript{-4}, and 10\textsuperscript{-5} dilutions had 626, 289, 41, and 2 colonies, respectively. What was the concentration of viable cells in the stock culture?

8. Twenty five grams of soil were added to100 ml sterile saline and thoroughly mixed. The following dilution series was performed, starting with the soil suspension: 1/4, 1/5, and 1/6. A spread plate inoculated from the 1/6 dilution produced 70 colonies.
   a. What was the total dilution? The dilution factor?
   b. What was the concentration of viable bacteria in the soil?
1. A particular brand of gasohol contains 10% (v/v) ethanol. (MW = 46, d = 0.789)
   a. What is the % (w/v) of ethanol?
   b. What is the molarity of ethanol?
      a. Convert 10 ml ethanol/100 ml volume to g/100 ml volume by multiplying by the density.
         So, 10 ml ethanol = 7.89 g ethanol. 7.89 g ethanol/ 100 ml = 7.89% (w/v).
      b. 7.89 g ethanol/100 ml = 78.9 g/L; (78.9g/L)/46 g/mol) = 1.71 mol/L

2. a. How would you make a 10% solution of sodium formate? (NaCOOH, MW= 68)
   b. What is the molarity of the solution?
      a. Add 10 g sodium formate for a final volume of 100 ml.  (This would be a 10% (w/v)
         solution.)
      b. (100g/L)/(68 g/mol) = 1.47 mol/L

3. a. How would you make a 25 mM solution of propionic acid (H₃CCH₂COOH, MW = 74.08, d = 0.99)?
   b. What would the %(w/v) and %(v/v) be?
      a. (2.5 x 10⁻² mol/L)(74.08 g/mol) = 1.85 g/L
      b. (1.85 g)/(0.99g/ml) = 1.87 ml; so, to make a 25 mM solution, add 1.87 ml water for a
         final volume of 1L. This is equivalent to 0.185%(w/v) or 0.187%(v/v).

4. a. How would you make one liter of a 12% NaCl solution? (MW = 58.44)
   b. What would the molarity of the solution be?
      a. Dissolve 120 g NaCl in water, bring volume to 1 L
      b. (120g/L)/(58.44 g/mol) = 2.05 mol/L

5. Eighteen grams of soil was added to 30 ml of water. After mixing, the suspension was
   serially diluted and used to inoculate spread plates. The inocula from the three highest
dilutions, 10⁻⁴, 10⁻⁵, and 10⁻⁶, produced 272, 33, and 2 colonies, respectively.
   a. What is the total dilution? The dilution factor?
      D₁ = (18g/48ml) x 10⁻⁴ = 3.75 x 10⁻⁷ g/ml and DF = 2.7 x 10⁵ ml/g for 272 colonies
      D₂ = (18g/48ml) x 10⁻⁵ = 3.75 x 10⁻⁷ and DF = 2.7 x 10⁶ ml/g for 33 colonies
   b. What was the bacterial concentration in the soil?
      C = (P/V) x DF
      C = (272 cfu/0.1 ml) x (2.7 x 10⁴ ml/g) = 7.3 x 10⁸ cfu/g ; C = (33 cfu/0.1 ml) x (2.7 x
      10⁶ ml/g) = 8.9 x 10⁸ cfu/g ((7.3 x 10⁸ cfu/g) + (8.9 x 10⁸ cfu/g))/2 = 8.1 x 10⁸ cfu/g

6. Twenty grams of soil was added to 50 ml of water. After mixing, the suspension was serially
diluted and used to inoculate spread plates. The inocula from the three highest dilutions, 10⁻⁴,
10⁻⁵, and 10⁻⁶, produced 210, 31, and 2 colonies, respectively. What was the bacterial
concentration in the soil?

First, select appropriate plates (between 30 and 300 colonies). Then, use the equation \( C = \frac{p}{V} \cdot DF \) to calculate the initial concentration. (For a spread plate, a plausible volume to plate is 0.1 ml.)

So, \( C = \frac{210 \text{ cfu}}{0.1 \text{ ml}} \cdot (10^4 \cdot 70/20 \text{ ml/g}) = 7.35 \times 10^7 \text{ cfu/g} \)
and \( C = \frac{31 \text{ cfu}}{0.1 \text{ ml}} \cdot (10^5 \cdot 70/20 \text{ ml/g}) = 1.09 \times 10^9 \text{ cfu/g} \)

Taking the average from the two plates, \( C = 9.1 \times 10^7 \text{ cfu/g} \)

7. A disinfectant was tested by adding it to a culture of *Pseudomonas aeruginosa*. After one minute of exposure, the culture was neutralized, serially diluted, and used to inoculate pour plates. The plates inoculated with aliquots from the \( 10^{-2}, 10^{-3}, 10^{-4}, \) and \( 10^{-5} \) dilutions had 626, 289, 41, and 2 colonies, respectively. What was the concentration of viable cells in the stock culture?

\[
C = \frac{P}{V} \cdot (DF) = \frac{289 \text{ cfu}}{1 \text{ ml}} (10^3) = 2.89 \times 10^5 \text{ cfu/ml}
\]
\[
C = \frac{41 \text{ cfu}}{1 \text{ ml}} (10^4) = 4.1 \times 10^5 \text{ cfu/ml}
\]
The average of the two calculations is \( 3.5 \times 10^5 \text{ cfu/ml} \)

8. Twenty five grams of soil were added to 100 ml sterile saline and thoroughly mixed. The following dilution series was performed, starting with the soil suspension: 1/4, 1/5, and 1/6. A spread plate inoculated from the 1/6 dilution produced 70 colonies.

   a. What was the total dilution? The dilution factor?
   \[
   D_t = \frac{25 \text{ g}}{125 \text{ ml}} \times \frac{1}{4} \times \frac{1}{5} \times \frac{1}{6} = \frac{1}{600} ; DF = 600
   \]

   b. What was the concentration of viable bacteria in the soil?
   \[
   C = \frac{P}{V} \times DF = \frac{70 \text{ cfu}}{0.1 \text{ ml}} \times 600 = 4.2 \times 10^5 \text{ cfu/g}
   \]