

SOLUTIONS TO THE PROBLEMS

① a) The molar mass is:

$$M = 23 + 35.5 = 58.5 \text{ g/mol}$$

The number of moles of solute:

$$n = 50 \text{ g NaCl} \frac{1 \text{ mol NaCl}}{58.5 \text{ g}} = \boxed{0.855 \text{ moles of NaCl}}$$

b) Density (d):

$$d = \frac{\text{mass solution}}{\text{volume solution}} = \frac{840 \text{ g}}{0.810 \text{ L}} = \boxed{1037 \frac{\text{g}}{\text{L}}}$$

c)

$$c \text{ (g/L)} = \frac{50 \text{ g NaCl}}{0.810 \text{ L}} = \boxed{61.73 \frac{\text{g NaCl}}{\text{L}}}$$

$$c \text{ (M)} = \frac{0.855 \text{ mol NaCl}}{0.810 \text{ L}} = \boxed{1.056 \text{ M}}$$

$$c \text{ (\%)} = \frac{50 \text{ g NaCl}}{840 \text{ g solution}} \times 100 = \boxed{5.95 \%}$$

② a) Mass of the solute:

$$m = 0.8 \text{ L solution} \frac{1040 \text{ g solution}}{1 \text{ L solution}} \frac{20 \text{ g HNO}_3}{100 \text{ g solution}} =$$
$$= \boxed{166.4 \text{ g HNO}_3}$$

b) Number of moles of HNO₃ in the solution:

$$n = 166.4 \text{ g HNO}_3 \frac{1 \text{ mol HNO}_3}{63 \text{ g HNO}_3} = \boxed{2.64 \text{ mol HNO}_3}$$

Molar mass:

$$M = 1 + 14 + (3 \times 16) = 63 \text{ g/mol}$$

c)

$$c \text{ (g/L)} = \frac{166.4 \text{ g HNO}_3}{0.8 \text{ L solution}} = \boxed{208 \frac{\text{g HNO}_3}{\text{L}}}$$

$$c \text{ (mol/L)} = \frac{2.64 \text{ mol HNO}_3}{0.8 \text{ L solution}} = \boxed{3.3 \text{ M}}$$