HC - Molality and Mole Fraction Problems

**Round final answers to the proper number of significant figures.
**Round atomic masses to the nearest hundredth when calculating molar masses.

1) A solution is made by dissolving 56.7 g sodium chlorate (solute) in 897 g water (solvent). What is the concentration of the solution in:
   a) percent by mass
   b) molality
   c) mole fraction of sodium chlorate

$56.7 + 897 = 953.7$ g solution

$897\text{ g } H_2O\left(\frac{1\text{ mol}}{18.02\text{ g}}\right) = 49.778$ mol H_2O

$NaClO_3$
Na $1 \times 22.99 = 22.99$
Cl $1 \times 35.45 = 35.45$
O $3 \times 16.00 = 48$
106.44 g/mol

$56.7\text{ g } NaClO_3\left(\frac{1\text{ mol}}{106.44\text{ g}}\right) = .532694$ mol $NaClO_3$

a) $\frac{\text{mass solute}}{\text{mass solution}} \times 100$

$\frac{56.7\text{ g } NaClO_3}{953.7\text{ g solution}} \times 100$

5.95% $NaClO_3$

b) $m = \frac{\text{mole solute}}{\text{kg solvent}}$

$\frac{.532694\text{ mol}}{.897\text{ kg } H_2O}$

.594 m $NaClO_3$

X_{NaClO_3} / Total moles

$\frac{.532694\text{ mol}}{(49.778 + .532694)}$

.0106

2) What is the molality of a solution made by dissolving 20.0 g sliver nitrate in 225 g water?

$m = \frac{\text{mole solute}}{\text{kg solvent}}$

don't have these units in problem

get the right units! $AgNO_3$

$20.0\text{ g } AgNO_3\left(\frac{1\text{ mol}}{169.88\text{ g}}\right) = .11773$ mol $AgNO_3$

Ag $1 \times 107.87 = 107.87$
N $1 \times 14.01 = 14.01$
O $3 \times 16 = 48$
169.88 g/mol

$225\text{ g } H_2O\left(\frac{1\text{ kg}}{1000\text{ g}}\right) = .225\text{ kg } H_2O$

$m = \frac{.11773\text{ mol}}{.225\text{ kg}} = .523\text{ m } AgNO_3$

3) What volume, in liters, of a 2.00 M KCl solution contains 2.5 g of KCl?

M = Molarity (mol/L)

$2.00\text{ M} = \frac{.033535\text{ mol}}{x\text{ L}}$

$x = .016767$

.017 L

* need to convert g KCl → mol KCl

K $1(39.10) = 39.10$
Cl $1(35.45) = 35.45$
74.55 g/mol

$2.5\text{ g KCl}\left(\frac{1\text{ mol}}{74.55\text{ g}}\right) = .033535$ mol

4) A solution of ethanol, C_2H_6O, is prepared by dissolving 14.0 g C_2H_6O in 100.0 g water.
   a) What is the molality of the solution?
   b) What is the % (m/m) concentration of the solution?

114.0 g solution

C $2(12.01) = 24.02$
H $6(1.01) = 6.06$
O $1(16.00) = 16.00$
46.08 g/mol

$14.0\text{ g}\left(\frac{1\text{ mol}}{46.08\text{ g}}\right) = .30382$ mol

a) $m = \frac{\text{mole solute}}{\text{kg solvent}}$

$m = \frac{.30382\text{ mol } C_2H_6O}{.100\text{ kg } H_2O}$

3.04 m C_2H_6O

b) $\frac{\text{mass solute}}{\text{mass solution}} \times 100$

$\frac{14.0\text{ g } C_2H_6O}{114.0\text{ g solution}} \times 100 =$ 12.3%

5) A solution is made by dissolving 65.0 g NaCl, 45.5 g KOH in 74.6 g H_2O. What is the mole fraction of NaCl in the solution?

NaCl
$22.99 + 35.45 = 58.44$ g/mol

$65.0\text{ g NaCl}\left(\frac{1\text{ mol}}{58.44\text{ g}}\right) = 1.1123$ mol NaCl

KOH
$39.10 + 16.00 + 1.01 = 56.11$ g/mol

$45.5\text{ g KOH}\left(\frac{1\text{ mol}}{56.11\text{ g}}\right) =$

.811052 mol KOH

$74.6\text{ g } H_2O\left(\frac{1\text{ mol}}{18.02\text{ g}}\right) = 4.1398$ mol H_2O

$\frac{1.1123\text{ mol NaCl}}{(1.1123 + .811052 + 4.138)}$

$\frac{1.1123\text{ mol}}{6.063152\text{ total}} =$ .183