

## Problems of Aqueous solutions

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- 1) An aqueous solution is prepared by mixing 60 g of sodium chloride with 391 g of water. Determine the percent composition by mass of the solution.
  
- 2) A 278 g solution is 9.71 % in ammonia. Calculate:
  - a) The mass of solute in grams. b) The mass of solvent in grams.
  
- 3) A 294 mL of aqueous solution of sugar 11.75 % has a density of 1.071 g/mL. Find out:
  - a) Grams of sugar, water, and solution. b) Concentration in g/L.
  
- 4) A solution is prepared by mixing 71 g of sodium hydroxide with 413 g of water to yield a solution with a density of 1.163 g/mL. Calculate:
  - a) Volume of solution and its percent composition by mass. b) Concentration in g/L.
  
- 5) We want prepare a solution by mixing 29 g of sodium hydroxide with water. If the percent composition by mass of the solution must be 16.2 %, determine:
  - a) Grams of solvent needed. b) Grams of solution obtained.
  
- 6) We have 420 mL of an aqueous solution of sodium chloride with a concentration of 192.86 g/L and a density of 1.108 g/mL. Find out:
  - a) Grams of sodium chloride. b) Percent composition by mass of the solution.
  
- 7) A solution is prepared by mixing 890.57 g of sodium hydroxide with 1808.1 g of water. Determine the molarity and the mole fraction of solute in the resulting solution.  
*Atomic masses (g/mol): Na=23 O=16 H=1*
  
- 8) We make a solution by mixing 17 g of ammonia with 266.33 g of water. The resulting solution has a density of 0.977 g/mL. Find out its concentration in molarity, molality and mass percent.  
*Atomic masses (g/mol): N=14 H=1 O=16*
  
- 9) 205 mL of an aqueous solution is 38 % in sulfuric acid and has a density of 1.285 g/mL. Determine: Grams of solute and solvent, molarity and molality.  
*Atomic masses (g/mol): H=1 S=32 O=16*
  
- 10) We mix 184.54 g of potassium hydroxide with water to obtain 330 mL of a solution with a density of 1.398 g/mL. Calculate the grams of solvent, molarity, mass percent and mole fraction of solute.  
*Atomic masses (g/mol): K=39.1 O=16 H=1*
  
- 11) We dissolve 417.95 g of 80.4 % aluminium hydroxide in water to obtain 540 mL of solution. Find out its molar concentration.  
*Atomic masses (g/mol): Al=27 O=16 H=1*

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**12)** We mix 200.71 g of impure hydrochloric acid in water to obtain 485 mL of solution. If the molarity of the resulting solution is 6.68 mol/L, determine the mass percent of pure hydrochloric acid in the initial solute (not in the resulting solution).

*Atomic masses (g/mol):* H=1 Cl=35.5 O=16

**13)** We want make 395 mL of phosphorous acid 7.18 mol/L solution. If the mass percent of pure phosphorous acid in the solute is 26.1 %, calculate the grams of impure solute needed.

*Atomic masses (g/mol):* H=1 P=31 O=16

**14)** We want make 363 mL of phosphoric acid 0.71 M solution diluting an aqueous solution of phosphoric acid 36 %. Calculate the grams of initial solution required.

*Atomic masses (g/mol):* H=1 P=31 O=16

**15)** Calculate the volume of a solution of phosphoric acid 42 % and density 1.685 g/mL needed to make 140 mL of solution 1.02 M.

*Atomic masses (g/mol):* H=1 P=31 O=16

**16)** Determine the volume of solution of hydrochloric acid 20.52 M needed to form 206 mL of solution 2.5 M.

*Atomic masses (g/mol):* H=1 Cl=35.5 O=16

**17)** We have an aqueous solution of phosphoric acid 33 % with a density of 1.82 g/mL. Find out the volume of this solution to make 1039.69 g of solution 4.4 % in phosphoric acid.

**18)** We have 21.3 mL of an aqueous solution of hydrochloric acid 47 %. The density of the solution is 1.72 g/mL. If the solution dilutes it to 152 mL, calculate its molarity.

*Atomic masses (g/mol):* H=1 Cl=35.5 O=16

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**Answers:**

- 1) 13.3 %
- 2) a) 27 g b) 251 g
- 3) a) 37 g 278 g 315 g b) 125.85 g/L
- 4) a) 416 mL 14.67 % b) 170.67 g/L
- 5) a) 150 g b) 179 g
- 6) a) 81 g b) 17.38 %
- 7) 12.31 mol/kg 0.181
- 8) 3.45 mol/L 3.75 mol/kg 6 %
- 9) 100.1 g 163.33 g 4.98 mol/L 6.25 mol/kg
- 10) 276.8 g 9.97 mol/L 40 % 0.176
- 11) 7.98 mol/L
- 12) 58.9 %
- 13) 890.8 g
- 14) 69.77 g
- 15) 19.7 mL
- 16) 25.1 mL
- 17) 76.2 mL
- 18) 3.1 M