CALCULATIONS RELATED TO SOLUTION COMPOSITION

KA1 type exercises (answers with four significant figures)

- Calculate the mass percent of the potassium dichromate (KMnO₄) solution with four significant figures, if 1.752 g of KMnO₄ were dissolved in 45.35 g water. M_r(KMnO₄)=158.03; M_r(H2O)=18.02 Answer: 3.720 m/m%
- Calculate the mass/volume percent of the aqueous solution of 3.567 g potassium hydroxide (KOH) in a 250 cm³ volumetric flask. *M_r*(KOH)=56.11; *M_r*(H₂O)=18.02 Answer: 1.427 m/V%
- Calculate the mass concentration of the aqueous solution of 3.679 g potassium nitrate (KNO₃) in a 100 cm³ volumetric flask. *M_r*(KNO₃)=101.10; *M_r*(H₂O)=18.02 Answer: 36.79 g/dm³
- Calculate the volume percent of the aqueous solution of 32.97 cm³ isopropanol ((CH₃)₂CHOH) in a 500 cm³ volumetric flask. *M_r*((CH₃)₂CHOH)=60.10; *M_r*(H₂O)=18.02 Answer: 6.594 V/V%
- Calculate the molar concentration of the aqueous solution of 1.056 mol acetic acid (CH₃COOH) in a 250 cm³ volumetric flask. *M_r*(CH₃COOH)=60.05; *M_r*(H₂O)=18.02 Answer: 4.224 mol/dm³
- 6. Calculate the mole fraction of the solution prepared by mixing 0.4253 mol diethylamine and 7.359 mol water. $M_r((C_2H_5)_2NH)=73.16; M_r(H_2O)=18.02$ Answer: 0.05464
- 7. Calculate the molality of the solution prepared by mixing 0.1379 mol formal dehyde and 349.6 g water. M_r (HCHO)=30.03; M_r (H₂O)=18.02 Answer: 0.3945 mol/kg
- Calculate the solubility of magnesium sulfite in water if 213.7 g of saturated solution contains 1.1112 g magnesium sulfite. *M_r*(MgSO₃)=104.36; *M_r*(H₂O)=18.02 Answer: 0.5227 g/100 g solvent

KA2 type exercises (answers with four significant figures)

- Calculate the mass of sodium chloride (NaCl) required to prepare 235.0 g solution with 12.54 mass percent NaCl. M_r(NaCl)=58.44; M_r(H₂O)=18,02 Answer: 29.47 g
- Calculate the mass of potassium chloride (KCl) required to prepare 85.55 cm³ solution with 8.340 mass per volume percent. *M_r*(KCl)=74.55; *M_r*(H₂O)=18.02 Answer: 7.135 g
- Calculate the mass of barium chloride (BaCl₂) required to prepare 520,0 cm³ solution with 5.123 g/dm³ mass concentration. *M_r*(BaCl₂)=208.24; *M_r*(H₂O)=18.02 Answer: 2.664 g
- 4. Calculate the volume of diethyl ether ((C_2H_5)₂O) required to prepare 172.5 cm³ solution with 41.23 volume percent. $M_r((C_2H_5)_2O)=74.14; M_r(H_2O)=18.02$ Answer: 71.12 cm³
- 5. Calculate the number of moles of potassium dichromate ($K_2Cr_2O_7$) required to prepare 352.0 cm³ solution with 0.2154 mol/dm³ molar concentration. $M_r(K_2Cr_2O_7)=294.20$; $M_r(H_2O)=18.02$ Answer: 0.07582 mol
- Calculate the number of moles of ethanol (C₂H₅OH) required to prepare 1.568 mol solution, there the mole fraction of ethanol is 0.3741. *M_r*(C₂H₅OH)=46.08; *M_r*(H₂O)=18.02 Answer: 0.5866 mol
- Calculate how much cobaltous sulfate (CoSO₄) can be dissolved in 156.0 g water, if its solubility is 38.31 g/100 g water. M_r(CoSO₄)=154.99; M_r(H₂O)=18.02 Answer: 59.76 g
- Calculate the number of moles of urea ((NH₂)₂CO) required to be dissolved in 793.0 g water, if the molality of the solution to be prepared is 0.3257 mol/kg. *M_r*((NH₂)₂CO)=60.13; *M_r*(H₂O)=18.02 Answer: 0.2583 mol

- 1. Calculate how much calcium chloride solution with 11.42 mass percent can be prepared from 15.86 g calcium chloride. M_r (CaCl₂)=110.98; M_r (H₂O)=18.02 Answer: 138.9 g
- Calculate how much potassium bromide (KBr) solution of 5.364 mass per volume percent can be prepared from 6.928 g potassium bromide. M_r(KBr)=119.00; M_r(H₂O)=18.02 Answer: 129.2 cm³
- 3. Calculate the mass of HCl solution with 25.43 g/dm³ mass concentration to be prepared from 46.36 g HCl gas. M_r (HCl)=36.46; M_r (H₂O)=18.02 Answer: 1.823 dm³
- Calculate the volume of aqueous acetone ((CH₃)₂CO) solution with 12.58 volume percent acetone to be prepared from 45.00 cm³ pure acetone. M_r((CH₃)₂CO)=58.09; M_r(H₂O)=18.02 Answer: 357.7 cm³
- Calculate how much sodium hydroxide (NaOH) solution of 0.1547 mol/dm³ molarity can be prepared from 0,8965 mol NaOH. M_r(NaOH)=40.00; M_r(H₂O)=18.02 Answer: 5.795 dm³
- 6. Calculate how much glucose solution of 0.1542 mole fraction can be prepared from 0.4379 mol glucose ($C_6H_{12}O_6$). $M_r(C_6H_{12}O_6)=180.16; M_r(H_2O)=18.02$ Answer: 2.840 mol
- 7. Calculate the mass of water required to prepare saturated barium hydroxide solution from 1.237 g barium hydroxide (Ba(OH)₂), if its solubility in water is 4.913 g/100 g water. M_r (Ba(OH)₂)=171.36; M_r (H₂O)=18.02 Answer: 25.18 g
- Calculate the mass of water needed to obtain ethyl acetate solution with 0.3698 mol/kg molality by dissolving 0.6972 mol ethyl acetate (CH₃COOC₂H₅). *M_r*(C₃H₈O₂)=76.11; *M_r*(H₂O)=18.02 Answer: 1885 g

Entrance questions (You determine the appropriate significant figures)

- 1. Calculate the mass of NaCl required to prepare 250 cm^3 NaCl solution with 0.250 mol/dm³ molarity. M_r (NaCl) = 58.5 Answer: 3.66 g
- 2. Calculate the mass of Mohr salt $(Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O)$ required to prepare 500 cm³ solution containing Fe²⁺ with 0.125 mol/dm³ molarity. M_r (Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O) = 392.18 Answer: 24.5 g
- 3. Calculate the mass of $BaCl_2 \cdot 2H_2O$ required to prepare 350 kg barium chloride solution of 15.0 w%. $M_r(BaCl_2 \cdot 2H_2O) = 244.27$ and $M_r(H_2O) = 18.02$ Answer: 61.6 kg
- 4. Calculate the volume of the HCl stock solution of 36.0 w% and density of 1.180 g/cm³ required to dilute with water to prepare 500 cm³ HCl solution with 1.25 mol/dm³ molarity. M_r (HCl) = 36.46 Answer: 53.6 cm³
- 5. Calculate the volume of the sulfuric acid stock solution (60.65 w% and density of 1.51 g/cm^3) required to prepare 2.00 litre sulfuric acid solution with 2.50 mol/dm³ molarity. $M_r(\text{H}_2\text{SO}_4) = 98.08$ Answer: 535 cm³
- 6. Calculate the molarity of acetic acid in a vinegar with 20.0 w% if the density of the vinegar is 1.0261 g/cm³. $M_r(CH_3COOH) = 60.05$ Answer: 3.42 mol/dm³
- 7. What is the molality of ethanol of a solution containing 45.0 g ethanol dissolved in 250 g water? What is the mole fraction of ethanol in this solution? $M_r(C_2H_5OH) = 46.07$ and $M_r(H_2O) = 18.02$ Answer: 3.91 mol/kg
- 8. The level of blood sugar of diabetics is ~ 0.140 g glucose in 100 ml blood. Calculate the molarity of glucose in the blood. $M_r(C_6H_{12}O_6) = 180.16$ Answer: 7.77×10^{-3} mol/dm³
- What is the mass of ethanol in 1 litre gin of 78 degrees. The density of ethanol is 0.80 g/cm³ and the degree stands for twice of the volume fraction of ethanol. Answer: 312 g
- 10. We have a stock solution of alanine with mass concentration of 0.0203 mg/l. How would you prepare a 10 cm³ solution of alanine with 1.5 μ g/l mass concentration? Answer: 0.739 ml alanine solution is to be diluted to 10 ml.