Concentrations - Solutions

Mass percent

1. Quartz: 50.5 m%; Mica: 26.2 m%; Feldspar: 23.3 m%
2. 97.5 g quartz
3. total mass (100 %) = 300g; 60 g of NaOH are **20 m%** of 300 g.
4. total mass: 555g (= 100%);
   $CaSO_4$: 2.16 %; $NaNO_3$: 3.24 % KCl: 4.50 % (water: 90.1 %)
5. total mass: 38.5 g → **13.5 g zinc**
6. a.) 660.4 kg
   b.) 825 kg Al_2O_3 → **437.3 g pure aluminium**
7. 5000 kg
8. a.) **$2\ KClO_{3(s)} \rightarrow 3\ O_{2(g)} + 2\ KCl_{(s)}$**
   b.) **2.15 g O_2** (5.5 g – 3.35 g)
   c.) 39.1 mass-%

Extra tasks:

   d.) (5 mol products) **60 mole-% O_2**
9. total: 28.37 moles (100%); **0.31 mole-% $CaSO_4$; 0.74 mole-% $NaNO_3$; 1.16 mole-% KCl**; (97.78% water)

Volume percent

1.

	Shandy	Beer	Red Wine	Kirsch
Vol.-% ethanol	2.0	4.8	13.5	35
Ethanol concentration [mL/ 100 mL]	2 mL / 100 mL	4.8 mL / 100 mL	13.5 mL / 100 mL	35 mL / 100 mL
Volume of the beverage [mL]	300 mL	300 mL	100 mL	40 mL
Total volume of ethanol in the beverage [mL]	6 mL	14.4 mL	13.5 mL	14 mL

   Therefore, except for shandy which is diluted with a soft drink, they all contain more or less the same amount of alcohol. This is the reason they are served in those amounts.
2. Prosecco: 10.5 mL ethanol. 1 Malibu = 21 mL ethanol; 2x10.5 = 21mL → 50 mL of Malibu
   The ethanol concentration in Malibu is twice that in Prosecco.
3. 40% of 1L = 0.4L of pure alcohol; 4.8% of 0.3L = 0.0144L
   0.4L / 0.0144L = 27.8 bottles
4. 14.6 x 500mL = 7.3L
5. 0.5 Vol.-% = 0.5 ml / 100ml → 25 ml in 5 litres. So why does drinking one litre of beer not kill you?

Mass concentration

1. 500 mg = 0.5 g; 0.5x10 = 5g proteins; 240 g carbohydrates; 1g fat
2. a.) 1 g/L
   b.) 0.02 g/L
   c.) 5 g/L
3. a.) 108 g per 1000ml → 108g/L
   b.) 54g in 500 mL → 13.5 sugar cubes (!)
   c.) if 65 g is 22% at a 2,000 calorie diet (on the food label!) that means: 310g for women, 354g for men

Extra task:
   d.) Molar mass: M($C_{12}H_{22}O_{11}$) = 342.3 g/mol
   162 g / 342.3 g/mol = 0.473 mol; around 0.5 mol = $2.85 * 10^{23}$ sugar molecules!

Molarity

1. Molar mass of NaOH: 23g/mol + 16g/mol + 1g/mol = 40g/mol → 40g NaOH
2. a.) Molar mass: 180.18 g/mol (= 12.01g/mol x6 + 1.01g/mol x12 + 16 g/ mol x6)
   18.02 g = 0.1 mol. This is a 0.1 M solution.
   b.) First put some water in a 1L beaker (e.g. half a litre), weigh 360.36 g (2 moles) of glucose and dissolve it. Then fill the beaker/ flask to the 1l mark with water. It is very important to follow this procedure to make sure you get exactly one litre, no more, no less.
   c.) 250 mL = ¼ litre. 360.26g/4 = 90.90 g of glucose powder → fill to the 250 mL mark.
   0.5 mol/0.250 L = 2 mol/L (1000xgreater volume)
3. Molar mass: 2*22.99g/mol + 32.07 g/mol + 4*16g/mol = **142.05 g/mol**
   1.42g in 200 mL ➔ 7.1g in 1000 mL
   7.1 g / 142.05 g → 0.05 mol/L = **0.05 mol/L**
4. M(LiF) = 25,94 g/mol → 25.5 g / 25.94 g/mol = 0.98 mol; 0.98mol / 0.88 M = **1.114 L**
5. 0.25L * 0.1 mol/L = 0.025mol; 0.025 mol / 0.5 mol/L **= 0.05 L**
6. 0.75 M: 0.035L * 0.75mol/L = 0.02625 mol
   0.15 M: 0.1L * 0.15mol/L = 0.015 mol
   In total: 0.04125 mol in 0.135 L → 0.04125 mol / 0.135 L **= 0.306 mol/L = 0.306 mol/L**
   or: (35 mL * 0.75M + 100mL * 0.15M)/135mL
7. Solution of known concentration: 0.5M: 0.1 L x 0.5mol/L = 0.05 mol
   0.55 mol – 0.05 mol = 0.5 mol in the unknown solution
   0.50 mol / 0.25 mL **= 2 mol/L**
8. $(1/100)^{30} = 1 * 10^{-60}$. Even if you could dissolve a ton in 1 litre of alcohol, it would still be extremely improbable to even find a single molecule in the final solution ($N_A = 6.02 * 10^{23}$!)
9. 0.015 L * 0.35 mol/L = 0.00525 mol H_2SO_4
   because each molecule of H_2SO_4 reacts with 2 KOH: 2 * 0.00525 mol = 0.0105 mol KOH
   0.0105 mol / 0.25 mol/L = 0.042 L
10. 0.22 mol/L * 0.0375 L = 0.00825 mol NaOH (=twice the amount of oxalic acid)
    0.00825 mol / 2 = 0.004125 mol oxalic acid →
    25mL -> 0.004125 mol / 0.025L = **0.165 mol/L**
11. a.) 2 H_3PO_4 + 3 $BaCl_2$ → $Ba_3(PO_4)_2$ + 6 HCl
    b.) M($Ba_3(PO_4)_2$): 601.93 g/mol; 3.26 g / 601.93 g/mol = 0.0054 mol
    Because 3 $BaCl_2$ are needed to form 1 $Ba_3(PO_4)_2$: 0.0054mol * 3 = **0.0162 mol $BaCl_2$**
    0.0162 mol / 0.125 mL = **0.130 M**
12. 2 $Na_{(s)}$ + 2 $H_2O_{(l)}$ -> $H_{2(g)}$ + 2 $NaOH_{(aq)}$
    with V_M = 24 L/mol → 0.0504L / 24 L/mol = 0.0021 mol H_2 → twice as much NaOH = 0.0042 mol
    0.0042 mol / 0.175 L = **0.024 mol/L**