**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%);   
   **CaSO4: 2.16 %; NaNO3: 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 Al2O3 🡪 **437.3 g pure aluminium**
7. 5000 kg
8. a.) **2 KClO3(s) → 3 O2(g) + 2 KCl(s)**   
   b.) **2.15 g O2**(5.5 g – 3.35 g)   
   c.) 39.1 mass-%

Extra tasks:

d.) (5 mol products) **60 mole-% O2**

1. total: 28.37 moles (100%); **0.31 mole-% CaSO4; 0.74 mole-% NaNO3; 1.16 mole-% KCl**;   
   (97.78% water)

**Volume percent**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 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.

1. 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.

1. 40% of 1L = 0.4L of pure alcohol; 4.8% of 0.3L = 0.0144L  
   0.4L / 0.0144L = 27.8 bottles
2. 14.6 x 500mL = 7.3L
3. 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

1. 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(C12H22O11) = 342.3 g/mol

162 g / 342.3 g/mol = 0.473 mol; around 0.5 mol = 2.85 \* 1023 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)

1. 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**

1. M(LiF) = 25,94 g/mol 🡪 25.5 g / 25.94 g/mol = 0.98 mol; 0.98mol / 0.88 M = **1.114 L**
2. 0.25L \* 0.1 mol/L = 0.025mol; 0.025 mol / 0.5 mol/L **= 0.05 L**

1. 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

1. 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**

1. (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 (NA = 6.02 \* 1023!)
2. 0.015 L \* 0.35 mol/L = 0.00525 mol H2SO4

because each molecule of H2SO4 reacts with 2 KOH: 2 \* 0.00525 mol = 0.0105 mol KOH

0.0105 mol / 0.25 mol/L = 0.042 L

1. 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**

1. a.) 2 H3PO4 + 3 BaCl2 🡪 Ba3(PO4)2 + 6 HCl

b.) M(Ba3(PO4)2): 601.93 g/mol; 3.26 g / 601.93 g/mol = 0.0054 mol

Because 3 BaCl2 are needed to form 1 Ba3(PO4)2: 0.0054mol \* 3 = **0.0162 mol BaCl2**

0.0162 mol / 0.125 mL = **0.130 M**

1. 2 Na(s) + 2 H2O(l) -> H2(g) + 2 NaOH(aq)

with VM = 24 L/mol 🡪 0.0504L / 24 L/mol = 0.0021 mol H2 🡪 twice as much NaOH = 0.0042 mol

0.0042 mol / 0.175 L = **0.024 mol/L**