Datum:
Klasse:

Counting particles

We have learned that a _particle_ is very, very small. Is it also possible to   Teilchen

count these little particles? A help could be a _scale_. But a particle is too   Waage

light for a simple scale. The mass of one _hydrogen_ particle is   Wasserstoff

m (hydrogen particle) = 0,000 000 000 000 000 000 000 00166 g

This number is so small that it is uncomfortable to use it. Instead chemists

use a short form, it is: "**u**" (_unit_). So we can also say: Einheit

m (hydrogen particle) = 1 u

The short form u (unit) was chosen _arbitrarily_.   willkürlich

☞1. How many grams are 12 particles of hydrogen?

☞ 2. How many units are 12 particles of hydrogen?

Counting and weighing other particles

Hydrogen particles are the smallest and the lightest particles we know.

So it was a good idea to say that the mass of one particle of hydrogen is

1u. The other particles of elements weigh a _multiple_ of this unit.   Vielfaches

E.g. one oxygen particle weighs 16 u, one carbon particle weighs 12 u

and one sulphur particle weighs as much as 32 hydrogen particles.

Here are the masses (in u) of different particles:

Name (English)	mass in u	Name (German)
hydrogen	1	Wasserstoff
carbon	12	Kohlenstoff
nitrogen	14	Stickstoff
oxygen	16	Sauerstoff
magnesium	24	Magnesium
aluminium	27	Aluminium
sulphur	32	Schwefel
iron	56	Eisen
copper	63,5	Kupfer
silver	108	Silber
gold	197	Gold
lead	207	Blei
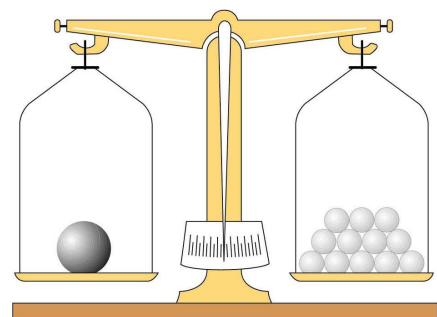
☞ 3. Which particles are shown in the picture?

☞ 4. Particle A weighs 9 times as much as particle B. What is A and what is B?

The masses of particles of one element are always the same. So each oxygen particle has the same mass (_____ u). **Particles of an element also react always in the same _ratio_ with particles of another compound.**

Verhältnis

To get a feeling for these ratios you can do a simple experiment:
Model experiment:

a) Weigh 2 (4, 6) one-cent _coins_ and 2 (4,6) one-€-coins with a scale

Münze

b) Calculate the following ratios:

   m (1 one-cent coin): m (one-€-coin) and

   m (2 one-cent coins): m (2 one-€-coins), ...

What do you find out?

The reaction of copper and sulphur

Let´s go back to the reaction of copper with sulphur. How can we find out if the ratio is 1:1. 1:2, 2:1 or something else?

In an experiment 0,72 g of copper and an unknown mass of sulphur react to yield 0,90g of copper sulfide.

1. Masses of the portions of copper and sulphur:

   m (copper)= 0,72g

   m (sulphur)= _____

2. Find the masses of the particles (look at the _table_):

Tabelle

   m (1 particle of copper)= _____ u

   m (1 particle of sulphur)= _____ u

3. Find the amount of particles that react:

N (copper)= m(reacting copper particles): m (1 particle of copper)=

N (sulphur)= m(reacting sulphur particles): m (1 particle of sulphur)=

4. Calculate the ratio of the reacting particles:

   N (copper) : N (sulphur)=

→ *Copper and sulphur react with a ratio of _____ !*