Documentation for the teaching material »Mathematics and Water«

School:	Staatliche Regelschule »Hermann Danz« Schmalkalden (grades 5–10)
Grade:	7
Subject:	Mathematics
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Target:	The students should apply and demonstrate general and mathematical competence while solving the tasks. Project work on the topic »Water«
Organization form/time needed:	– Individual or pair work – On a project day or project week on the subject »Water« – Three lessons – Second term (percent calculation has to be covered)
Evaluation of the students' performances:	Assessment is possible after the work sheets are handed in, (Individual help from the teacher should be definitely considered)
Material Requirements:	Copies of the worksheets for each student, 1 sheet millimeter paper per student
Methodical Indications:	Preparing the students for this comprehensive project work by disclosing the mathematical topics (converting the volume units, formulas, diagrams) Possibly repeating important basics in preceding lessons Independent student's work with individual help from the teacher
Students' Materials:	Copies of the work sheets for each student, 1 sheet millimeter paper per student »Tafelwerk« (Book of formulas and tables), calculator, possibly, notes of learning contents
Literature:	Textbooks grade 7, information material of the local Potable Water Authority, internet

Project »Water«, Grade 7 – Mathematics
■ **Water is the source of all life**

Water frequently occurs in our environment and appears in many forms. It plays an important role
for most processes in our environment. Nothing works without water – especially nothing in nature,
not in our households nor in the industry.

■ **Fill in the boxes with examples!**

Water in daily life	Professions connected with water

Water in the industry and other areas of life

Water as a mean of transportation	Water and health

Water as a symbol	Water in leisure activities

Water is also an important »survival tool«. Humans can survive up to 30 days without food,
however, one would die of thirst after 3 days without water.
You should drink 30 ml water a day per kilogram of your body weight.

■ **How many liters of water do you have to drink every day at the least?**
   Calculate! Check if you comply with that!

Have you noticed that there are problems in converting the units?
Okay, so go ahead and practice some formal tasks before you solve extensive word problems!

■ **Task 1:**
Write down all measuring units of volumes for solids and liquids and add the conversion numbers!
Specify the relationship between dm^3 and l (liter)!

■ **Task 2:**
Convert each unit in the other stated unit!

$5\ m^3 = $ .... dm^3 $\qquad$ $20{,}000\ cm^2 = $ .... m^2

$400\ dm^3 = $ .... m^3 $\qquad$ $12\ dm^3 = $ l

$25.5\ l = $ .... dm^3 $\qquad$ $500\ ml = $ .... mm^3

$1{,}700\ mm^3 = $ .... cm^3 $\qquad$ $250\ m^2 = $ .... a

$4\ cm^3 = $ .... mm^3 $\qquad$ $55{,}000\ l = $ .... hl

$0.55\ m = $ .... cm $\qquad$ $0.8\ l = $ .... dm^3

$0.25\ km = $ .... m $\qquad$ $300\ dm^2 = $ .... m^2

$35\ ha = $ .... m^2 $\qquad$ $2\ cm^3\ 5\ mm^3 = $ .... mm^3

■ **Task 3:**
Calculate the volume of the cubes! Pay attention to the measuring units!

length	12 m	17.5 dm	4 m
width	4 m	12.8 dm	8 dm
height	3.5 m	45 cm	65 cm
volume			

■ **Task 4:**
A swimming pool is 50 meters long and 12 m wide. When full, the level of water comes up to 1.5 m.
Through a drain it is emptied within 2.5 hours.
a) How many cubic meters of water does the pool contain?
b) How many liters of water drain out per second?

■ **Task 5:**
The inside of an aquarium is 40 cm long, 25 cm wide and 30 cm high.
a) How many liters of water fit into the aquarium?
b) Sandra gets a new aquarium as a birthday gift.
    The length, width and height are exactly twice as large as those of the old aquarium.
    Tino says: »Twice as many liters of water fit into this aquarium compared to the old aquarium.«
   Is Tino right? Explain with a calculation!

■ **Abundance of water in Germany**

■ **Task 6:**

The frequent amount of rainfall in Germany means that in most cases enough water is available.
There are about 182 billion m³ of water available per year. We only use about 24 % though.
The following description shows how much m³ of water are used in agriculture, industry, in public water supply,
or in power plants.

Water supply (182 billion m³) and water use in Germany

agriculture	1.6
public water supply	5.5
industry	9
power plants	27.8
unused	138.3

■ water use in billion m³
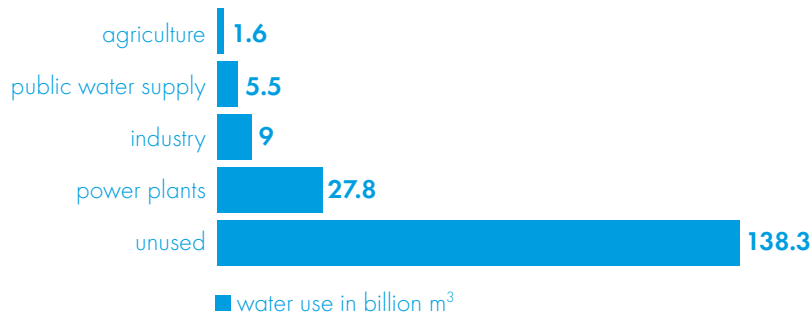
a) How many m³ of water are used in total?
b) What is the percentage of each application area relating to the total amount of water?
   Round the percentages to one decimal place!
c) Extra: Demonstrate the use of water in a strip chart and pie chart!
   Use an additional sheet for this!

Global water use

■ **Task 7:**

a) Take the required information
   off the diagram!

   water use in billion m³

   1975 in the industry: ....

   2000 in households: ....

b) Calculate how much of a percentage
   water use in households is expected
   to rise by the year 2025!

c) How many times will the water consumption
   have rose from 1900 to 2025?

Global water use increases
especially for food production, which needs more and more water.
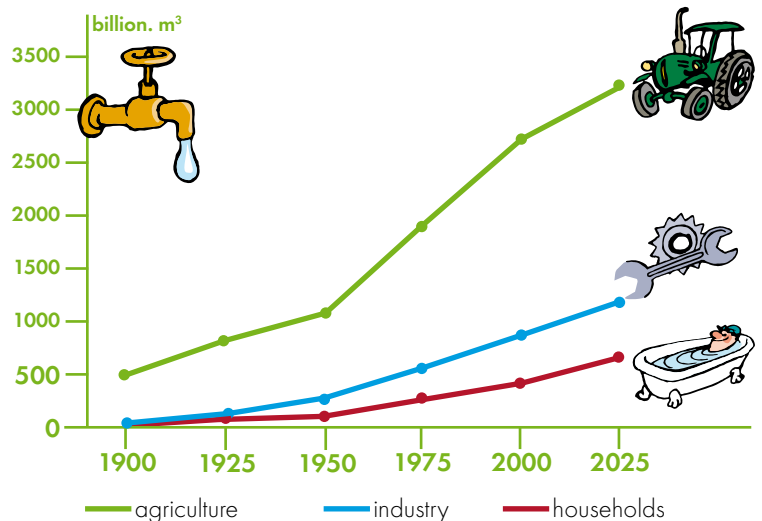
Source: DWHH-Grafik – Tränkle+Immel – UNEP 2002

■ Water use in households

Today, we cannot even imagine anything different. Fresh water is available at any time in our homes.
Turn the faucet on and the water flows.
In pre-industrial times, it was different. Back then a person spent only 30 liters a day, today it is 132 liters.
A significant and steady increase of water consumption began in 1950. Until 1990, water consumption of 147 liters per capita, per day was reached. The growing environmental awareness of the population ensured that the numbers declined slightly to date. And that's a good sign.
If every German citizen behaves equally, every liter of drinking water that is consumed more every day in a year, will account for a total of 30 million cubic meters of water.

■ Task 8:
The following table provides a summary of the composition of the current average water consumption per person.

Purpose	per day in liter	per day in % of total demand
Toilet flushing	41	
Bathing, showering	40	
Laundry	17	
Dish washing	8	
Personal hygiene	8	
House cleaning	7	
Drinking, cooking	4	
Other (car, flowers ...)	8	
Total:	**132**	

a) Calculate how many liters of water are used a year by one person just by flushing the toilet!
b) Calculate the percentage of the total consumption and write it into the table!
c) Display the percentage distribution in a bar chart on millimeter paper!
d) Give 5 examples of how to save water in the household!

Water saving measures in the household
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