

UNIVERSITY OF OSLO

Creating labels for diluted solutions for use in chemistry research and education

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Nitric acid 65 % HNO_3

CAS number 7697-37-2



Danger

May intensify fire; ~~oxidiser~~. Toxic if inhaled. Causes severe skin burns and eye damage.

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Keep away from clothing and other combustible materials. Avoid ~~breathing vapours~~. Use only outdoors or in a well-ventilated area. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a doctor. Wear eye protection. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water (or shower). IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. ~~Immediately call a doctor~~.

Date: 11/08/2026

~~Uddannet~~ Made by: Svein Tveit

Who is attending the workshop?



Aim of this workshop

Enable students to:

- create labels for diluted solutions of some common chemicals used in chemistry education, based on harmonized CLP classification from ECHA CHEM.
- Be aware of the regulations that apply to classification and labelling of chemicals
- Explain some fundamental concepts used in classification and labelling of hazardous substances and mixtures
- Familiarize with the elements of CLP hazard labelling



Outline

Before lunch: Create labels for diluted solutions of substances classified in the hazard classes Skin Corrosion/Irritation and Serious eye Damage/Eye irritation using specific and generic concentration limits.

After lunch: Create labels for diluted solutions of substances classified additionally in the hazard classes of Acute Toxicity (oral exposure), Aquatic Acute, and Aquatic Chronic

IMPORTANT: The labels are sufficient for educational use and use in research, but not for commercial use because downstream users have many more requirements, such as self classification for hazard classes with out a harmonized classification.

Where to find the documents for this workshop?

Google “Seksjon for kjemididaktikk uio”

In the left menu, choose “kurs”

In the left menu, choose “tidligere kurs”

Under 2026 you will find this presentation (handout version) and a word file with a checklist, templates, links and detailed SOP’s for the exercises.

Why is it important to classify and label chemicals?



HSE/HMS – authorities in Norway

	Nature of hazards	Responsible authorities for HSE-laws and regulations
Health Helse	Health	Norwegian Labour Inspection Authority Arbeidstilsynet 
Safety Sikkerhet	Physical	Norwegian Directorate for Civil Protection Direktoratet for samfunnssikkerhet og beredskap (DSB) 
Environment Miljø	Environment	Norwegian Environment Agency Miljødirektoratet 

European chemical legislation

- GHS is a global harmonized system for classification and labelling of chemicals
- European Chemicals Agency, ECHA, is responsible for implementing GHS in Europe by establishing and updating an inventory on GHS substances.

There are two cornerstones of chemical legislation in the EU:

- Regulation (EC) 1907/2006 on Registration, Evaluation, Authorization and Restriction of Chemicals – The REACH regulation.
- Regulation (EC) 1272/2008 on Classification, Labelling and packaging of substances and mixtures – The CLP regulation
- Norway as part of EØS is bound to EU chemical legislation and only CLP is used since 2017.

Hazard communication in CLP

Sulphuric acid
1 mol/L H₂SO₄
CAS number 7664-93-9



Warning

Causes skin irritation. Causes serious eye irritation.

Wear eye protection. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Date: 09/11/2024. Made by: Svein Tveit, Department of Chemistry, University of Oslo

Product identifier

Hazard pictogram

Signal word

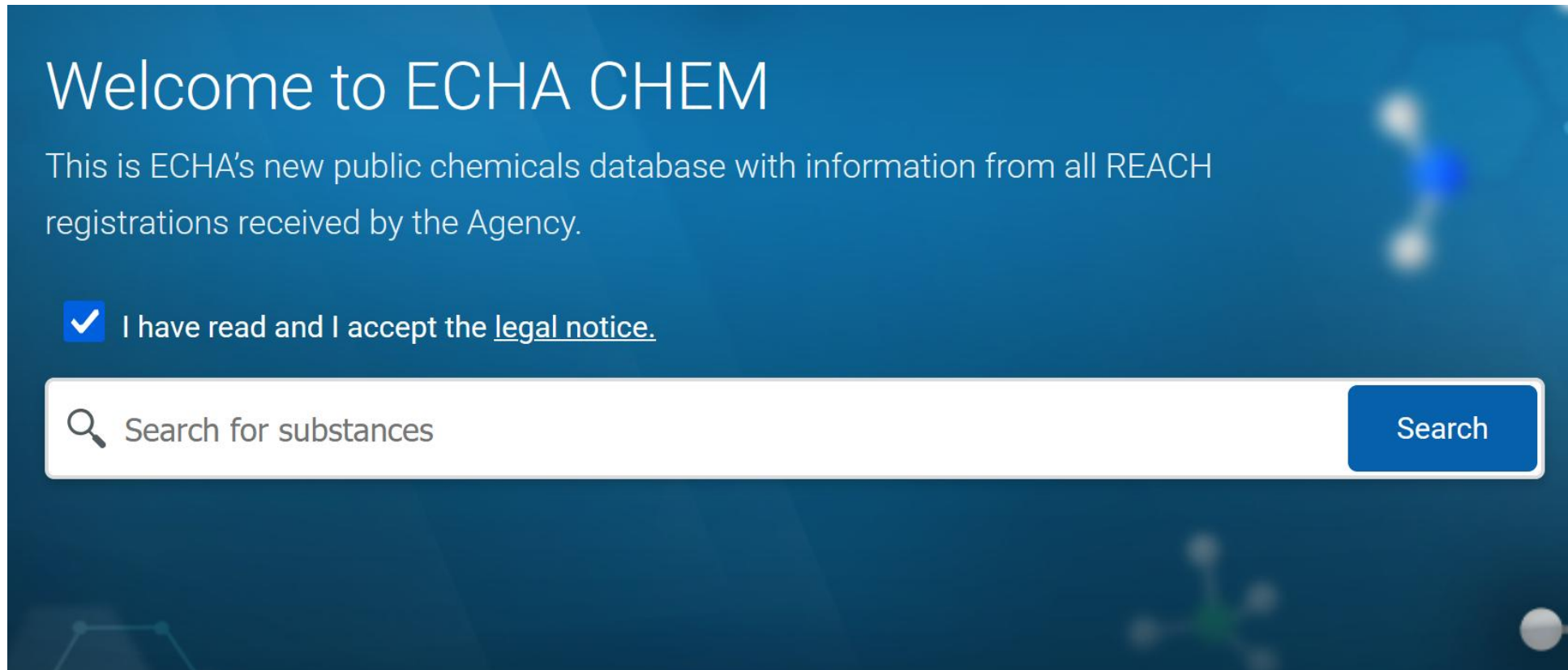
Hazard statement(s)

Precautionary
Statements

Company identity

Product identifier

- Name and identification number given in ECHA CHEM
- If not included in ECHA CHEM use the CAS number and IUPAC name

The image shows a screenshot of the ECHA CHEM website. The background is a dark blue gradient with faint molecular structures. At the top, the text "Welcome to ECHA CHEM" is displayed in white. Below it, a paragraph states: "This is ECHA's new public chemicals database with information from all REACH registrations received by the Agency." Further down, there is a checkbox with a white checkmark inside a blue square, followed by the text "I have read and I accept the [legal notice](#)." Below this is a white search bar with a magnifying glass icon on the left and the placeholder text "Search for substances". To the right of the search bar is a blue button with the word "Search" in white. The overall layout is clean and professional, typical of a government or scientific database interface.

Welcome to ECHA CHEM

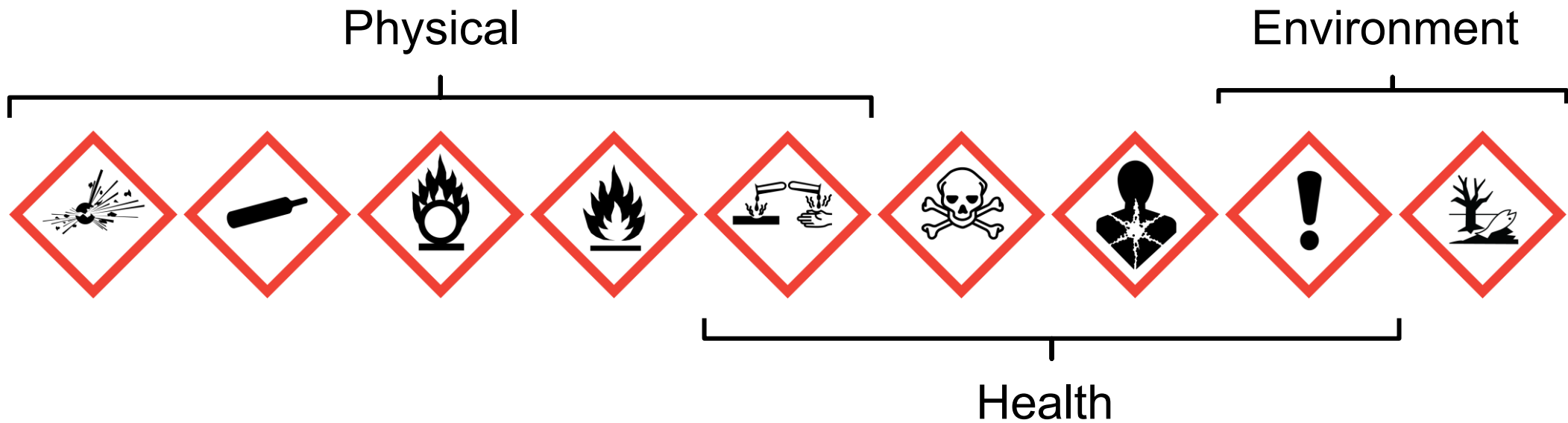
This is ECHA's new public chemicals database with information from all REACH registrations received by the Agency.

☒ I have read and I accept the [legal notice](#).

Hazard classes and categories (Not part of labelling)

Skin corrosion / irritation						
Skin corrosion / irritation	Category 1 ⁽³⁾	Skin Corr. 1	 GHS05	Danger	H314	Causes severe skin burns and eye damage
	Category 1A	Skin Corr. 1A				
	Category 1B	Skin Corr. 1B				
	Category 1C	Skin Corr. 1C				
	Category 2	Skin Irr. 2	 GHS07	Warning	H315	Causes skin irritation

Hazard pictograms



Signal words and hazard statements

Skin corrosion / irritation	Category 1 ⁽³⁾	Skin Corr. 1	 GHS05	Danger	H314	Causes severe skin burns and eye damage
	Category 1A	Skin Corr. 1A				
	Category 1B	Skin Corr. 1B				
	Category 1C	Skin Corr. 1C				
	Category 2	Skin Irr. 2	 GHS07	Warning	H315	Causes skin irritation

Groups of hazard and precautionary statements

Code	Hazard statements	Code	Precautionary statements
H200-H299	Physical	P100-P199	General
H300-H399	Health	P200-P299	Prevention
H400-H499	Environment	P300-P399	Response
		P400-P499	Storage
		P500-P599	Disposal

Skin corrosion/irritation and Serious eye damage /eye irritation

Skin corrosion / irritation	Category 1 ⁽³⁾	Skin Corr. 1	 GHS05	Danger	H314	Causes severe skin burns and eye damage
	Category 1A	Skin Corr. 1A				
	Category 1B	Skin Corr. 1B				
	Category 1C	Skin Corr. 1C				
	Category 2	Skin Irr. 2	 GHS07	Warning	H315	Causes skin irritation
Serious eye damage / eye irritation	Category 1	Eye Dam. 1	 GHS05	Danger	H318	Causes serious eye damage
	Category 2	Eye Irr. 2	 GHS07	Warning	H319	Causes serious eye irritation

Specific concentration limits – ECHA CHEM

Harmonized classification of sulfuric acid

Classification [What asterisks mean?](#)

Hazard class, category	Hazard statement code	Affected organs / Route of exposure
Skin Corr. 1A	H314	

Specific concentration limits [What asterisks mean?](#)

C ≥ 15 %
Skin Corr. 1A H314

5 % ≤ C < 15 %
Skin Irrit. 2 H315

5 % ≤ C < 15 %
Eye Irrit. 2 H319

Example 1 – Classifying and create label

Create a label for 3 mol/L H₂SO₄

Calculate approximately mass percentage concentration

$$M_m (\text{H}_2\text{SO}_4) = 98 \text{ g/mol}$$

Calculate concentration in g/L:

$$3 \text{ mol/L} \cdot 98 \text{ g/mol} = 294 \text{ g/L}$$

For simplicity we assumed that the density is 1000 g/L:

$$\text{Mass \%} = 294 \text{ g/L} / 1000 \text{ g/L} \cdot 100 \% = 29,4 \%$$

(If we consider the density, the mass % is: $294 \text{ g/L} / 1170 \text{ g/L} \cdot 100 \% = 25 \%$)

Exercise 1a

Create a label for 2 mol/L NaOH

Severity of hazards decreases as concentration decreases

- Pure sodium hydroxide is classified as Skin Corr. 1A
- Solutions with a concentration of 5 % and more are also classified as Skin Corr. 1A.
- Solutions with a concentration of 2 % or more, but less than 5 % is classified as Skin Corr 1 B.
- What about solutions with concentrations below 2 %?

Specific concentration limits

[What asterisks mean?](#)

$C \geq 5 \%$

Skin Corr. 1A H314

$2 \% \leq C < 5 \%$

Skin Corr. 1B H314

$0,5 \% \leq C < 2 \%$

Skin Irrit. 2 H315

$0,5 \% \leq C < 2 \%$

Eye Irrit. 2 H319

Exercise 1b

Make a label for 20 % (6 mol/L) Hydrochloric acid, HCl(aq).

Note: Be aware that there are two different harmonized classifications. One is for hydrogen chloride, HCl(g) while the other one, which you are going to use, is for Hydrochloric acid, HCl(aq).

Generic concentration limits – CLP regulation

■ Table 3.2.3 (page 132 in clp)

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:	
	Skin corrosion	Skin irritation
	Category 1 (see note below)	Category 2
Skin corrosion Sub-Category 1A, 1B, 1C or Category 1	$\geq 5 \%$	$\geq 1 \%$ but $< 5 \%$
Skin irritation Category 2		$\geq 10 \%$
$(10 \times \text{Skin corrosion Sub-Category 1A, 1B, 1C or Category 1}) + \text{Skin irritation Category 2}$		$\geq 10 \%$

■ Table 3.3.3 (page 138 in clp)

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:	
	Serious eye damage	Eye irritation
	Category 1	Category 2
Skin corrosion Sub-Category 1A, 1B, 1C or Category 1 + Serious eye damage (Category 1) ^(a)	$\geq 3 \%$	$\geq 1 \%$ but $< 3 \%$
Eye irritation (Category 2)		$\geq 10 \%$
$10 \times (\text{Skin corrosion Sub-Category 1A, 1B, 1C or Skin corrosion Category 1} + \text{Serious eye damage (Category 1)}) + \text{Eye irritation (Category 2)}$		$\geq 10 \%$

For strong acid and bases, pH should be used as criteria, see CLP regulation

Using generic

Example: A 3 % mixture

Generic concentration
or 2) the

Sum of ingredier

Skin Corrosive Categ

Skin irritant Category

(10 × Skin Corrosive
1C) + Skin irritant C

Sum of ingredients clas- sified as:	Concentration triggering classification of a mixture as:	
	Serious eye damage	Eye irritation
	Category 1	Category 2
Skin corrosion Sub- Category 1A, 1B, 1C or Category 1 + Serious eye damage (Category 1) ^(a)	≥ 3 %	≥ 1 % but < 3 %
Eye irritation (Category 2)		≥ 10 %
10 × (Skin corrosion Sub-Category 1A, 1B, 1C or Skin corrosion Category 1 + Serious eye damage (Category 1)) + Eye irritation (Category 2)		≥ 10 %

1B.

hazard (Category 1
skin

a mixture as:

in Irritant

category 2

% but < 5 %

≥ 10 %

≥ 10 %

Example 2 – Classifying and making labels

Create a label for 1 mol/L CuSO_4

Using generic

16 % mixture classification

Generic concentration
or 2) the

Sum of ingredients

Skin Corrosive Category

Skin irritant Category

(10 × Skin Corrosive
1C) + Skin irritant C

Sum of ingredients classified as:	Concentration triggering classification of a mixture as:	
	Serious eye damage	Eye irritation
	Category 1	Category 2
Skin corrosion Sub-Category 1A, 1B, 1C or Category 1 + Serious eye damage (Category 1) ^(a)	≥ 3 %	≥ 1 % but < 3 %
Eye irritation (Category 2)		≥ 10 %
10 × (Skin corrosion Sub-Category 1A, 1B, 1C or Skin corrosion Category 1 + Serious eye damage (Category 1)) + Eye irritation (Category 2)		≥ 10 %

Hazard (Category 1
skin

a mixture as:

Skin Irritant

Category 2

% but < 5 %

≥ 10 %

≥ 10 %

Hazardous to the aquatic environment

One category for aquatic acute and four categories for aquatic chronic

Hazardous to the aquatic environment	Acute Category 1	Aquatic Acute 1	 GHS09	Warning	H400	Very toxic to aquatic life
	Chronic Category 1	Aquatic Chronic 1			H410	Very toxic to aquatic life with long lasting effects
	Chronic Category 2	Aquatic Chronic 2	No Pictogram	No Signal Word	H411	Toxic to aquatic life with long lasting effects
	Chronic Category 3	Aquatic Chronic 3		No Signal Word	H412	Harmful to aquatic life with long lasting effects
	Chronic Category 4	Aquatic Chronic 4			H413	May cause long lasting harmful effects to aquatic life

Classification for acute and/or chronic aquatic hazard

If not given in ECHA CHEM, a multiplication factor is found from LC_{50} , EC_{50} (acute hazard) or NOEC (chronic hazard) values in section 12 of the safety data sheet (SDS) and table 4.1.3 on page 206 in the CLP regulation (also on next slide)

Table 4.1.3

Multiplying factors for highly toxic components of mixtures

Acute toxicity	M factor	Chronic toxicity	M factor	
L(E)C ₅₀ value (mg/l)		NOEC value (mg/l)	NRD ^(a) components	RD ^(b) components
$0,1 < L(E)C_{50} \leq 1$	1	$0,01 < NOEC \leq 0,1$	1	—
$0,01 < L(E)C_{50} \leq 0,1$	10	$0,001 < NOEC \leq 0,01$	10	1
$0,001 < L(E)C_{50} \leq 0,01$	100	$0,0001 < NOEC \leq 0,001$	100	10
$0,0001 < L(E)C_{50} \leq 0,001$	1 000	$0,00001 < NOEC \leq 0,0001$	1 000	100
$0,00001 < L(E)C_{50} \leq 0,0001$	10 000	$0,000001 < NOEC \leq 0,00001$	10 000	1 000
(continue in factor 10 intervals)		(continue in factor 10 intervals)		

^(a) Non-rapidly degradable.

^(b) Rapidly degradable.

Classification for acute and/or chronic aquatic hazard

If not given in the C&L inventory, a multiplication factor is found from LC_{50} , EC_{50} (acute hazard) or NOEC (mainly chronic hazard) values in section 12 of the safety data sheet (SDS) and table 4.1.3 on page 206 in the CLP regulation (also on next slide)

All components classified as Acute Category 1 are considered. If the sum of these components multiplied by their corresponding M-factors is equal to or greater than 25 % the whole mixture is classified as Acute Category 1.

All components classified as Chronic Category 1 are considered. If the sum of these components multiplied by their corresponding M-factors is equal to or greater than 25 % the whole mixture is classified as Acute Category 1. If not, we proceed according to table 4.1.2 on page 205 in the CLP regulation.

**Classification of a mixture for long-term (chronic) hazards,
based on summation of the concentration of classified
components**

Sum of components classified as:	Mixture is classified as:
$\text{Chronic 1} \times M^{(a)} \geq 25 \%$	Chronic 1
$(M \times 10 \times \text{Chronic 1}) + \text{Chronic 2} \geq 25 \%$	Chronic 2
$(M \times 100 \times \text{Chronic 1}) + (10 \times \text{Chronic 2}) + \text{Chronic 3} \geq 25 \%$	Chronic 3
$\text{Chronic 1} + \text{Chronic 2} + \text{Chronic 3} + \text{Chronic 4} \geq 25 \%$	Chronic 4

^(a) For explanation of the M-factor, see 4.1.3.5.5.5.

Acute toxicity

Divided into oral, dermal and inhalation and 4 categories

Acute toxicity estimate, ATE, is used to classify the acute toxicity of mixtures of that chemical.

Acute Toxicity	Category 1	Acute Tox. 1	 GHS06	Danger	H300 H310 H330	Fatal if swallowed Fatal in contact with skin Fatal if inhaled
	Category 2	Acute Tox. 2				
	Category 3	Acute Tox. 3	 GHS07	Warning	H301 H311 H331	Toxic if swallowed Toxic in contact with skin Toxic if inhaled
	Category 4	Acute Tox. 4			H302 H312 H332	Harmful if swallowed Harmful in contact with skin Harmful if inhaled

Classification for acute toxicity

The acute toxicity estimate (ATE) for the classification of a substance in a mixture is derived using:

- the LD 50 /LC 50 where available (section 11 in SDS),
- the appropriate conversion value from Table 3.1.2 (page 124 in the CLP regulation) that relates to the results of a range test, or
- the appropriate conversion value from Table 3.1.2 (page 124 in the CLP regulation) that relates to a classification category

Classification for acute toxicity

The acute toxicity estimate (ATE) for the classification of a substance in a mixture is derived using:

- the LD 50 /LC 50 where available (section 11 in SDS),
- the appropriate conversion value from Table 3.1.2 (page 124 in the CLP regulation) that relates to the results of a range test, or
- the appropriate conversion value from Table 3.1.2 (page 124 in the CLP regulation) that relates to a classification category

From section 11 in Safety data sheet (CuSO₄)

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - male and female - 481 mg/kg

(OECD Test Guideline 401)

Acute toxicity estimate Oral - 481 mg/kg

(Acute toxicity estimate according to Regulation (EC) No. 1272/2008)

Inhalation: No data available

LD50 Dermal - Rat - male and female - > 2.000 mg/kg

(OECD Test Guideline 402)

Table 3.1.2

Exposure routes	Classification Category or experimentally obtained acute toxicity range estimate	Converted acute toxicity point estimate (see Note 1)
Oral (mg/kg body-weight)	$0 < \text{Category 1} \leq 5$ $5 < \text{Category 2} \leq 50$ $50 < \text{Category 3} \leq 300$ $300 < \text{Category 4} \leq 2\,000$	0,5 5 100 500
Dermal (mg/kg body-weight)	$0 < \text{Category 1} \leq 50$ $50 < \text{Category 2} \leq 200$ $200 < \text{Category 3} \leq 1\,000$ $1\,000 < \text{Category 4} \leq 2\,000$	5 50 300 1\,100
Gases (ppmV)	$0 < \text{Category 1} \leq 100$ $100 < \text{Category 2} \leq 500$ $500 < \text{Category 3} \leq 2\,500$ $2\,500 < \text{Category 4} \leq 20\,000$	10 100 700 4\,500
Vapours (mg/l)	$0 < \text{Category 1} \leq 0,5$ $0,5 < \text{Category 2} \leq 2,0$ $2,0 < \text{Category 3} \leq 10,0$ $10,0 < \text{Category 4} \leq 20,0$	0,05 0,5 3 11

Then we calculate the ATE of the mixture

Formula is found on page 123 in the CLP regulation

$$ATE_{mix} = \frac{100 * ATE}{c} = \frac{100 * 481}{16} = 3006$$

Exercise 2

2a) Make a label for 0,1 mol/L ZnCl_2

2b) Make a label for 2,0 mol/L ZnSO_4 , (Use Cas nr 7733-02-0 for zinc sulfate)

Harmonised classification

- Harmonised classification (as provided in Annex VI to CLP), must always be used by a manufacturer
- Harmonised classification normally applies to those properties of the highest concern
- Where some, but not all hazard classes or differentiations within hazard classes have been harmonised, the remainder should be **self-classified** to complete the classification

[Guidance on the Application of the CLP Criteria](#)

Leads to different classification of the same chemical

Ammonia 25 % (Avantor)

Skin corrosion 1B

Aquatic acute, 1

STOT, SE, 3

Serious eyedamage, 1

Aquatic chronic, 2

Ammonia 25 % (Merck)

Skin corrosion, 1B

Aquatic acute, 1

STOT, SE, 3

Corrosive to metals, 1

CLP in scientific research

This Regulation (CLP) shall not apply to the following:

substances and mixtures for scientific research and development, which are not placed on the market, provided they are used under controlled conditions in accordance with Community workplace and environmental legislation.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:353:0001:1355:en:PDF>

Title 1, Article 1, 2d

Online label generator for some common chemicals

- The chesse.org website is developed to help teachers handle the chemical safety work. www.chesse.org
- The website has a label generator for some common acid, bases and solution of salts.

CONCENTRATION	HAZARD PICTOGRAM	SIGNAL WORD	H-STATEMENTS	P-STATEMENTS
$17.4 \text{ M} > C \geq 13.3 \text{ M}$ $100 \% > C \geq 80 \%$ Generate label	 	Danger	Flammable liquid and vapour. Causes severe skin burns and eye damage.	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. Wear eye protection. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water (or shower). IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a doctor.
$13.3 \text{ M} > C \geq 4.1 \text{ M}$ $80 \% > C \geq 25 \%$ Generate label		Danger	Causes severe skin burns and eye damage.	Wear eye protection. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water (or shower). IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a doctor.
$4.1 \text{ M} > C \geq 1.6 \text{ M}$ $25 \% > C \geq 10 \%$ Generate label		Warning	Causes skin irritation. Causes serious eye irritation.	Wear eye protection. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.
$C < 1.6 \text{ M}$ $C < 10 \%$ Generate label	Not classified as a harmful mixture			

Evaluation

<https://nettskjema.no/a/640862>

