

# Tittle: Sulfur volcano

### **Work instructions**

**Task:** The redox reactions of the zinc-sulfur mixture induced by ignition of the mixture achieve exothermic explosive-pyrophoric effects.

### Theory

Powdered zinc combines violently with powdered sulfur after the reaction is initiated by temperature. The reaction is violently exothermic.

$\mathbf{Zn} + \mathbf{S} \rightarrow \mathbf{ZnS}$	(1	l)

In addition to white zinc sulfide, white zinc oxide is also formed:

$2 \ Zn + O_2 \rightarrow 2 \ ZnO$	(2)

and pungent sulfur dioxide:

$$S + O_2 \rightarrow SO_2$$
 (3)

Equipment: mortar and pestle, evaporating dish, laboratory spoon, burner, fume hood

Chemicals: zinc powder, sulfur powder

### **Procedures:**

- 1. Weigh 0.1 g of S and 0.2 g of Zn.
- 2. Grind the mixture well and homogenise in a mortar.
- 3. Then place the mixture in an evaporating dish and heat over the flame of a stove in a fume hood.
- 4. Observe the rapid ignition, a flash of color and the ZnS and ZnO products are formed.

Chemicals	Form	H-statements	P-statements
Zn	Solid, powdered		
S	Solid, powdered	H315	P302 + P352, P332 + P313

### Management of chemical substances

Name of the<br/>project:Digitization of chemistry experiments to improve the quality and<br/>support chemistry teaching in secondary schoolsAcronym:ChemIQSocProject2021-1-SK01-KA220-VET-000027995number:ChemIQSOC



### Sources of risk and assessment of risk severity

Possibility of skin burns and eye damage.

## Waste management method

Certified chemical waste disposal company.

# **Risk reduction measures**

Lab coat, goggles, gloves, keeping a safe distance.

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# Worksheet

### Calculations

1. Calculate how many grams of zinc sulphate are formed by reacting 0.1 g of sulphur with a stoichiometric amount of zinc.

Reaction:  $Zn + S \rightarrow ZnS$ M(S) = ...... g.mol<sup>-1</sup>, M(ZnS) = ..... g.mol<sup>-1</sup>

### Observation

1. Describe the course of the sulphur volcano experiment.

### Questions

1. Write the reactions that take place in the sulfur volcano experiment.

Reaction No. 1: Reaction No. 2: Reaction No. 3:



- Write the oxidation and reduction half-reactions in the reaction of zinc with sulphur. Oxidation: Reduction:
- 3. Decide whether zinc is an oxidizing or reducing agent in this reaction.
- 4. Write the equations of the reactions in the presence of ammonium chloride.

Reaction No. 1: Reaction No. 2: Reaction No. 3:

- 5. Explain why it is necessary:
  - a. to spread out the individual components of the mixture
  - b. carry out the experiment in the fume hood
- 6. Explain what pyrophoric substance means.



### Conclusion

Instructions to elaborate conclusions:

- 1. Briefly summarise the aim of the demonstration experiment. What was the experiment trying to find out or prove??
- 2. Describe what you observed during the experiment. What were the most important results and what connections did you notice?
- 3. Explain the results using theory. How do the results confirm or refute the assumed principles?
- 4. Think about the practical meaning. How can the findings from the experiment be used in real life or in further study?

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