Dependence of the reaction behavior of metals

Chemistry > Inorganic chemistry > Chemistry of metals

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	10 minutes

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Teacher information

Application

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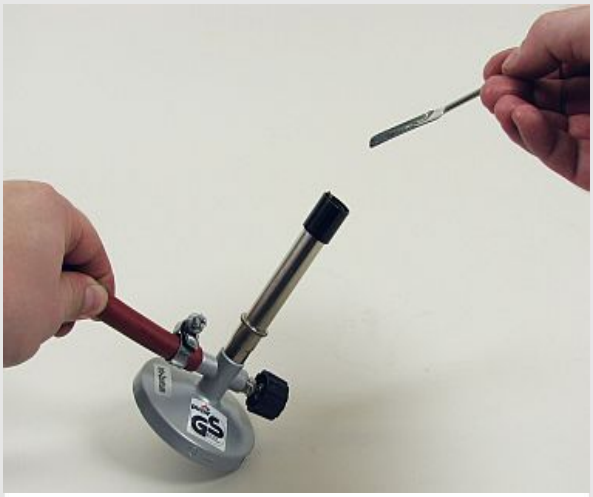

Test setup

As with other substances, metals react at different rates when heated in air. The speed and intensity of the reaction depends on the one hand on the type of metal (e.g. noble or base metal), and on the other hand on its degree of fragmentation. With a higher degree of fragmentation, the surface area of the substance becomes larger and the probability of an "encounter" with the reactant increases. Substances with a high degree of fragmentation have a larger reactive surface. This means that they react faster and more violently than substances with a lower degree of fragmentation. The violence and speed of the reaction also depends on the type of metal. Here the terms "noble" and "base" play a major role. Base metals react well. In contrast, noble metals react less well or not at all when heated in air.

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Other teacher information (1/2)

Prior

- The degree of fragmentation describes the ratio of the surface area to the volume of a substance.
- Base metals react with oxygen from the air under normal conditions.
- The reaction of metals with oxygen is called oxidation.

Principle

- In this student experiment, various metals are heated in air.
- In particular, the reactivity of the metals as a function of the "degree of decomposition" is investigated in this experiment.
- In this process, (identical) metals react faster the greater the degree of fragmentation.

Other teacher information (2/2)

Learning

- Metals react at different rates when heated in air.
- The speed and severity of the reaction depends on the type of metals on the one hand, and on their degree of distribution on the other.

Tasks

- Students heat various metals in air.
- The influence of the degree of fragmentation on the reaction rate is also investigated.
- The students then evaluate the experimental results and assess the reaction behavior of metals with atmospheric oxygen.

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Safety instructions

- Metal powder burns with hot flame! Handle with care!
- The general instructions for safe experimentation in science education apply to this experiment.
- Use protective goggles!
- Observe the corresponding safety data sheets for the respective chemicals.
- When carrying out the test, attention must be paid to thermal hazards from the gas burner.

Student Information

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Motivation

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Candy sugar has a lower degree of fragmentation

The degree of fragmentation influences the speed and violence of a reaction. The degree of fragmentation is the ratio of the surface area to the volume of a substance. To better understand the term, the following examples from everyday life.

Wood chips are easier to light than a thick log, iron powder easier than iron nail.

Another example of the dependence of the reaction rate on the degree of disintegration is the decomposition of foodstuffs. Candy sugar has a lower degree of disintegration compared to fine crystal sugar. Candy sugar (pieces) therefore take longer to dissolve in water, even with the same quantities.

Tasks

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What does the reaction behavior of metals depend on when heated in air?

- Heat various metals and metal shapes in the air.
- Observe the changes and the speed of the reactions.
- Note your experimental observations and answer the questions in the protocol.

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Equipment

Position	Equipment	Item no.	Quantity
1	Evaporating dish, 75 ml, top-d = 80 mm	32516-00	1
2	Wire mesh with ceramic, 160 x 160 mm	33287-01	1
3	Burning spoon (phosphorus spoon)	33346-00	1
4	Crucible tongs, stainless steel, l = 200 mm	33600-00	1
5	Watch glass bowl, d = 60 mm	34570-00	2
6	Safety glasses "classic" - OneSize, Unisex	39316-00	1
7	Powder spatula, steel, l = 150 mm	47560-00	1
8	Iron, coarse powder, 500 g	30067-50	1
9	Platinum wire, d = 0.3 mm, l = 100 mm	31739-03	

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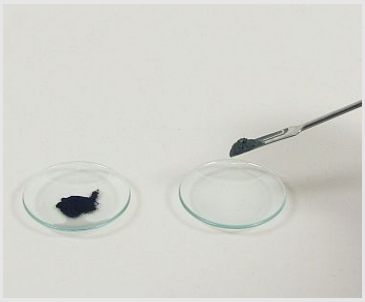
Set-up



- Take a gas burner and connect the gas burner to the gas supply.
- Follow your teacher's instructions when connecting the gas burner.
- Place the burner in the center of the workstation.

- Now take two watch glass bowls.
- Put a little metal powder (a spatula tip) on each watch glass.
- Mark the watch glass shells with a laboratory recorder.

Procedure (1/2)

Put a spatula tip of iron powder into the combustion spoon (Fig. bottom left).

Set the non-luminous burner flame and heat the iron powder vigorously. Hold the spoon at a slight angle so that no powder falls out.

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Procedure (2/2)

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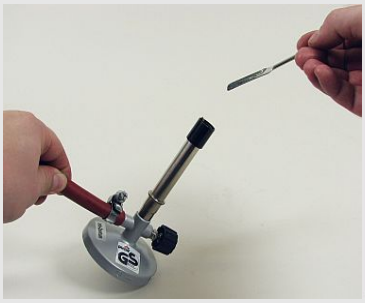

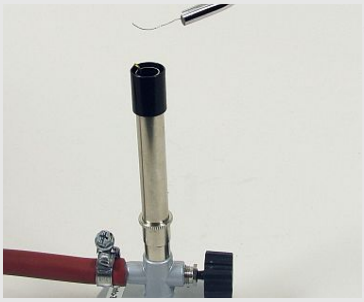

- In between, let the burn spoon cool down and clean it from metal traces.
- Take some iron powder from the watch glass dish with the spatula.
- Hold the burner at an angle with the left hand and tap the spatula lightly above the flame from a sufficient height so that some iron powder enters the flame.
- Use only the smallest amounts of powder and make sure that it does not get into the burner opening.
- Grasp the platinum wire with the crucible tongs and heat it intensively in the hottest part of the burner flame.
- Look closely at the wire before and after the test.

Disposal: Add the metal powder in the evaporating dish to the heavy metal waste.

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Report

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Task 1

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Write down your observations!

Metal	Burning spoon	open flame
Iron powder		
Zinc powder		
Platinum wi		

Task 2

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Complete the sentences.

The metal powders react much _____ violently in the open flame than when heated in the combustion spoon. They partially burn in the open flame under _____ heat development, which can be seen from the bright flame.

Sheets, on the other hand, do not _____ and react very _____ compared to the powder. However, the substances formed in the reactions are _____, even though the reaction rates were _____.

the same
burn
different
more
slowly
strong

Check

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Task 3

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Complete the sentences.

1. the platinum wire _____ change even after long and strong heating. So no chemical reaction takes place here. Platinum is a _____ metal that does _____ react when heated in air.

2. The reactivity of metals when heated in air depends on the type of metal. _____ metals react well, _____ metals react less well or not at all. Like metals react better the _____ they are distributed.

noble
fine
does not
not
noble
precious

Check

Task 4

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Which combustion process is the fastest (for the same quantity in each case)?

- 1 gram iron nails
- 1 gram platinum powder
- 1 gram silver powder
- 1 gram magnesium powder

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Slide	Score/Total
Slide 15: Metal powder combustion	0/6
Slide 16: Reactivity of metals	0/6
Slide 17: Burn reaction rate	0/1

Total 0/13

Solutions Repeat Export text

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