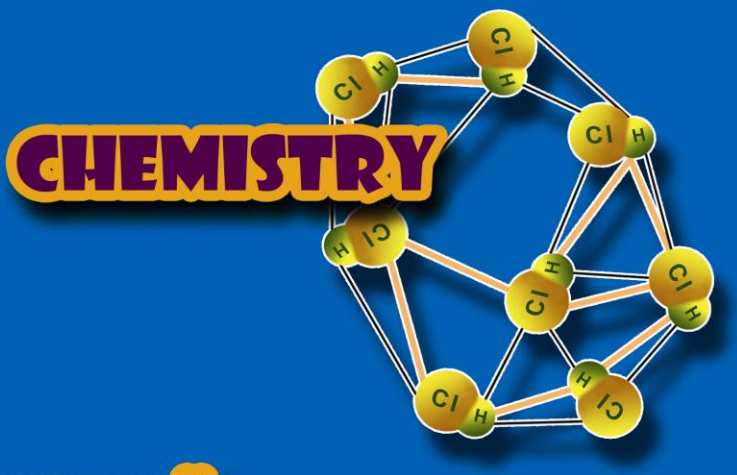
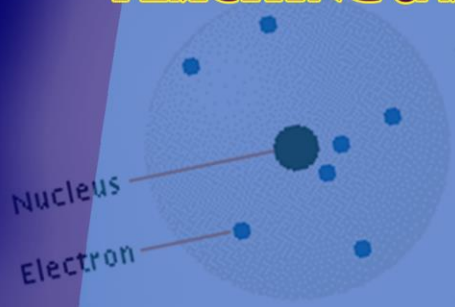


CHEMISTRY

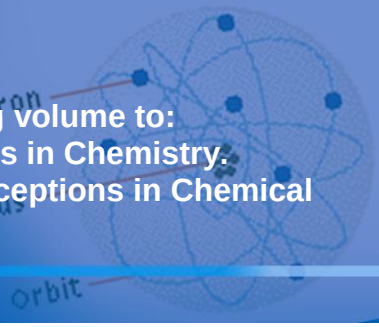
Concept Cartoons

AS A STRATEGY IN LEARNING, TEACHING & ASSESSMENT



The Rutherford Model pictured the atom as a miniature solar system with the electrons moving like planets around the nucleus.

Hans-Dieter Barke (Prof.Dr.)
Temechegn Engida (Ph.D.)
Sileshi Yitbarek (B.Sc.,MA)



The Bohr Model 'quantized' the orbits in order to explain the stability of the atom.

Accompanying volume to:
Misconceptions in Chemistry. Adressing Perceptions in Chemical Education

2008

Concept Cartoons as a Strategy in Teaching and Learning Chemistry

Accompanying volume to-
Chemistry Misconceptions: Strategies for Teaching and Learning

Hans-Dieter Barke
Temechegn Engida
Sileshi Yitbarek

2008

Contents

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Thank you all!

Barke, Temechegn & Sileshi

Background

Concept cartoons are cartoon-style drawings that put forward alternative conceptions (a range of viewpoints or misconceptions) about the science involved. By offering new ways of looking at the situation they make it problematic and provide a stimulus for developing ideas further. Concept cartoons provoke discussion and stimulate scientific thinking. (Naylor, S. and Keogh, B. 2000).

A typical Concept cartoon has the following features: Visual representation of scientific ideas, minimal text-in dialogue form, and alternative conceptions in equal status

This volume presents eight concept cartoons which are the results of research on the alternative conceptions. It is designed to accompany the book entitled "Chemical Misconceptions: Strategies for Teaching and Learning"*. The concepts are namely: Substances and Properties, Particle Concept, Structure-Property Relationships, Chemical Equilibrium, Acid-base Reactions, Redox Reactions, Complex Reactions and Energy.

The purpose of relying this volume on research of the alternative conceptions (misconceptions) is to ensure that the alternatives presented are plausible, so that learners will usually identify directly with some of the alternatives in the concept cartoons. Although many students and teachers find such kind of research on alternative conceptions fascinating it is *not* always easy to see how it can be used in the classroom. Now we strongly believe that as a strategy of diffusion and use of the research finding the concept cartoons are very valuable and have a profound effect on the quality of teaching, learning and assessment in chemistry education.

The organization of a typical lesson using a concept cartoon might be (Naylor, S. and Keogh, B. 2000).:

- Introduce the topic
- Provide a concept cartoon to focus on a particular situation
- Request a brief period of individual reflection,
- Encourage small group discussion and invite groups to see if they can reach consensus
- Some brief feedback to see what range of views is present - perhaps a class vote on the alternatives
- Discussion of how we could investigate the situation to find out which alternative(s) is most acceptable
- Small group enquiry
- Share outcomes of enquiry
- Whole class discussion, including which alternative(s) seems most acceptable now, why other alternatives seem less acceptable and what further information we might need to be sure
- Consider how relevant theory applies to the situation
- Draw ideas together and provide an explicit summary of the initial problem, the enquiry, the outcome and what has been learnt from the enquiry

* Barke, AL Hazari, and Sileshi. 2008. Chemical Misconceptions: Strategies for Teaching and Learning. Springer-verlag Berlin Heidenberg.

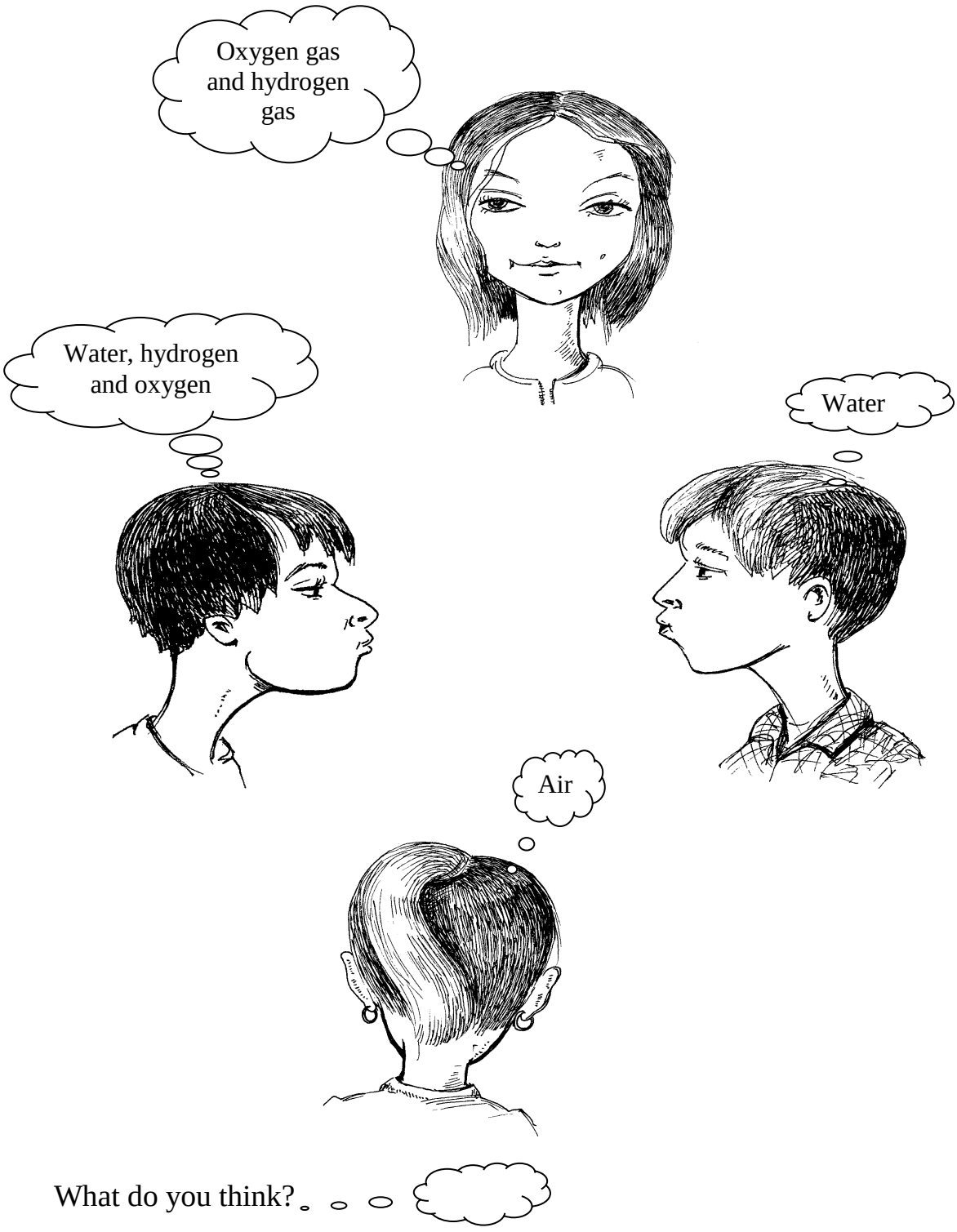
Chemical Concepts

1. Substances and Properties

1.1 Concepts of Miscibility for Compounds

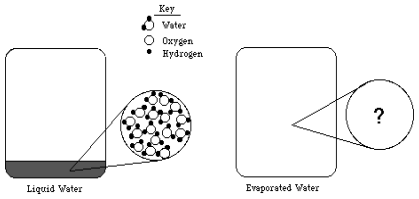
i. Evaporation of Water

Assume a beaker of pure water has been evaporated completely in a closed container. What is the composition of the vapor?

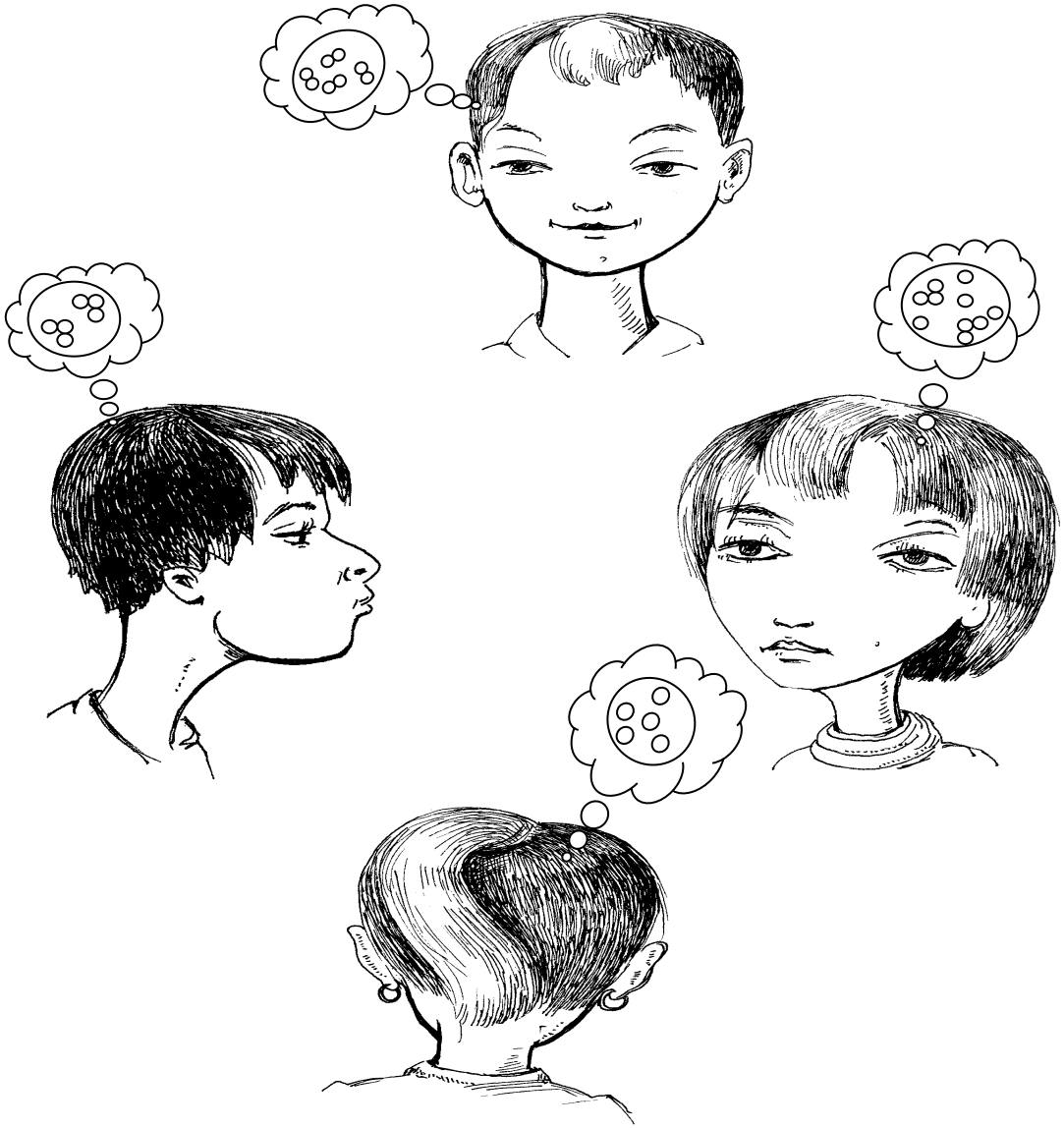


ii. Evaporation of Water (Pictorial)

The circle on the right of picture-1 shows a magnified view of a very small portion of liquid water in a closed container. What would the magnified view on the right of picture-2 show after the water evaporates?



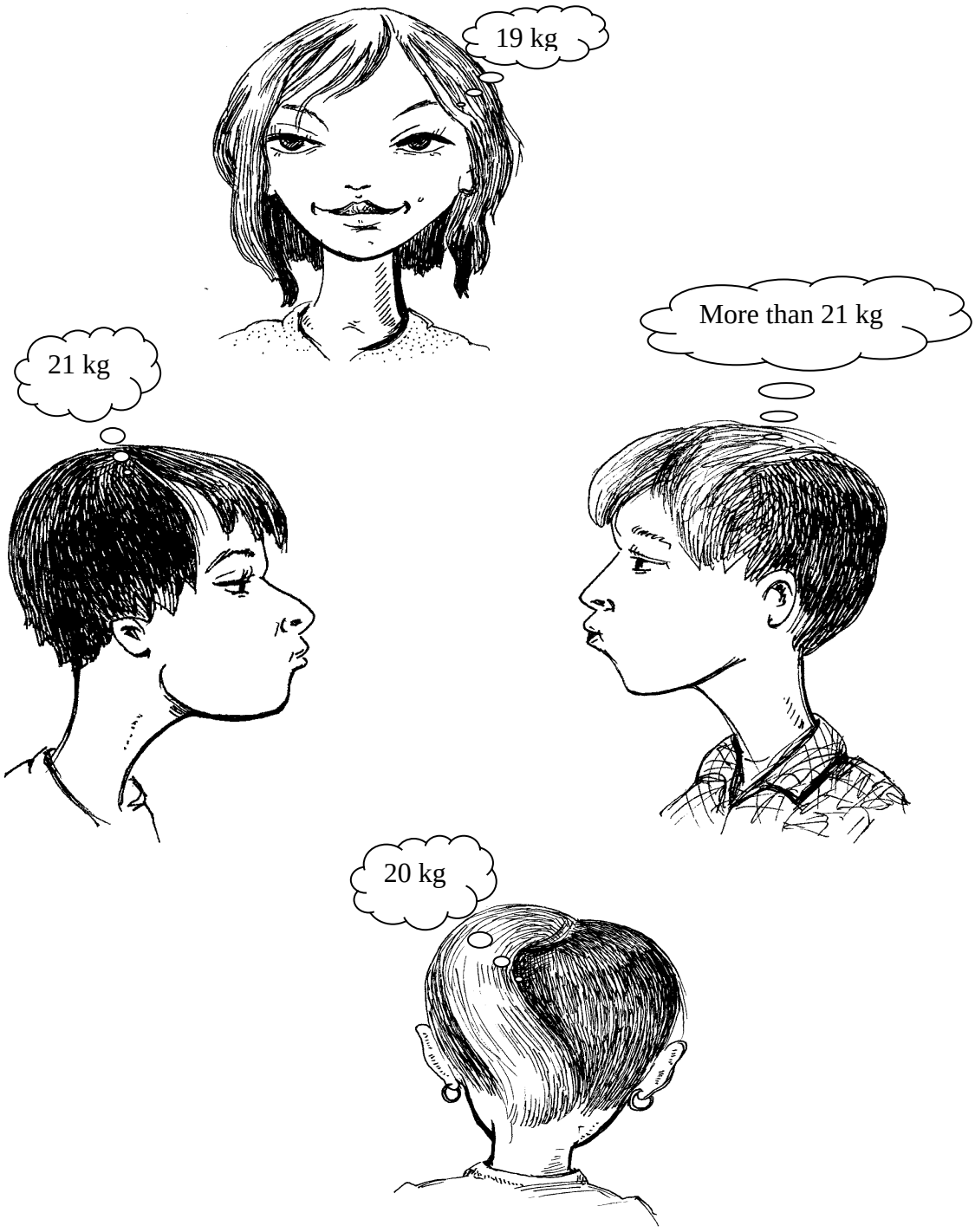
Picture-1 Picture-2



What do you think?

1.2 Concepts of Dissolution

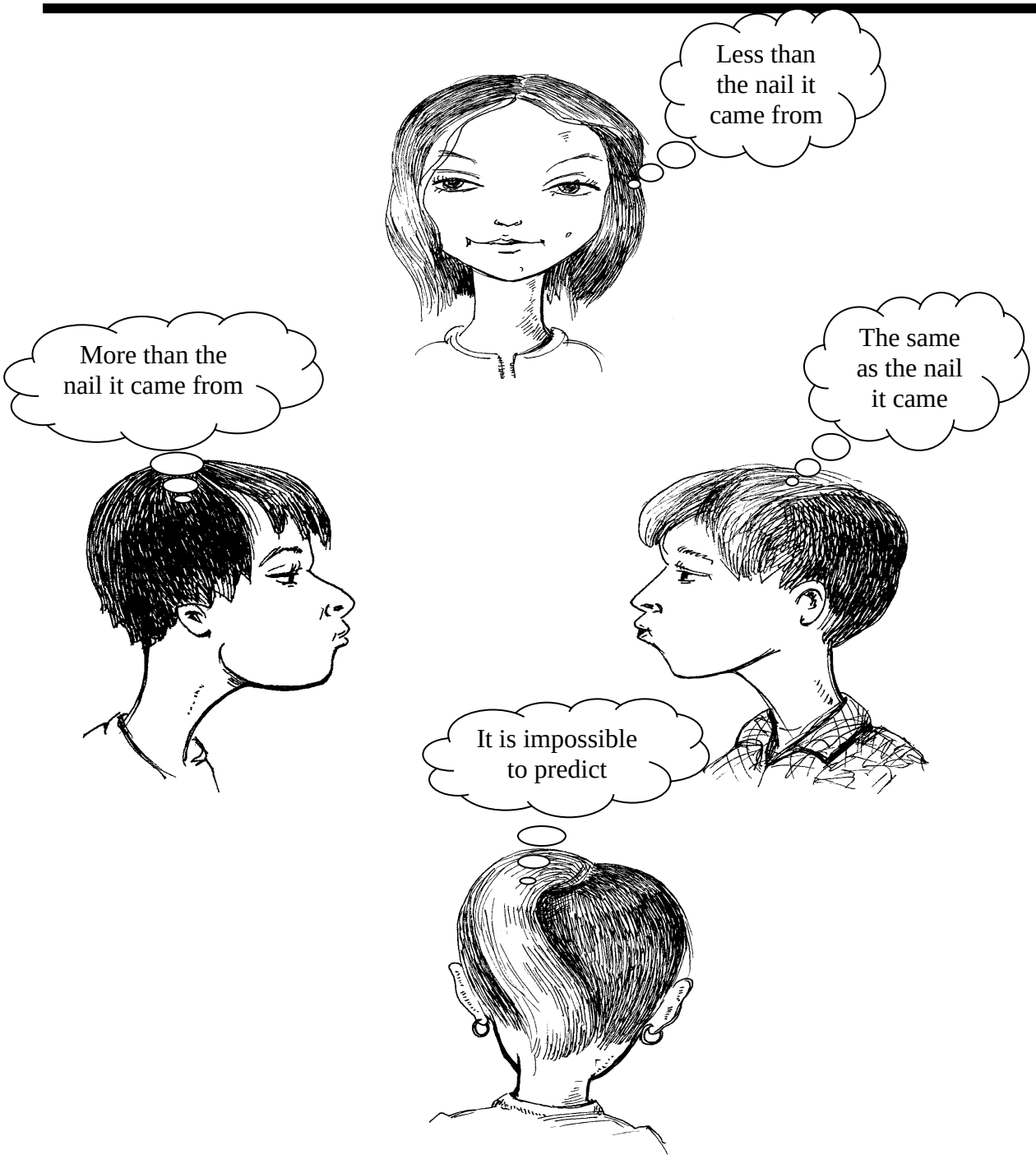
What is the mass of the solution when 1 kilogram of salt is dissolved in 20 kilograms of water?



What do you think?

1.3 Concepts of Rusting

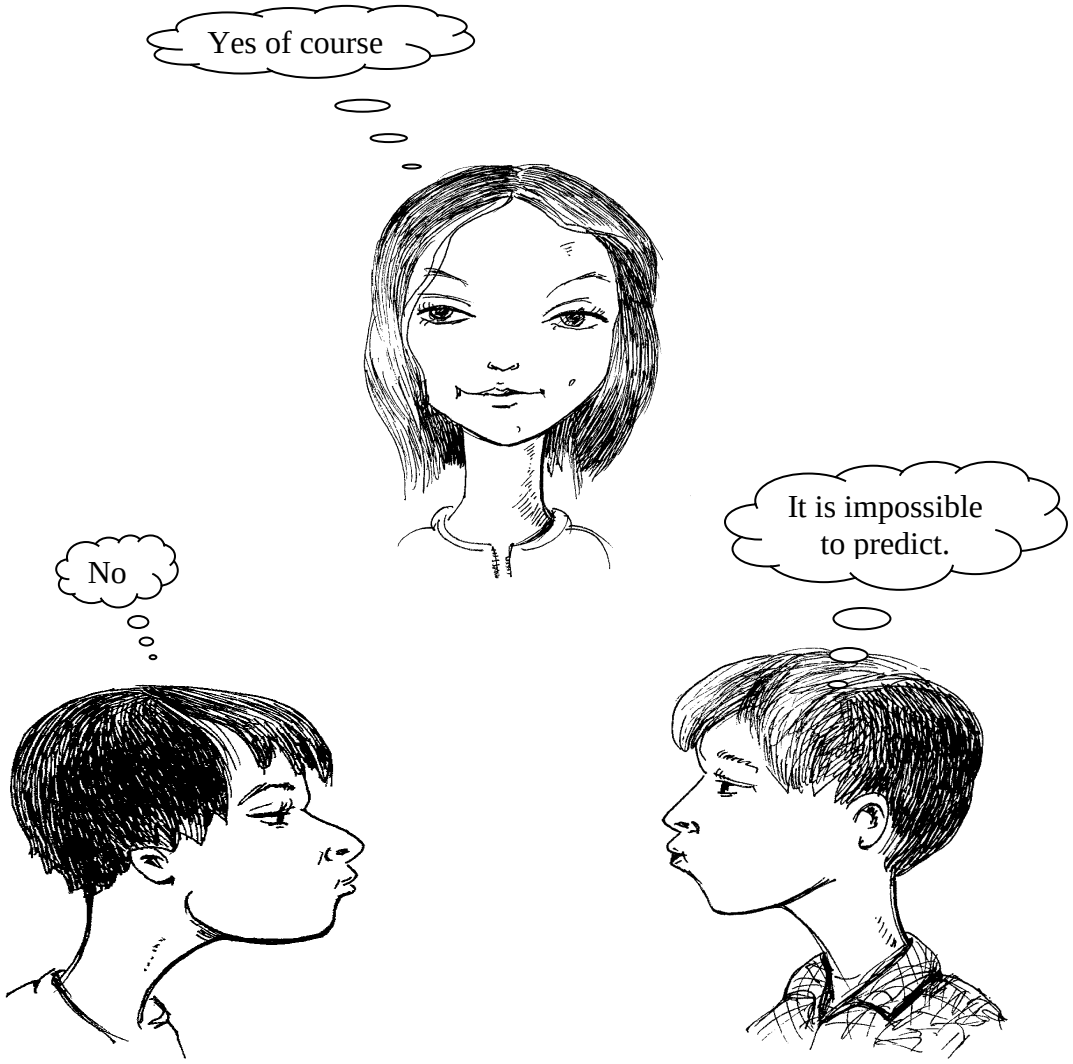
Iron combines with oxygen and water from the air to form rust. If an iron nail were allowed to rust completely, one should find that the rust weighs:



What do you think?

1.4 Concept of destruction

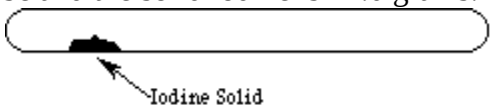
A match burns in a closed container. Some matter is destroyed.
Is this what really happens ?



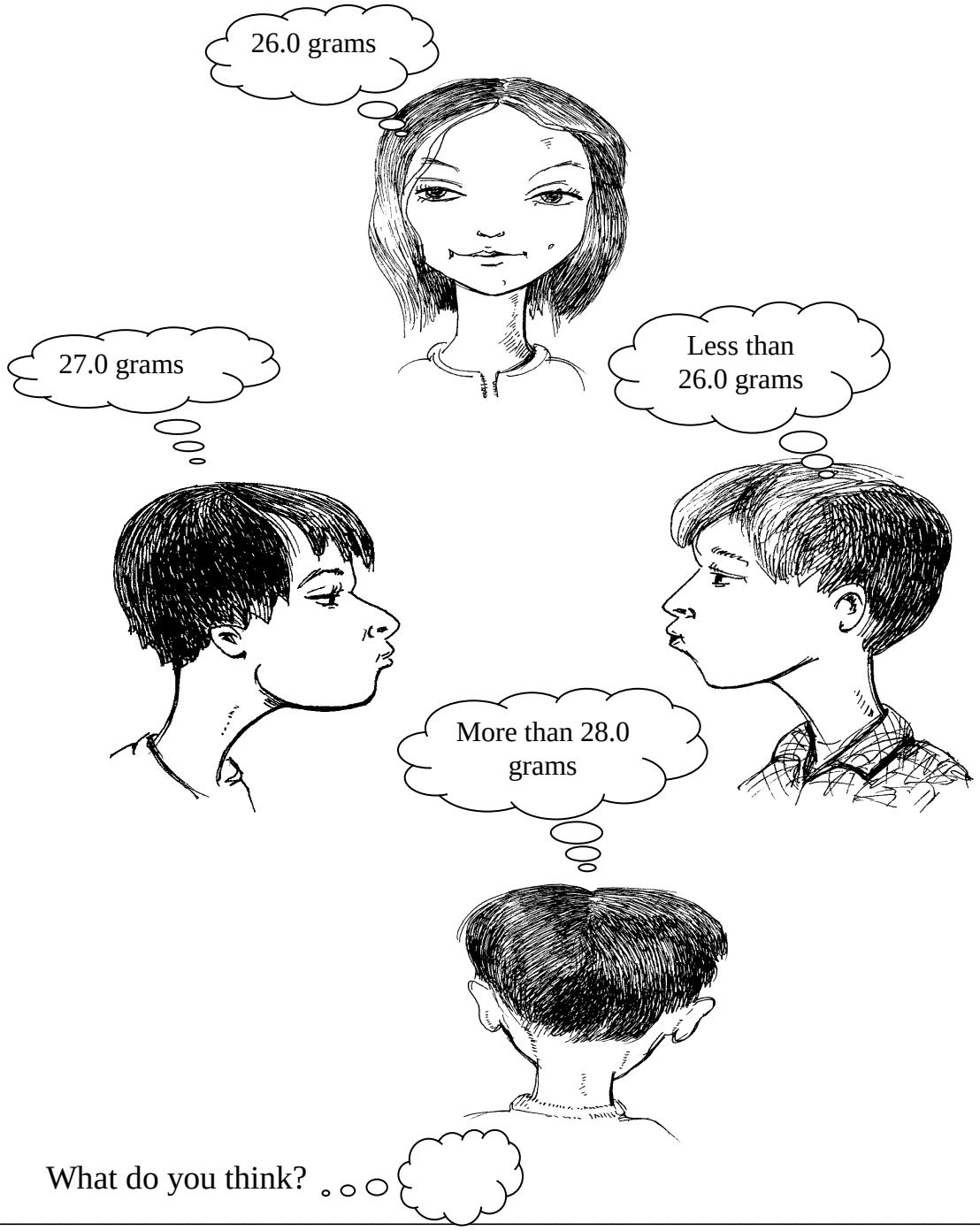
What do you think?

1.5 Concepts of "Gases are not Substances"

A 1.0-gram sample of solid iodine is placed in a tube and the tube is closed after all of the air is removed. The total weight of the tube and the solid iodine is 27.0 grams.



The tube is then heated until all of the iodine evaporates and the tube is filled with iodine gas. What will be the total weight after heating?



2. Particle concept

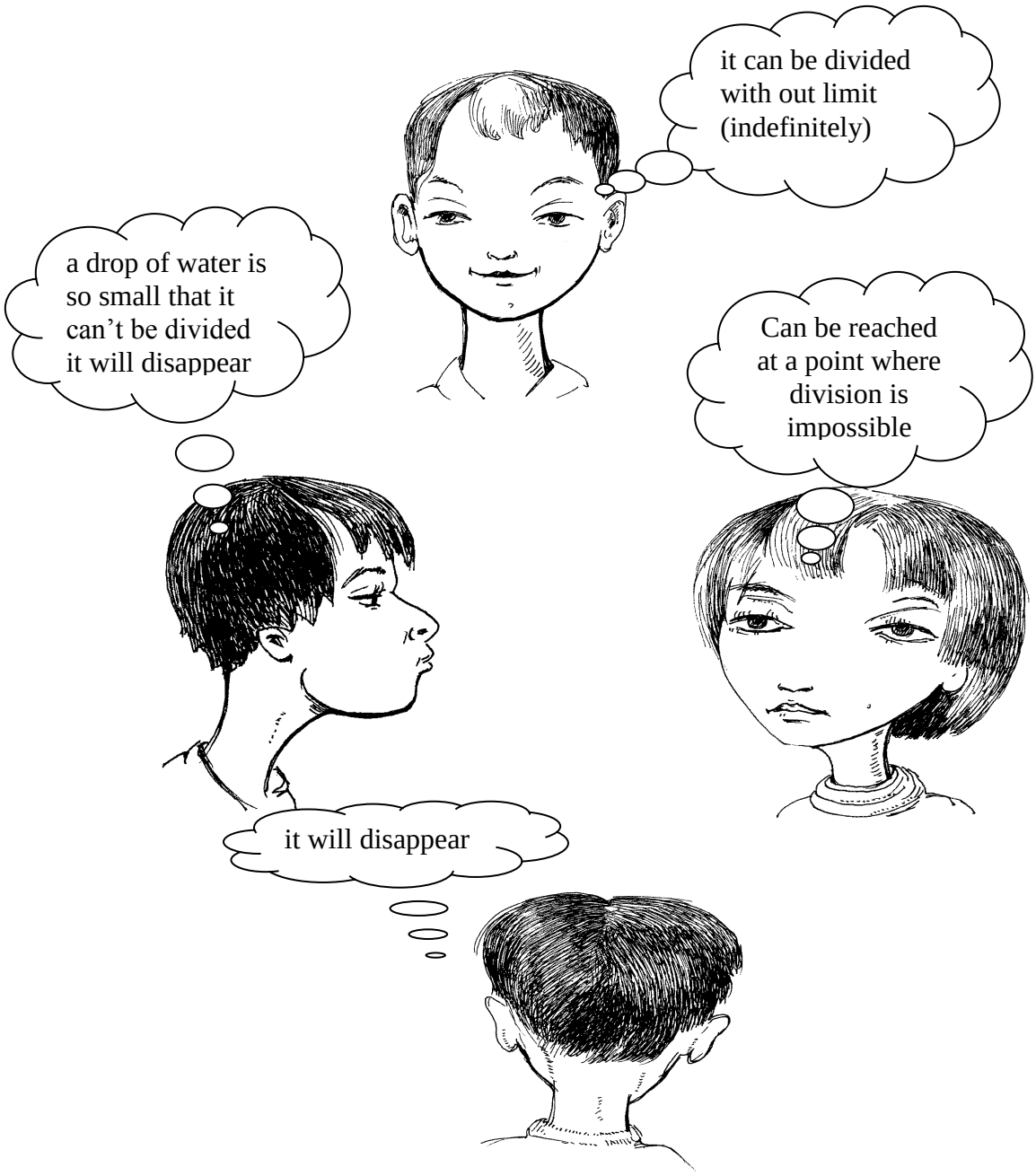
2.1 Macro versus Micro

What would be the properties of **single atom of copper** obtained from a copper wire?

What do you think?

2.2 Continuous Vs Discrete views

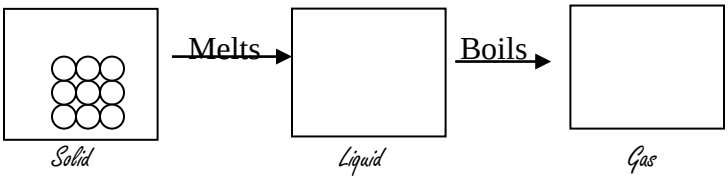
What would ultimately be found if you divide and subdivide a drop of water in to smaller and smaller parts, with out destroying the water itself?

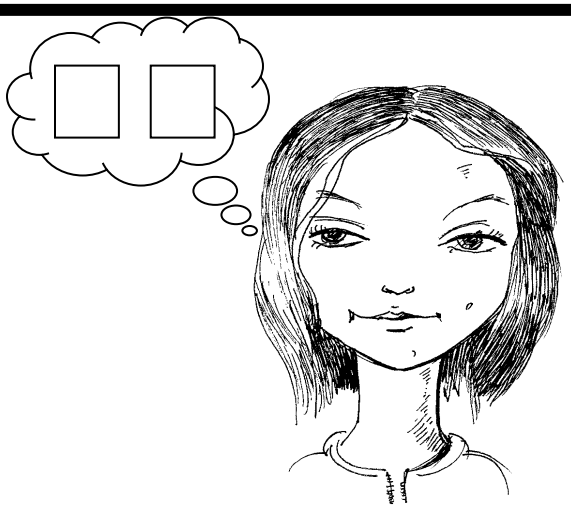


What do you think?

2.3 Nature of matter Inventory

Draw a liquid after the solid melts and draw a gas after the liquid boils, on the concept cartons.

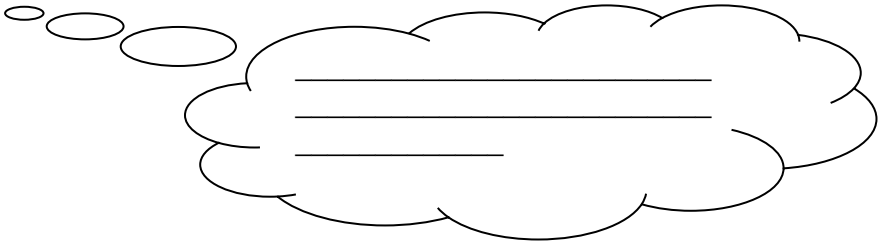




Assess your Conceptual Drawing using the criteria provided under:
Criteria of Assessment for the 'Nature of Matter Inventory'

	Criteria	Liquid	Gas
1	Conservation of particles		
2	Proximity of particles		
3	Orderliness of Particle arrangement		
4	Location of particles in container		
5	Constancy of particle size and shape		

Self reflection:

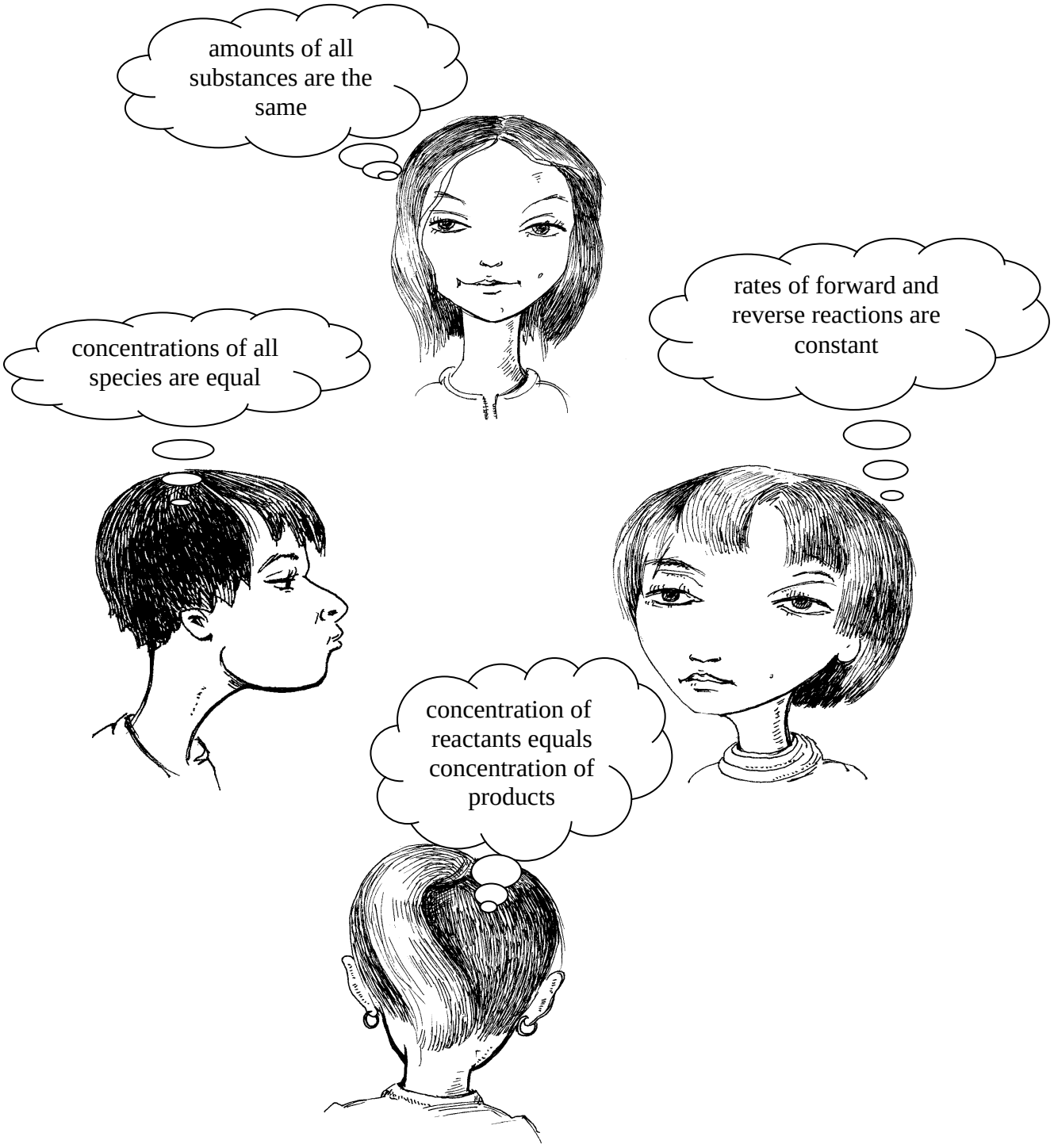


3. Structure-Property Relationships

How particles are combined in solid sodium chloride, NaCl ?

4. Equilibrium

What is valid for chemical equilibrium?



What do you think?

5. Acid-base reactions

What species are present in hydrochloric acid ?

What do you think?

6. Redox reactions

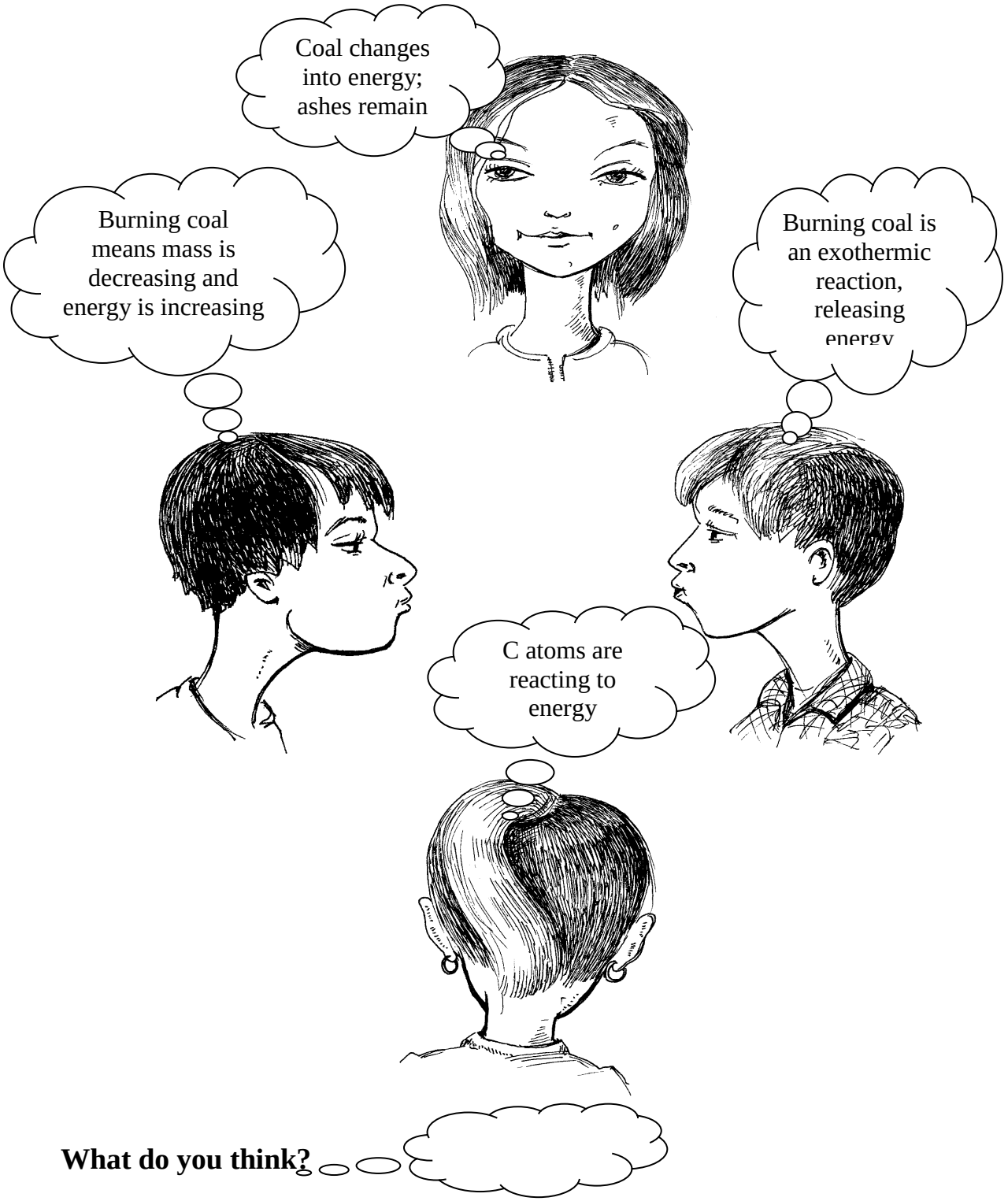
What is the reason that an iron nail turns red-brown in a solution of copper sulfate ?

What do you think?

7. Complex reaction

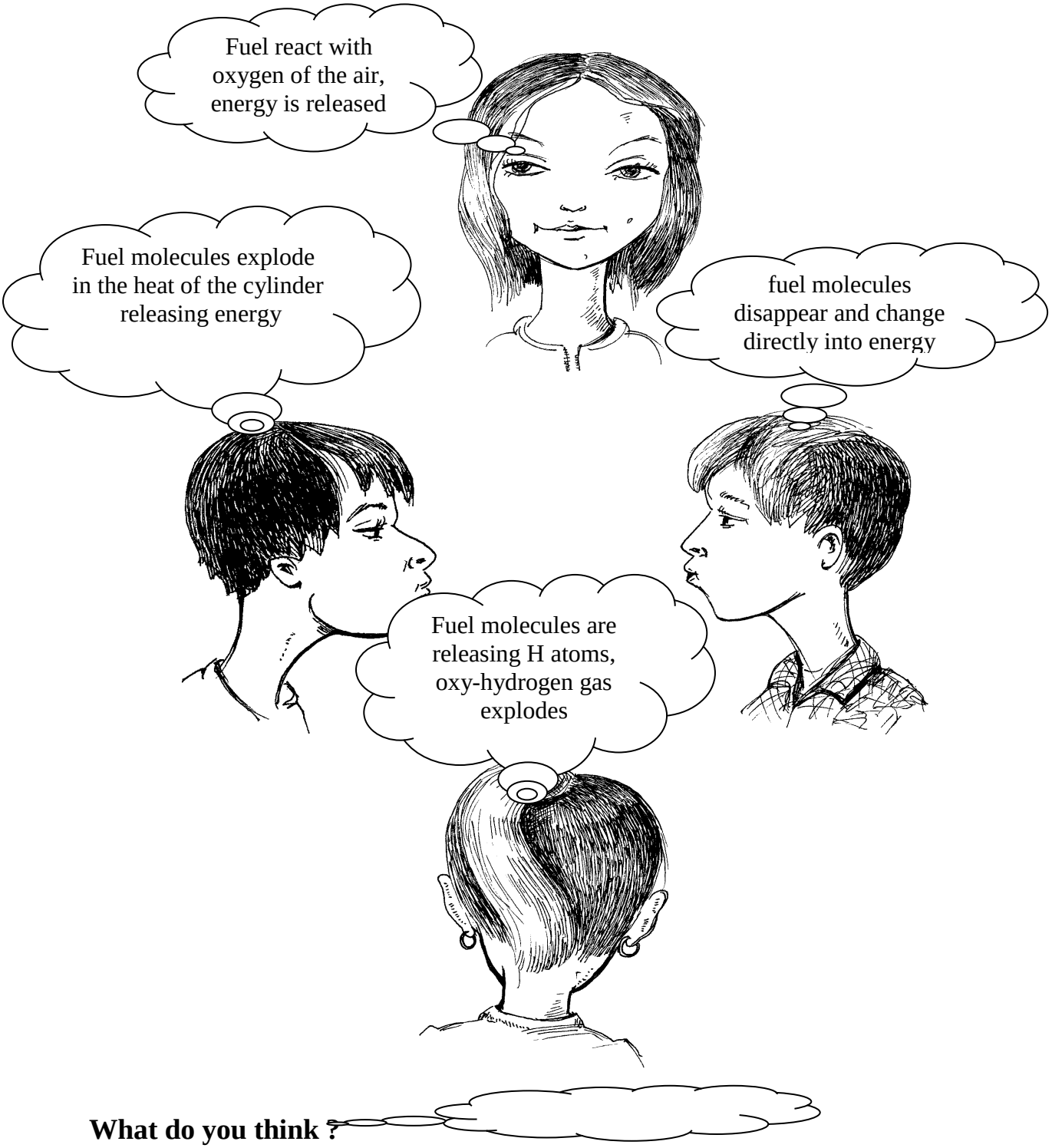
What particles are present in a blue solution of copper sulfate pentahydrate ($CuSO_4 \cdot 5\ H_2O$)?

Coal is burning and red glowing. Where the energy is coming from?



Fuel is evaporating in the car engine, the mixture with air explodes and moves the cylinder of the engine. Where the energy is coming from?

_____



What do you think ?

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