

Appendix 1

1. Fill in the table by placing the + sign in the boxes that correspond to the properties of the given gases.

Substance	Supports combustion (reactant in the oxidation reaction)	Has higher density than air
Oxygen		
Carbon dioxide		

2. Encircle YES if a statement below is true or NO if it is untrue.

- a) Carbon monoxide is used in the production of fizzy drinks. **YES NO**
- b) Air enriched with oxygen is given to persons who have breathing problems. **YES NO**
- c) There is dissolved oxygen in water. **YES NO**
- d) In a reaction between carbon dioxide and water, carbonic acid is created. **YES NO**

3. On the line next to each equation write down **C** if that equation represents a combination reaction or **D** if it is a decompositions reaction.

- a) $2\text{HgO} \rightarrow 2\text{Hg} + \text{O}_2$ _____
- b) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$ _____
- c) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ _____
- d) $2\text{Hg} + \text{O}_2 \rightarrow 2\text{HgO}$ _____

4. Complete the following sentences so that you get accurate statements:

In the process of photosynthesis, plants use _____ and _____ in order to produce food and _____.

As a source of energy for the synthesis of food, in the process of photosynthesis plants use _____.

Appendix 2

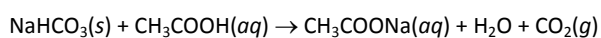
1.A Encircle the letter in front of the name of the gas to which the warning sign presented here refers:



- a) oxygen,
- b) carbon dioxide,
- c) nitrogen.

1.B Explain your answer.

2. Is it possible to extinguish a candle without blowing? Consider the following situation. Two spoonfuls of sodium bicarbonate (NaHCO_3) are poured into a bottle, adding vinegar up to one-fifth of the volume of the bottle. A chemical reaction occurs (Fig. 1), represented by the following equation:



When the reaction ends, the bottle is carefully leaned over a candle, so as **NOT** to spill the content at the bottom of it (Fig. 2). The candle is extinguished (Fig. 3).



Fig. 1



Fig. 2



Fig. 3

On the basis of the above description, draw two conclusions.

Conclusion A:

Conclusion B:

3. Propose an experiment to prove the properties of carbon dioxide of your choice.

State the CO_2 properties for which you propose an experiment.

Write down an experiment proposal.

4. On bottles of non-carbonated mineral water and carbonated mineral water there are labels containing information about their composition. A part of a label containing data on the composition of each type of water is shown underneath.

sodium, Na^+
 potassium, K^+
 calcium, Ca^{2+}
 magnesium, Mg^{2+}
 iron, $\text{Fe}^{2+/3+}$
 bicarbonates, HCO_3^-
 sulphates, SO_4^{2-}
 chlorides, Cl^-
 fluorides, F^-
 carbon dioxide, CO_2

Label 1

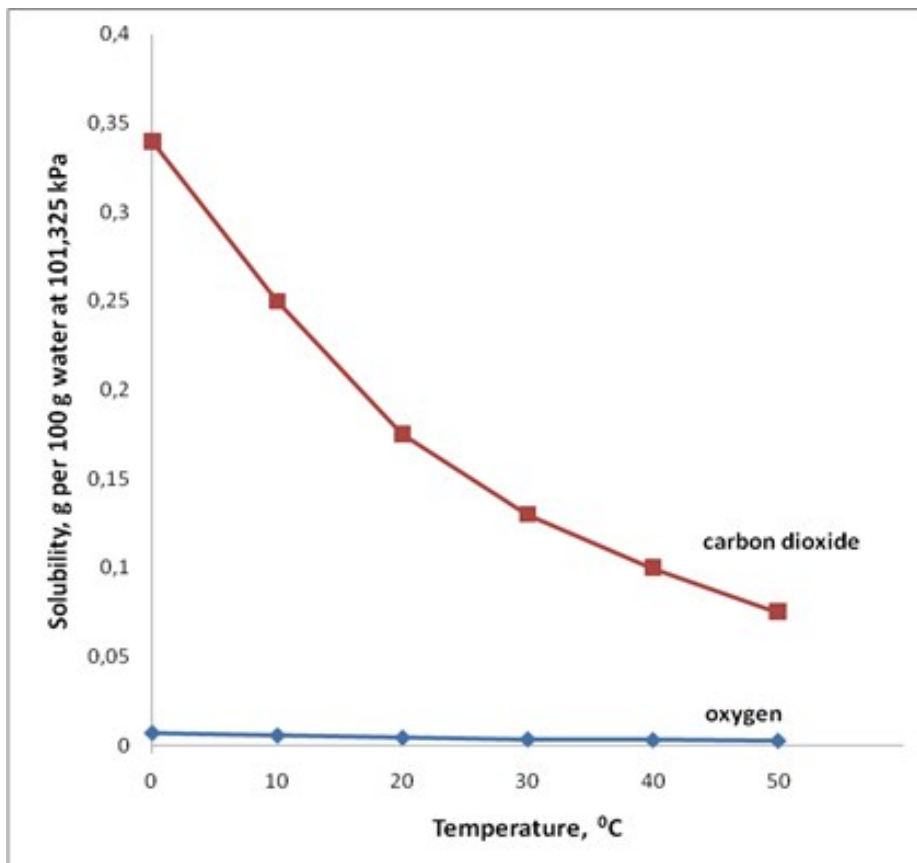
sodium, Na^+
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 bicarbonates, HCO_3^-
 sulphates, SO_4^{2-}
 chlorides, Cl^-
 fluorides, F^-

Label 2

A The label which marks a bottle of carbonated water is number _____.

B Explain your answer.

5. The graph below shows the solubility of oxygen and carbon dioxide in water at different temperatures at pressure of 101,325 kPa.



A Encircle the letter in front of a correct statement.

- a) The solubility of gases increases with the increase of the temperature of the solvent.
- b) The solubility of gases decreases with the increase of the temperature of the solvent.
- c) The solubility of gases decreases with the decrease of the temperature of the solvent.

d) The solubility of gases does not change when the temperature of the solvent changes.

B Encircle the letter in front of a correct statement.

- a) The solubility of oxygen in water at 20 °C is higher than the solubility of carbon dioxide in water at the same temperature.
- b) The solubility of oxygen in water at 20 °C is lower than the solubility of carbon dioxide in water at the same temperature.
- c) The solubility of oxygen in water at 20 °C is equal to the solubility of carbon dioxide in water at the same temperature.

6. State one use of oxygen for medical purposes.

7. On the line next to each equation write down **C** if that equation represents a combination reaction or **D** if it is a decompositions reaction.

- a) $2\text{HgO} \rightarrow 2\text{Hg} + \text{O}_2$ _____
- b) $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$ _____
- c) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ _____
- d) $2\text{Hg} + \text{O}_2 \rightarrow 2\text{HgO}$ _____

8. Maja set up the following experiment at home: inside the aquarium, she placed an Erlenmeyer flask filled with water over a water plant, so that not a bubble of air remained inside the flask (Fig. 4). After a while, she noticed that a bubble had appeared inside the flask. Maja decided to follow the change and noticed that the bubble became larger over time (Fig. 5 and 6).



Fig. 4



Fig. 5



Fig. 6

A Encircle the letter in front of the correct answer. What is the bubble in the upper part of the flask, which was filled with water at the beginning of the experiment, made of?

- a) air
- b) oxygen
- c) carbon dioxide
- d) helium

B Explain your answer.

Appendix 3

Item	The answer was coded as correct if a student:
1B	explained that the warning sign shown corresponded to oxygen, for it participated in the process of combustion,
2A	concluded that carbon dioxide did not support combustion,
2B	concluded that carbon dioxide had a higher density than air,
3	proposed an appropriate experiment to prove the stated properties,
4B	explained that carbon dioxide was a part of the composition of carbonated mineral water,
6	stated any use of oxygen for medical purposes (for example, for the purpose of inhalation, in hyperbaric chambers, in incubators for babies),
8	explained that water plants produced oxygen in the process of photosynthesis.
