# Conservation of mass: supporting resources

### This resource supports the practical video Conservation of mass, available here: [**rsc.li/373X3aW**](rsc.li/373X3aW)

## Using the structure strips

Writing about chemistry encourages students to reflect on their understanding, formulate new ideas and make links between ideas in new ways. Students also need to practice for longer-answer questions in examinations. Structure strips provide scaffolded prompts and help overcome ‘fear of the blank page’. The student sticks the strip into the margin of their exercise book or onto an A4 sheet of paper and writes alongside it. Use this long- answer question to consolidate learning after the practical and/or for revision. (Read more at rsc.li/2P0JDlW.)

**Long-answer question:**

*A student has a conical flask containing 200 cm3 of hydrogen peroxide.*

*They added the catalyst manganese oxide which speeds up the decomposition of hydrogen peroxide to water and oxygen. At the end of the reaction they observed that the mass of water produced was less than the mass of hydrogen peroxide they started with.*

*The student is concerned that the law conservation of mass does not work.*

*Explain how conservation of mass can still be applied even when there is an observed change in mass.*

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| **Conservation of mass Structure strip** | **Conservation of mass Structure strip** | **Conservation of mass Structure strip** | **Conservation of mass Structure strip** | **Conservation of mass Structure strip** |
| Define what is meant by ‘conservation of mass’. | Define what is meant by ‘conservation of mass’. | Define what is meant by ‘conservation of mass’. | Define what is meant by ‘conservation of mass’. | Define what is meant by ‘conservation of mass’. |
| Describe an open and closed system. | Describe an open and closed system. | Describe an open and closed system. | Describe an open and closed system. | Describe an open and closed system. |
| State the products of the decomposition of hydrogen peroxide. | State the products of the decomposition of hydrogen peroxide. | State the products of the decomposition of hydrogen peroxide. | State the products of the decomposition of hydrogen peroxide. | State the products of the decomposition of hydrogen peroxide. |
| Compare the states of matter of the reactants and products. | Compare the states of matter of the reactants and products. | Compare the states of matter of the reactants and products. | Compare the states of matter of the reactants and products. | Compare the states of matter of the reactants and products. |
| Explain why an observed change in mass has occurred. | Explain why an observed change in mass has occurred. | Explain why an observed change in mass has occurred. | Explain why an observed change in mass has occurred. | Explain why an observed change in mass has occurred. |
| Suggest an improvement to the method or equipment which  would allow the law of conservation of mass to be observed. | Suggest an improvement to the method or equipment which  would allow the law of conservation of mass to be observed. | Suggest an improvement to the method or equipment which  would allow the law of conservation of mass to be observed. | Suggest an improvement to the method or equipment which  would allow the law of conservation of mass to be observed. | Suggest an improvement to the method or equipment which  would allow the law of conservation of mass to be observed. |

### Structure strip: suggested answer content

**Conservation of mass Structure strip**

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| Define what is meant by ‘conservation of mass’. | The law of conservation of mass states that mass is always conserved during a chemical reaction. Mass cannot be created or destroyed during a reaction. This means that the total mass of the reactants before a reaction will be the same as the total mass of the products after the reaction. The total number of atoms remains the same but they are rearranged to make new products. |
| Describe an open and closed system. | An open system is one in which energy and matter can pass easily to and from the surroundings. A closed system does not allow any mass or energy to escape. In a closed system you will be able to easily observe the conservation of mass. Reactions in an open system may appear to violate the law of conservation of mass. |
| State the products of the decomposition of hydrogen peroxide. | Hydrogen peroxide slowly decomposes to form the products water and oxygen. Manganese oxide acts as a catalyst in this reaction. This means that it speeds up the decomposition of hydrogen peroxide while undergoing no change itself and so its mass remains constant. |
| Compare the states of matter of the reactants and products. | Hydrogen peroxide is a liquid at room temperature. The decomposition reaction is exothermic, but does not give off enough heat to vaporise the water therefore the products of the reaction are liquid water and oxygen gas. This can be shown by using state symbols in the word equation:  Hydrogen peroxide (aq)\* → water (l) + oxygen (g)  \*The state symbol for hydrogen peroxide is aq because we do not use 100% hydrogen peroxide by volume. However, do not reduce marks if a learner uses the symbol (l) in their answer. |
| Explain why an observed change in mass has occurred. | In an open system there will be an observed change in mass during this reaction. The total mass of the water and manganese oxide at the end of the reaction will be less than the total mass of the hydrogen peroxide and manganese oxide before the reaction. Since the manganese oxide is unchanged the loss of mass has to have occurred during the decomposition. Since the oxygen is in a gaseous state and the reaction occurred in an open system we can account for the loss in mass because the oxygen has dissipated into the surroundings. Therefore the loss in mass is equal to the mass of oxygen produced. |
| Suggest an improvement to the method or equipment which  would allow the law of conservation of mass to be observed. | In order to be able to observe the law of conservation of mass you need to prevent the oxygen from escaping into the surroundings. There are a number of methods you could use to collect the oxygen gas. You could attach a balloon to the neck of the flask or complete the reaction inside a sealed bag. Alternatively, you could connect the conical flask to a gas syringe using a rubber bung and delivery tube. This way you could measure the volume of gas collected and use that to calculate the mass. |