Chapter 5: Physical and chemical change

Experiment 5.1: Melting chocolate

Experiment worksheet answers (pages 80–81 and 189)

Discussion

1 Was there any difference in the time it took for each type of chocolate to melt?

Student results will vary according to the chocolate used.

2 Did all three types of chocolate melt in the same pattern? (Inside first or outside edges first?)

Student results will vary.

3 How could a chef apply your observations in the kitchen?

If a chef has an understanding of how the different chocolates melt, then they will be more efficient in using chocolate in their recipes.

4 Did you burn any of the types of chocolate?

Student results will vary.

5 If you burnt the chocolate, did a new substance form? How can you tell?

Burnt chocolate changes its appearance (dull and black), texture (crumbly) and can produce a gas.

Conclusion

What similarities and differences are there between milk, dark and white chocolate?

Student results will vary according to the chocolate used in the experiment.

Challenge 5.1: Exploring physical change

Experiment worksheet answers (pages 80–81 and 190)

Discussion

1 List three different ways in which a physical change can take place.

Changing state by adding or removing heat; changing shape or by changing size.

2 What did each change have in common?

The elements or molecules do not change, just the shape of the whole substance.

Challenge 5.2: Making caramel

Experiment worksheet answers (pages 82–83 and 190)

There are no questions for this experiment.

Experiment 5.2: Observing chemical reactions

Experiment worksheet answers (pages 82–83 and 191)

Discussion

1 What happened to the copper carbonate when it was heated?

The copper carbonate changed from green to black copper oxide when heated.

2 Did it change when taken away from the heat?

No.

3 Is this similar to the melting chocolate experiment? Why or why not?

No. The change is not temporary and does not spontaneously change back to green copper carbonate.

4 What is produced in the baking soda and acid experiment?

Water, a metal salt and gas (carbon dioxide) are formed.

5 Why does the flame on the burning splint go out if carbon dioxide is present?

A flame requires oxygen to burn. If carbon dioxide is present, then often there is no oxygen present.

6 What happened to the magnesium metal?

The magnesium metal underwent a combustion reaction (it burned) to form black magnesium oxide.

Conclusion

What did you observe about the reactants and products of chemical reactions?

The products of a chemical reaction are different from the reactants of a chemical reaction. A new substance is formed.

Experiment 5.3: Comparing reactants and products

Experiment worksheet answers (pages 84–85 and 192)

Discussion

1 Do magnesium and magnesium oxide have the same physical properties?

Magnesium and magnesium oxide do not have the same physical properties. Magnesium is a silver-grey metal, whereas magnesium oxide is a white crystalline powder.

2 Do magnesium and magnesium oxide have the same chemical properties?

Magnesium and magnesium oxide do not have the same chemical properties. Magnesium oxide is formed by an ionic bond between one magnesium and one oxygen atom. Magnesium is a metal and a pure substance/element.

Conclusion

What do you know about the physical and chemical properties of reactants and products?

The physical and chemical properties of reactants and products are completely different. When a chemical reaction occurs or a chemical changes, the chemical properties also change. An example is salt (sodium chloride). Sodium needs to be kept in oils as it reacts with oxygen, while chlorine is a pale green gas. When combined, they create salt, a totally different substance with completely different chemical and physical properties.

Experiment 5.4A: Effect of particle size on reaction rates

Experiment worksheet answers (pages 86–87 and 193)

Discussion

1 Which eggshell dissolved faster?

The ground-up eggshells will dissolve faster than the large eggshell pieces.

2 How many times faster was the rate of the reaction for the ground-up eggshell than for the large piece of eggshell?

Student results will vary.

3 Why do small pieces react faster than one large piece?

Small pieces have more edges for the acid particles to contact. This means there is more surface area for the chemical reaction to occur.

4 Why is stirring necessary?

Stirring the eggsshells and acid allows the products of the chemical reaction to be removed from the edge of the eggshells, allowing fresh acid to contact the eggshell.

5 Did grinding up the eggshell change the amount of calcium carbonate in it?

No. There is the same amount of calcium carbonate in both the large pieces and the ground-up eggshells. Therefore the same amount of product is formed. The ground-up eggshell reaction just occurs at a faster rate.

Conclusion

What do you know about how particle size affects reaction rate?

Smaller particle size provides a greater surface area for chemical reactions to occur and therefore chemical reactions occur at a faster rate.

Experiment 5.4B: Speeding up reactions with enzymes

Experiment worksheet answers (pages 86–87 and 194)

Discussion

1 Was the breakdown of hydrogen peroxide into oxygen and water noticeable before the yeast was added?

No. No gas could be seen to be produced.

2 What happened to the rate of hydrogen peroxide breakdown when the yeast was added?

The rate of gas produced as a result of the breakdown of the hydrogen peroxide increased.

3 What effect did the gas produced have on the glowing splint?

The glowing splint was relit when placed in the gas produced by the breakdown of the hydrogen peroxide.

4 What gas would cause this reaction?

oxygen

Conclusion

What do you know about how enzymes affect the rate of a reaction?

Enzymes increase the rate of a chemical reaction, not the total amount of product produced.

Experiment 5.5: Making casein glue

Experiment worksheet answers (pages 88–89 and 195)

Discussion

1 Why is it important to wear safety glasses in this experiment?

It is important to wear safety glasses in this experiment to ensure chemicals or animal products don’t get in the eyes.

2 What are the reactants used in this experiment? What are the products?

The reactants in this experiment are milk, vinegar and baking soda. The products are curds, whey and, ultimately, casein glue.

3 How could you compare the strength of different glues?

The strengths of different glues could be compared by gluing two icy pole sticks together and waiting until the glue has dried before trying to pry them apart.

4 How do you think someone worked out that you could make glue from milk?

Casein glue was probably discovered by mistake.

Conclusion

What do you know about making glue?

Making glue is a chemical reaction as a new substance is produced.