Figure 5.3.2 The slow chemical reactions that ferment wine and give it its flavour mean that it can take years before the wine is ready to drink.

Controlling the rate of chemical reactions

The rate of almost every reaction can be increased or decreased. For example, when you run a race and then breathe deeply, your heart pumps faster to speed up the rate of respiration. In contrast, the rate of respiration slows down when you're calm and relaxed. Scientists examine how each chemical reaction works to determine the best method for controlling its rate of reaction.

Factors that affect the rate of reaction are:

- temperature
- concentration of the reactants
- surface area (if the reactants are in lumps or fine powder)
- agitation (mixing and stirring)
- catalysts (chemical helpers).

By changing these variables, scientists can control how fast or slow a chemical reaction proceeds.

Temperature

Increasing the temperature will normally increase the rate of a chemical reaction. This occurs for two reasons.

First, increasing the temperature increases the speed of the particles in liquids and gases. As a result, particles collide more frequently, so more chemical reactions occur in a shorter amount of time.

Second, increasing the temperature gives the particles more energy. So, when the molecules collide, chemical bonds are more likely to break and the atoms in the reactants can rearrange more easily to form products.

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There are many reasons for using heat to increase the rate of a reaction. When you bake a batch of biscuits, you place it in the oven to increase the rate of chemical reactions that convert your dough into biscuits. However, you can't increase the temperature too much or the rate of reaction will be so fast that the biscuits will burn before they are cooked all the way through. This is what has happened in Figure 5.3.3.

Figure 5.3.3 Biscuits must be baked at the right temperature. If the temperature is too high, the reaction is so fast that they burn before they are cooked inside.

Sometimes you may want to decrease the rate of reaction by lowering the temperature. When you place a carton of milk in the fridge, it slows the rate of the chemical reaction that turns milk sour. Similarly, fruit farmers will transport their produce in refrigerated trucks to stop the fruit ripening before it gets to market.

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Putting life on hold

Through the process of in-vitro fertilisation (IVF), human egg cells can be fertilised and frozen for later use. Freezing the eggs stops the chemical reactions that cause the embryo to develop. Today, one in 33 births in Australia is the result of IVF. That's almost one in every classroom.

Figure 5.3.4 Frozen human eggs