SECTION 3 *Questions 28–40*

Read the text on pages 125 and 126 and answer Questions 28–40.

Serendipity – accidental discoveries in science

What do photography, dynamite, insulin and artificial sweetener have in common? Serendipity! These diverse discoveries, which have made our everyday living more convenient, were discovered partly by chance. However, Louis Pasteur noted the additional requirement involved in serendipity when he said, '… chance favours only the prepared mind'.

The discovery of modern photography provides an example of serendipity. In 1838, L. J. M. Daguerre was attempting to 'fix' images onto a copper photographic plate. After adding a silver coating to the plate and exposing it to iodine vapour, he found that the photographic image was improved but still very weak. Desperate after an investigation lasting several months, Daguerre placed a lightly exposed photographic plate in the cupboard in which laboratory chemicals such as alcohol and collodion were stored. To his amazement, when he removed the plate several days later, Daguerre found a strong image on its surface.

This image had been created by chance. It was at this point that Louis Pasteur's 'additional requirement' came into play: Daguerre's training told him that one or more of the chemicals in the cupboard was responsible for intensifying the image. After a break of two weeks, Daguerre systematically placed new photographic plates in the cupboard, removing one chemical each day. Unpredictably, good photographic images were created even after all chemicals had been removed. Daguerre then noticed that some mercury had spilled onto the cupboard shelf, and he concluded that the mercury vapour must have improved the photographic result. From this discovery came the universal adoption of the silver-mercury process to develop photographs.

Daguerre's serendipitous research effort was rewarded, a year later, with a medal conferred by the French government. Many great scientists have benefited from serendipity, including Nobel Prize winners. In fact the scientist who established the Nobel Prize was himself blessed with serendipity. In 1861, the Nobel family built a factory in Stockholm to produce nitroglycerine, a colourless and highly explosive oil that had first been prepared by an Italian chemist fifteen years earlier. Nitroglycerine was known to be volatile and unpredictable, often exploding as a result of very small knocks. But the Nobel family believed that this new explosive could solve a major problem facing the Swedish State Railways – the need to dig channels and tunnels through mountains so that the developing railway system could expand.

However, as turnover increased, so did the number of accidental explosions resulting from the use of nitroglycerine. Some people blamed the people who used the explosive more than the substance itself, because nitroglycerine had become popular for inappropriate purposes such as polishing the leather of shoes.

At the age of thirty, Alfred Nobel made the first of his major inventions: an innovative blasting cap, a device designed to control the nitroglycerine explosion. Nobel was also determined to discover a way to make this explosive safer to manufacture, transport and use. Firstly, he experimented with adding chemicals to nitroglycerine, but because the chemicals required huge amounts of resources and energy to wash out, this process was considered to be impractical. He then tried to use fibrous material such as sawdust, charcoal or paper to stabilise the explosive, but these combustible materials tended to catch fire when placed near nitroglycerine. As an alternative, he added powdered brick dust to tame the explosive, as he knew that brick dust would not catch fire. However, the brick dust reduced the explosive power of the product, and so was also found to be unsatisfactory.

According to one version of how the eventual solution was found, a metal container of nitroglycerine sprang a leak, and some of the liquid soaked into packaging material that lay around the container. Nobel immediately set to work to examine the connection between the two materials and found that when the packaging material was mixed with nitroglycerine it could be pressed into a compact solid. This solid retained the explosive power of the liquid, but was entirely safe and reliable because it would not ignite until set off by a blasting cap.

As a scientist who had worked systematically towards a solution for a number of years, Nobel immediately understood the importance of this discovery. But the discovery had only come about because of his perseverance. Through Nobel's clear vision, systematic research and his quick grasp of the significance of his discovery, he set himself apart from the many scientists who were not 'fortunate' enough to create new products that would make them famous.

Alfred Nobel, a lifelong pacifist, hoped that his explosive would be a powerful deterrent to warfare. Nobel sought to achieve permanent worldwide peace. In setting up the Nobel Foundation and the Nobel Peace Prizes, he hoped to accomplish what he had not been able to do during his lifetime: to encourage research and activities that would bestow the 'greatest benefit to mankind', especially peace and fraternity between nations. His vision was of a peaceful world.