Technical consideration – Plastic syringes

Most chemists are not familiar with syringes, since these are usually associated with medical use and fitted with a hypodermic needle (which must not be used in a school context). However, the plastic syringe is a very useful and inexpensive piece of equipment for delivering volumes of liquid (in a similar way to a measuring cylinder) and for capturing gases. Syringes are made to International Standards and so they can be used in place of measuring cylinders for liquids. The names of the parts and components are shown in Figure1.

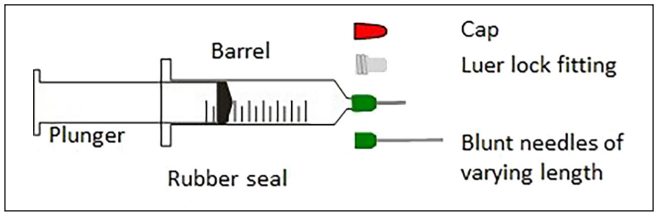

Figure 1 The components of a syringe.

If we want to deliver very small drops (by a method similar to that employed in titration, where plastic transfer pipettes are used), then one option would be to use the varying lengths of a blunt needle (see Figure 5.1 in the book). The size of drops from the nozzle or needle depends upon the surface tension of the liquid as well as the diameter of the opening.

Caps can be fitted to keep liquids and gases in the barrel of the syringe. A special "Luer" lock nozzle requires the user to twist the cap or needle on the nozzle, which means that they are more securely fitted. This is not a special requirement here.

Another fitting is the 3-way tap, which is discussed on page 88 in the book (Figure 8.14).

Polypropylene syringes can hold aqueous solutions and many organic solvents and glues. The rubber seal is very efficient, and hydrogen has been stored in a capped syringe for many days. However, oxidising agents can be an issue with the rubber seal, so, if chlorine or nitrogen dioxide is present for long periods, the seal sticks.

The plunger is not free-flowing (as with the glass gas syringe) so, to deliver liquids, it is better to hold the stem of the plunger, rather than the flat end. The plunger should be pushed slowly.

Filling the syringe with a liquid.

When the plunger is raised to draw a liquid up the barrel, dissolved gases in the liquid are removed and form bubbles under the rubber seal. This makes establishing the volume of the liquid difficult.

The method below indicates that raising the barrel a little to provide space that the removed gases can fill (Figure 2a) overcomes the problem. The liquid is drawn up beyond the volume required (Figure 2b). Finally, the plunger can be moved to the volume required (Figure 2c), in this case 10 cm^3.