4Q The Lead – Acid Battery

This is the most important use of lead today. Invented in 1859, the lead acid battery is still be best way to start the engine of a car, because it delivers a large amount of power, and can quickly be recharged.

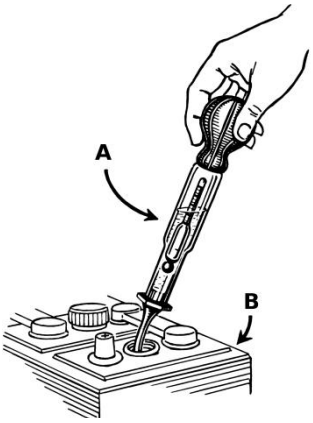
Inside each cell of the battery are two electrodes. These are connected to the positive (red) and negative (black) terminals on the battery. The cell is filled with sulphuric acid. In the discharged state the acid reacts with both the lead and the lead oxide to produce Lead Sulphate and water.

Charging the battery reverses the reaction, so that the lead sulphate turns to lead on one electrode and lead oxide on the other. As lead sulphate reacts, the concentration of Hydrochloric Acid gets stronger. As the acid is much denser than water, an easy way to test the level of charge is to use a hydrometer, which sucks a little of the acid into a tube with a calibrated float inside.

The importance of this process is that the reaction is REVERSIBLE. The battery can be charged and discharged several hundred times.

Because both lead and sulphuric acid are dangerous, demonstrating this requires care. A car battery provides a larger quantity of acid to be tested, but a transparent motor cycle battery may give a clearer indication of what is inside the cells of the battery.

1. Charge the battery fully.
2. Test the density of the acid by removing the caps to the battery cells, and suck up some of the acid with a hydrometer. These can be obtained from car spares shops like Halfords. All the acid should be put back in the battery after testing.
3. Replace the caps on the cells.
4. Use the battery to power bulbs and leave them for some time until the light dims.
5. Test the density of the acid again. It should have reduced.
6. Replace the caps and recharge the battery.
7. It should now be possible to demonstrate that the density of the acid is high again.



Using a Hydrometer

Overcharging the battery will release hydrogen and this could cause an explosion if it is a confined space.

If the battery can be placed on scales, such as a sensitive electric balance this change in density of the liquid can be demonstrated in another way.

1. Weigh the battery, to prove that the total weight is the same whether it is charged or discharged.
2. Take one full syringe of liquid from the battery when it is charged, and note how much the battery weight falls.
3. Return the liquid, discharge the battery, and then take out another syringe of liquid. The loss of weight should be slightly less than before, showing that water is not as dense as acid.