CONTENTS

CHEMISTRY

BIOLOGY

ENERGY AND ELECTRICITY

GENERATING ELECTRICITY

Electricity has to be up there as mankind's favourite energy source. It's easy to work with and we can use it to power all kinds of machines and processes. However, naturally occurring electricity is rare and unpredictable – harnessing lightning strikes isn't really a practical option, for example. So we generate our electricity by converting other, more easily obtainable, energy sources.

Natural Energy Sources

Our world is replete with many different potential sources of energy, which we can convert into our preferred form – electricity. Some of them are sustainable – we can keep on using them indefinitely; others aren't – we'll use them up eventually and they won't get replaced.

Fossil fuels are coal, natural gas and oil. They are called

fossil fuels because they are the compressed remains of ancient forests (coal) or tiny sea animals (gas and oil), squashed up and broken down into carbon-based compounds which burn readily, releasing heat. They are not sustainable because the conditions that produced them no longer exist. Also, burning them releases extra carbon dioxide and other unwelcome gases into Earth's atmosphere, contributing to global warming. Despite that, about 75% of the electricity used in the UK comes from power stations that burn fossil fuels, though alternative sources are becoming more and more widely used.

Nuclear power is generated by breaking up atoms of plutonium and uranium. When nuclei of atoms from these two elements are battered with particles called neutrons, they release heat energy. Inside the nuclear reactor of a nuclear power station, this process (nuclear fission) is initiated and controlled, and the energy harnessed. The process doesn't release toxic gases, but the waste it generates is dangerous. Nuclear fuel is non-sustainable, and an accident at a nuclear power station could have very far-reaching and disastrous consequences.

Wind power is a sustainable source of energy. Large wind turbines, like giant futuristic windmills, are sited in exposed places with strong prevailing winds. The wind turns the turbine's blades, and this kinetic (moving) energy is captured. No pollutants are produced, but wind farms can be unsightly, noisy and dangerous to birds.

$E=mc^2$

Bet you weren't expecting to see this quite so soon. This most famous formula, from Einstein's Theory of Special Relativity and first proposed in 1905, is not as scary as you might think, however. It just means that matter (any kind of physical substance – like rock, a star, a bar of chocolate or your cat) and energy are different versions of the same thing. This comes into play in nuclear fission: the products of the fission reaction together weigh slightly less than the original fission material because the 'missing mass' has been converted into energy.

E = energy
m = mass (measured in grams and kilograms)
c = the speed of light (which is a constant, i.e. it doesn't change no matter what)

The formula shows us how much energy is stored in a quantity of matter. The main points to understand from this are that a) matter is a kind of energy, and b) energy doesn't go anywhere. You can't add new energy to the universe and you can't take any away, but you can change it from one form to another. What this has to do with generating electricity is