1.0 Electricity

I INTRODUCTION

Electricity, all the phenomena that result from the interaction of electrical charges. Electric and magnetic effects are caused by the relative positions and movements of charged particles of matter. When a charge is stationary (static), it produces electrostatic forces on charged objects, and when it is in motion it produces additional magnetic effects. So far as electrical effects are concerned, objects can be electrically neutral, positively charged, or negatively charged. Positively charged particles, such as the protons that are found in the nucleus of atoms, repel one another. Negatively charged particles, such as the electrons that are found in the outer parts of atoms, also repel one another (*see* Atom). Negative and positive particles, however, attract each other. This behaviour may be summed up as: like charges repel, and unlike charges attract.

II ELECTROSTATICS

The electric charge on a body is measured in coulombs (*see* Electrical Units; International System of Units). The force between particles bearing charges q_1 and q_2 can be calculated by Coulomb's law, $F_{elec} = \frac{q_1 q_2}{4\pi\varepsilon r^2}$ This equation states that the force is proportional to the product of the charges, divided by the square of the distance that separates them. The charges exert equal forces on one another. This is an instance of the law that every force produces an equal and opposite reaction. (*see* Mechanics: *Newton's Three Laws of Motion*.) The term is the Greek letter pi, standing for the number 3.1415..., which crops up repeatedly in geometry. The term is the Greek letter epsilon, standing for a quantity called the absolute permittivity, which depends on the medium surrounding the charges. This law is named after the French physicist Charles Augustin de Coulomb, who developed the equation.

Every electrically charged particle is surrounded by a field of force. This field may be represented by lines of force showing the direction of the electrical forces that would be experienced by an imaginary positive test charge within the field. To move a charged particle from one point in the field to another requires that work be done or, equivalently, that energy be transferred to the particle. The amount of energy needed for a particle bearing a unit charge is known as the potential difference between these two points. The potential difference is usually measured in volts (symbol V). The Earth, a large conductor that may be assumed to be substantially uniform electrically, is commonly used as the zero reference level for potential energy. Thus the potential of a positively charged body is said to be a certain number of volts above the potential of the Earth, and the potential of a negatively charged body is said to be a certain number of volts below it.