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Electric fields worksheet

1) An electron volt (eV) is a unit of energy. It represents the change in potential energy of an electron that moves through a potential difference of 1 V (the size of the charge on an electron is 1.6×10^{-19} C).

   What is the equivalent energy of 1 eV in joules?

2) An electron has energy of 5 MeV. Calculate its energy in joules.

3) An electron accelerates between two parallel conducting plates A and B.

   The p.d. between the plates is 500 V. (mass of electron = 9.1×10^{-31} kg, charge on electron = 1.6×10^{-19} C)

   (a) Calculate the electrical work done in moving the electron from plate A to plate B.

   (b) How much kinetic energy has the electron gained in moving from A to B?

   (c) What is the speed of the electron just before it reaches plate B?

4) A proton is accelerated from rest across a p.d. of 400 V. Calculate the increase in speed of the proton.

5) In an X-ray tube electrons forming a beam are accelerated from rest and strike a metal target. The metal then emits X-rays. The electrons are accelerated across a p.d. of 25 kV. The beam of electrons forms a current of 3.0 mA.
   (a) (i) Calculate the kinetic energy of each electron just before it hits the target.
       (ii) Calculate the speed of an electron just before it hits the target.
       (iii) Find the number of electrons hitting the target each second.

       (mass of electron = 9.1×10^{-31} kg, charge on electron = $1.6 \times 10^{-1}9$ C)

   (b) What happens to the kinetic energy of the electrons?

6) An electron enters a region of space where there is a uniform magnetic field. As it enters the field the velocity of the electron is at right angles to the magnetic field lines. The energy of the electron does not change although it accelerates in the field.

   Use your knowledge of physics to explain this effect.