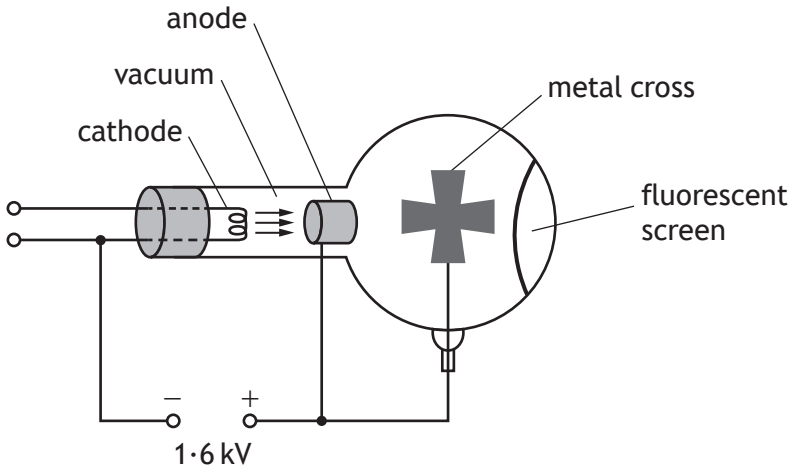
6. An experiment is set up to demonstrate a simple particle accelerator.



(a) Electrons are accelerated from rest between the cathode and the anode by a potential difference of 1·6 kV.

(i) Show that the work done in accelerating an electron from rest is $2{\cdot}6 \times 10^{-16}$ J. **2**

Space for working and answer

(ii) Calculate the speed of the electron as it reaches the anode. **3**

Space for working and answer

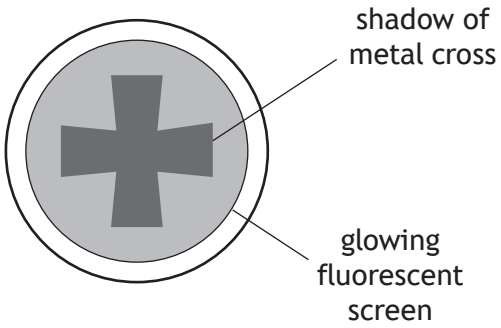
6. (continued)

(b) As the electrons travel through the vacuum towards the fluorescent screen they spread out.

In the path of the electrons there is a metal cross, which is connected to the positive terminal of the supply. The electrons that hit the cross are stopped by the metal.

Electrons that get past the metal cross hit a fluorescent screen at the far side of the tube.

When electrons hit the fluorescent screen, the screen glows.



The potential difference between the anode and the cathode is now increased to 2·2 kV. This changes what is observed on the screen.

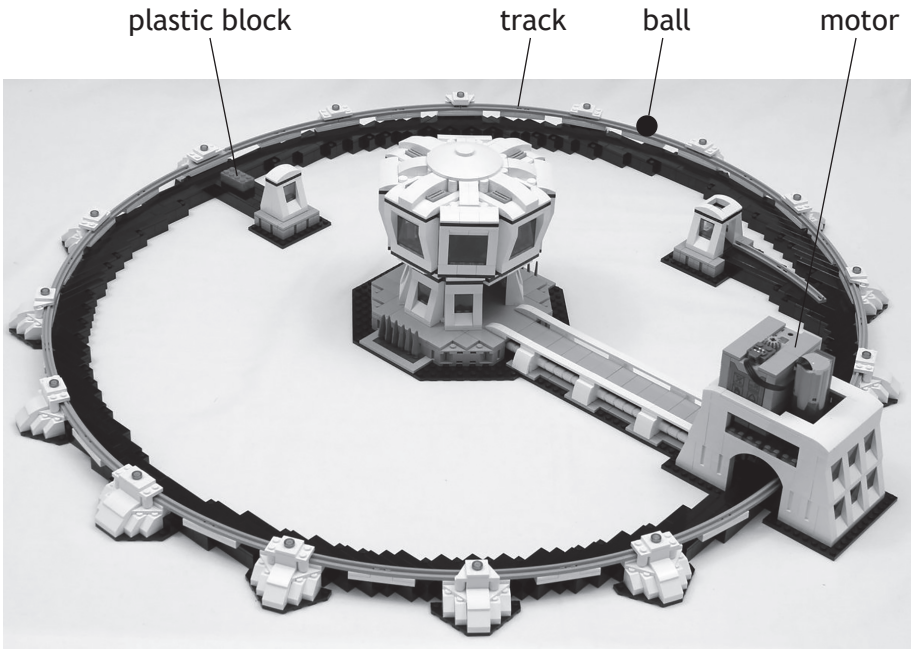
Suggest one change that is observed. **2**

You must justify your answer.

[Turn over

6. (continued)

(c) A student builds a model of a particle accelerator. The model accelerates a small ball on a circular track. A battery-operated motor accelerates the ball each time it passes the motor. To cause a collision a plastic block is pushed onto the track. The ball then hits the block.



Using your knowledge of physics comment on the model compared to a real particle accelerator, such as the large hadron collider at CERN. **3**