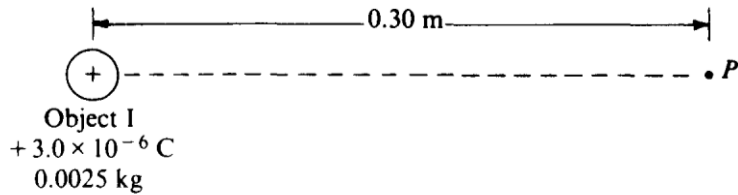


AP Physics – Spring 2014 – Electrostatics Review Classwork

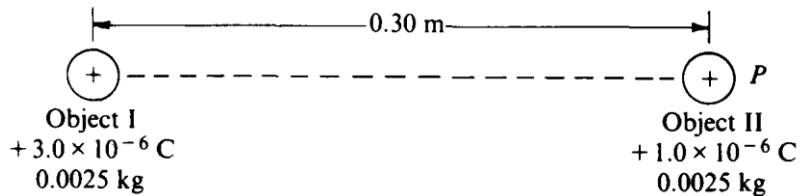
Instructions: Answer all questions in the space provided. Show all work and explain when necessary.



1. 15 points (1987B2)

Object I, shown above, has a charge of $+ 3 \times 10^{-6}$ coulomb and a mass of 0.0025 kilogram.

(a) What is the electric potential at point P, 0.30 meter from object I? [9E4 V]



Object II, of the same mass as object I, but having a charge of $+ 1 \times 10^{-6}$ coulomb, is brought from infinity to point P, as shown above.

(b) How much work must be done to bring the object II from infinity to point P? [0.09 J]

(c) What is the magnitude of the electric force between the two objects when they are 0.30 meter apart? [0.3 N]

(d) What are the magnitude and direction of the electric field at the point midway between the two objects? [8E5 N/C]

The two objects are then released simultaneously and move apart due to the electric force between them. No other forces act on the objects.

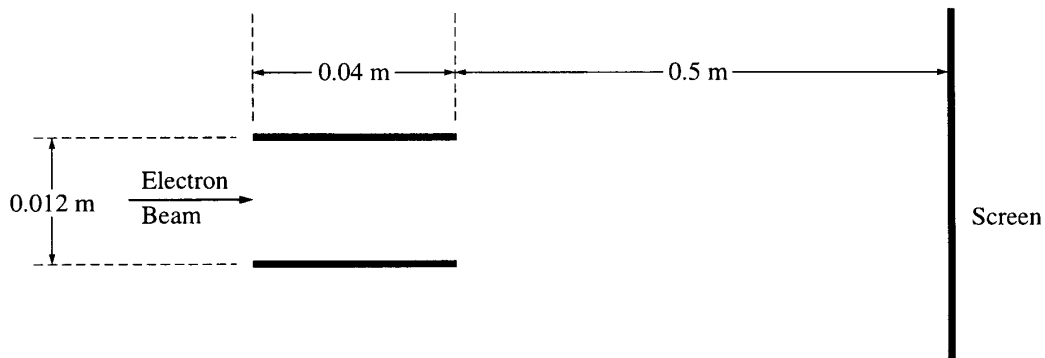
(e) What is the speed of object I when the objects are very far apart? [6 m/s]

2. 15 points (1999B2)

In a television set, electrons are first accelerated from rest through a potential difference in an electron gun. They then pass through deflecting plates before striking the screen.

(a) Determine the potential difference through which the electrons must be accelerated in the electron gun in order to have a speed of 6.0×10^7 m/s when they enter the deflecting plates. [1E4 V]

The pair of horizontal plates shown below is used to deflect electrons up or down in the television set by placing a potential difference across them. The plates have length 0.04 m and separation 0.012 m, and the right edge of the plates is 0.50 m from the screen. A potential difference of 200 V is applied across the plates, and the electrons are deflected toward the top of the screen. Assume that the electrons enter horizontally midway between the plates with a speed of 6.0×10^7 m/s and that fringing effects at the edges of the plates and gravity are negligible.



Note: Figure not drawn to scale.

- (b) Which plate in the pair must be at the higher potential for the electrons to be deflected upward?
Check the appropriate box below.

Upper plate

Lower plate

Justify your answer.

- (c) Considering only an electron's motion as it moves through the space between the plates, compute the following.

i. The time required for the electron to move through the plates [6.7E-10 s]

ii. The vertical displacement of the electron while it is between the plates [6.5E-4 m]

- (d) Show why it is a reasonable assumption to neglect gravity in part c.

- (e) Still neglecting gravity, describe the path of the electrons from the time they leave the plates until they strike the screen. State a reason for your answer.