

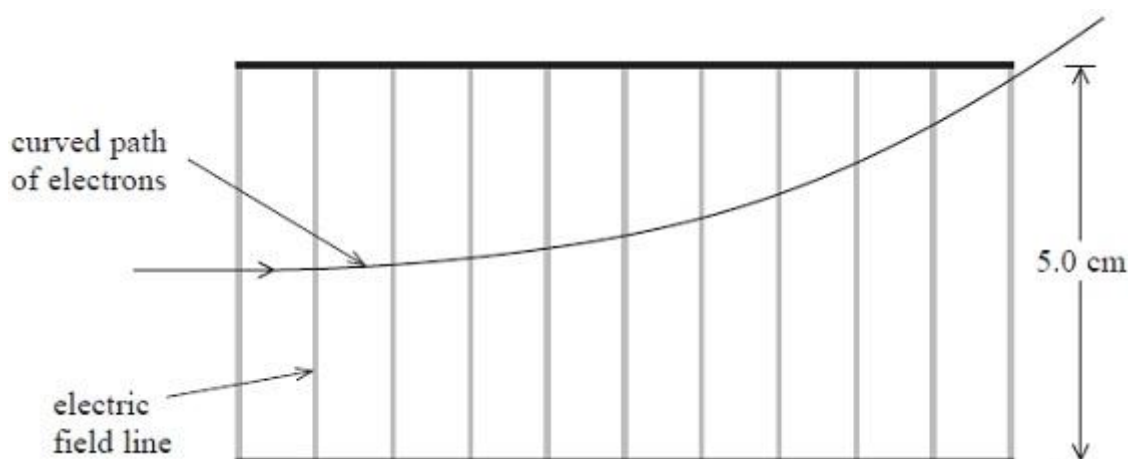
Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

A teacher uses an electron beam tube to demonstrate the behaviour of electrons in an electric field. The diagram shows the path of an electron in a uniform electric field between two parallel conducting plates.



(a) Mark on the diagram the direction of the electric field.

(1)

(b) The conducting plates are 5.0 cm apart and have a potential difference of 160 V across them. Calculate the force on the electron due to the electric field.

(3)

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Force =

(c) Explain why the path of the electron is curved between the plates and straight when it has left the plates.

(3)

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(d) The electron was initially released from a metal by thermionic emission and then accelerated through a potential difference before entering the region of the electric field.

(i) State what is meant by thermionic emission.

(1)

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(ii) In order to be able to just leave the plates as shown, the electron must enter the electric field between the plates with a speed of $1.2 \times 10^7 \text{ m s}^{-1}$.

Calculate the potential difference required to accelerate an electron from rest to this speed.

(3)

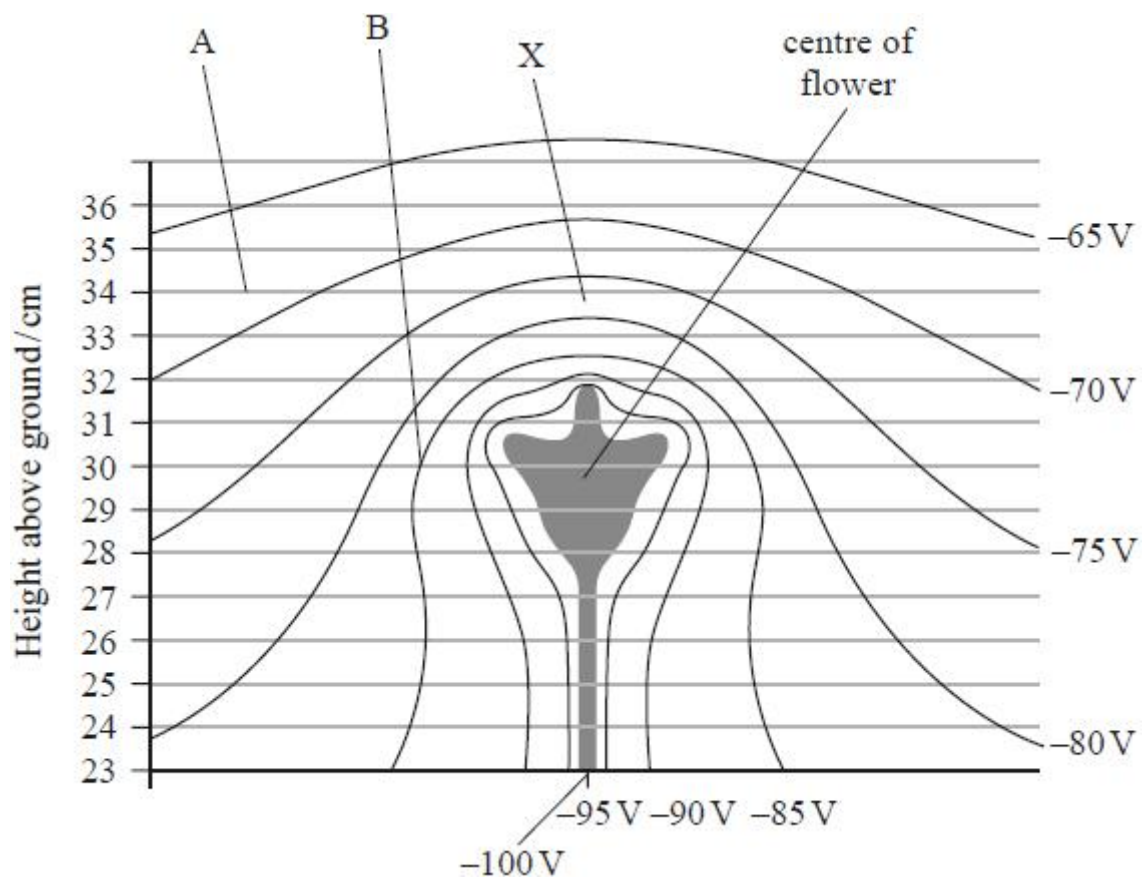
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Potential difference =

(Total for Question = 11 marks)

Q2.

Some flowers are negatively charged and surrounded by an electric field. This helps to attract bees. The diagram shows lines of equipotential surrounding a flower.



(i) Determine the electric field strength at X.

(3)

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Electric field strength at X =

(ii) Draw the electric field line between point A and point B on the diagram.

(2)

(iii) An equation for electric potential V is

$$V = \frac{Q}{4\pi\epsilon_0 r}$$

This applies to a radial field.

Deduce whether the electric field in the region directly above the flower is radial.

You should take values from the diagram. A graphical method is not required.

(3)

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(Total for question = 8 marks)