Name of the Student:_____

Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

An oscilloscope is used to investigate various voltage sources. In order to do this a voltage source is connected to the y-input and the time base is switched off. **Figure 1** below shows the screen of the oscilloscope when the y-input is not connected to a voltage source.

Figure 1

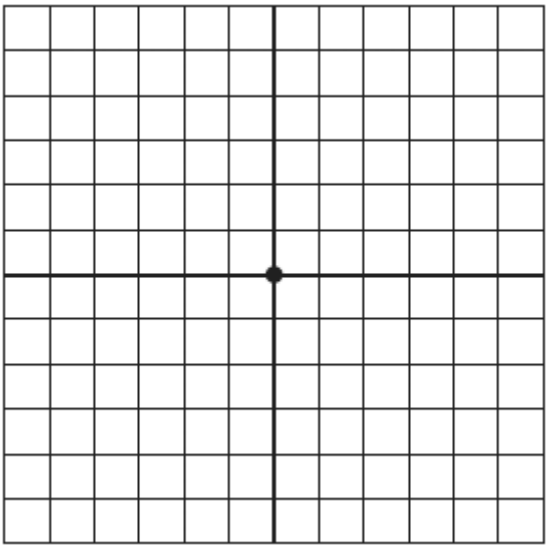
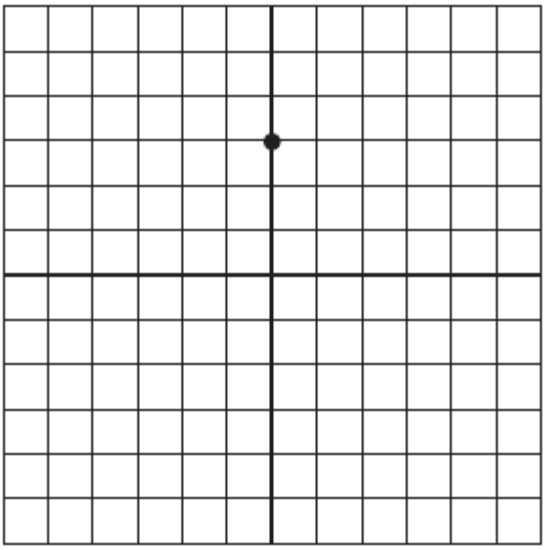
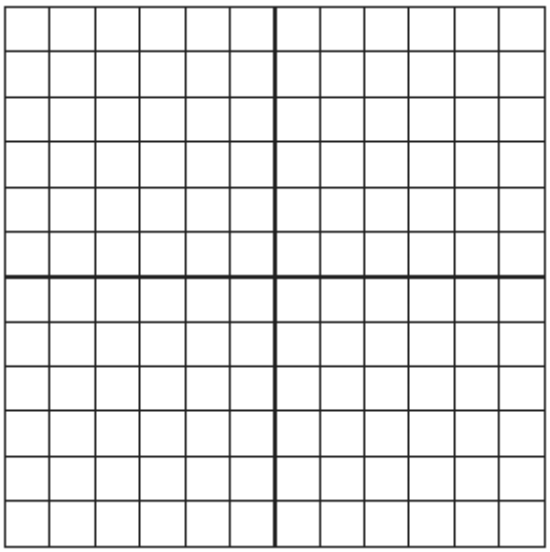


Figure 2 shows the screen when a 1.5V cell is connected to the y-input.

Figure 2



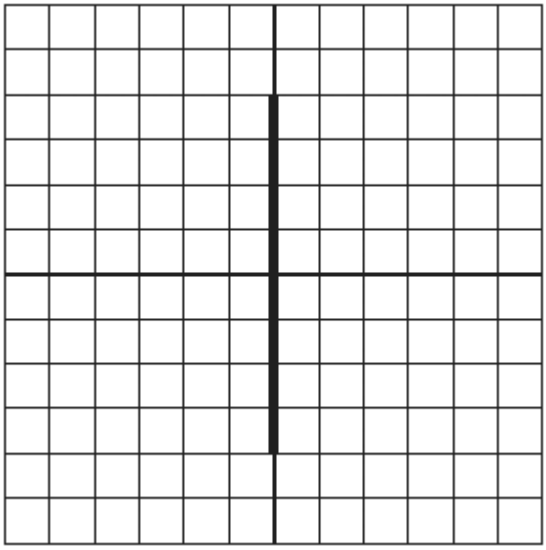
(a) On the grid below show the appearance of the screen if the y-input is connected to a 2.5V dc supply.



(1)

(b) The y-input is now connected to a sinusoidal ac voltage supply and the screen is shown in **Figure 3**.

Figure 3



(i) Explain why a vertical line is now seen on the screen.

_____

_____

_____

_____

_____

_____

(2)

(ii) Calculate the peak-to-peak voltage of the ac supply.

answer = _____ V

(2)

(iii) Calculate the root mean square voltage of the supply.

answer = _____ V

(2)

(Total 7 marks)

Q2.

(a) The equation $F = BQv$ may be used to calculate magnetic forces.

(i) State the condition under which this equation applies.

_____

_____

(1)

(ii) Identify the physical quantities that are represented by the four symbols in the equation.

F _____

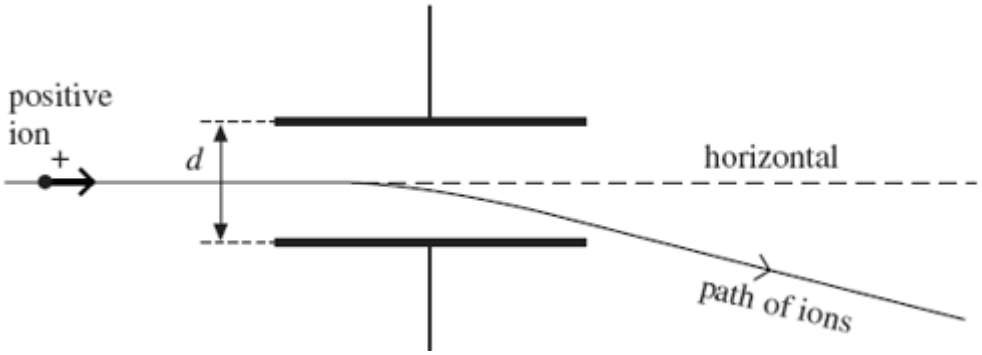
B _____

Q _____

v _____

(1)

(b) The figure below shows the path followed by a stream of identical positively charged ions, of the same kinetic energy, as they pass through the region between two charged plates. Initially the ions are travelling horizontally and they are then deflected downwards by the electric field between the plates.



While the electric field is still applied, the path of the ions may be restored to the horizontal, so that they have no overall deflection, by applying a magnetic field over the same region as the electric field. The magnetic field must be of suitable strength and has to be applied in a particular direction.

(i) State the direction in which the magnetic field should be applied.

_____

(1)

(ii) Explain why the ions have no overall deflection when a magnetic field of the required strength has been applied.

_____

_____

_____

_____

_____

(2)

(iii) A stream of ions passes between the plates at a velocity of $1.7 \times 10^5 ms^{-1}$. The separation *d* of the plates is 65 mm and the pd across them is 48 V. Calculate the value of *B* required so that there is no overall deflection of the ions, stating an appropriate unit.

answer = _____

(4)

(c) Explain what would happen to ions with a velocity higher than $1.7 \times 10^5 ms^{-1}$ when they pass between the plates at a time when the conditions in part (b)(iii) have been established.

_____

_____

_____

_____

_____

(2)
(Total 11 marks)