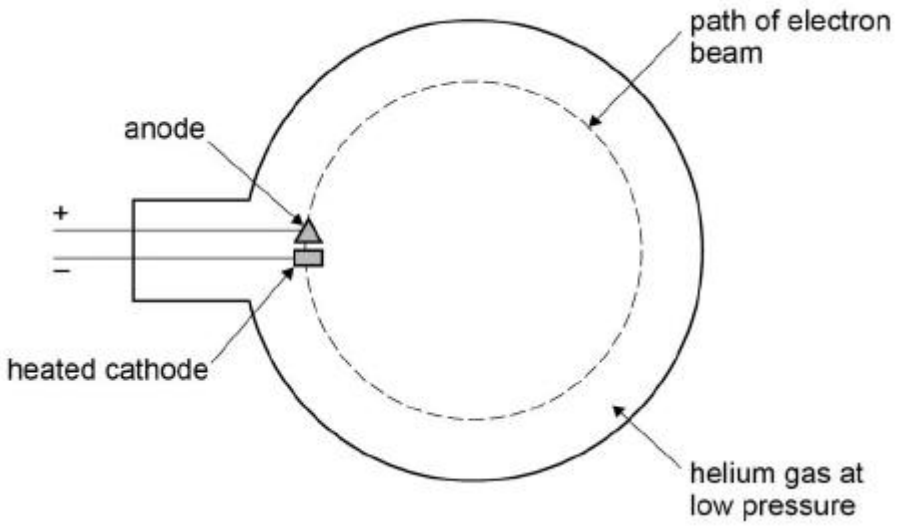
Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

The diagram below shows part of an apparatus used to determine the specific charge of an electron.



Electrons are emitted by the cathode by thermionic emission. They are accelerated by the potential difference between the cathode and anode. The tube contains helium gas at a low pressure and the gas emits light to show the path of the electron beam.

The beam is bent into a circular path by applying a magnetic field perpendicular to the plane of the diagram.

(a) Explain how light is emitted as the electrons travel through the helium gas.

_____

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_____

(3)

(b) In one experiment the potential difference between the cathode and anode is 2.5 kV.

Show that the speed of the electrons is about 3.0×10^7 m s^{-1}.

_____

_____

(2)

(c) When the flux density of the magnetic field is 3.1 mT the diameter of the path of the beam is 0.114 m.

Calculate the value for the specific charge of an electron from the data in this experiment.

specific charge _____ C kg^{-1}

(3)

(d) In practice the path of the electron beam is not a perfect circle.

Discuss how the presence of the gas affects the path of the electrons.

_____

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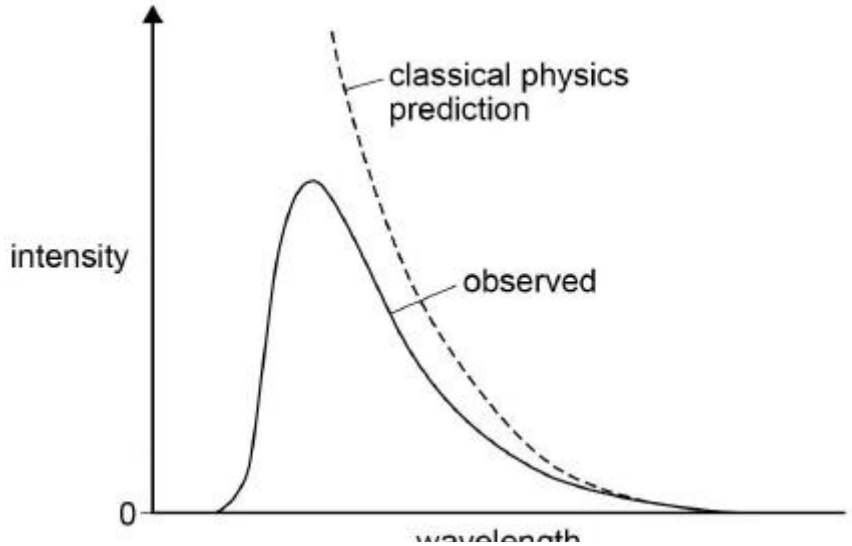
(3)

(Total 11 marks)

Q2.

The solid line on the graph below shows how the intensity of radiation from a black body varies with wavelength at a particular temperature. The dotted line shows the variation as predicted by classical physics.



(a) Explain why the difference between the predicted and experimental curves is called the ultraviolet catastrophe.

(2)

(b) Describe the difference between the classical physics view and the quantum theory proposal made by Max Planck that enabled the distribution of the shape of the intensity−wavelength graph to be correctly predicted.

(2)

(c) Discuss the evidence that the photoelectric effect provides in support of the quantum theory.

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_____

(3)

(Total 7 marks)