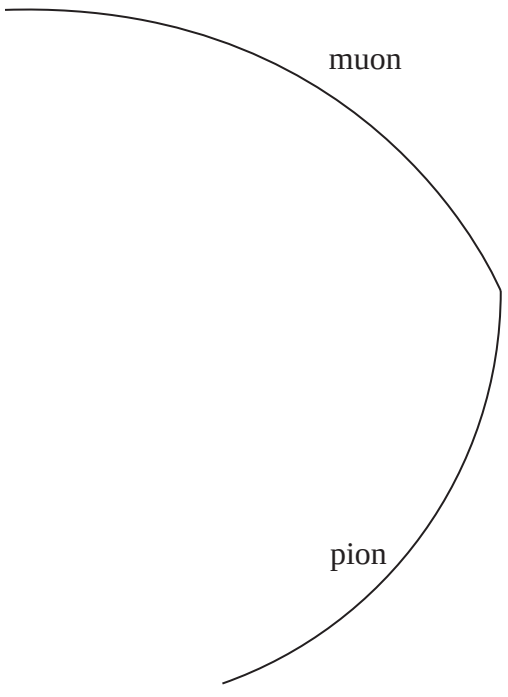
18 A negatively charged pion decays into a muon and an antineutrino. The diagram shows tracks in a particle detector formed in such an event.



(a) Deduce whether the antineutrino is charged, giving two reasons for your decision.

(2)

(b) Write a particle equation to represent this decay.

(1)

(c) According to the standard model, the pion and muon are classified within two different groups of particles.

State which group each particle belongs to and describe the two groups.

(4)

(d) The momentum of the pion just before it decays is 9.1×10^{-20} N s.

Determine the magnetic flux density of the magnetic field which acts in the detector and state its direction.

Scale of diagram 1 cm represents 10 cm

pion charge = -1.6×10^{-19} C

(4)

Magnetic flux density = ...

Direction of magnetic field = ...

(e) Use a vector diagram to determine the momentum of the antineutrino.

The initial momentum of the muon is 1.59×10^{-19} N s.

(5)

Momentum of antineutrino = ...

Direction of antineutrino = ...

(Total for Question 18 = 16 marks)