Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 8_ Nuclear and Particle Physics

Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

The neutral lambda Λ^0 particle is a baryon of mass 1116 MeV/c^2 and contains one strange quark.

The table shows quarks and their relative charge.

Quark	Charge / *e*
u	+2/3
d	–1/3
s	–1/3

Calculate the mass of the Λ^0 particle in kg.

(3)

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Mass of Λ^0 particle = ... kg

(Total for question = 3 marks)

Q2.

Pions belong to a group of particles called mesons. Pions can be used in a form of radiotherapy to treat brain tumours.

The mass of a pion is 140 MeV/c^2.

Calculate the mass of a pion in kg.

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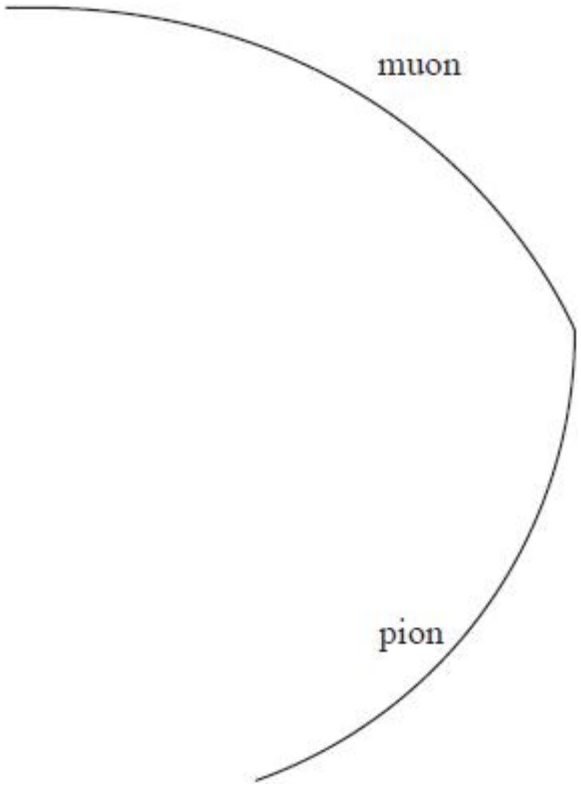
Mass = ...

Q3.

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



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

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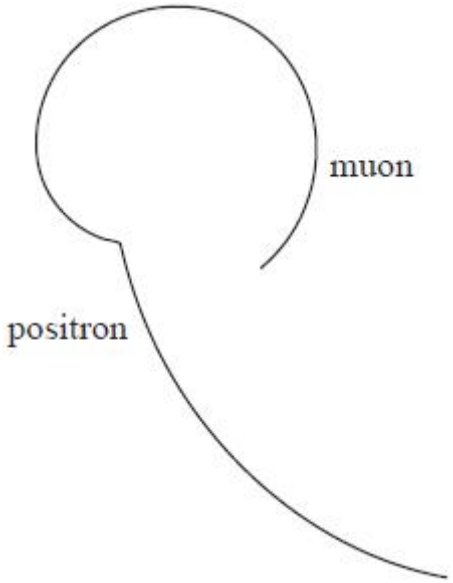
(Total for question = 2 marks)

Q4.

The decay of a positive muon produced a positron, an electron neutrino and a muon antineutrino. The diagram shows the tracks formed in a particle detector.



A muon belongs to a family of particles called leptons.

State two features that all particles in the lepton family have in common.

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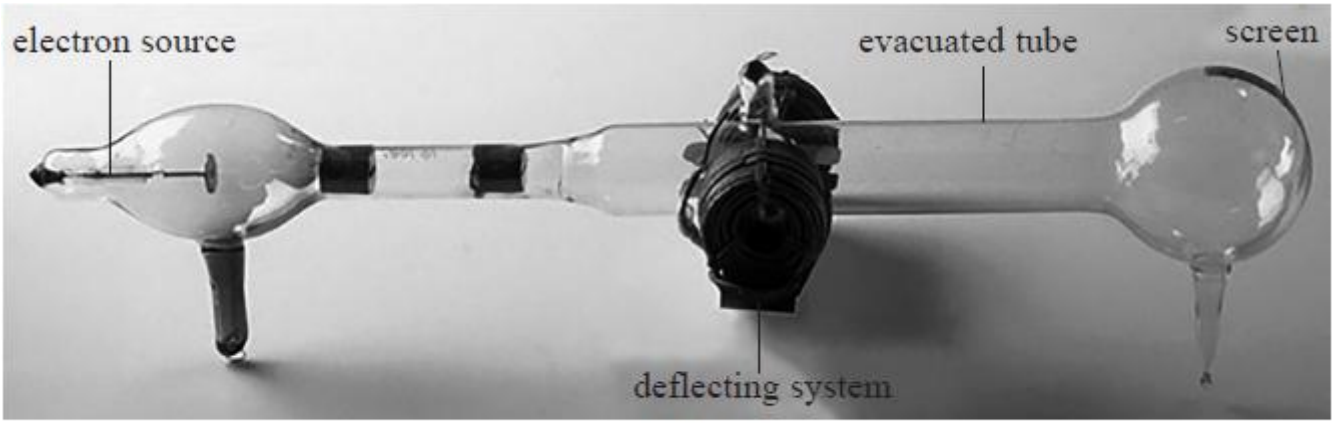
(Total for question = 2 marks)

Q5.

At the end of the 19th century, J.J. Thompson used electric and magnetic fields to deflect beams of charged particles. A photograph of his apparatus is shown.



Electrons were accelerated through a potential difference to produce a beam of high-energy electrons. The beam was then deflected in perpendicular directions by the magnetic and electric fields. The final position of the beam on the screen was determined by the charge and mass of the electrons.

In his original experiments, Thompson determined the specific charge of a range of particles. His results indicated that the specific charge of an electron is about 2000 times bigger than that for a hydrogen ion.

Deduce what conclusion can be made from this information.

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(Total for question = 1 mark)

Q6.

* Particle accelerators accelerate particles to very high speeds before collisions occur.
New particles are created during the collisions.

Two particles of the same type can undergo two kinds of collision.

Fixed target: a high speed particle hits a stationary particle.

Colliding beams: two particles travelling at high speeds, in opposite directions, collide head-on.

By considering the conservation of energy and momentum, explain which type of collision is able to create a new particle with the largest mass.

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