Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

Over one hundred years ago, Rutherford supervised a series of experiments using a source of alpha particles and thin gold foil.

Describe the model of the atom that Rutherford proposed as a result of this series of experiments.

(3)

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(Total for question = 3 marks)

Q2.

A cosmic ray, consisting of a fast-moving proton, collides with a proton within the nucleus of an atom in the upper atmosphere. Three particles, a proton, a neutron and a pion result from the collision.

The table shows the properties of two quarks.

Quark	Charge / e
u	+2/3
d	−1/3

Give the quark structure for each of the particles produced by this collision.

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(Total for question = 3 marks)

Q3.

Beams of antiprotons are often used in particle physics experiments.

Show that the rest mass of an antiproton is about 900 MeV / c^2.

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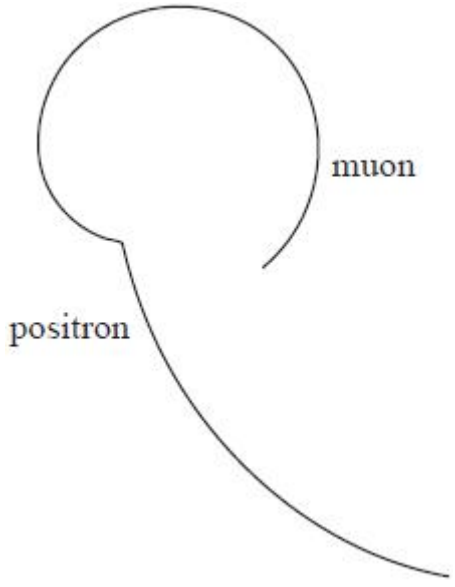
(Total for question = 4 marks)

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.



Describe the role of the magnetic field in a particle detector.

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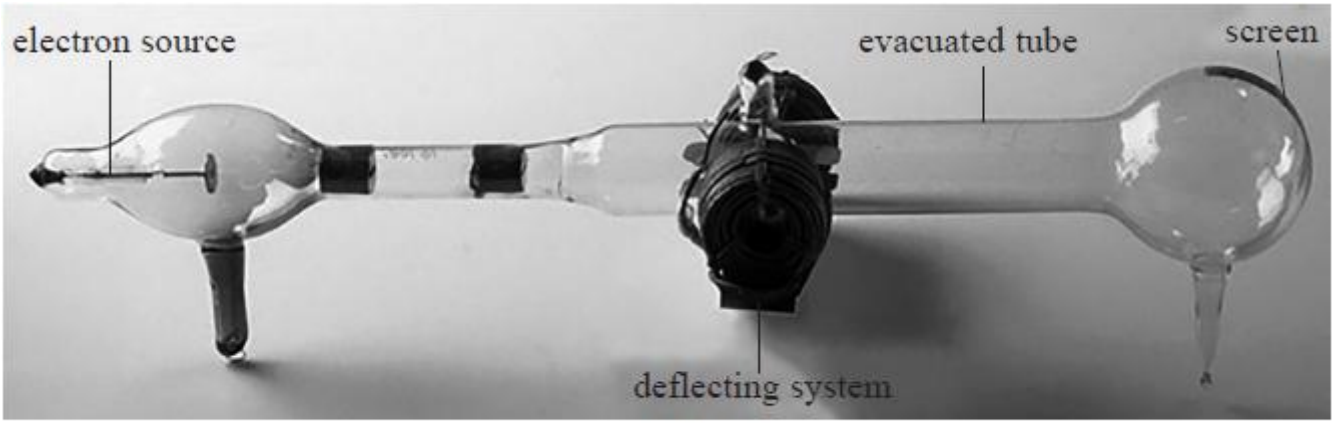
(Total for question = 3 marks)

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.

Explain how electrons from the source become a beam of high-energy electrons.

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(Total for question = 2 marks)

Q6.

Tomatoes can be made into a puree.

The mass of the puree is reduced by boiling. The saucepan is heated by a radiant electric heater run from a mains supply which has a peak voltage of 325 V. The peak current in the heater is 12.4 A.

Calculate the time taken to reduce the mass of the puree at boiling point by 0.225 kg.

Specific latent heat of vaporisation of tomato puree = 2.37×10^6 J kg^{-1}

(4)

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Time = ...

(Total for question = 4 marks)

Q7.

A physicist investigates how light intensity varies with distance from a light bulb. She sets up the apparatus as shown.

Explain why the resistance *R* of the LDR will increase as it gets further away from the bulb.

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(Total for question = 2 marks)