Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

(a) (i) State **two** differences between a proton and a positron.

difference 1 _____

_____

difference 2 _____

_____

(ii) A narrow beam of protons and positrons travelling at the same speed enters a uniform magnetic field. The path of the positrons through the field is shown in **Figure 1**.

Sketch on **Figure 1** the path you would expect the protons to take.

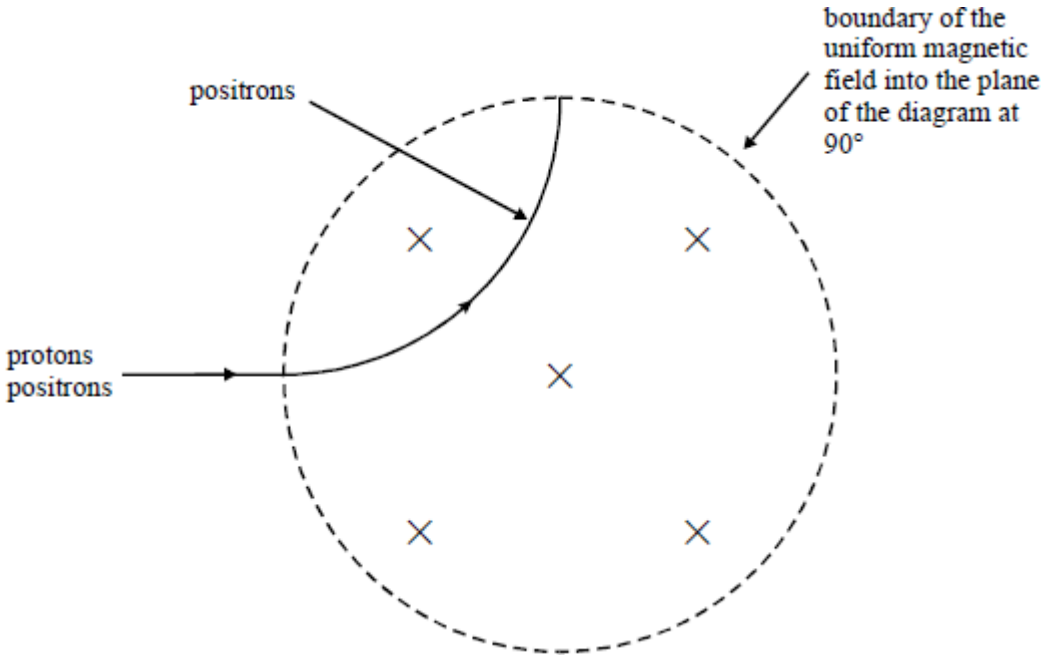


Figure 1

(iii) Explain why protons take a different path to that of the positrons.

_____

_____

_____

_____

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_____

_____

(5)

(b) **Figure 2** shows five isotopes of carbon plotted on a grid in which the vertical axis represents the neutron number N and the horizontal axis represents the proton number Z.
Two of the isotopes are stable, one is a beta minus emitter and two are positron emitters.

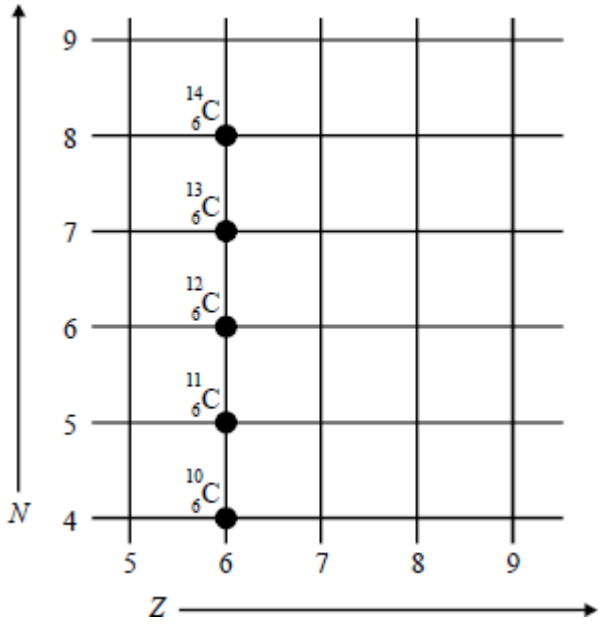


Figure 2

(i) Which isotope is a beta minus emitter?

_____

(ii) Which of the two positron emitters has the shorter half-life? Give a reason for your choice.

_____

_____

_____

(3)

(c) A positron with kinetic energy 2.2 MeV and an electron at rest annihilate each other. Calculate the average energy of each of the two gamma photons produced as a result of this annihilation.

_____

_____

_____

_____

(2)

(Total 10 marks)

Q2.

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(a) Explain what is meant by the term *magnetic flux linkage*. State its unit.

_____

_____

_____

_____

(2)

(b) Explain, in terms of electromagnetic induction, how a transformer may be used to step down voltage.

_____

_____

_____

_____

_____

_____

(4)

(c) A minidisc player is provided with a mains adapter. The adapter uses a transformer with a turns ratio of 15:1 to step down the mains voltage from 230 V.

(i) Calculate the output voltage of the transformer.

(2)

(ii) State **two** reasons why the transformer may be less than 100% efficient.

_____

_____

_____

(2)

(Total 10 marks)

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