Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Particle And Radiation

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

Q1.

Helium is the second most abundant element in the universe. The most common isotope of helium is $^{4}_{2}He$ and a nucleus of this isotope has a rest energy of 3728 MeV.

In 2011, at the Relativistic Heavy Ion Collider, anti-helium nuclei were produced. Nuclei of anti-helium are made up of antiprotons and antineutrons.
It is suggested that an antineutron can decay to form an antiproton in a process similar to β^- decay.

In one particular collision between an anti-helium nucleus and a helium nucleus, the nuclei are annihilated and two photons are formed.

(a) State what is meant by isotopes.

_____

_____

_____

_____

(2)

(b) Explain why two photons are formed instead of a single photon when a helium nucleus annihilates with the anti-helium nucleus.

_____

_____

_____

_____

_____

_____

_____

_____

(2)

(c) Calculate, using data from the passage, the maximum frequency of the photons produced in this annihilation of a $^{4}_{2}He$ nucleus.

frequency = _____ Hz

(4)

(d) Complete this equation for the possible decay of an antineutron.

$$ {}^{1}_{0}\bar{n} \rightarrow {}^{1}_{-1}\bar{p} + \_\_\_\_ + \_\_\_\_ $$

(2)

(e) What interaction would be responsible for the decay in **part (d)**?
Tick (✔) the correct answer in the right-hand column.

	✔ if correct
electromagnetic	
gravitational	
strong nuclear	
weak nuclear	

(1)

(Total 11 marks)

Q2.

The element uranium has an isotope $^{237}_{92}U$.

(a) Explain what is meant by an isotope.

_____

_____

_____

_____

(2)

(b) Determine the charge in coulomb of the $^{237}_{92}U$ nucleus.

charge = _____ C

(2)

(c) A positive ion of $^{237}_{92}U$ has a charge of $+4.80 \times 10^{-19}$ C.

Determine the number of electrons in the ion.

number of electrons = _____

(2)

(d) $^{237}_{92}U$ decays by β^- emission to form an isotope of neptunium (Np).

Complete the equation for this decay.

$$^{237}_{92}U \rightarrow \text{.....}Np + \text{.....}\ \beta^- + \text{.....}$$

(3)

(Total 9 marks)