Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

More than 200 subatomic particles have been discovered so far. However, most are not fundamental and are composed of other particles including quarks.

It has been shown that a proton can be made to change into a neutron and that protons and neutrons are made of quarks.

(a) Name **one** process in which a proton changes to a neutron.

_____

_____

(1)

(b) Name the particle interaction involved in this process.

_____

_____

(1)

(c) Write down an equation for the process you stated in part **(a)** and show that the baryon number and lepton number are conserved in this process.

baryon number _____

_____

_____

lepton number _____

_____

_____

(2)

(d) The strange quark was used to explain the existence of particles whose tracks had been seen in experiments in the early 1950s. These were unexplained at that time and were referred to as 'strange particles'. One of these particles was later named the K^+ kaon.

State the quark composition of a K^+ kaon.

_____

_____

(1)

(e) A K^+ kaon decays into a π^+ particle and a π° particle.

Explain **one** property which is conserved and **one** property which is not conserved in this decay.

conserved _____

_____

not conserved _____

(2)

(Total 7 marks)

Q2.

(a) Complete the table comparing some of the properties of the positive pion, π^+, and the proton.

Name	π^+	**Proton**
Relative charge	+1	
Baryon number		
Quark composition		

(5)

(b) When a positive pion interacts with a proton, a kaon can be produced, along with another strange particle, as shown in this equation

$$\pi^+ + p \rightarrow K^+ + X$$

Circle the type of interaction shown in this equation.

Electromagnetic Gravitational Strong Nuclear Weak Nuclear

(1)

(c) Deduce the relative charge, baryon number and strangeness of particle X.

(3)

(d) Particle X can decay to produce a neutron and positive pion as shown in this equation

$$X \rightarrow n + \pi^+$$

Circle the type of interaction shown in this equation.

Electromagnetic Gravitational Strong Nuclear Weak Nuclear

(1)

(e) Explain your answer.

_____

_____

_____

_____

(2)

(f) The neutron and positive pion will then decay. The positive pion can decay into a positron and an electron neutrino.

Write down the equation for the decay of the neutron.

(2)

(g) Explain why no further decays occur.

_____

_____

_____

_____

(2)
(Total 16 marks)