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

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

Q1.

(a) Complete the table to show the four fundamental forces and their corresponding exchange particles.

fundamental force	corresponding exchange particle
strong nuclear	gluon
electromagnetic	
	$W^+W^-Z^0$
gravitational	graviton

(2)

(b) Name the physical quantity that a particle must have for the electromagnetic force to act on it.

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(1)

(c) Name the particle believed to be responsible for mass.

_____

(1)
(Total 4 marks)

Q2.

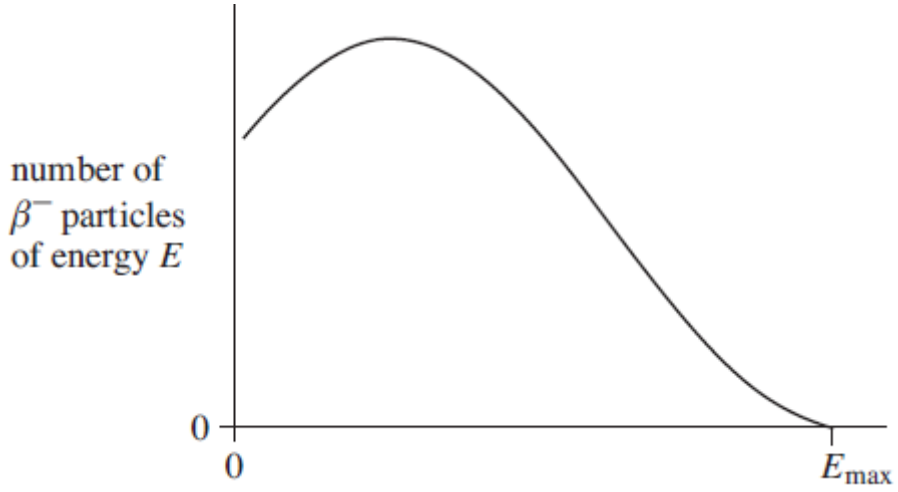
(a) Complete the following equation to describe the decay of potassium−40 $(^{40}_{19}\text{K})$ by β^- emission.

$$^{40}_{19}\text{K} \longrightarrow \,^{\cdots}_{\cdots}\text{Ca} + \,^{\cdots}_{\cdots}\beta^- + \,^{0}_{0}\bar{\nu}_e$$

(2)

(b) When a sample of potassium-40 decays, the emitted β^- particles have a range of energies from almost zero to a maximum value, E_{max}. The spectrum of energies observed is shown in the figure below.

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Explain how this evidence led Pauli to predict the existence of a previously unidentified particle.

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(3)

(Total 5 marks)

Q3.

The *work function* of sodium is 2.28 e V.

(a) State what is meant by the term work function.

_____

_____

_____

(2)

(b) Calculate the threshold frequency for sodium.

threshold frequency _____ Hz

(3)

(Total 5 marks)

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Q4.

(a) The table provides information on the quark structure of some particles.

particle	symbol	quark structure
negative pion	π^-	$\bar{u}d$
positive pion	π^+	$u\bar{d}$
kaon	K°	$d\bar{s}$
proton	p	uud

(i) Name the particle class to which these particles belong.

_____

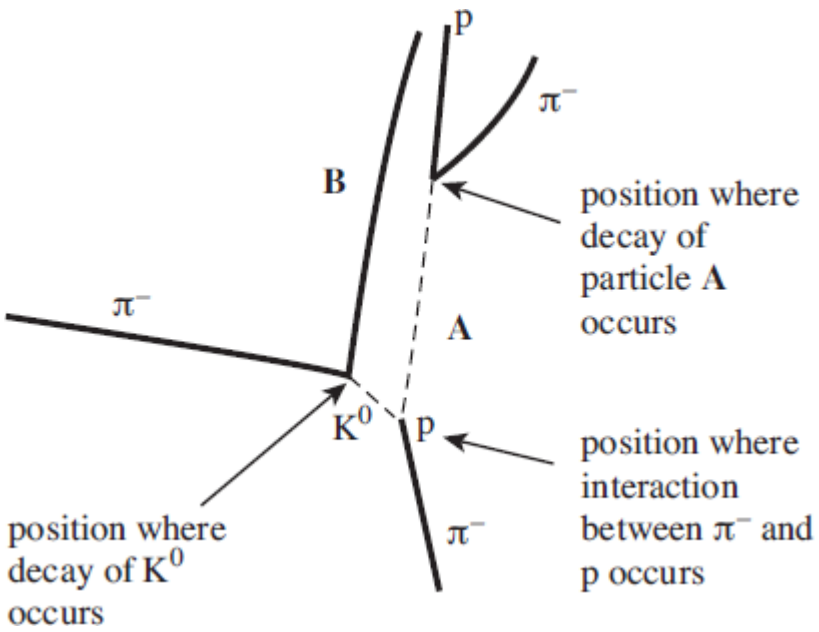
(1)

(ii) Show that the kaon (K°) is a neutral particle by considering its quark structure.

_____

(1)

(b) The figure below shows the track of a negative pion (π^-) interacting with a proton (p) to produce two particles: a kaon (K°) and an unidentified particle labelled **A**. Both of these particles subsequently decay through the weak interaction.



(i) The interaction between the negative pion (π^-) and the proton (p) is:

$$\pi^- + p \longrightarrow K^0 + \mathbf{A}$$

This interaction involves the strong force and is therefore a strong interaction. Determine the baryon number and strangeness of particle **A**.

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baryon number of particle **A** _____

strangeness of particle **A** _____

(2)

(ii) The K^0 particle decays through the weak interaction into a π^- particle and an unidentified particle labelled **B**.

The decay is:

$$K^0 \longrightarrow \pi^- + \mathbf{B}$$

Give **one** reason to support the deduction that particle **B** is a positive pion (π^+).

_____

_____

(1)

(iii) State how physicists accounted for the unusually long lifetime of the kaon (K^0).

_____

_____

(1)

(Total 6 marks)

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