



NATIONAL OPEN UNIVERSITY OF NIGERIA  
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA  
FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCE

2020\_2 EXAMINATIONS...

COURSE CODE: PHY 303  
COURSE TITLE: SPECIAL RELATIVITY  
CREDIT UNIT: 2  
TIME ALLOWED:(2 HRS)

INSTRUCTION: *Answer question 1 and any other three questions*

QUESTION 1

- (a) A particle is travelling through the Earth's atmosphere at a speed of  $0.75c$ . To an Earth-bound observer, the distance it travels is 2.5km. How far does the particle travel in the particle's frame of reference?  
(4mks)
- (b) State Einstein's special theory of relativity. (4mks)
- (c) What is the principle of simultaneity? (2mks)
- (d) Write down the Lorentz transformation equations. (6mks)
- (e) A man in a boat moving at a constant speed of 50km/h relative to the shore throws an object in the forward direction with a speed of 20km/h. Determine the speed of the object as measured by an observer at rest at the shore. (5mks)
- (f) State the properties of Lorentz transformation. (4mks)

QUESTION 2

Calculate the momentum of an electron moving at a speed of  $0.8c$ . (15mks)

QUESTION 3

Evaluate  $\frac{1}{\sqrt{1-\left(\frac{v^2}{c^2}\right)}}$  for:

- (i)  $v = 10^{-2}c$  (5mks)      (ii)  $v = 0.87c$  (5mks)      (iii)  $v = 0.9998c$  (5mks)

QUESTION 4

A starship Enterprise moves at a speed of  $0.9c$  relative to the earth and a Bird-of-Prey moves in the same direction at a speed of  $0.7c$  relative to the earth. (a) What does the navigator of the Bird-of-Prey report for the speed of the Enterprise? (7½ mks)

(a) If the Enterprise has blue light of wavelength, 475nm, what wavelength does the Kling on ship see as it leaves? (7½ mks)

QUESTION 5

If an electron travels through a conductor in a laboratory at a speed of  $0.95c$ , determine the total energy of the electron in laboratory frame of reference. (15mks)