Student Name:_____Student ID:_____

Date: JANUARY 2021

Duration: 90 minutes

SUBJECT: PHYSICS 4	
Head of Department of Physics: Signature:	Lecturer: Signature:
Full name: Phan Bao Ngoc	Full name: Do Xuan Hoi

INSTRUCTIONS: This is a closed book examination. Use of cell phones, laptops, dictionaries is not allowed.

$h = 6.63 \times 10^{-34}$ J.s; $c = 3 \times 10^8$ m/s; $e = 1.6 \times 10^{-19}$ C; rest mass of electron: 9.1×10^{-31} kg

Question 1 (20 pts) The objective lens of a telescope has a focal length of 171 cm. The distance between objective and eyepiece is 180 cm. This telescope is used to observe a star and the final image is at infinity. Determine the position of the first image of the star and compute the focal length of the eyepiece.

Question 2 (20 pts) Suppose that the momentum of a certain particle can be measured to an accuracy of 0.1%. Determine the minimum uncertainty in the position of the particle if the particle is

(a) a 5×10^{-3} kg mass moving with a speed of 2 m/s,

(b) an electron moving with a speed of 1.8×10^8 m/s.

(c) Explain the physical meaning of your answers in (a) and (b).

Question 3 (20 pts) Knowing that the energy of hydrogen atom is given by: $E_n = -\dfrac{13.6}{n^2} eV$.

(a) What are the shortest and the largest wavelengths of light emitted in the Lyman series of the hydrogen atom spectrum lines?

(b) From the result in (a), deduce the range of the Lyman series in the electromagnetic spectrum.

Question 4 (20 pts) A μ-meson with an average lifetime of 2×10^{-6} s is created in the atmosphere of the Earth at an elevation of 6000 m. When it is created it has a velocity of $0.998c$ in a direction toward the Earth.

(a) Will this particle reach the surface of the Earth before decaying according to classical mechanics?

(b) What is its lifetime because of time dilation and what is the average distance that it will travel before decaying, as determined relativistically by an observer on the earth?

(c) Compare two results in (a) and (b) and give your observation.

Question 5 (20 pts) A nucleus $^A_Z X$ undergoes β^- decays and has $^3_2 He$ as product after a nuclear reaction.

(a) Write the reaction and determine the mass number A of the nucleus X. How many neutrons are there in a X nucleus?

(b) Knowing that the halflife of X is 12.3 years. Suppose some quantity of gas of X nucleus is released into the atmosphere in a nuclear power plant accident. What is the time needed for 90.0% of X to become nonradioactive?

END OF QUESTION PAPER