THE INTERNATIONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY - HCMC

FINAL EXAMINATION – CLASS

Student Name:_____Student ID:_____

Date: JUNE 2021

Duration: 48 hours (13:00 PM 16/06/2021 – 13:00 PM 18/06/2021)

GROUP 3

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

INSTRUCTIONS: $h = 6.63\times10^{-34}\,\text{J.s}$; $c = 3\times10^{8}\,\text{m/s}$; $e = 1.6\times10^{-19}\,\text{C}$

Avogadro number: $N_A = 6.022 \times 10^{23}$ atoms/mole; rest mass of electron: 9.1×10^{-31} kg.

Question 1 (20 pts) The camera lens can be modeled as a thin lens that forms an image on the film. A student uses a camera with a 36 mm-wide film to take a picture of a 12 m-long airplane landing at 46.7 m from the lens. The image of the airplane fills only 1/4 of the width of the film.

a/ What is the focal length of the lens?

b/ How much closer must the airplane be to you for its image to fill the width of the film?

Question 2 (20 pts) The lifetimes of the levels in a hydrogen atom are of the order of 10^{-8} s.

a/ Find the energy uncertainty of the first excited state and compare it with the energy of the state.

b/ Demonstrate the formula computing the wavelength spread of a spectrum line in function of the energy uncertainty of a state. Compute the numerical value of the wavelength spread of the corresponding spectrum line and explain the monochromaticity of a laser light.

Q**uestion 3 (20 pts)** Consider a hydrogen atom at the energy level *n*.

a/ Find the formula to compute the total number of different spectrum lines that can be emitted by this atom if it ends up in the ground state.

b/ A hydrogen atom in the ground state is excited by radiations and emit 10 spectrum lines. Compute the wavelength of these radiations.

Question 4 (20 pts) Knowing that some fundamental particles are not stable; they decay to other particles and after an interval of time *t*, the remaining number of these fundamental particles decreases according to the law: $N = N_0 e^{-t/\tau}$ where τ is constant called the mean life time. Suppose these fundamental particles move at speed 0.95*c*.

a/ What is the mean life time of these particles observed by a scientist on the Earth?

b/ After travelling a distance of 3 km, how many fundamental particles remain?

Question 5 (20 pts) Some nuclei are unstable and decay at a rate of 432 per second at t = 15 minutes. At t = 48 minutes, the counting rate has fallen to 213 per second.

a/ What is the half-life of the radioactivity?

b/ What will be the decay rate at t = 100 minutes?

END OF QUESTION PAPER