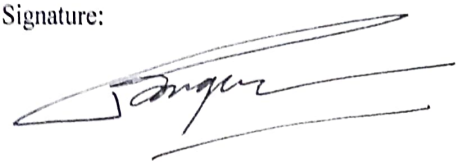
THE INTERNATIONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY - HCMC

FINAL EXAMINATION – CLASS

Student Name: **Student ID:**

Date: JANUARY 2020

Duration: 90 minutes

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

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

$h = 6.63\times10^{-34}\,J.s$; $c = 3\times10^{8}\,m/s$; $e = 1.6\times10^{-19}\,C$; rest mass of electron: $9.1\times10^{-31}\,kg$

Question 1 (20 pts) A converging lens with a focal length of 90.0 cm forms on a screen an image of a 3.20-cm-tall real object. The image is 4.50 cm tall.

(a) Where are the object and image located in relation to the lens?

(b) Draw a principal-ray diagram.

Question 2 (20 pts) The wave function for a hydrogen atom in the 2s state is $\psi(r) = A\left(2-\frac{r}{a}\right)\exp\left(-\frac{r}{2a}\right)$ where a is Bohr radius.

(a) Find the value of the constant A in terms of a by using the formula: $\int_0^\infty x^n \exp(-\alpha x)\,dx = \frac{n!}{\alpha^{n+1}}$.

(b) At what value of r is the radial probability density maximum? How does your result compare to $4a$, the distance between the electron and the nucleus in the $n = 2$ state of the Bohr model?

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

In which region of electromagnetic spectrum does the Paschen series fall? Explain your answer.

Question 4 (20 pts) A 100 MeV electron moves along the axis of an evacuated tube of length 4m fixed to the laboratory frame. What length of the tube would be measured by the observer moving with the electron?

Question 5 (20 pts) Tritium (^3_1H) undergoes β^- decay with a half-life of 12.3 years. It is also highly toxic to living things.

(a) What nucleus is produced in the β^- - decay of tritium?

(b) Suppose some tritium gas is released into the atmosphere in a nuclear power plant accident. How long will it take for 90.0% of the tritium to become nonradioactive?

END OF QUESTION PAPER