International University – VNUHCM
Department of Physics

Student Name: .....
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30/08/2024
Final Sem 03

QUESTIONS

$h = 6.63\times10^{-34}$ J.s; $c = 3\times10^{8}$ m/s; $e = 1.6\times10^{-19}$ C; rest mass of electron: 9.1×10^{-31} kg;

Avogadro number: $N_A = 6.02\times10^{23}$ particle/mol

Q1. (20 marks) A 1.50-cm-high object is placed 20.0 cm from a concave mirror with focal length 15.0 cm.

(a) Determine the position of the image and its size.

(b) Draw a ray diagram.

Q2. (20 marks) The x-coordinate of an electron is measured with an uncertainty of 0.20 mm

(a) What is the x-component of the electron's velocity if the minimum percentage uncertainty in a simultaneous measurement of this velocity is 1.0%?

(b) What is your observation about the precision of the measurement of this electron's position? What is the result in the precision of the velocity's measurement?

Q3. (20 marks) Consider a box with width L centered at $x = 0$, so that it extends from $x = -L/2$ to $x = +L/2$ **(Fig. 1)**. Consider possible wave functions of the form: $\psi(x) = A\sin(kx)$ where $k = \frac{2\pi}{\lambda} = \frac{h}{p}$ is the wave number and $p = mv$ is the linear momentum.

(a) Apply the boundary conditions at the wall: $\psi(L/2) = \psi(-L/2) = 0$ to obtain the allowed energy levels.

(b) Show that the energy levels are not equidistant.

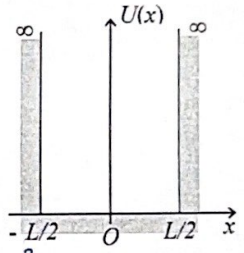

Fig. 1

Q4. (20 marks) 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 Lyman series fall? Explain your answer.

ultraviolet.

Q5. (20 marks) World War II aircraft had instruments with glowing radium-painted dials. The activity of one such instrument was 1.0×10^{5} Bq when it was new. Knowing that the half life of Ra is 1600 years.

(a) What mass of $^{226}_{88}Ra$ was present?

(b) What is the activity of this instrument 57.0 years after it was made?

END OF QUESTION PAPER