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Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Final Semester Examination, Spring 2025

Course Code: PHY102, Course Title: Physics II

Level:1 Term:2 Batch:67

Time: 2:00 Hrs. **Marks: 40**

Answer ALL the Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	*a)*	Which atomic model introduced quantized energy levels?	**1**	**CO1**
	b)	Because of which force do neutrons and protons not separate?	**1**	
	c)	List the types of particles emitted during alpha, beta, and gamma radioactive decay.	**2**	
	d)	State the postulates of the special theory of relativity.	**2**	
	e)	Define isotope, isotone, and isobar with examples.	**2**	
	f)	Label the key components of the Compton Effect using a diagram.	**2**	
2.	*a)*	Interpret Einstein's photoelectric equation.	**3**	**CO2**
	b)	Explain the key observations and limitations of Rutherford's atomic model.	**4**	
	c)	How does Einstein's theory relate mass to energy?	**4**	
	d)	Show that the half-life of a radioactive element is inversely proportional to the decay constant of that element. What will be the mean lifetime of a radioactive substance if its half-life is 67 days?	**4**	
3.	*a)*	Find the frequency and wavelength of the photon emitted by the hydrogen atom when it comes from −15 eV energy state to −34 eV state.	**3**	**CO3**
	b)	A man aged 40, left in a spacecraft moving with velocity 0.95c for a trip to space, leaving behind his 15-year-old son on Earth. According to his own time, he returned to Earth after spending 25 years in space. After returning, what are the ages of both?	**3**	
	c)	Find the binding energy and binding energy per nucleon of the $^{238}_{92}U$ nucleus in both MeV and joule units, given that the atomic mass of hydrogen is 1.007825 u, the mass of a neutron is 1.008665 u, and the atomic mass of $^{238}_{92}U$ is 238.05078 u.	**3**	
	d)	The decay constants of two radioactive elements A and B are 0.181 d^{-1} and 0.257 d^{-1}, respectively. (a) Find the half-life of element B. (b) Will the required time to decay 75% of both elements be the same?	**3**	
	e)	When an X-ray with a wavelength of 0.2400 nm is incident on an electron, it is scattered at an angle of 60°. Find the wavelength of the scattered X-ray.	**3**	