Shahjalal University of Science & Technology, Sylhet

Department of Physics

B. Sc. (Hons.) 1st Year 2nd Semester Examination-2011

Course: PHY105B (Physics for Biologists-I) for BMB

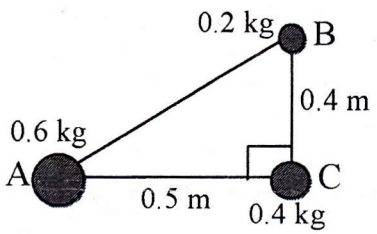
Full Marks: 70, Credit: 3, Time: 3 hours.

[**Answer any five questions**. The figures on the right margin indicate full marks.]

1. (a) Define projectile motion. Show that the trajectory of a projectile is parabolic. 1+6
   (b) A shell is fired horizontally from a gun located 144 m above a horizontal plane with a speed of 800 m/s. How long does the shell remain in the air? 4
   (c) State and explain Newton's third law. 3

2. (a) State and explain the principle of conservation of momentum. 4
   (b) Define elastic and inelastic collisions. 3
   (c) For a head-on elastic collision between two bodies A and B, what are their velocities after collision? Their velocities before collision are $v_{A1} = 3\,\text{m/s}$ and $v_{B1} = -3\,\text{m/s}$, and masses are $m_A = 9\,\text{kg}$ and $m_B = 4\,\text{kg}$. 4
   (d) Show that the total kinetic energy always decreases in an inelastic collision. 3

3. (a) What is meant by moment of inertia of a body? 2
   (b) State and prove the parallel-axis theorem on moment of inertia. 8
   (c) What is the moment of inertia of the system (i) about an axis through point A and perpendicular to the plane of the diagram, and (ii) about an axis coincides with the rod BC. 4



4. (a) What is a simple harmonic motion? 2
   (b) Show that a uniform circular motion is equivalent to two simultaneous simple harmonic motions at right angles to each other. 6
   (c) A simple harmonic oscillator obeys the equation $x(t) = 6\cos(3\pi t + \pi/3)$ meters. Calculate the displacement, velocity and acceleration at $t = 2$ s. 6

5. (a) What is damped harmonic motion? Derive differential equation for this motion. 2+2
   (b) State Fourier's theorem. 2
   (c) What is Doppler effect? Derive an expression for the observed frequency of sound when the observer is moving with respect to a stationary source. 2+6

6. (a) What are the discrepancies of Rutherford's model of the atom? 2
   (b) State the basic assumptions of the Bohr theory of atomic model. 5
   (c) Derive an expression for the orbital radii in the Bohr atom. 7

7. (a) What is radioactivity? Describe the mechanisms of radioactive transformation. 2+3
   (b) What is an alpha particle? How it is emitted from an unstable nucleus? 2+2
   (c) Derive the relation between the kinetic energy, E of an alpha particle and the total energy release, Q in an alpha emission. 5

8. (a) Define the terms radiation absorbed dose and dose equivalent. 3
   (b) Discuss sometic and genetic effects of ionizing radiation on human body. 8
   (c) Distinguish between stochastic and non-stochastic effects. 3

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