

Name: _____

Examination 4

Please circle your Section Number and Section Instructor.

1 Stroe 2 Keil 3 Burnham 4 Zozulya 5 Zozulya 6 Bennani 7 Burnham

This is a fifty-minute exam, with closed books and closed notes. You may use a calculator for numerical calculations. The exam will be graded out of one-hundred points. Show all of your work. If you require more space for writing, please use the back of the preceding page – the page facing the problem statement. Express numerical answers with units and with up to three significant digits, as appropriate. Please place your answers in the boxes provided.

- **Newton's Second Law:** $\sum \vec{F} = m\vec{a}$ (Translational); $\sum \tau = I\alpha$ (Rotational)
- $\omega = \frac{d\theta}{dt}$, $\alpha = \frac{d\omega}{dt}$, $v = \omega r$, $s = r\theta$, $g = 9.80 \text{ m/s}^2$
- Magnitude of tangential acceleration (a_t) = αr ; Radial acceleration (a_{rad}) = $\omega^2 r$,
- For $\alpha = \text{constant}$,
 $\omega_f = \omega_i + \alpha t$; $\theta_f = \theta_i + \omega_i t + \frac{1}{2} \alpha t^2$;
- **Kinetic energy (K) :**
 (a) Translational K.E. (K_t) = $\frac{1}{2} mv^2$; (b) Rotational K.E. (K_{rot}) = $\frac{1}{2} I\omega^2$;
- The work done by a constant torque τ : $W_\tau = (\tau)(\Delta\theta)$
- **The Work-Energy Theorem:**
 $W_{\text{total}} = K_f - K_i$
- The M.I. of objects:
 (a) Point-mass and hoop: $I = mr^2$ (b) Uniform disk: $I = \frac{1}{2} mr^2$
 (c) Uniform rod/stick (about one end): $I = \frac{1}{3} ml^2$, where l is the length.
- **The conservation of energy:**
 $K_i + mgh_i + W_{\text{other}} = K_f + mgh_f$
- **Angular momentum of a rotating object:** $L = I\omega$
- **Angular momentum of a point mass in translation:** $L = m v r_\perp$
- If there is no external torque,
 $L_i = L_f$ (Conservation of Angular Momentum)

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