Physics 202
Individual Quizbit | Rotational Mechanics

Work individually to produce a single handwritten solution to these questions. The first part of activity is a timed quiz, where you are graded on effort and completeness. Turn that into Gradescope under the associated timed assignment. Then you will have until the end of the week to submit to a separate Gradescope assignment a well organized and thorough solution. Start with fundamental principles and use multiple representations to communicate understanding of the physics.

For questions 1 through 2 **fill in the square** next to all correct answers. A given problem may have more than one correct answer. Each correctly bubbled answer will receive two points. There are **3** correct answers in this section and only the first **3** filled in answers will be graded. There is no partial credit.

1. A dumbbell-shaped object is composed of two equal masses, **m**, connected by a rod of negligible mass and length **r**. If $\mathbf{I_1}$ is the moment of inertia of this object with respect to an axis passing through the center of the rod and perpendicular to it and $\mathbf{I_2}$ is the moment of inertia with respect to an axis parallel to the first axis but passing through one of the masses, it follows that:
   - □ (a) $\mathbf{I_1 = I_2}$
   - □ (b) $\mathbf{I_1 > I_2}$
   - □ (c) $\mathbf{I_1 < I_2}$

2. A disk is spinning with an angular velocity **ω** and an angular acceleration **α**. For which of the following cases would the disk rotation be slowing down?
   - □ (a) **α** is negative, **ω** can be positive or negative
   - □ (b) **α** is positive, **ω** can be positive or negative
   - □ (c) **ω** is negative, **α** can be positive or negative
   - □ (d) **ω** is positive, **α** can be positive or negative
   - □ (e) **α** is negative, **ω** is negative
   - □ (f) **α** is negative, **ω** is positive
   - □ (g) **α** is positive, **ω** is negative
   - □ (h) **α** is positive, **ω** is positive

3. The circle near the south-west corner of OSU-Cascades Campus has a radius of about 25.0 meters. Suppose a cyclist is traveling around the circle at the maximum speed possible and is leaning at a constant 10.4 degrees relative to the vertical as shown in the image below. Use a torque analysis, with a reference axis at the center of mass, to determine the coefficient of static friction between the tires and the road. (*Hint:* The cyclist has no angular acceleration about the center of mass.)

   Sensemaking Follow-up (not due during timed quiz but should be part of final solution)

   What common material interface has a similar static friction coefficients as what you determined? Do you think the pavement was dry? Explain your reasoning.