Name:_____ ID:_____

Physics 202

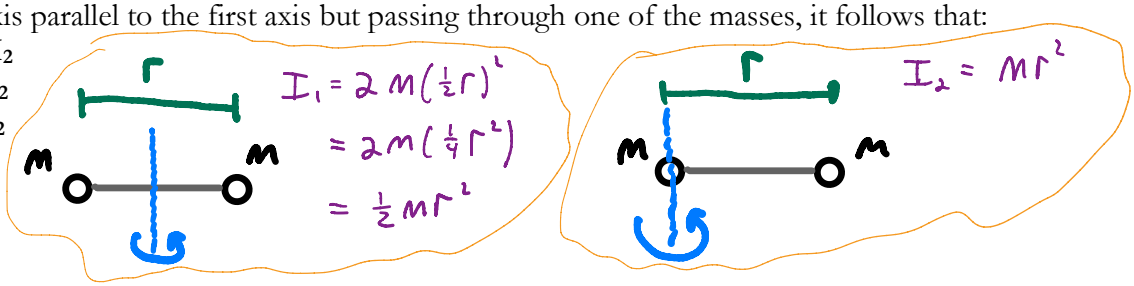
Quizbit 1

Week 3 Winter 2023

Collaboration is not allowed. Allowed on your desk are: three 8.5 x 11 inch doubled sided sheets of notes that are bound together, non-communicating graphing scientific calculator, a page of scratch paper, writing utensils, and the exam. You will have 25 minutes to complete this exam.

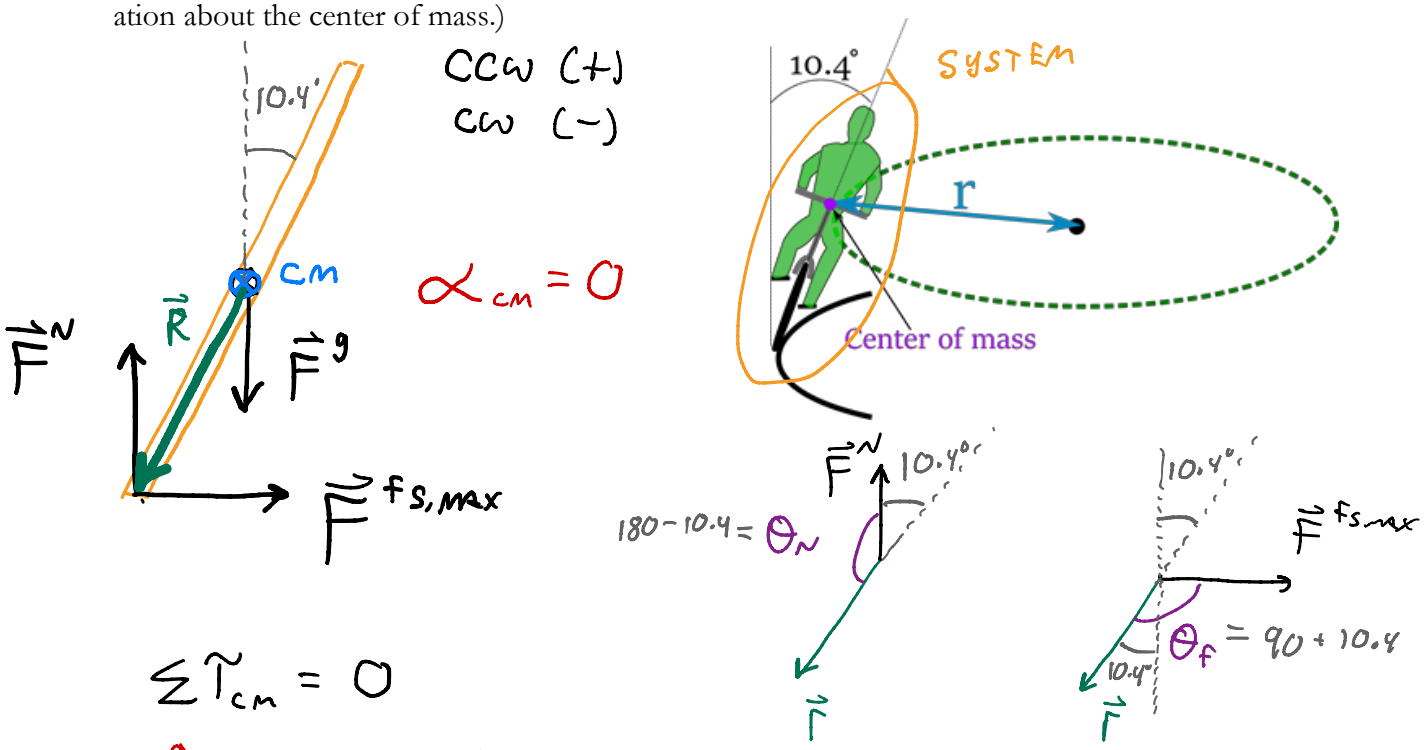
For questions 1 through 2 **fill in the square** next to all correct answers. A given problem may have more than one correct answer. Each correctly bubbled answer will receive two points. There are **3** correct answers in this section and only the first **3** filled in answers will be graded. There 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. (4 points) 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.)



CCW (+)
CW (−)

$\alpha_{cm} = 0$

$$\Sigma \vec{\tau}_{cm} = 0$$

$$\vec{\tau}^{g}_{cm} + \vec{\tau}^{N}_{cm} + \vec{\tau}^{F_{s,max}}_{cm} = 0$$

$$-R F^N \sin\theta_N + R F^{f_{s,max}} \sin\theta_f = 0$$

$$-F^N \sin(169.6) + \mu_s F^N \sin(100.4) = 0$$

$$-\sin(169.6) + \mu_s \sin(100.4) = 0$$

$$\mu_s = \frac{\sin(169.6)}{\sin(100.4)} = \frac{0.180519}{0.983571}$$

$$\mu_s = 0.18353$$

$$\boxed{\mu_s = 0.184}$$