Polytechnic Tutoring Center
Final Review – PH 1213 Spring 2021

Disclaimer: This mock exam is only for practice. It was made by tutors in the Polytechnic Tutoring Center and is not representative of the actual exam given by the Academic Department.

1. A 20 kg block is hanging by a vertical spring that has spring constant 20 N/m. If the block is released from rest when the spring is unstretched, how much time does it take for the block travel a total distance of 100m in air? (Take g=10 m/s^2)

2. An astronaut travels to a faraway planet, where he finds that the acceleration due to gravity on the planet's surface is 5.5 m/s^2. If the planet has the same radius as that of the earth, what is the escape speed for the planet?

3. A 65 cm long guitar string that has mass of 1.5 g is vibrating at a fundamental frequency of 330 Hz. Calculate the tension in the string.

4. An Atwood machine (a free to move pulley that hangs a mass on each side) has a 5 kg mass on one side and 2 kg mass on the other. How fast are the blocks accelerating?

5. You are sitting at rest in a free-to-rotate chair while holding electric motor whose center of rotation is parallel and 1 m away from yours. The electric motor is connected to a 0.5 kg disk that has a diameter of 0.6 m. If the electric motor can spin the disk at an angular velocity of 200 rad/s, how fast will you be rotating when you turn on the electric motor? Assuming your moment of inertia is 8 kg m^2.

6. Friction exerts a torque of 1 Nm to a 20 kg spinning ball rotating at 20 rad/s. If the radius of the ball is 0.2 m, how long does it take for the ball to come to rest?

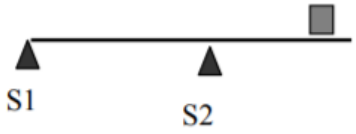
7. Marauder is currently known as the toughest car on the market. If a speeding Marauder running at 140km/h runs into a slow Marauder running at 20km/h to the same direction and result in a perfect elastic collision. What will be the difference in their speed after the collision?

8. A stationary horizontal disk-shaped platform is free to rotate about its center. The radius of the platform R = 1.6 m, and mass is 200 kg. A 43 kg boy jumps on the rim of the platform with the velocity 2.2 m/s tangential to the rim. What will be the angular speed of the platform with the boy?

9. A stone is thrown at an angle of 35° above the horizontal with an initial speed of 6.3 m/s. What will be the speed of the stone 0.12 seconds after it was thrown?

10. A ball was hit straight up into the air and fell to the same height 10 s later. What was the initial velocity of the ball?

11. A uniform plank of mass 22 kg and length 12 m rests horizontally on two supports S1 and S2. Support S2 is 3.2 m from the right end of the plank. What is the furthest distance from S2 that a 53 kg box can be placed without the plank tipping over?



12. Mass of 10kg is hanging onto 2m rope right next to a block. If the mass was pulled back 10° from the center and released from rest. How long does it take for the mass to hit the block?

13. A 1kg particle is at location $2\hat{\imath} + 3\,\hat{\jmath} + 5\,\hat{k}$ traveling in the direction $7\hat{\imath} + 11\hat{\jmath} + 13\hat{k}$. What is its angular momentum with respect to the origin in vector form?

14. A bat with coronavirus is flying toward a prey at 10 m/s while using echolocation to detect the prey. The bat sends out a 100 kHz ultrasonic sound, and the wave bounces back after having contact with the stationary prey. What is the frequency that the bat will be hearing?

15. Two 1-ton planets are rotating around each other in a circular orbit due to gravity. If the distance between them is 120 km, how long is the period of their rotation?