

Physics 1403-002 Exam #2 sample questions

Instructions: Do real good. Show your work for all problems. Partial credit will be assigned for things that make sense.

Short questions:

1. A mass on a string moves on a vertical circle of radius 5.5 m. At what speed must it move at the top of its path for the string tension to be 15% of the weight of the mass?
2. A 0.050 kg rabbit is swung on a 3.5 m long string in a horizontal circular path. If the period of the rabbit's motion is 1.20 s, find the centripetal force on the rabbit.
3. An astronaut in space can be given the sensation of gravity by being in a rotating cylinder. What is the real (not fictitious) force that provides the feeling of gravity (I do not want you to answer, "the centripetal force")?
4. A 1200 kg elevator's cable snaps and it falls freely until its speed is 15 m/s. Then emergency brakes kick in and stop the elevator. The elevator drops a distance of 20 m while it is being slowed. How much work did the brakes have to do to stop the elevator?
5. If I stand on a highway overpass and throw rocks I will be arrested. But before that, I throw rock #1 outwards and upwards, rock #2 horizontally, and rock #3 downwards and outwards, all at the same initial speed. Which rock has a higher speed when it hits the road, and why?
6. 25,000 kg/s of water falls over a 32 m high dam wall. How much power is generated?

7. A 2.5 kg weight moves on a horizontal surface at 3.2 m/s. It strikes a spring and compresses it by a distance of 0.12 cm, at which time the weight is moving at 1.2 m/s. What is the spring constant of the spring?
8. A 3.5 kg mass slides a vertical distance of 1.20 m down a frictionless ramp. What is its speed when it reaches the bottom?
9. A 1.8 kg mass moving at 2.5 m/s on a horizontal frictionless surface strikes an unknown mass and they stick together. If the combined masses move at 2.0 m/s after the collision, what is the unknown mass?
10. A baseball bat exerts an average force of 1200 N on a 0.070 kg baseball for 1.2 ms. If the ball is pitched at 15 m/s, what speed will it have when it leaves the bat?
11. A 1200 kg car moving north at 15 m/s collides with a 1500 kg car going east at 20 m/s. They stick together and move with a common velocity just after the collision. What is that velocity (magnitude and direction)?
12. You are stuck in the center of a frictionless lake of ice. However, you have an AK-47 and several full magazines. How can you use the rifle to get to the edge of the lake?