Honors Study Guide for Physics Momentum/Rotational Motion/Gravity Unit

This study guide contains questions very similar to the test. It is meant to let you know what you need to study and put on you 15 square inches of cheat sheet. ***Do not turn this in; I will not grade it, but you can ask me to check it.***

In addition to the questions below, you will need to be able to calculate momentum, change in momentum, impulse, force of impact, and time of impact, just like on the chart and ranking task worksheets we completed.

1. If the time of impact in a collision is extended by four times, how does the force of impact change?
2. When you throw a ball, do you experience an impulse? What if you instead catch a ball of the same speed? What if you catch it, then throw it out again? Which impulse is greatest? (Visualize yourself on a skateboard.)
3. In terms of momentum conservation, why does a gun kick (recoil) when fired?
4. Imagine that you are hovering next to a space shuttle in orbit around the earth and your buddy of equal mass who is moving at 4 m/s with respect to the ship bumps into you. If he holds onto you, how fast do you both move with respect to the ship?
5. Everybody knows that you will be harmed less if you fall on a floor with "give" (like a firemen's net) than a hard floor. In terms of impulse and momentum, why is this so?
6. What happens if you throw a heavy rock from your hands while standing on a skateboard? What about if you didn't actually throw the rock, but went through the motions of doing so? Explain.
7. A bug and the windshield of a fast-moving car collide. Tell whether the following statements are true or false:
    a. The forces of impact on the bug and on the car are the same size.
    b. The impulses on the bug and on the car are the same size.
    c. The changes of speed (acceleration) of the bug and of the car are the same.
    d. The changes in momentum of the bug and of the car are the same size.

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8. Who is in greater trouble – a person who comes to an abrupt stop when he falls to the pavement or a person that bounces from the same pavement on impact? Explain.
9. A railroad diesel engine has 4 times the mass of a flatcar. If a diesel engine coasts at 5 m/s into a flatcar that is initially at rest, how fast do the two coast after they hook together?
10. You are outside repairing a spaceship when you realize you are drifting slowly away and can no longer reach the ship. All you have is a massive tool belt, but nothing in it can reach the ship either. What can you do to save yourself? Explain.
11. A ladybug sits on a spinning turntable. What happens to its tangential velocity if:
    a. The rotational speed (RPM rate) is doubled?
    b. It quadruples its distance from the axis of the turntable?
    c. Both a and b happen?
12. If you stood atop a ladder that was so tall that you were five times as far from the earth's center as you are now, how would your weight compare to its present value?
13. If the moon were four times as massive, how would the attractive force of Earth on the moon change? What about the force of the moon on the earth? Why?
14. What causes the tides in Earth's oceans, and why are there two high tides per day, not one?
15. You are driving around a curve with a radius of 150 meters in a car with a mass of 500 kg and a tangential velocity of 30 m/s. How much centripetal force is needed for you to stay on the road?
16. If the coefficient of static friction between your tires and the car is 0.7, is there enough friction to keep you on the road while turning? Explain.
17. If you spin a ball at the end of a string and then let the string go, which way will the ball fly? Why? Be specific!

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