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Physics Mid-Term Review

These are the concepts that we have covered so far this semester. These are the things you should be very familiar with by now: Velocity, displacement, uniform acceleration, vector diagrams, laboratory safety, graphical analysis, freefalling objects, resultant vectors, vector components (SohCaahToa), Projectile motion, relative velocity, force, free-body diagrams, newton's laws, normal force, gravity, weight, frictional force and frictional coefficients, Gravitation, work, Kinetic and potential energy, mechanical energy, spring potential energy, conservation of energy, power, momentum and conservation of momentum. If any of these concepts seem unfamiliar, I suggest reading your notes and specific sections of the textbook for clarification.

Velocity, Displacement, Acceleration

1. A ball is thrown horizontally with a velocity of 3m/s . How long does it take to hit the ground if it was 1.2m above the ground when thrown? How far will the ball be thrown?
2. If you throw a ball vertically, what is the acceleration acting on the ball on the way up? At the top? On the way down? What is its velocity at the top? Why does the acceleration remain constant?
3. Justice drives her new BMW Alpina Roadster down US Route 79 at 12m/s . If she slams on the gas and accelerates at 2.5m/s^2 , how fast is she going after 5s ? At that speed, how far would she go in 1 minute?
4. How many m in 2km ?
5. How many kg in 3g ?
6. What is 400cm/s in m/s ?
7. How many M in 6mm ?
8. Tim Duncan is running down the court at 3m/s and passes the basketball to Ginobili at 10m/s . how fast is the ball moving when Ginobili receives it?
9. The Union Pacific Freight train is traveling at 22m/s from Hutto to Taylor. If the conductor is walking at 3m/s toward the back of the train, what is his velocity relative to the ground?

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10. An object is moving with uniform acceleration. If you needed to solve for distance, what formula would you use? What uniform acceleration do we encounter most frequently?
11. If an object were moving with constant velocity, what formula would we use for distance? Why would we not use the previous formula?
12. An arrow is shot from a cliff at an angle of 0° with respect to the vertical at a speed of 30 m/s. It takes 4 seconds for the arrow to hit the ground.
- How high is the cliff?
 - How far horizontally did the arrow travel?
13. A ball is thrown upward and returns to the same height from which it was thrown. The total round trip takes 4 seconds. (Fill in the blanks.) (Take up as a positive direction.)
- | | |
|-------------------------------------|-----------------------------|
| _____ Time moving up | _____ time moving down |
| _____ Sign of the velocity going up | _____ acceleration going up |
| _____ Acceleration at the top | _____ velocity at the top |
| _____ Acceleration going down | |
14. A seagull flying horizontally at 15 m/s drops a clam. The clam takes 3.0 s to hit the ground. How high was the seagull when the clam was dropped? (Approximately) a. 15m b. 30m c. 45m d. 90m
What was the horizontal speed of the clam after falling for 1.0 s? _____
What was the acceleration of the clam after falling for 1.0 s? _____

Force

15. What is the difference between weight and mass? What is the weight and mass of a 40kg medicine ball?
16. What is normal force? It is always perpendicular to the _____ the object is resting on. How is F_N different from friction?
17. What is friction? How do we find out how much friction is being exerted?
18. Draw a Free-body diagram of a Human walking a dog. You must include the 40N the dog is pulling on the leash.

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19. If a tennis ball is being suspended by a string from a ceiling, and the ball weighs 0.22kg, how much force is the ball pulling down on the ceiling? How much force is the ceiling pulling on the ball?
20. If a Cessna 172 takes off from Taylor Airport with a velocity of 32m/s at an angle of 38°, what are the vertical and horizontal components (vectors)? What is the hypotenuse called?
21. If that Cessna was taking off with a velocity of 32m/s but the vertical component was only 10.4m/s, what is the takeoff angle?
22. A brick on concrete has a μ_s of 1.3, how much horizontal force is required to get a 2kg brick to slide on concrete? If that brick has a μ_k of .8, how much less force is required to keep the brick moving?
23. A 3kg computer takes 12N of horizontal force to maintain movement across a desk. What is its kinetic frictional coefficient?
24. If your new car has a normal force of 17,640N while stationary on a level surface, what is its mass?
25. Two students on a space exploration have been ordered to go on a space walk. One has a mass of 60kg; the other has a mass of 75kg. They are tethered together as to not drift too far apart. If the tether is 3m, what is the gravitational force between them? $G= 6.67 \times 10^{-11}$
26. Think about the orbit of earth around the sun. What shape is the orbit? When the earth is further away from the sun, is the gravitational pull affected? Does it slow down?

Energy and Work

27. What is the difference between gPE and ePE?

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28. How does Kinetic Energy and Kinetic friction relate
29. Define the conservation of energy and what it means.
30. A large steel ball is placed at the top of a playground slide. It has a mass of 18kg and the slide is 3m high. What is the gPE of that ball?
31. A small child is at the top of the same slid. His gPE is 647J. What is his mass?
32. Where would their gPE=KE?
33. The steel ball has a KE of 358J. How far off the ground is the ball?
34. There is a spring at the bottom of a 60m cliff. A strange coyote throws a 40kg anvil off that cliff. What is the initial gPE of the anvil? When the anvil hits the spring, the spring compresses 1.2m. By how much gPE the anvil had to begin with, what is the spring constant of this particular spring?
35. If the spring is switched out with a stiffer one which compresses a mere 0.5m, what would its spring constant be?
36. How much work is done pushing a 46N-shopping cart down a 1.8m ramp that has a 16° decline?
37. If we are searching for an angle, what function(s) do we use on our calculators?
38. Bacon walks 3km to the movie theater to see the latest moving picture. If he uses 360,000J of work, how much force was he exerting?
39. If that trip to the theater took 15min, how much power did he use?

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40. $900W=567/t$

41. Mr. Redmond's rolly-chair has a weight of 50N. If a thieving hooligan tied it to the back of his pickup truck and drove it for 200km, how much work was done on that chair. At 80km/hr, how much power?

Momentum

42. What are the units of Momentum?

43. What is the formula for impulse-momentum?

44. What is the momentum of Josh's busted car that has a mass of 1800kg and a velocity of 22m/s?

45. If Josh runs into a small woodland mammal with his car, would the collision be elastic or inelastic?

46. Lets assume it's perfectly inelastic. If the woodland mammal has a mass of 2kg and a velocity of -3m/s, how would it's velocity change upon impact? (Remember the mammal's mass will be added to the vehicles mass after the collision)

47. A paper airplane is thrown toward an old, blue haired organist in church. The airplane has a mass of 4g and a velocity of 4m/s. what is it's momentum?

48. If it collides with the organist's hair and becomes lodged, how long is the impulse that has an acceleration of $20m/s^2$?

49. What are the units of Velocity?

50. What are the units of Work?

51. What is the variable of impulse?