Review Guide for Physics Themed Final Exam Semester 2

For FULL curve, answer the following questions in your journal. The problems should be numbered and done in order in your journal. For any math problems, show ALL work including step 2 where useful; Use your notes, packet, course website for review and make a good faith attempt at 90%+of the problems.

1. Name the three kinds of graphs and the three ways to get information from them

2. If you walk 5 kilometers in one hour, what is your average speed in SI units?

3. What would you have to know before you could determine your average velocity?

4. How many meters per second is a car moving if its speedometer reads 60 mph?

5. What is the only SI unit with a prefix? Convert 50 grams to kilograms.

6. What is the difference between position and displacement?

7. What will be your displacement from the moment you leave your seat today till the moment you sit again tomorrow?

8. What do you need to know to calculate average speed?

9. If you have a position-time graph, what will you find out if you take the slope?

10. What does the area under the curve of a position-time graph give you? (careful!)

11. What does the slope of a velocity graph tell you?

12. What does the area of a velocity graph tell you?

13. What does the area of an acceleration graph tell you?

14. Of the three graphs, which is most useful?

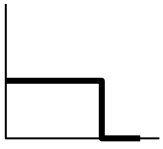
15. How do you get instantaneous velocity from a velocity graph?

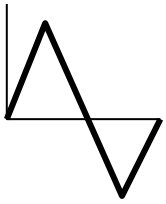
16. If your position graph is a curve, how do you get instantaneous velocity?

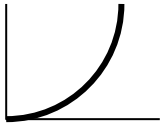
17. What does it mean if you have a negative slope on your velocity graph?

18. What does it mean if you have a negative value on your velocity graph?

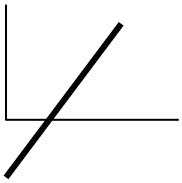
19. Explain the following position graphs:

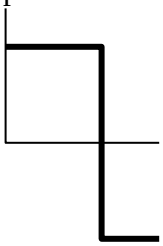


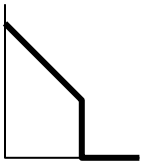




20. Explain the following velocity graphs:







21. What does a straight horizontal line on a position graph mean?

22. What does a negatively sloped straight line on a velocity graph mean?

23. What does a curve on a position graph mean?

24. A runner completes one mile in 5 minutes. If he can maintain that speed, how long would it take him to run 6 miles?

25. A pitch travels 17 m to get to home plate. Calculate the time it takes if the ball is traveling at 50 m/s.

26. A rule of thumb states that if it takes a runner time T to run a certain distance, it will actually take that runner 2.2T to run twice that distance. If a jogger runs 2 miles in 16 minutes, how long would it take the jogger to run 4 miles? 1 mile?

27. What is the value of the acceleration of gravity in m/s^2?

28. You drop a rock off a cliff and hear it hit the water 2 seconds later.
a) Which of the following do you know?

Δd Δt v_i v_f a

b) Which of the TNEOM will help you find out the height of the cliff?
$v_f^2 = v_i^2 + 2a\Delta d$
$v_f = v_i + a\Delta t$
$\Delta d = v_i\Delta t + ½\ a\ \Delta t^2$

c) What is the height of the bridge?

29. You can jump a height of .5meters.
a) which of the following do you know?

Δx Δt v_i v_f a

b) Which of the TNEOM will help you find out your hang time?
$v_f^2 = v_i^2 + 2a\Delta x$
$v_f = v_i + at$
$\Delta x = v_i t + ½\ a\ t^2$

c) is the Δt in the equation the hang time?

d) what is your hang time?

30. If you throw a baseball from first to second base, which changes, the ball's horizontal speed or its vertical speed, and why?

31. How far does an object which is dropped from rest fall in one second? In two seconds? In three seconds?

32. What are some examples of hidden information?

33. If you toss a ball straight up at 10 m/s, how fast will it be moving when you catch it again?

34. What is the velocity of the ball at the peak? The acceleration at the peak?

35. A car goes from 0 to 50 m/s in 10 seconds on a flat road. What is its acceleration?

36. A trampoline artist is airborne for 2 seconds. What was her maximum height?

37. What angle should a football be kicked at for maximum range?

38. A football is punted at 20 m/s at an angle of 30 degrees. What other angle would give an identical range if the ball were kicked at the same speed?

39. What are the units of displacement? Velocity? Acceleration?

40. Which would hit the ground first, a bullet fired horizontally at 300 m/s or a bullet dropped from the same height?

41. A skydiver is moving at 14 m/s. 2.5 seconds later she is moving at 29 m/s. What is her downward acceleration?

42. You drop your physics book over a cliff. (You wish!) How fast is it moving after one second? After two seconds? After three seconds?

43. What determines how much time a diver has in which to do flips and such?

44. Why is a spring board better than a platform diving board for doing acrobatic dives?

45. What sports physics topics did you investigate in our projects?

46. You travel 5 miles north, 3 miles east, 1 mile south, and 6 miles west. What is the shortest path? Remember angle and length!

47. You travel 4 meters exactly due southwest, 7 meters north, and 3 meters west. What is the shortest path?

48. A ball has a horizontal speed of 40 m/s and a vertical speed of 10 m/s. What is its velocity (angle and amount!)

49. You travel 10 m north, 5 meters east, and 8 meters at 20 degrees south of west. What is the shortest path?

50. For the above problem, what would you have to do to end up home again?

51. Who has the most weight: Super Man with a mass of 250 lbs or the Spider Man with a mass of 80 kg?
52. What type of energy is stored in the DareDevil Dive's bungee jump cord after falling 125 feet?
53. What is the PE of an empty Batman car (mass of 4500. kg) on the first hill (30.5 m high)?
54. What is ultimately the first source of energy on our planet?
55. Where do you have the most PE while riding on Giant Drop?
56. What is the principle type of energy provided by cotton candy?
57. How does the KE of a moving bumper car change if its total mass is doubled?
58. What is the velocity of a Viper car of mass 1000 kg and a KE of 50,000 J?
59. A heavy truck passes a car on the highway. Which vehicle has the most PE ?
60. A frictionless raft has 20,000 J of total energy. How much KE does it have at the bottom of the ride?
61. How much energy do you need to walk up 10 steps? Assume mass of 65 kg, each step is 0.25 m
62. What is the total energy of a 2 kg swing moving at 4 m/sec and 10 meters off the ground?
63. How does mass affect the speed of a coaster?
64. Name one example of a perpetual motion machine
65. What are the units for weight?
66. A shoe bounces up 2 meters after being dropped 10 m out of a ride. What is the bounce efficiency?
67. A coin has 4.5 J of PE when it falls out of your pocket. How much KE will it have half-way down?
68. Name the law that states energy is never lost or gained but rather converted between types?
69. What is the difference between impulse and momentum?
70. What are the SI units for momentum?
71. Which among these is/are always conserved? Momentum, energy, kinetic energy.
72. A collision is which KE is conserved is called what?
73. Which has a greater impulse: A collision with a brick wall or a pile of hay?
74. What does time have to do with force during collisions?
75. What collision type is also called "Bouncy"? "Sticky"?
76. Which type of energy is the graveyard of all energy conversions?
77. How far down on the first hill is a frictionless coaster if its KE is three times greater than its PE?
78. Joule is the unit for what?
79. Where does the kinetic energy go when you clap your hands together?
80. When is your mass the greatest, on the moon or on Earth?
81. A frictionless coaster starts from rest down a 30 m high hill. How fast is the car when it climbs to the top of the next hill, which is 20 m high?
82. Give an example of an action that does not require work from you?
83. What are the two criteria to determine if work is being done?
84. Which 3 stages of a roller coaster require work to be done by machines?
85. Give an example of how a ramp is used at a roller coaster park.
86. What are the units for work?
87. How much work is needed to lift a 150 gram coin to a height of 2.5 m?
88. A 3500 kg roller coaster comes to a stop after the brakes expend 12,000 J of energy. What was the speed of the coaster the moment the brakes were applied?
89. A teeter-totter is an example of which simple machine?
90. A teacher pulls on the door and the door closes. Did the teacher do positive or negative work?
91. Magnets are used on Giant Drop to slow down the falling passengers. Do the magnets do positive or negative work?
92. How does the skidding distance change if the speed of a car is tripled?
93. A student exerts twice as much force as another student over the same distance. How do their works compare?
94. Explain using energy terms how car tires can be used as bumps to slow down water coasters?
95. Machines change how work is done by changing which of the following: work, force, distance?
96. Where does the potential energy at the top of the first hill come from ?
97. Sketch a picture of a chain dog:
98. What is the name of the energy resulting from work associated with friction?
99. Where are levers used in a roller coaster park?
100. How much power is needed to accelerate a coaster from 0 to 25 m/sec in 10 seconds?
101. Kilowatt – hours is a unit for what?
102. How much work is done by a 40? watt light bulb left on for 25 minutes?
103. If the cost for electricity is 8 cents per kilowatt-hour, what is the cost for a chain dog uses a force of 15,000 Newtons over a distance of 35 m in a total time of 40 seconds?
104. A student has a power of 240 Watts and a mass of 75 kg. How high does he climb in 8.5 seconds?
105. What is the unit for force?
106. A pulley is used to lift Giant Drop. If the machine is slowed down so that it takes twice as much time, how does the power of the pulley change? How does the work change?

107. A machine has a mechanical advantage of three. How much force is needed using the machine to lift an object that has a weight of 9000 N?
108. What is the ideal (no friction) mechanical advantage of a ramp that is 12 m long and 4 m high?
109. Why can a ramp never have a mechanical advantage less than one?
110. A chain dog machine uses 420 J of energy to do 500 J of work. What is the dog's efficiency?

111. A catapult uses a force of 8500 N to propel a 3200 kg coaster a distance of 6.5 m. Then the coaster falls down a 3 m hill. The speed at the bottom of the hill is 7 m/sec.
How much heat was created by the catapult?
112. A 3200 kg coaster is moving at 7 m/sec at the bottom of a 100 m tall incline. What is the speed at the top of the incline if a pulley uses a force of 35,000 N to pull the coaster up the 145 m long incline?
113. What braking force is needed to stop a coaster in 6.5 m if the coaster has a velocity of 7 m/sec? The mass of the coaster is 3200 kg.

114. How heavy do you feel at 3 g's? How heavy do you feel at 0.5 g's?
115. How are "red outs" different from "black outs"?
116. How are roller coasters designed to minimize the health hazards of large g forces?
117. What do you expect is the typical range of g's on a roller coaster?
118. What is the name of the force that prevents you from falling through the floor?
119. How does the direction of friction or air resistance compare to the direction of your motion?
120. Does inertia increase with more mass, more speed, or both?
121. Explain using inertia why it is more difficult for an elephant to make quick turns than a cheetah
122. Which coaster has more inertia, an empty coaster at rest or the same coaster at rest but loaded with passengers?
123. What are the two possibilities if the net force is zero?
124. If an object is accelerated in an upwards direction, what is the direction of the net force?
125. What is the acceleration of a 5000 kg coaster pushed by a net force of 25,000 N?
126. A 2000 kg coaster is accelerated from 0 to 20 m/s in 4 seconds. What was the net force used?
127. Centripetal forces cause objects to move in a circle. For each event, identify the centripetal force:
    a. roller coaster loop
    b. moon going around the Earth
    c. toy swinging on a string in a circle
128. What is the centripetal acceleration of a coaster which is moving at 40 m/s in a circular loop that has a diameter of 20 m?
129. Which direction would the earth follow if suddenly the sun was removed ?
130. A student swings a toy on a string over his head in a horizontal circle. What is the direction of the tension in the string?
131. A gun shoots off a bullet. Since the gun pushes out the bullet with the same force that the bullet pushes back on the gun, why don't the gun and bullet have the same acceleration?
132. The restraining bar in the ride Shockwave hits your head. What is the reaction force?
133. Use action-reaction pairs to explain what happens if you were in outer space and pushed off from the side of your space vessel?
134. As the Space Shuttle orbits our planet, it is actually free falling around the earth. Why does this not mean the Shuttle has no weight?
135. Imagine you are standing on a weigh scale while free falling inside an elevator. If your mass is 90 kg, what would the scale read? What is your true weight?
136. How is it possible to be truly weightless (not just feel weightless)?
137. What is the one force that must be missing in order to feel weightless, for example on Giant Drop?
138. What is the acceleration of a 1000 kg elevator supported by an 8800 Newton(N) normal force?
139. How is the direction of the normal force determined?
140. What happens to you on a trampoline if your normal force is greater than your weight?
141. Where do you expect on a roller coaster the normal force is greater than the weight?
142. When is the only time on a ride where static not moving friction must be overcome?
143. If a coaster is moving up a hill, what direction is the force of friction?
144. Modern coasters use rubber instead of steel wheels to roll against the steel track. Which type of wheel would you expect to have a lower coefficient of friction and why?
145. Which friction, static or kinetic, holds a parked car from sliding down a steep hill?
146. What would happen to the force of friction if the normal force is doubled?
147. Is it the centripetal or centrifugal force that makes circular motion possible?
148. Why does a coaster have a tendency to go straight when making a turn?
149. If g-force is not actually a force, then what does it measure?
150. At positive g's, do you feel heavier or lighter?
151. At what g force can you feel absolutely nothing?
152. Do you get bumped out of your seat or pushed into when experiencing negative g's?
153. What happens to the g-force you feel if the normal force on you were to double?

154. Where on a coaster ride will you most likely experience positve g's? negative g's? zero g's?
155. What is the acceleration of a coaster at the start if it begins moving with a g-force of 0.8?
156. What is the normal force of a 5100 kg coaster while at rest on a flat section of track?
157. What g-force would you feel on a new coaster which is accelerated from 0 to 40 m/s in 2 s?
158. A hill is designed to produce a feeling of weightlessness. How should the shape of the hill be changed if later it's found out the coaster speed is slower than expected?
159. If a Giant Drop rider is truly free falling from rest, what speed should she have after 2 seconds?
160. What danger exists if a coaster hill is not curved enough?
161. In which seat will you be traveling fastest when riding a coaster over a hill?
162. What g-force do you feel if riding at 25 m/s over a hill of radius 40 m?
163. What can happen to a coaster car when experiencing negative g's?
164. Why is no forward force needed to keep a coaster moving when traveling into a loop?
165. How does the speed of an actual coaster change as it completes a loop?
166. How do the g-forces change as a coaster goes from the bottom to the top of the loop?
167. If at the top of the loop the normal force is zero, what force must provide the centripetal acceleration to complete the turn?
168. For a circular loop of constant radius, if the acceleration is 9.8, what is the g-force at the bottom, side,and top of the loop? Would you ride this loop?
169. If a piece of track suddenly broke along a loop, which direction would the coaster move towards?
170. It is possible in a coaster to fall faster than the acceleration due to gravity. How is this possible?
171. How does the radius at the bottom of a Klothoid loop compare to that at the top?
172. Why are Klothoid loops preferred over circular loops?
173. What are the advantages of banked turns over flat horizontal turns ?