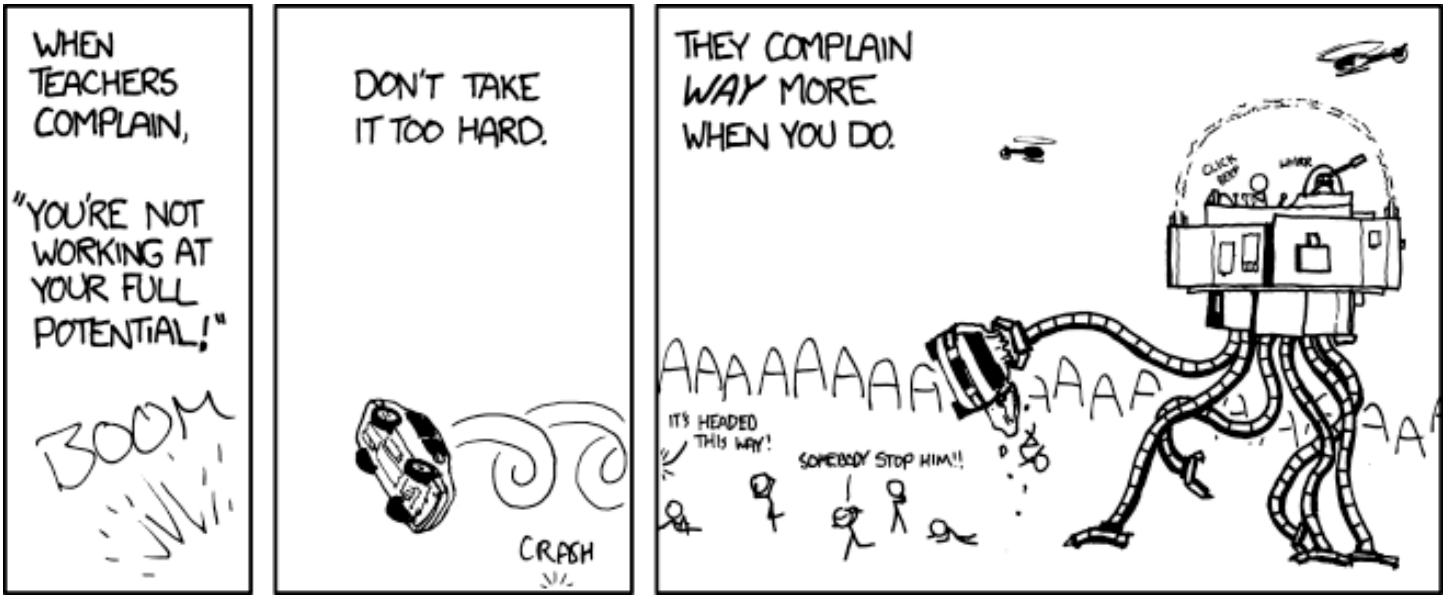
AP Physics – Summer Packet



Name:

Period:

All work on this packet is my own. I have not done anything to give myself or anyone else an unfair advantage on this assignment.

Signature:

- I care significantly less about the completion of this packet and much, much more about the speed with which you will recollect the physics herein in class.
- The questions presented here are not important in and of themselves, but are of the degree of difficulty that should come close to automatically at the beginning of the year.
- If you find that you need more practice than this, you might choose to complete problems from the book from the appropriate chapter. I'd suggest doing odd problems so that you can check your answers.
- This packet will be worth points and is the first assignment that will go in the gradebook.
- I plan to scan in answers and/or solutions shortly before the first day of school. This will only fail to happen should there be some technological concern. Please check your answers and determine if you have any consistent conceptual issues before arriving.
- If you have trouble with a particular topic, grab our textbook early – it will be extremely helpful.

Motion (ch 2, ch 3)

1) Starting from rest, a skateboard accelerates at 1.2 m/sec^2 for 5 seconds. It then cruises at this final velocity for 15 more seconds. How far has it gone total? Why are there two steps required to solve this problem?

2) Tim starts his car up and takes off with an acceleration of 12 m/sec^2. He maintains this rate of acceleration for 9 seconds, cruises at that final velocity for 6 seconds, and accelerates to a stop over the course of 15 seconds. What was his displacement over the course of the trip?

3) Using a single d vs. t graph, graph the following velocities. Assume that during each step Mr. Ikezi maintains a constant speed and north is in the positive direction.
    a. Ikezi starts at home and walks 800 m north to school in 240 seconds.
    b. Ikezi stays in school for 2 minutes.
    c. He returns home in 120 seconds.
    d. He hangs out at home for 60 seconds.
    e. Ikezi heads 400 m south to Rubin's house for 180 seconds.

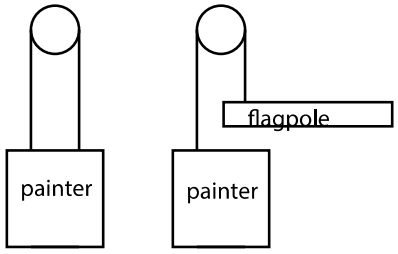
During which part of the trip (a/b/c/d/e) did Ikezi have the greatest velocity? No velocity? What was the total distance traveled? What is the total displacement, and how are those two answers different? What is Ikezi's overall average velocity?

4) Draw a v vs. t graph to demonstrate the following situations. Draw two lines, one assuming a positive initial velocity and another assuming a negative initial velocity:
    a. No acceleration
    b. Constant negative acceleration
    c. Constant positive acceleration
    d. Increasing acceleration

Forces (ch 4)

1) In football team blocking, why does a defending lineman often attempt to get his body under that of his opponent and push upward? What effect does this have on the friction force between the opposing lineman's feet and the ground?

2) Harry the painter swings year after year from his painter's chair. His weight is 500 N and the rope, unknown to him, has a breaking point of 300 N. Why doesn't the rope break when he's supported as shown left? One day Harry is painting near a flagpole, and for a change he ties the free end of the rope to the flagpole instead of his own chair. Why does Harry end up taking his vacation early in the picture shown on the right?



3) If you walk on a log that is floating in the water, the log moves backwards. Why?

4) If a bicycle and a semi truck have a head-on collision, upon which vehicle is the force of impact greater? Which vehicle undergoes the greatest acceleration? Explain.

5) You are in an elevator waiting patiently at the ground floor. Your mass is 57 kg.
    a. If you were standing on a Newton scale and not accelerating, what would the scale read as your normal force?
    b. If the elevator accelerates up at 3.4 m/s^2, what is the net force acting on you?
    c. What would the scale read as the upward force if you were accelerating up at 3.4 m/s^2?
    d. What would a scale of "0" Newtons mean?

6) A 5000 N vehicle is towed at an angle of 55 degrees above the horizontal. If the tow truck applies 1300 N of force at that angle to the vehicle, at what rate will the vehicle accelerate? (The coefficient of kinetic friction is 0.65)

7) A mass of 300 kg is supported by two strings, both of which are attached to its top and to the ceiling above it. The first string forms an angle of 50 degrees with the horizontal, the other an angle of 62. What are the tensions in each string?

Work and Energy (ch 5)

1) A car is on a ramp 100 m from the bottom of the ramp (angle of incline = 30 degrees):
   a. If the potential energy of the car is 80902 J, how much does the car weigh?
   b. What is the KE halfway down the ramp?
   c. What speed is the car moving at the bottom of the ramp?

2) You (50kg) are hanging out in a spring-loaded cannon, pointed vertically. The spring has k = 20000 N/m, and is compressed 2m.
   a. What is the TE of the system?
   b. How high will you get above the cannon?
   c. How fast will you be going before you land in the safety net, the same height as the cannon?
   d. How fast will you be going if you miss the safety net and smash onto the ground, 10m below the cannon?

3) You pull a sled by a rope across a flat field. This rope makes an angle of 35 degrees with the horizontal. If you pull at 100 N and drag the sled 100 m, how much work did you do on the sled? Lets assume there is also a force of friction of 50 N opposing your motion. How much work did IT do? How much total energy was added to the sled?

4) We load a 50 kg crate up into a spring. The spring with constant k = 14000 N/m is compressed 0.5 m. The spring shoots the mass horizontally.
   a. What is the speed as soon as the spring hits the rest position?
   b. What is the force of friction, if $\mu = 0.2$?
   c. How far does the sled go before friction causes it to stop?

Rotation and Torque (ch 7, ch 8)

1) Three kids are going to play on a seesaw. Kid #1 (m = 40 kg) is on one end 8 m from the center. Kid #2 (m = 25 kg) is only 1 m from the center but on the other side. Kid #3 (m = 25 kg) is on the same side as Kid #2. How far from the center is Kid #3 to make the seesaw balanced?

2) Two buckets are hung on opposite ends of a long board. The first bucket (m = 18 kg) is 2 m from the board's pivot point. The second bucket is on the opposite end of the board, 1.3 m from the pivot point. What is the mass of the second bucket?

3) I'm merging from highway 17 onto 280 on my morning commute. The perfectly circular interchange has a radius of 45 m, and I have fantastic tires with a coefficient of friction of 1.9. What's the fastest I can take the curve? (hint: I didn't forget to give you the mass – try anyway)