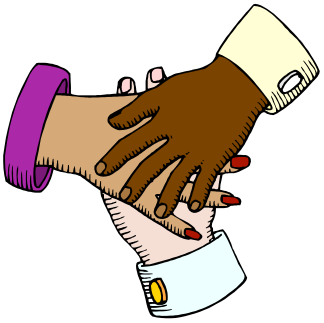
Fusion Class Physics Group Project



Great scientific discoveries are never uncovered by just one person. Usually it is a collaborative effort by many researchers and their support personnel. For this assignment, assume that you are part of a group of researchers of diverse backgrounds. The object is to complete the project while utilizing the different strengths and skill sets that the group members bring to the team. Make sure that everyone has a chance to contribute. (You will complete a self assessment at the end of the project where you tell me how much you and every individual on the team participated in the project.)

I assign the groups and you will be given some class time to work on the project, but you should be prepared to meet at least two times outside of class.

Your final delivery should be a PowerPoint presentation that contains no less than 5, but no more than 10 slides describing your project. Your audience is the general public and your fellow classmates (not me or Lori.) You'll get graded on effort (evaluated by me and your fellow team mates) and quality of work, but most importantly is that you have fun while completing the assignment.

The Group Project is due at the end of week 7.

Physics Group Project: Alternative 1 – Decoding Fossil Footprints

In 1978, a team of scientists led by paleontologist Mary Leakey discovered fossilized footprints in the volcanic Northern Tanzania region of East Africa. Leakey believes these adjacent footprints had been created by two bipedal human-like creatures that were about 4'8''and 4'0'' in height. These prints were the evidence that our human ancestors walked upright more than 3.5 million years ago.

The two creatures walked through volcanic ash and scientists believe that their footprints were preserved through a fortunate set of circumstances. A gentle rain turned the ash into fine-grained mud which was then baked by the sun into the hard indentations. Finally, other volcanic eruptions buried the prints in more ash, which protected them from eroding.

You like Mary Leaky are working with a group of fellow paleontologists. Your team is searching for more tracks in an attempt to reconstruct a picture of both the physical size and the hunting practices of these early human-like creatures. Your examination of fossil bones has revealed that the proportions of their limbs are quite similar to those of humans living today. You decide that it is reasonable to assume that the manner in which these creatures walk and run is similar to ours.

You have been asked by the museum that your group is affiliated with to make a power point presentation that answers the following questions:

1. What is the relationship between foot length and height?
2. What is the relationship between stride length and speed?
3. What kind of factors would influence the average speed that a band of hunters could maintain while traveling all day?
4. What is the distance these individuals could cover in a single day if their speed was given by the estimates you made in the previous question?

Assume that the museum is going to use your information to present your findings to the general public, so your language should not be too scientific. However, you should include a bibliography of the sources you used for your research.

Physics Group Project: Alternative 2 – Underwater Motion

In the 2000 Olympic Games, sixteen-year-old Megan Quann from Puyallup, Washington, swam the 100 meters in 1:07.05, beating Australia's Lisel Jones, and sending world record holder Penny Heyns of South Africa into third place.

Megan's success is in part due to a revolutionary development of the backstroke in 1990 when a new technique known as the extended underwater dolphin kick was introduced. This technique has swimmers spending as much time under water as possible before coming up to the surface. Using this technique, the world record was completely shattered and it was soon clear that anybody who wanted to remain competitive would have to learn how to use it.

For most us, underwater motion does not seem as simple as movement in air. This is probably because we have much more experience of object moving around above the water surface, not below it. However, studying underwater motion is beneficial to all of us and parallels to motion below the surface can be found to motion where only air resistance is involved.

Suppose that you and your team are a group of sport scientists who have been tasked by the US Olympic Committee to study the factors that influence underwater motion. While preparing your power point presentation to the committee, you should look at how some different shaped objects travel in water, by dropping them in a tall class container filled with water. Some questions you may want to explore in your presentation are:

5. Does the shape of an object affect the way it falls?
6. Does the weight of an object affect the way it falls?
7. What is the best shape for an object so that it falls in the quickest time?
8. Can you describe the objects motion using the terms forces, acceleration and velocity?

Assume that the committee members are not scientists, so your language should be one that they can understand. However, you should include a bibliography of the sources you used for your research.

Physics Group Project: Alternative 3 – Ball Speed

Serena Williams is one of of tennis' most hard hitters. In recent years, advances in tennis racket design and player training have led to higher and higher ball speeds in professional tennis. It is not uncommon for serves to reach speeds over 130 mph. While this may sound exciting, it turns out that the public finds it very boring when the balls are so fast that the players can't rally back and forth. Since the spectators pay for watching the games, the International Tennis Federation (ITF) is extremely interested in making sure that people keep coming to watch the matches. Therefore the ITF started to look into the factors that determine the speed of a tennis ball, such as air resistance and sliding friction.

In order to slow down the game under certain circumstance, the ITF began a two year experiment in July 2000 to allow different types of tennis balls to be used in tournaments:

- New Ball Type 1 is faster for use on slow surfaces such as clay. These balls will be harder and lower bouncing than standard balls.
- New Ball Type 2 will be used on medium paced surface such as hard courts and will be made according to existing specifications.
- New Ball Type 3 is slow paced for use on fast surfaces such as grass and some indoor carpets. This ball will be about 8% larger in diameter than standard balls.

Your group of scientists has been assigned by the ITF to determine what factors play a role in sliding friction. To do so, you need to be able to investigate the force applied to the different tennis ball types and see how the slide along different court-like surfaces.

Some questions you may want to explore in your power point presentation to the ITF are:

9. Does the sliding frictional force depend on the speed of the ball?
10. Does the sliding frictional force depend on the nature of the surface it slides on?
11. Does it depend on the surface of the ball?
12. How much will a type 1 ball slow down as it slides along a surface during a typical bounce compared to type 2 (the current ball).
13. Can you estimate what impact the new balls will have on the speed of a tennis game?

Assume that the ITF members are not scientists, so your language should be one that they can understand. However, you should include a bibliography of the sources you used for your research.