NAME:_____ DATE: _____
CLASS:_____

LAB09: STRONGMAN COMPETITION

Power is often associated with mechanical engines, or electrical motors. Many other devices also produce power. Light bulbs dissipate power in order to provide light. The human body converts stored energy in food into heat, and in turn into mechanical energy through muscles. Anything that produces power including the human body is subject to the same laws of physics that govern mechanical processes.

PURPOSE:

To investigate the power produced by different muscles in the human body to do various athletic exercises.

BACKGROUND:

Remember POWER = WORK / TIME. The muscles in the human body are capable of applying a force through different distances. So the body is capable of doing work. But remember, that an applied force can only do work if it is in the same direction as the resulting displacement. For example, if a person runs up the stairs, the WORK done is moving the persons WEIGHT up. So the DISTANCE the WEIGHT is lifted is just the vertical height the person climbs – not the distance along the stairs. If the time it takes to get up the stairs is measured, the power output of the body can be determined. This same type of analysis can be used for almost any physical activity.

NEEDED EQUATIONS:

Work = Force * displacement ~~ $W = F*d$
Power = Work / time = Force · velocity ~~ $P = W / t$, $P = F \cdot v$

1 pound = 4.45 Newtons

MATERIALS:

- Stairs
- Stopwatch
- Meterstick or tape measure
- Weights
- Weight scale
- Rope

NAME:_____ DATE: _____
CLASS:_____

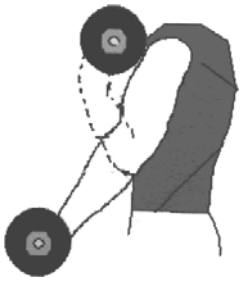
PROCEDURE:

1. In this lab, the following activities will be tested and compared.

A. DOING PUSH UPS

B. RUNNING UP STAIRS

C. CURLING A MASS



D. DRAGGING A WEIGHT

2. First the group must decide which member(s) will be performing each activity. All members should perform all the activities, but if all members are unable to, at least one member should perform all of them.

3. Once it is decided who will perform the activities, the group must decide how each activity can be tested, and what is actually being tested. Several values must be known in order to find the power of an activity.

   - What is the force being applied
   - Over what displacement is it being applied
   - Is the force causing the displacement, and if so what is its direction relative to the displacement
   - How long does it take for the force to produce the displacement

   If you are having trouble determining what these values are or how to test for them, ask your teacher for some help. Try to come up with some ideas before going to the teacher. Write down your final process in the space provided under Testing Procedures.

4. Before testing begins, write down your hypothesis concerning which activity will require the most power. Rank the activities 1-4, 1 being the most powerful, 4 being the least.

5. Test each activity for each person in the lab group. Measure the applied force, displacement, and time for each activity and record this data in the data table.

6. After the first activity is completed, move on to the second activity and record force, displacement, and time data for each lab member.

7. Repeat the procedure again for the 3rd and 4th activities.

8. Use the force, displacement and time data to calculate the power supplied by the human body to complete each activity.

NAME:_____ DATE: _____
CLASS:_____

HYPOTHESIS: (*rank which events will require the most work and power*)

DATA:

	Student 1				*Student 2*			
Exercise	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Force (N)								
Distance (m)								
Time (s)								
Work (J)								
Power (W)								

	Student 3				*Student 4*			
Exercise	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Force (N)								
Distance (m)								
Time (s)								
Work (J)								
Power (W)								

CALCULATIONS:

NAME:_____ DATE: _____
CLASS:_____

ANALYSIS: (answer the following questions in your lab report)

1. In which activity was the most power produced? Which muscle group(s) was used primarily in this activity?

2. Which activity produced the least power? Which muscle group(s) were used in this activity?

3. How did your answers to 1 and 2 compare to your hypothesis? Do your results make sense?

4. Did the activity that used the largest force result in the largest power produced? Explain how a large force can result in a small power output.

5. Power can also be described as a force producing a velocity of an object. Determine the average velocity during each activity based on your calculations of average power and average force.

6. We often use simple machines such as inclined planes, pulleys and levers to make work easier. Does this make us more powerful? Explain why or why not.

7. There is also something called electrical power, which we will learn later in the year. Just as a comparison, could any of the performances light a 60-Watt light-bulb? And if so, how many light-bulbs could it light?

8. Use Microsoft Excel or a similar computer program to produce graphs comparing and contrasting your data. For this case, you should use BAR GRAPHS. Make a graph comparing the **Work** and a graph comparing the **Power** for the *Student who did all 4 events*, and make a graph comparing the **Work** and a graph comparing the **Power** of the *various students for the one event they did in common*. You should have a total of ***4 graphs, 2 Work and 2 Power***.