Bess Beetle Lab

Purpose
Students will observe and quantify the pulling power of a bess beetle. Students will compare relative pulling strengths of an arthropod versus a human.

Background
Many insects are capable of moving or lifting extraordinary weights in comparison to their own body weight. For a human to achieve comparable feats would be impossible without the aud of simple machines. The basis for this difference lies in the relative sizes of beetle versus man and in the differences in the way muscles are attached.

Materials
Bess beetles, properly maintained
Rectangular cloth or textured paper (eg. Paper towel) about 30 cm^2
Scotch Tape
Heavy thread or very fine twine/string
Scale or balance able to weigh in grams
Roll of pennies
Data sheet
Smooth surface table top
Plastic Petri dish or similar lightweight container such as an empty match box

Procedure
1. Work in groups of two in a quiet area of the room. Avoid making sudden noise or movement during experiments.
2. Weight the Petri dish and record its weight on the data sheet.
3. Weight a penny and record its weight on the data sheet.
4. Place a bess beetle upside down on its back in the Petri dish and weigh both. Subtract the weight of the Petri dish and record the difference as the weight of the beetle.
5. Predict how many pennies the beetle will be able to pull on the Petri dish sled and write this hypothesis on the data sheet. (Alternative: have all class members write theirs on the board prior to beginning).
6. Cut a piece of thread about 20 cm long. Make a slip knot lasso on one end. Slip the lasso as a harness over the head and body of the bess beetle and gently tug it around the middle of the body between the front and middle legs. Tape the other end to the inside rim of the Petri dish.
7. Secure the cloth or paper to the tabletop by taping the corners down to prevent it from sliding. Put the beetle on one end of the cloth or paper surface such that the sled is on the smooth surface of the table top with room to move as the beetle walks.
8. When the beetle begins to pull or move the sled by walking, slowly add pennies to the sled one at a time, until you find the maximum weight the insect can pull. It may be necessary to reposition the beetle to prevent the sled from touching the cloth or paper. Do not prod or push the beetle.
9. Remove the harness from the beetle and return the beetle to its container. Count the total number of pennies in the Petri dish and enter the result on the data sheet.

10. Compute the relative pulling power of the insect by dividing the weight of the beetle into the total weigh pulled.
11. Make remaining calculation on the data sheet and answer the discussion questions in your lab report.

Data

1. Record your prediction for how many pennies the bess beetle will pull: _____
2. Weight chart: record to nearest gram or tenths of a gram if possible
    a. Petri dish _____ grams
    b. Petri dish plus beetle _____grams
    c. Beetle weight = b-a = _____ grams
    d. penny weight _____ grams
3. Experimental results
    a. Maximum number of pennies pulled _____
    b. Number of pennies x weight of a penny = total penny weight pulled = _____ grams
    c. Total penny weight + weight of Petri dish sled= grand total weight pulled = _____ grams
4. Calculations
    a. Compute the pulling power of the beetle by dividing the grand total weight pulled (3c) by the beetle's weight (2c). Calculate total pulling power = _____ times the beetle's body weight
    b. If you had the strength equivalent to your beetle, how many pounds could you pull? (Multiply your weight x the calculated beetle pulling power (4a)) = _____