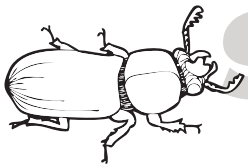


SIMPLE SCIENCE

Bessbug Test of Strength

Teacher's Guide

How much weight can a bessbug pull? How do two bessbugs compare?

Standards

Science: Ability to do scientific inquiry; understanding about scientific inquiry
Life Science: Characteristics of organisms
Math: Multiplying and dividing fractions or decimals

Materials

Two bessbugs; dental floss; sheet of black construction paper; two 3" x 3" squares of aluminum foil; transparent tape; 20 pennies/student; large, shallow box or a box lid
Optional: a gram balance sensitive enough to weigh a penny

In a Nutshell

Which bessbug will pull the most weight? How much will each pull? Work on a table. Tape construction paper to inside of box lids. Make a dental floss lasso for each bessbug. Tape other end of floss to foil square. Place each bug in a box lid. Place 15 pennies on each square. Add more pennies until you reach the limit of your bessbug's strength. Calculate the weight each bug pulled and compare.

The average bessbug weighs 1½ grams. The average penny minted after 1982 weighs 2½ grams. The foil and dental floss "sled" weighs about 1 gram.

Safety Tips for Handling Bessbugs

Bessbugs don't bite! Bessbugs travel slowly! Wash your hands **BEFORE** and **AFTER** handling bessbugs, for your safety and for theirs. Lift bugs by their abdomens (back section). To keep them from running off, lay bugs belly up in a shallow box. Be gentle. Don't rush.

Step One

1. Get ready – Print and copy the Bessbug Lab Report, one for each student.

Step Two

2. Set up

Students can help with the following.

Cut two aluminum foil squares, 3 inches on each side.

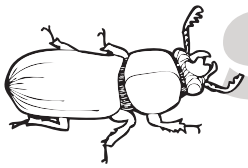
Cut two equal lengths of dental floss. Make two little lassos: tie a small loop in one end of floss; thread other end through the loop.

Tape a piece of black construction paper at one end of the box. The paper will give your bugs a rough surface for traction. The black color will attract them.

Divide pennies into stacks of 5.

Decide which bessbug is A, which is B. Keep them in separate containers while you're going through all the steps.

Be sure to give each bug some wood and keep the wood moist.



SIMPLE SCIENCE Bessbug Test of Strength

Teacher's Guide *continued*

Bessbug Test of Strength

Step Three

3. Make predictions

How many pennies do you think a bessbug can pull? Do you think one of your bugs can pull more pennies than the other? Write your prediction for each bug on the Lab Report.

Step Four

4. Take measurements with a gram balance (Optional)

If you prefer not to do the weighing yourself, use these numbers:
Average weight of pennies minted after 1982 — 2½ grams
Average weight of bessbugs — 1½ grams

Step Five

5. Harness Bessbug A to sled

Be careful not to mix up bessbugs as you go through steps 5, 6 and 7.
Gently lay Bessbug A belly up in the box. Slip the lasso over its abdomen and secure it around the waist, just above the wing covers and behind the first legs.
Tape the loose end of the lasso to the bottom edge of a foil sled.
Put 15 pennies in the sled.
Gently place Bessbug A on its feet at the edge of the construction paper.

Step Six

6. Test to see how many pennies Bessbug A will pull

Put 5 more pennies in the sled. Repeat until Bessbug A can't pull more. Take off one penny at a time until it can pull again.
Gently turn Bessbug A onto its back. Unharness it and return it to its container.
Wash your hands!
Count the pennies in the sled. Write this number on the Bessbug A result line of your Lab Report.

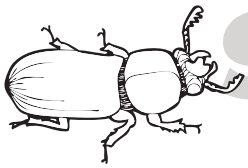
Step Seven

7. Repeat steps 5 and 6 with Bessbug B.

Step Eight

8. Do some math to analyze results

First, figure out how much weight each bug pulled. Multiply number of pennies times the average weight of one penny. For example, if one bessbug pulled 34 pennies and if the average weight of a penny is 2.5 grams and if the sled weighed 1 gram, then the bessbug pulled 86 grams — (34 x 2½ grams) + 1 gram = 86 grams.
Figure out how many times its own weight each bessbug can pull. Divide the weight of the bessbug into the total weight of the pennies and the sled. For example, 86 grams ÷ 1½ grams = 57 times its own weight!



Bessbug Test of Strength

Teacher's Guide *continued*

Bessbug Test of Strength

Step Nine

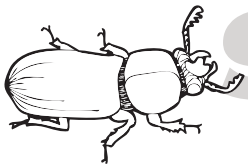
9. If you were super strong

If you had the pulling power that a bessbug does, how much weight could you pull? Multiply your weight times 57. WOW!

Helpful Hints

Helpful Hints for the Bessbug Challenge

- Dental floss should be non-waxed so the knot doesn't slip out.
- White construction paper works well to make the black beetles easy to see.
- You do not need to use a box lid. Instead, you can use 2 sheets of construction paper on a table and keep putting a second sheet in front of the bessbug as it gets to the edge of the sheet it's on.
- Start with 5 pennies on the sled and add another each time the bessbug pulls the sled forward.
- Test only one beetle at a time.
- Plastic petri dishes work very well for observing the beetles if some students don't wish to hold them. If a bessbug flips onto its back, use a pencil to turn it over. This helps because the bugs grasp the pencil.
- A smaller square of aluminum foil, 1½ inches square also works.
- Lasso your bessbugs by letting them walk through the lasso and then tighten it at the "waist."



SIMPLE SCIENCE Bessbug Test of Strength

Teacher's Guide *continued*

Weighing Bugs and Pennies (Optional)

Materials Gram balance, small dish (a plastic petri dish works nicely), 2 bessbugs, foil and dental floss, 10 pennies

Pennies Weigh 10 pennies, one at a time.
Average the weight of the pennies. Record and use as your average weight for each penny pulled by bessbugs.

Sleds Each sled will be made of one piece of floss and one piece of foil. Weigh these together. Record weight. Repeat with second sled.

Bessbugs Place dish on balance and weigh it.
Place bessbug in dish and weigh dish and bug together. Subtract the weight of the dish from the weight of dish and bug together. This is the weight of your first bug.
Repeat step 2 with second bessbug.

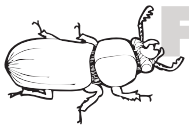
Compare Human and Bessbug Pulling Power (Optional)

How much weight can a human being pull?
How would you investigate to discover this number?
Work as a class to design an imaginary experiment.

Choose an average age for your human being.
How about 11 years old? Or 9, 10 or 12?

Most children can't do one pull-up. (They can't lift their own weight with the muscles in their arms.)
Using legs and backs, to pull a sled on a smooth surface, a child ought to be able to pull more than her own weight. How much more?
How would you test to see how much weight you can pull?
How would you find an average weight that an average kid your age can pull?
How would you find the average weight of children your age?
How would you figure out the pulling power of the average child?
(*Divide pounds pulled by average body weight.*)

What do you think is the most weight that a human being ever pulled?
Find the answer at Guinness World Records – www.guinessworldrecords.com



FUN STUFF

Bessbug Lab Report

Name _____

Date _____

Weights

Penny = _____ grams Sled A = _____ grams Sled B = _____ grams

Bessbug A = _____ grams Bessbug B = _____ grams

Predictions — How many pennies will each bessbug pull?

Bessbug A _____ Bessbug B _____

Procedure — Describe how you tested your bugs.

_____

_____

_____

_____

_____ Use the back of the paper for more room.

Results (math)

Bessbug A: (_____ pennies x _____ grams) + sled _____ = _____ total grams

Bessbug B: (_____ pennies x _____ grams) + sled _____ = _____ total grams

Analysis (more math)

What is each bessbug's pulling power? Another way to ask this question is How many times its own weight can each bessbug pull?

Bessbug A: (total penny + sled weight) ÷ bessbug weight = _____

Bessbug B: (total penny + sled weight) ÷ bessbug weight = _____

Conclusions

Did you prove or disprove your prediction? How close was your guess?

_____

_____ Use the back of the paper for more room.