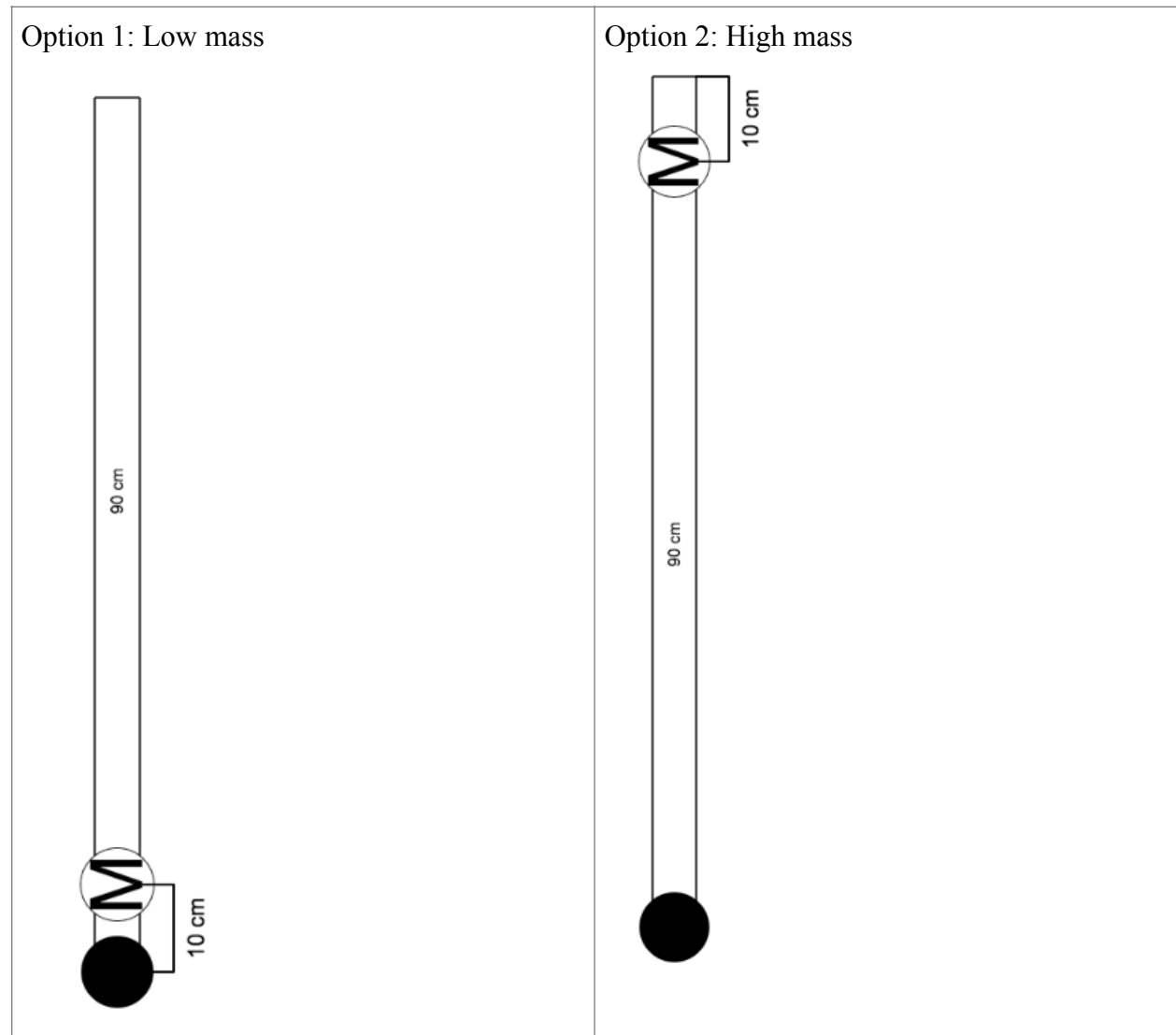


**Written Question 4:** A low-budget circus performer wants to balance a stick with a heavy mass on one end in his palm.

He can balance it in two ways, with the mass low or with the mass high:

Which method is *easier*?

How do you know?



**Written Question 5: Hoop and Disc**

Someone has a hoop and a disc. They both have precisely the same mass.

When they roll down a ramp, which one reaches the ground sooner?

Explain the result using the concept of rotational inertia!

**Written Question 6: The Soup Can Challenge**

Strangely enough, somebody tries rolling two cans of soup down the table:

1 is a thick, bisque like soup such as cream of mushroom

2 is a chunky soup in a liquid broth such as chunky chicken soup

Both cups of soup have roughly the same mass.

For reasons that make no sense to most people, the thick, bisque like soup reaches the bottom of the ramp faster.

**Written Question 7:**

We all know that a heavy object and a non-heavy object fall and strike the ground at the same time.

But what about this situation:

- two long sticks are standing up straight.
- one of the long sticks has a weight attached to one end, the other does not.
- the are released and fall over.
- which one hits the ground first?

**Written Question 4 Answers:**

3 points total

If you mentioned this is a rotational motion situation: you got 1 point.

If you mentioned the mass that is high has more rotational inertia: 1 more point

If you mentioned the mass that is high has more rotational inertia specifically because of the  $r^2$  term in the rotational motion formula: 1 more point

**Written Question 5 Answers:**

4 points:

1 point for knowing the disc will reach the ground sooner than the hoop.

1 point for indicating this is a rotational motion situation (because the hoop and disc are rolling)

1 point for indicating the hoop has more rotational inertia than the disc because all of its mass is far from the center, whereas the disc's mass is evenly distributed.

1 point if you specifically mentioned the  $r^2$  term of the formula  $I = mr^2$

**Written Question 6 Answers:**

3 points:

for indicating this is basically the same as the previous problem: 1 point

for mentioning the thick, bisque-like soup is similar to the disc from the previous problem: 1 point

for mentioning that the chicken soup is similar to the hoop from the previous problem (because all the vegetables and chicken bits cling to the outside of the can): 1 point

Bonus if you mention a totally liquid soup (such as conusmme) rolls even faster because it does not rotate at all.

Bonus if you mention the advantages of eating the chicken soup with provides a high protein and vegetable based diet but with lower sodium than had you eaten it with a spoon.

**Written Question 7 Answers:**

4 points:

1 point for recognizing this is a rotational motion situation

1 point for knowing the stick with the weight falls *slower* than the stick without the weight

1 point for knowing the stick with the weight has more *rotational inertia*

1 point for specifically referring to the  $I = mr^2$  formula and mentioning that mass far from the pivot gives a large contribution to rotational inertia.