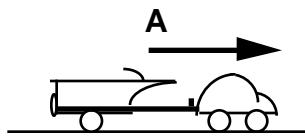
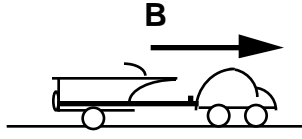


## Moving Car and Boat Trailer—Force Difference <sup>29</sup>

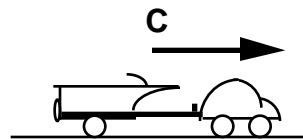
Rank, from greatest to least, on the basis of the difference between the strength (magnitude) of the force the car exerts on the boat trailer, and the strength of the force the boat trailer exerts on the car. All the boat trailers and cars are identical, but the boat trailers have different loads, so the boat trailers masses vary.



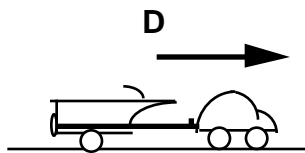
$$m = 1000 \text{ kg} \quad v_f = 20 \text{ m/s}$$



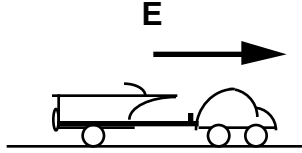
$$m = 2000 \text{ kg} \quad v_f = 20 \text{ m/s}$$



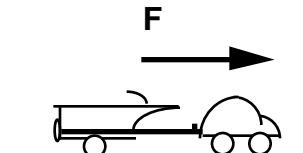
$$m = 1000 \text{ kg} \quad v_f = 40 \text{ m/s}$$



$$m = 4000 \text{ kg} \quad v_f = 10 \text{ m/s}$$



$$m = 2000 \text{ kg} \quad v_f = 10 \text{ m/s}$$



$$m = 1000 \text{ kg} \quad v_f = 10 \text{ m/s}$$

Greatest 1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_ 5 \_\_\_\_\_ 6 \_\_\_\_\_ Least

Or, the differences between the two forces are the same in each situation. \_\_\_\_\_

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed

Sure

Very Sure

1

2

3

4

5

6

7

8

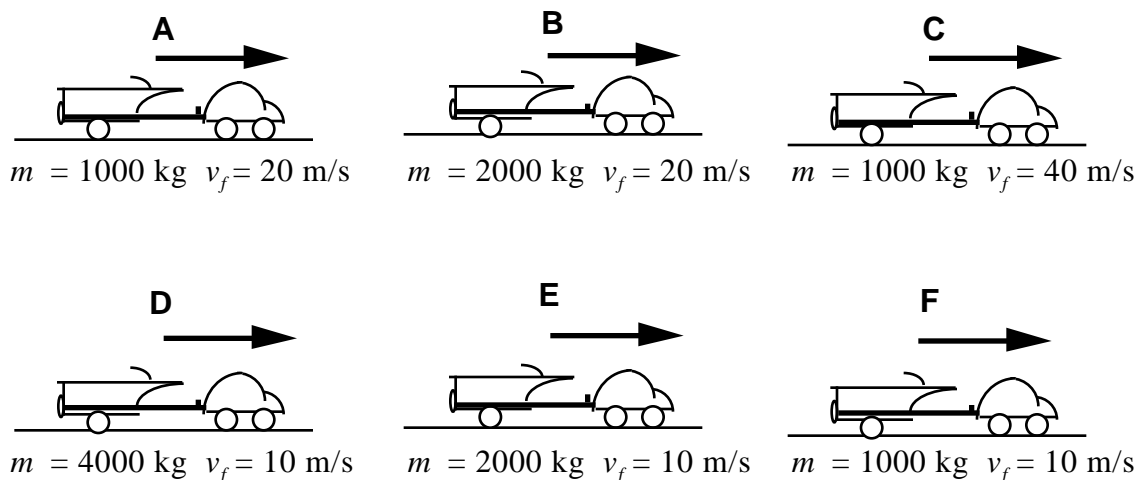
9

10

<sup>29</sup> P. Golden, A. Dickison, D. Maloney, T. O’Kuma, C. Hieggelke

### Accelerating Car and Boat Trailer—Force Difference <sup>30</sup>

Rank from greatest to least on the basis of the difference between the strength (magnitude) of the force the car exerts on the boat trailer and the strength of the force the trailer exerts on the car during the period when the boat trailers are accelerating from rest to the given final speeds. All the trailers and cabs are identical, but the boat trailers have different loads, so the boat trailer masses vary.



Greatest 1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_ 5 \_\_\_\_\_ 6 \_\_\_\_\_ Least

Or, the differences between the two forces are the same in all situations. \_\_\_\_\_

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed

Sure

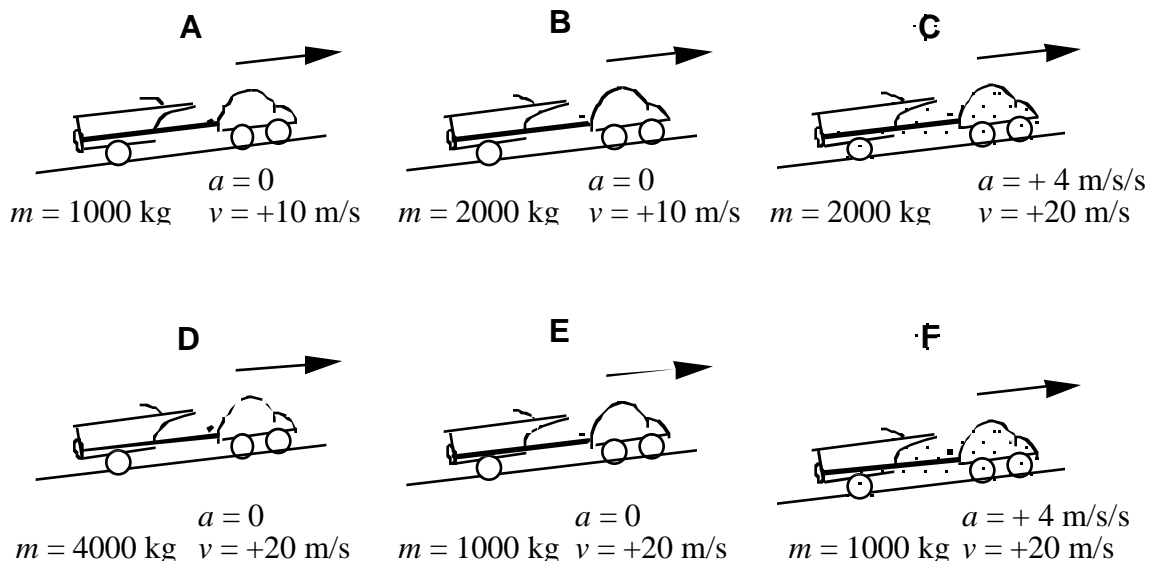
Very Sure

1      2      3      4      5      6      7      8      9      10

<sup>30</sup> P. Golden, A. Dickison, D. Maloney, T. O’Kuma, C. Hieggelke

## Car and Boat Trailer on an Incline—Force Difference <sup>31</sup>

Rank from greatest to least on the basis of the difference between the strength (magnitude) of the force the car exerts on the boat trailer and the strength of the force the boat trailer exerts on the car. All the cars are identical, but the boat trailers have different loads, so the boat trailer masses vary as specified on the diagram. All inclines are the same.



Greatest 1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_ 5 \_\_\_\_\_ 6 \_\_\_\_\_ Least

Or, the differences between the two forces are the same in each situation. \_\_\_\_\_

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed

Sure

Very Sure

1      2      3      4      5      6      7      8      9      10

<sup>31</sup> P. Golden, A. Dickison, D. Maloney, T. O’Kuma, C. Hieggelke