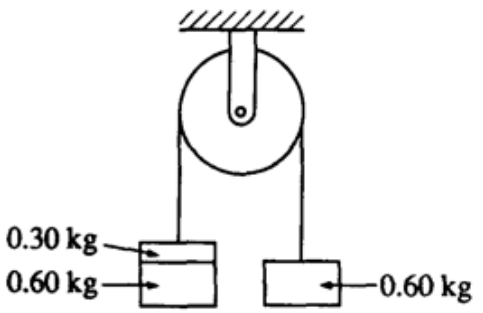
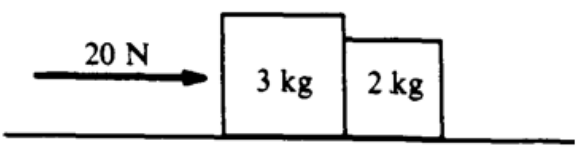
5. If F_1 is the magnitude of the force exerted by the Earth on a satellite in orbit about the Earth and F_2 is the magnitude of the force exerted by the satellite on the Earth, then which of the following is true?
(A) F_1 is much greater than F_2. (B) F_1 is slightly greater than F_2.
(C) F_1 is equal to F_2. (D) F_2 is slightly greater than F_1 (E) F_2 is much greater than F_1



9 Two 0.60-kilogram objects are connected by a thread that passes over a light, frictionless pulley, as shown above. The objects are initially held at rest. If a third object with a mass of 0.30 kilogram is added on top of one of the 0.60-kilogram objects as shown and the objects are released, the magnitude of the acceleration of the 0.30-kilogram object is most nearly
(A) 10.0 m/s^2 (B) 6.0 m/s^2 (C) 3.0 m/s^2 (D) 2.0 m/s^2 (E) 1.0 m/s^2

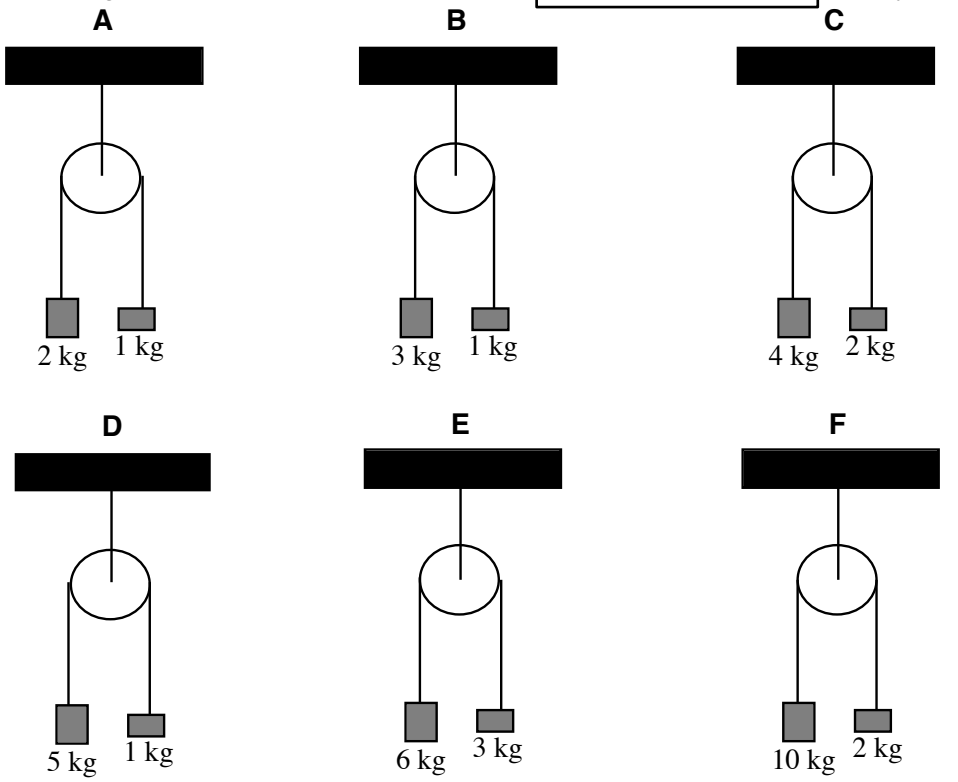


29. Two blocks are pushed along a horizontal frictionless surface by a force of 20 newtons to the right, as shown above. The force that the 2-kilogram block exerts on the 3-kilogram block is
(A) 8 newtons to the left (B) 8 newtons to the right (C) 10 newtons to the left
(D) 12 newtons to the right (E) 20 newtons to the left

Two Different Blocks and a Pulley— acceleration

Each figure below shows two blocks hanging from the ends of a strong but massless string, which passes over a frictionless pulley. In each figure, the block on the left is more massive than the block on the right, so the block on the left accelerates down, and the block on the right accelerates up. The mass of each block is given in the figures.

Rank the figures from greatest to least on the basis of the magnitude of acceleration of the system of blocks.



Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

Or, all of the accels will be the same (but not zero). ___

Or, accel is zero for all of these. ____

Please carefully explain your reasoning.

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

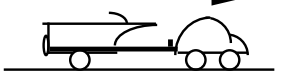
Basically Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[28] S. Loucks

Moving Car and Boat Trailer—Force Difference [29]

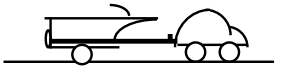
Rank, from greatest to least, on the basis of the difference between the strength (magnitude) of the force the car exerts on the boat trailer, and the strength of the force the boat trailer exerts on the car. All the boat trailers and cars are identical, but the boat trailers have different loads, so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

A



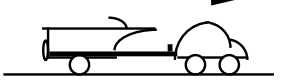
m = 1000 kg v_f = 20 m/s

B



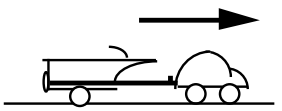
m = 2000 kg v_f = 20 m/s

C



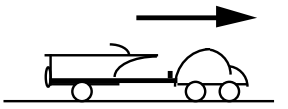
m = 1000 kg v_f = 40 m/s

D



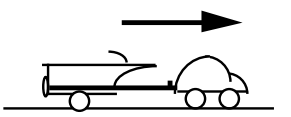
m = 4000 kg v_f = 10 m/s

E



m = 2000 kg v_f = 10 m/s

F



m = 1000 kg v_f = 10 m/s

Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

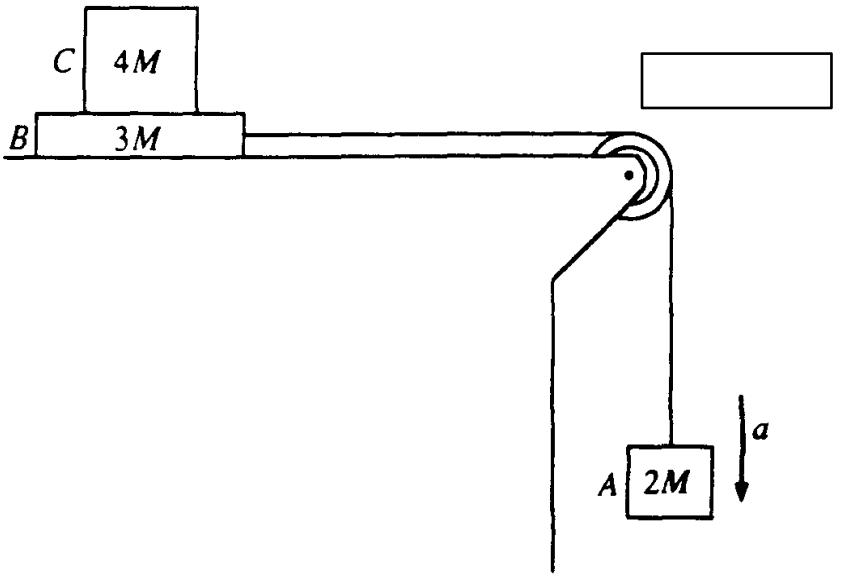
Or, the differences between the two forces are the same in each situation. _____

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

[29] P. Golden, A. Dickison, D. Maloney, T. O'Kuma, C. Hieggelke



Block A of mass 2M hangs from a cord that passes over a pulley and is connected to block B of mass 3M that is free to move on a frictionless horizontal surface, as shown above. Block C of mass 4M is on top of block B. The surface between blocks B and C is NOT frictionless. Shortly after the system is released from rest, block A moves with a downward acceleration a, and the two blocks on the table move relative to each other.

In terms of M, g, and a, determine the

a) Tension in the cord.
b) [deleted]

If a = 3 meters per second squared, determine the

c. coefficient of kinetic friction between blocks B and C
d. acceleration of block C

Hints Page

5. Newton's 3rd Law.

9. ΣF=ma (look at the difference in the weights vs the total mass being moved)

29. Treat them as a whole object, figure the accel, then go back and figure how much force it takes to move the front block.

Ranking Task: Net Force: Look at the difference in the weights vs the total mass being moved.

Ranking Task: Force differences. Note: you're being asked about the difference between the car's force on the trailer and the trailer's force on the car.

FR
a) Do the free body diagram for the hanging mass. Remember that your answer can be in terms of M, g, and a.

c) Go back and do a free body diagram for the 3M mass. Use the T you found in part a.

d) Now do a free body diagram for the 4M mass. Use the coefficient of friction you found in part c.

Answers Page

5. C

9. D

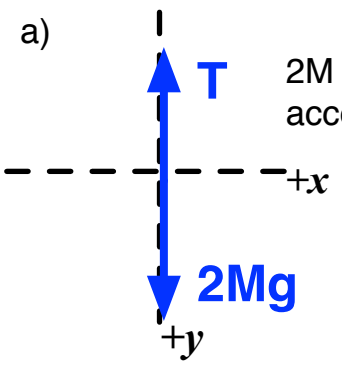
29. A

Ranking Task: Atwood Acceleration:
greatest - [D, F], B, [A, C, E] - least

Ranking Task: Force Difference:
greatest - [A, B, C, D, E, F] - least

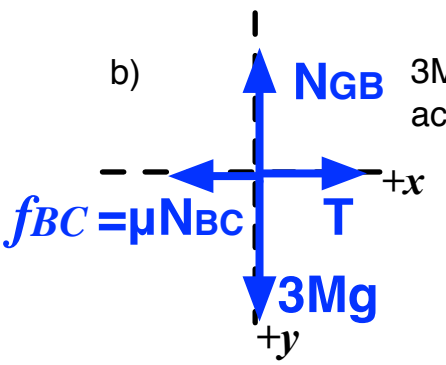
FR

a)



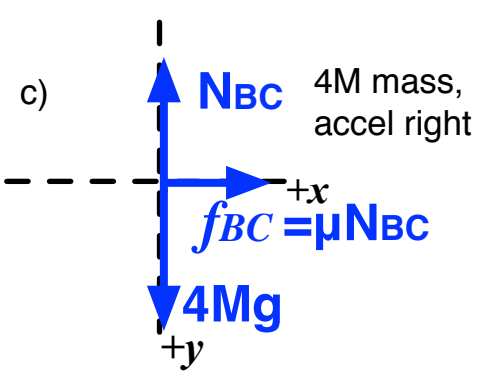
$$\sum F = ma$$
$$2Mg - T = 2Ma$$
$$2Mg - 2Ma = T$$

b)



$$\sum F = ma$$
$$T - \mu N = 3Ma$$
$$T - \mu(4Mg) = 3Ma$$
$$T - 3Ma = \mu(4Mg)$$
$$(2Mg - 2Ma) - 3Ma = \mu(4Mg)$$
$$2Mg - 5Ma = \mu(4Mg)$$
$$2g - 5a = \mu(4g)$$
$$\frac{2g - 5a}{4g} = \mu$$
$$\frac{2(10) - 5(3)}{4(10)} = \mu$$
$$\frac{20 - 15}{40} = \mu$$
$$0.125 = \mu$$

c)



$$\sum F = 0$$
$$N - 4Mg = 0$$
$$N = 4Mg$$

$$\sum F = ma$$
$$\mu N = 4Ma$$
$$\mu(4Mg) = 4Ma$$
$$\mu g = a$$
$$(0.125)(10) = a$$
$$1.25 \text{ m/s}^2 = a$$