

**cq6-2**

1. CJ6 4.CQ.009. [311025] Three particles have identical masses. Each particle experiences only the gravitational forces due to the other two particles. How should the particles be arranged so each one experiences a net gravitational force that has the same magnitude?

- The particles should be placed at the circumference of a circle of arbitrary radius.
- The particles should be placed at the corners of an equilateral triangle.
- The particles should be placed in a straight line equidistant from each other.

Give your reasoning.

2. CJ6 4.CQ.011. [310990] The force of air resistance acts to oppose the motion of an object moving through the air. A ball is thrown upward and eventually returns to the ground.

(a) As the ball moves upward, is the net force that acts on the ball greater than, less than, or equal to its weight?

- net force will be greater than the weight of the ball
- net force will be lesser than the weight of the ball
- net force will be equal to the weight of the ball

Justify your answer.

(b) Repeat part (a) for the downward motion of the ball.

- net force will be greater than the weight of the ball
- net force will be lesser than the weight of the ball
- net force will be equal to the weight of the ball

Justify your answer.

3. CJ6 4.CQ.014. [310912] A "bottle rocket" is a type of fireworks that has a long thin tail that you insert into an empty bottle, to provide a launch platform. One of these rockets is fired with the bottle pointing vertically upward. An identical rocket is fired with the bottle lying on its side, pointing horizontally. In which case does the rocket leave the

bottle with the greater acceleration?

- when the rocket is fired vertically
- the acceleration of the rocket will be same in both cases
- when the rocket is fired horizontally

Explain, ignoring air resistance and friction.

4. CJ6 4.CQ.017. [310992] Suppose you are in an elevator that is moving upward with a constant velocity. A scale inside the elevator shows your weight to be 640 N.

(a) Does the scale register a value that is greater than, less than, or equal to 640 N during the time when the elevator slows down as it comes to a stop?

- scale registers a value greater than 640 N
- scale registers a value less than 640 N
- scale registers a value equal to 640 N

Explain.

(b) What is the reading when the elevator is stopped?

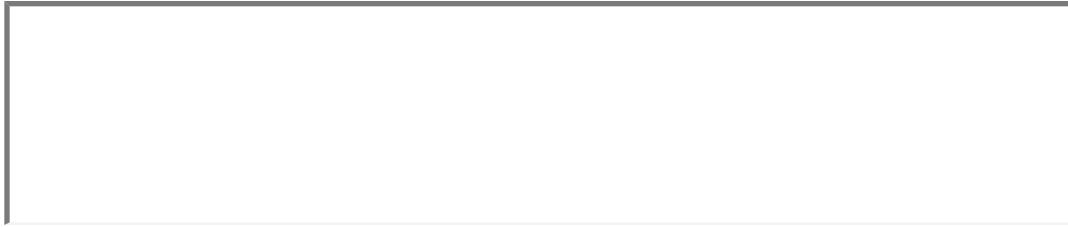
N

Explain.

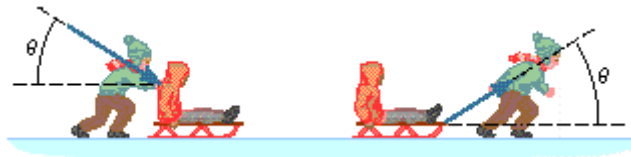
(c) How does the value registered on the scale compare to 640 N during the time when the elevator picks up speed again on its way back down?

- scale registers a value greater than 640 N
- scale registers a value less than 640 N
- scale registers a value equal to 640 N

Explain.



5. CJ6 4.CQ.018. [310920] A person has a choice of either pushing or pulling a sled at a constant velocity, as the drawing illustrates. Friction is present.



If the angle  $\theta$  is the same in both cases, does it require less force to push or to pull?

- less force is required to pull the sled
- less force is required to push the sled
- equal force is required to either push or pull the sled

Account for your answer.

6. CJ6 4.CQ.020. [311059] A box rests on the floor of an elevator. Because of static friction, a force is required to start the box sliding across the floor when the elevator is (a) stationary, (b) accelerating upward, and (c) accelerating downward. Rank the forces required in these three situations in ascending order, i.e., smallest first.

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|--|---|--|---|--|
| <input type="radio"/> stationary<br><input type="radio"/> accelerating<br>upward | < | <input type="radio"/> stationary<br><input type="radio"/> accelerating<br>upward | < | <input type="radio"/> stationary<br><input type="radio"/> accelerating<br>upward |
| <input type="radio"/> accelerating<br>downward                                   |   | <input type="radio"/> accelerating<br>downward                                   |   | <input type="radio"/> accelerating<br>downward                                   |

Explain.

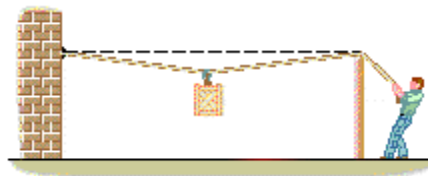
7. CJ6 4.CQ.021. [310962] A rope is used in a tug-of-war between two teams of five people each. Both teams are equally strong, so neither team wins. An identical rope is tied to a tree, and the same ten people pull just as hard on the

loose end as they did in the contest. In both cases, the people pull steadily with no jerking. Which rope, if either, is more likely to break?

- rope used in the tug-of-war
- rope tied to the tree
- neither rope has any likelihood of breaking
- both ropes have equal likelihood of breaking

Justify your answer.

8. CJ6 4.CQ.026. [311067] A weight hangs from a ring at the middle of a rope, as the drawing illustrates.



Can the person who is pulling on the right end of the rope ever make the rope perfectly horizontal?

- yes
- no
- not enough information to decide

Explain your answer in terms of the forces that act on the ring.

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