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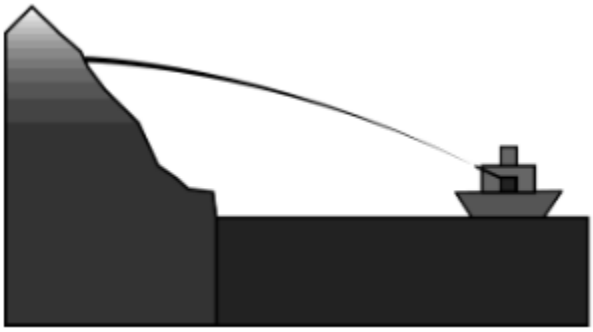
Question: 1

A cannon fires off a ship up towards a mountain range. Neglecting air resistance, where will the velocity of the projectile be greatest?



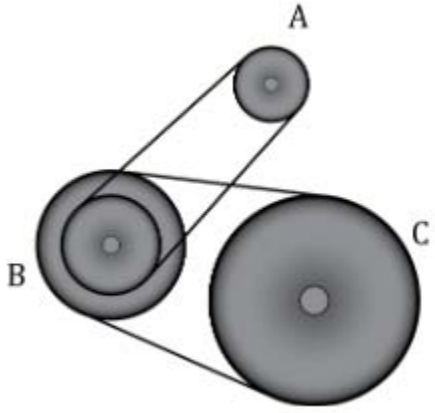
A. Exiting the muzzle
B. Halfway to the mountains
C. As it impacts the mountains

Answer: A

Explanation:
The velocity is made up of two components, the x and y components. The x component is not changing during flight, but the weight of the projectile decreases the positive y component of the velocity. Thus, the total velocity will be greatest before the y component has decreased.

Question: 2

These pulleys are connected by belts. Which pulley travels the fastest?



A. Pulley A

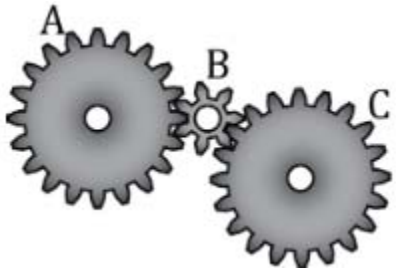
B. Pulley B
C. Pulley C

Answer: A

Explanation:
Because the linear speed of two connected pulleys is the same, the pulley with the smaller radius spins faster. The largest pulley will spin slower than the middle pulley. The smallest pulley will spin faster than the middle pulley, making it the fastest pulley.

Question: 3

If Gear A is traveling at 10 rpm, how many times will Gear C rotate in 3 minutes?



A. 1.7 times
B. 3 times
C. 30 times

Answer: C

Explanation:
Gear A and gear C have the same number of teeth. Thus, gears A and C will have the same speed. Since gear C is rotating at 10 rpm, the total number of rotations is calculated by multiplying the rpm by the number of minutes.

Question: 4

Where should the fulcrum be located to balance this beam?

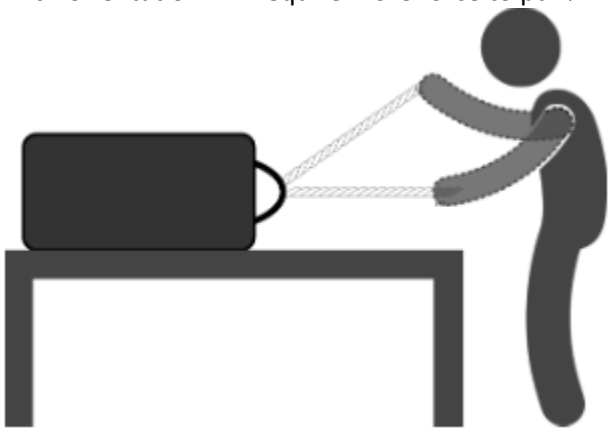
A. closer to the large mass
B. closer to the small mass
C. exactly between the two masses

Answer: A

Explanation:
Because the large mass will produce a greater torque at the same distance from the fulcrum as the small mass, the distance from the large mass to the fulcrum should be shortened. Then, the torque produced by the large mass will decrease and the torque produced by the small mass will increase.

Question: 5

Which orientation will require more force to pull?



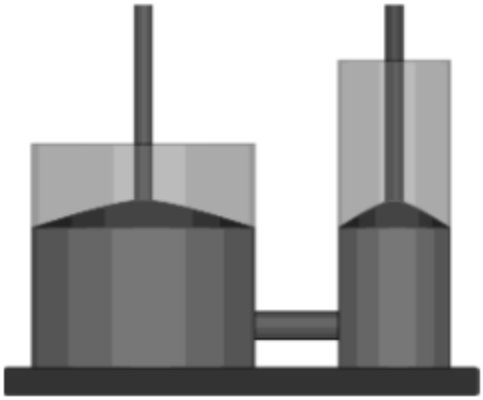
A. with the rope at an angle to the table
B. with the rope parallel to the table
C. both orientations are equal

Answer: A

Explanation:
When the rope is not parallel to the intended path of motion, the force is divided into useful force (x direction) and not useful force direction). If only some of the force is useful, then the man will need to apply more force to achieve the same pulling force as if the rope were parallel to the table.

Question: 6

The larger piston has four times as much horizontal area as the smaller piston. If the small piston is compressed 8 inches, how far will the larger piston move?



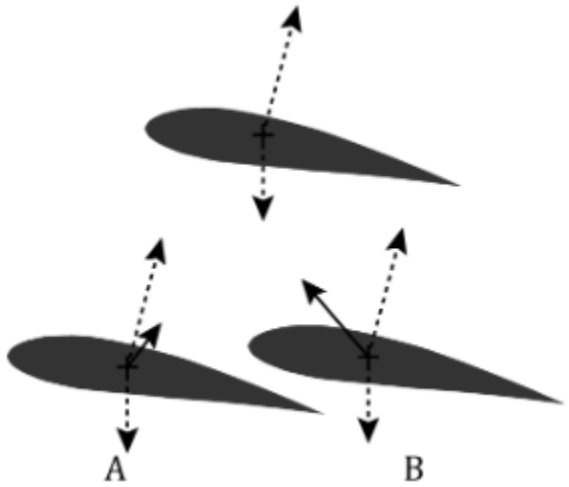
A. 8 inches
B. 2 inches
C. 32 inches

Answer: B

Explanation:
Because the volume of the liquid doesn't change, when the small piston is compressed, the volume decrease in one piston is the volume increase in the other piston. As the volume is the area times the height the height of the larger piston only needs to raise one fourth the height that the small piston moved.

Question: 7

A wing in flight has a set of pressures causing the overall forces on the top and bottom of the wing. Where will the total force on the wing point?



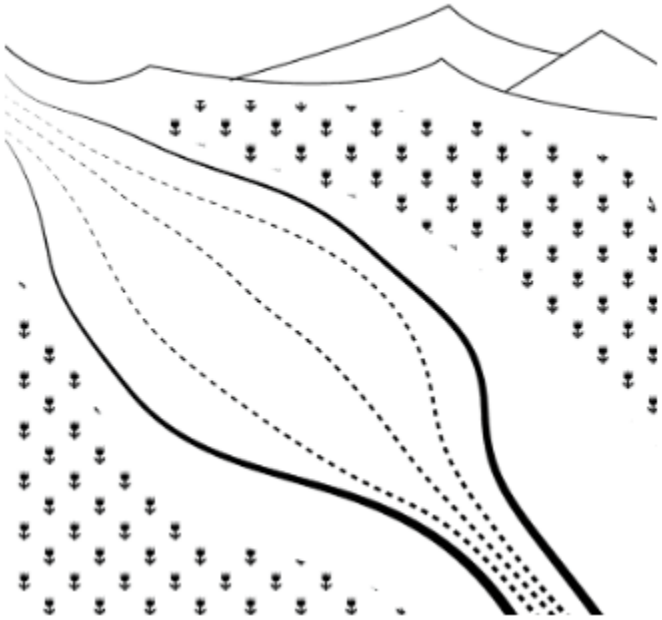
A. up and to the right
B. up and to the left
C. neither A nor B

Answer: A

Explanation:
The downward force decreases part of the y component of the top force, but does not affect the x component of the force. Thus, the resultant force is up and to the right.

Question: 8

River water enters a section where the water spreads out into a wide, deep are
a. Is the water likely to speed up, slow down, or remain at a constant speed?



A. speed up
B. slow down
C. remain at a constant speed

Answer: B

Explanation:
because the same volume of water has to flow through all parts of the river, the water will slow down to fill the wide section.

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