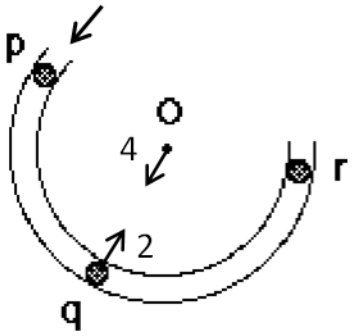
Phys 220
Quiz 4

Names: _____

Answer all of the following questions by choosing the best multiple choice answer. Then ***provide an explanation for every problem*** in the space below.

1. The figure shows a frictionless channel in the shape of a segment of a circle with center at "O". The channel has been anchored to a frictionless horizontal table top. You are looking down at the table. Forces exerted by the air are negligible. A ball is shot at high speed into the channel at "p" and exits at "r."



Consider the following distinct forces:

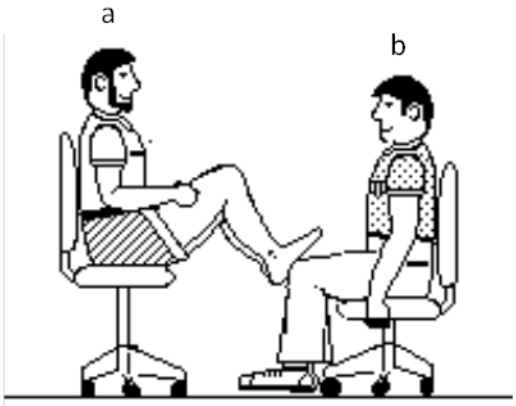
1. **A downward force of gravity.**
2. **A force exerted by the channel pointing from q to O.**
3. A force in the direction of motion.
4. A force pointing from O to q.

Which of the above forces is (are) acting on the ball when it is within the frictionless channel at position "q"?

A. 1 only.
B. 1 and 2.
C. 1 and 3.
D. 1, 2, and 3.
E. 1, 3, and 4.

The ball is moving with a constant speed but is turning. So it has a force pushing it towards the center of the circle but no other force is needed for it to continue at a constant speed. Gravity is pulling down.

2. Student "a" has a mass of 95 kg and student "b" has a mass of 77 kg. They sit in identical office chairs facing each other.



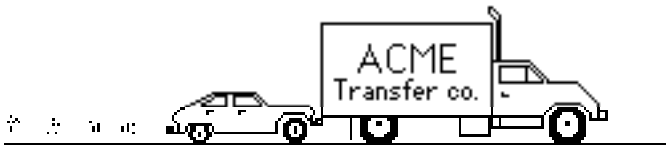
Student "a" places his bare feet on the knees of student "b", as shown. Student "a" then suddenly pushes outward with his feet, causing both chairs to move.

During the push and while the students are still touching one another:

A. neither student exerts a force on the other.
B. student "a" exerts a force on student "b", but "b" does not exert any force on "a".
C. each student exerts a force on the other, but "b" exerts the larger force.
D. each student exerts a force on the other, but "a" exerts the larger force.
E. each student exerts the same amount of force on the other.

Newton's 3rd Law: The force on A from B equals the force on B from A. This is always true. These two forces are a force pair.

A large truck breaks down out on the road and receives a push back into town by a small compact car as shown in the figure below.



3. While the car, still pushing the truck, is speeding up to get up to cruising speed:
   - **A. the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.**
   - B. the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the car.
   - C. the amount of force with which the car pushes on the truck is greater than that with which the truck pushes back on the car.
   - D. the car's engine is running so the car pushes against the truck, but the truck's engine is not running so the truck cannot push back against the car. The truck is pushed forward simply because it is in the way of the car.
   - E. neither the car nor the truck exert any force on the other. The truck is pushed forward simply because it is in the way of the car.

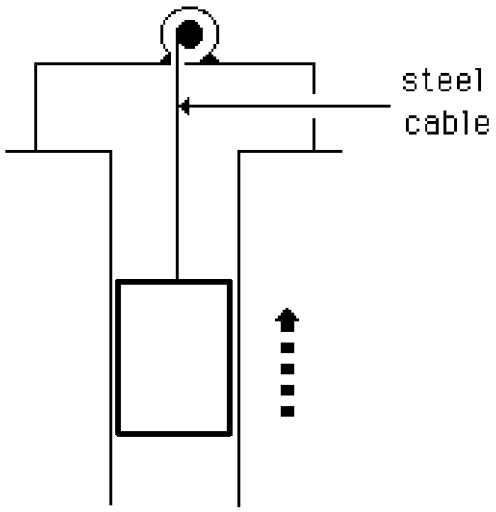
   Newton's 3rd Law: The force on A from B equals the force on B from A. This is always true. These two forces are a force pair.

4. After the car reaches the constant cruising speed at which its driver wishes to push the truck:
   - **A. the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.**
   - B. the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the car.
   - C. the amount of force with which the car pushes on the truck is greater than that with which the truck pushes back on the car.
   - D. the car's engine is running so the car pushes against the truck, but the truck's engine is not running so the truck cannot push back against the car. The truck is pushed forward simply because it is in the way of the car.
   - E. neither the car nor the truck exert any force on the other. The truck is pushed forward simply because it is in the way of the car.

   Newton's 3rd Law: The force on A from B equals the force on B from A. This is always true. These two forces are a force pair.

5. An elevator is being lifted up an elevator shaft at a constant speed by a steel cable as shown in the figure below. All frictional effects including air resistance are negligible. In this situation, forces on the elevator are such that:

   A. the upward force by the cable is greater than the downward force of gravity.
   B. the upward force by the cable is equal to the downward force of gravity.
   C. the upward force by the cable is smaller than the downward force of gravity.
   D. None of the above



Elevator going up
at a constant speed

The elevator is moving at a constant velocity. That means there is no net force and we have no friction. So the force of the cable equals the force of gravity providing zero net force, zero acceleration and therefore a constant velocity.

A large box is pulled with a constant horizontal force. As a result, the box moves across a level floor at a constant speed.

6. The pull:

(A) has the same magnitude as the weight of the box.

(B) is greater than the weight of the box.

(C) has the same magnitude as the total force which resists the motion of the box.

(D) is greater than the total force which resists the motion of the box.

(E) is greater than either the weight of the box or the total force which resists its motion.

The box has a constant speed so no net force. That means the pulling force must equal any forces that resist the boxes motion. This means zero net force so zero acceleration therefore constant velocity.

7. If the pulling suddenly stops, then the box will:

(A) immediately come to a stop.

(B) continue moving at a constant speed for a while and then slow to a stop.

(C**) immediately start slowing to a stop.**

(D) continue at a constant speed.

(E) increase its speed for a while and then start slowing to a stop.

If the only force on the box is friction, then the net force is opposite the motion, so acceleration is opposite the motion which means it will slow to a stop. When it stops the friction goes to zero so there is no more horizontal force on the box.

8. If, *instead*, the horizontal force pulling the box is doubled. The box's speed:

(A) continuously increases.

(B) will be double the speed but still constant.

(C) is greater and constant, but not necessarily twice as great.

(D) is greater and constant for awhile and increases thereafter.

(E) increases for a while and constant thereafter.

If the horizontal force is doubled, then the box will have a net force in the direction of the pull. This means there will be an acceleration in the direction of motion, which means the box will speed up.