Force Quiz

1. A constant force is exerted for a short time on a cart that is initially at rest on a (frictionless) air track. This gives the cart a certain final speed, v_{real}. If the cart were double the mass and the same force were applied, the final speed would be:

A one-fourth as much as v_{real}
B four times as much as v_{real}
C one-half as much as v_{real}
D twice as much as v_{real}

2. A constant force is exerted for a short time on a cart that is initially at rest on a (frictionless) air track. This gives the cart a certain final speed, v_{real}. If the cart were not initially at rest and the same force were applied in the direction of movement, the increase in the final speed would be:

A twice as much as v_{real}
B the square of v_{real}
C four times as much as v_{real}
D exactly v_{real}

3. Consider a person standing in an elevator that is accelerating upward. The upward normal force exerted by the floor of the elevator on the person is:

A larger than the person's weight
B equal to the person's weight
C smaller than the person's weight
D zero

4. A weight is hung on a clothesline from a hook, causing it to sag. Assuming the clothesline is weightless, frictionless, massless, etc., which of the following is true?

A There are no forces acting on the weight, since there's no movement and therefore no acceleration.
B When the weight is hung closer to one side of the clothesline, there is more tension on the near side.
C The clothesline exerts only a horizontal force on the weight while gravity exerts a vertical force, and they're equal.
D The tension everywhere in the clothesline must be the same.

Authored by Gordon Wong

5. *Answer with all that apply*: A force that only exists in reaction to other applied forces is:

A larger than the person's weight
B equal to the person's weight
C smaller than the person's weight
D zero

6. An object rests on a ramp whose angle of inclination is slowly rising. At the moment the object slides down the ramp, what has happened?

A The normal force has become less than gravity.
B The ramp has become aligned enough with gravity that friction is overcome.
C The coefficient of static friction has changed.
D The normal force has become strong enough to push the object down the ramp.

7. A force of 3 N applied to the west and a force of 4 N applied to the north are both exerted on the same object at the same time. What is $\vec{R}$, the resultant force?

A 7 N
B 5 N
C 1 N
D None of these

8. Which of the following is not an example of a force in action?

A A space probe that has left Mars's orbit moves towards Neptune.
B A neutron in a reactor collides with a uranium nucleus, splitting it into two smaller nuclei.
C A Ferris wheel moves thrillseekers around at constant angular velocity.
D A chain snaps taut, stopping an angry dog from eating a hapless letter carrier.

9. Two tug-o'-war teams, pulling on the same rope in opposite directions, are evenly matched. If the rope were to break, what would happen?

A Both teams fall forward to the centre since there was a force exerted on them in that direction a moment ago.
B Both teams stand still because all the forces are balanced, just as it was before the rope broke.
C Both teams fall backward because the tension of the rope became higher than the applied force of the teams.
D Both teams fall backward because suddenly neither team experiences a counterforce.

10. Photons, particles of light, have no mass. Can they experience forces?

A Yes, because they can still undergo acceleration.

B Yes, because they're still particles.

C No, but they can still exert forces.

D No, and therefore they also can't undergo acceleration.

11. My little brother pushes his toy car due west along the floor. I drive my fire truck into it heading due south. What happens?

A The toy car experiences a counterforce and my brother cries.

B The toy car moves west at the same speed as before and he hits me.

C The toy car moves due south and my brother tells on me.

D The toy car stops and my brother moves south.

12. A tennis racket strikes a ball. Which of the following is true?

A The racket exerts a force on the ball in an instant with no time duration.

B The racket exerts a force on the ball until the acceleration runs out.

C The racket exerts a force on the ball for as long as they are in contact.

D The racket exerts a force on the ball from the moment of contact until the ball encounters another force.

13. Crewmen inside the "vomit comet" float around inside the plane as though they were in space, but the plane is still inside the earth's atmosphere. This can happen because:

A it's an illusion; the plane and crew are in freefall, so they can't fall to the floor of the plane.

B the crewmen are shielded from air resistance.

C the plane flies up at an acceleration equal to g, cancelling all forces, and this makes them weightless.

D the plane is in the part of the atmosphere where there is no gravity.

14. A baseball player hits a ball into left field. Which of these is an action-reaction pair?

A The pitcher throws the ball, and the batter hits it.

B The first baseman stands on first base, while the batter slides into it.

C The ball collides with the bat, and the bat hits the ball.

D The fielder catches the ball on its second bounce, and throws it to first.

15. A car is travelling due west at 30 $^{km}/_{h}$. Ten minutes later, the car is travelling due west at 30 $^{km}/_{h}$. Has the engine exerted a force on the car during this time?

A Yes, because there have been counterforces.

B Yes, because the car is still moving.

C No, because the car's speed and direction haven't changed.

D Maybe, but we can't be sure unless we know what happened in that time.

SOLUTIONS

1) **C.** The acceleration will be halved, so the final speed will be too.
2) **D.** Acceleration is a change in velocity, so the speed would be increased by the same amount.
3) **A.** The floor isn't only holding the person up, it's also accelerating her upwards.
4) **D.** Assuming no friction, the weight will slide to a position where tension is equal.
5) **B, C, D.** Gravity exists no matter what, but there's no friction without sliding, there's no normal force without weight or pressure and there's no tension without something pulling on a rope.
6) **B.** The friction stays the same, but the component of gravity that moves along the ramp gets larger as the ramp rises. When that component overcomes friction, the object moves.
7) **D.** $\vec{R}$ requires a direction. (Its magnitude would be 5 N, however.)
8) **A.** The probe will not have any forces acting on it. C and D contain examples of acceleration (change in direction and slowing down).
9) **D.** The teams were standing up because forces were in balance, but when the rope broke, one of the forces (tension) acting on each team as a system disappeared, and they move in the direction the remaining forces dictate.
10) **C.** $F = m \cdot a$, so if $m = 0$, there's no force. Light changes direction when it hits a mirror. Light can exert a force, but not much of one.
11) **B.** A force acting on the car from a perpendicular direction won't change its velocity heading west. The car's velocity will now have a south component, too, though.
12) **C.** Forces take time, but the racket can only act on the ball as long as there's contact.
13) **A.** No one inside is weightless. The plane flies *down* at an acceleration equal to g.
14) **C.** The bat acts on the ball, and the ball acts on the bat.
15) **A.** The car has experienced air resistance and friction, so a force is required to maintain speed.