

Honors IPC Forces Exam

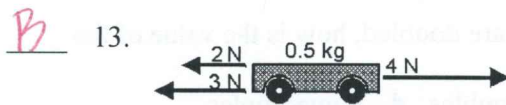
Multiple Choice

Identify the choice that best completes the statement or answers the question.

- D 1. A car is traveling down a straight stretch of highway at 90 kilometers per hour. The driver suddenly slams on the brakes and brings the car to a quick stop. As a result, the unbelted passengers will at first:
a. be pushed against the back of the seat. b. come to a stop at the same time as the car. c. be pushed against the door on the passenger side. d. continue to move forward in a straight line.
- A 2. When the forces on an object are balanced, we say that the object:
a. is in equilibrium. b. must be moving at a constant speed. c. must be at rest. d. is accelerating.
- A 3. Which one of the following is NOT TRUE concerning mass and weight?
a. Mass is measured in newtons and weight is measured in pounds. b. An object at rest has the same mass everywhere, but its weight depends on the strength of gravity where the object is located. c. Mass is measured in kilograms and weight is measured in newtons. d. Mass is a property of matter and weight comes from gravity acting on matter.
- C 4. An astronaut with a mass of 100 kilograms is floating in outer space. If the astronaut throws a 2-kilogram wrench at a speed of 10 meters per second, his motion would best be described as:
a. in the same direction as the wrench at a speed less than 10 m/sec. b. in the same direction as the wrench at a speed greater than 10 m/sec. c. in a direction opposite to the wrench at a speed less than 10 m/sec. d. in a direction opposite to the wrench at a speed greater than 10 m/sec.
- D 5. If an object changes its direction of motion:
a. the inertia of the object had to change. b. the mass of the object had to change. c. the speed of the object stays the same. d. a force must have been applied to the object.
- C 6. What is the mass of a rock that weighs 49 newtons?
a. 1 kilogram b. 2 kilograms c. 5 kilograms d. 10 kilograms
- C 7. When you kick a ball, your foot feels the ball because:
a. your foot is harder than the ball. b. the ball accelerates away from your foot. c. the ball exerts a force on your foot as a reaction to the force of your foot on the ball. d. the ball is harder than your foot.
- A 8. If the net force is negative and the speed is positive:
a. the speed will decrease over time. b. the speed will increase over time. c. the speed will stay the same. d. the speed will immediately drop to zero.
- A 9. A 0.25-kilogram ball is observed to accelerate at $4,000 \text{ m/sec}^2$ as it is hit with a bat. How much force is exerted on the bat by the ball?
a. 1,000 newtons b. 2,500 newtons c. 4,000 newtons d. 16,000 newtons
- B 10. The same engine is placed in a large truck and a small car. The engine produces the same amount of force between the vehicle and the road in both cases. The truck:
a. has a greater acceleration than the car because the truck has a greater mass. b. has a smaller acceleration than the car because the truck has a greater mass. c. has the same acceleration as the car because the engine produces the same force. d. has a smaller acceleration than the car because the truck is longer than the car.

- B 11. If every force has an equal and opposite reaction, why don't all forces cancel out with each other?
 a. The action and reaction forces act in the same direction. b. The action and reaction forces act on different objects. c. The action and reaction forces are perpendicular to each other. d. Acceleration separates objects before the forces can cancel out.

- A 12. A potato launcher uses a spring that can apply a force of 20 newtons to potatoes. A physics student who is studying projectiles launched a 100-gram potato, a 150-gram potato, and a 200-gram potato with the launcher. Which had the greatest acceleration?
 a. The 100-gram potato. b. The 150-gram potato. c. The 200-gram potato. d. They all had the same acceleration.



Three forces act on the cart shown in the diagram. The acceleration of the cart is:

- a. to the left at 1 m/sec^2 b. to the left at 2 m/sec^2 c. to the right at 1 m/sec^2 d. to the right at 2 m/sec^2

- B 14. Objects tend to resist changes in motion. This property is called:
 a. momentum. b. inertia. c. weight. d. potential energy.

- D 15. A rocket can fly into space because:
 a. the launch pad pushes the rocket forward like a slingshot. b. when it is launched, the hot exhaust gases hit the ground and push the rocket forward. c. when the gases are burning up, the mass of the rocket decreases, changing the amount of gravity on the rocket. d. the rocket pushes the exhaust gases backward, and there is an equal and opposite reaction pushing the rocket forward.

- C 16. When a diver jumps off a diving board, gravity pulls him or her down to the water. What is the reaction force to Earth's gravity?
 a. Air resistance slows the diver. b. The diver's legs push against the board. c. The diver pulls the Earth up. d. Friction between the diver and water slows the diver.

- D 17. Of the four fundamental forces, which one is credited with holding together the nuclei of atoms by overcoming the repulsion of protons to other protons?
 a. charming force b. electromagnetism c. weak force d. strong force

- D 18. Compared to your weight and mass on Earth, if you were on the moon:
 a. your weight would remain the same, but your mass would be less. b. your weight and mass would be less. c. your weight would increase, but your mass would remain the same. d. your weight would be less but your mass would remain the same.

- A 19. A net force must be applied to an object to do all of the following EXCEPT:
 a. maintain constant speed. b. slow down. c. stop moving. d. turn.

- A 20. The force you must overcome to start object moving is
 a. static friction b. air resistance c. rolling friction d. sliding friction

- A 21. When the drag force on an object falling through the air equals the force of gravity, the object has reached
 a. terminal velocity b. terminal acceleration c. terminal illness d. terminal force

- B 22. An object that is in free fall, seems to be
 a. sped up by air resistance b. weightless c. not moving d. slowed by air resistance

C 23.

A boy on a skateboard throws a ball. The skateboard moves in the opposite direction from the thrown ball because:

- a. the ball has positive energy, and the boy and skateboard are left with negative energy. b. the ball carries away some inertia. c. the ball exerts a reaction force on the boy as it is being thrown. d. the skateboard resists acceleration due to Newton's second law.

D 24. Think about universal gravitation: If both masses that are interacting are doubled, how is the value of the gravitational force affected?

- a. it is reduced by half b. it increases by a factor of 9 c. it also doubles d. it quadruples

B 25. The engine of a rocket accelerates fuel backward to push the rocket forward. The mass of the rocket is 10,000 kilograms. The rocket engine accelerates 10 kilograms of fuel backward at $1,000 \text{ m/sec}^2$. The forward acceleration of the rocket is:

- a. 0.1 m/sec^2 b. 1.0 m/sec^2 c. 10 m/sec^2 d. 100 m/sec^2

C 26. As an elevator ascends (goes up), your apparent weight right when the elevator first starts moving is

- a. feels exactly the same b. less than normal c. more than normal d. is weightless

C 27. As you get farther from the center of the Earth, your weight will

- a. stay the same b. increase c. decrease d. no one could possibly know this

C 28. An object is observed to have an acceleration of 2 m/sec^2 when a net force of 4 newtons is applied. The mass of the object is:

- a. 0.5 kilogram. b. 1.0 kilogram. c. 2.0 kilograms. d. 8.0 kilograms.

B 29. A rock with a mass of 25 kg has a weight of 40.8 N on the moon. What is the value of the acceleration of gravity (g) on the moon?

- a. 0.63 m/sec^2 b. 1.6 m/sec^2 c. 9.8 m/sec^2 d. $1,020 \text{ m/sec}^2$

D 30. The force of friction acting on a cart on a ramp is exactly balanced by the force of gravity acting on the cart down the ramp. The cart:

- a. may be accelerating down the ramp. b. must be moving with constant speed down the ramp. c. must be stationary. d. may be moving with constant speed down the ramp.

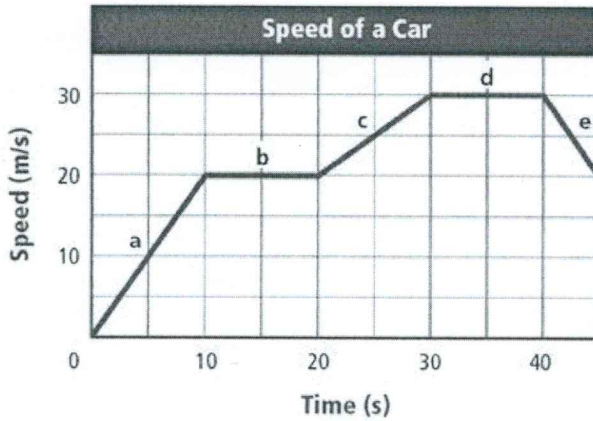
B 31. This is a force that is both attractive and repulsive, and is credited with keeping electrons buzzing around protons:

- a. universal gravitation b. electromagnetism c. weak force d. strong force

D 32. A cart is rolling down a special ramp where there is no friction at all. What will happen if the amount of mass on the cart is increased?

- a. The cart will move at a constant velocity. b. The cart will accelerate less. c. The cart will accelerate more. d. The cart's acceleration will not be affected.

- 9 33. Choose the answer choice that has only graph segments in which the car experiences a non-zero net force?



- a. a, b, & c b. none of the segments c. c, d, & e d. c & d e. b, c, & d f. b & d g. a, c, & e
h. b, d, & e

- 4c 34. The acceleration of an object is:
a. equal to its weight. b. equal to its mass divided by the force acting on the object. c. equal to the force acting on the object divided by the mass of the object. d. equal to the force acting on an object multiplied by the mass of the object.

- c 35. The acceleration due to gravity is approximately 10 m/sec^2 . If a golf ball is dropped from the thirteenth floor of a building, ignoring air resistance, after falling for 3 seconds the speed of the ball will be:
a. 10 m/sec. b. 15 m/sec. c. 30 m/sec. d. 45 m/sec.