



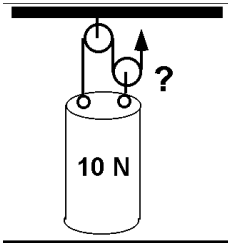
- 1 Suppose that the average force that is needed to draw a bow is 400 Newtons. If the arrow moves back by one meter when the bow is drawn, how much potential energy is stored in the bow?
  - a. 400J.
  - b. 0J.
  - c. 4000J.
  - d. 200J.
  - e. 2000J.
  
- 2 Which of the following objects is in equilibrium?
  - a. A baseball being thrown.
  - b. A rocket rising at a constant rate.
  - c. Any object in free fall.
  - d. A thrown stone at its highest point.
  
- 3 In the MKS system of units, the kilogram is the unit of
  - a. acceleration.
  - b. force.
  - c. velocity.
  - d. momentum.
  - e. mass.
  
- 4 A 1000kg boat is slowly lowered into the water on a ramp that starts out 10m above sea-level. The potential energy of the boat
  - a. increases by 100,000J.
  - b. decreases by 10,000J.
  - c. decreases by 100,000J.
  - d. increases by 10,000J.
  - e. stays the same.
  
- 5 At the surface of the earth, a 2kg mass weighs approximately
  - a. 30 N.
  - b. 5 N.
  - c. 20 N.
  - d. 2 N.
  - e. 10 lb.

- 6 Each of the following statements is included in Newton's three laws. Most of the statements are really just definitions that say something about the language that we use but nothing about the real world. One of the statements says something about physical reality. Which one?
- Mass is resistance to acceleration. The acceleration of an object is inversely proportional to its mass.
  - An object's resistance to acceleration depends only on the object and not at all on its surroundings.
  - Force is the cause of acceleration. The acceleration of an object is proportional to the force on it.
  - An inertial frame is one in which Newton's Law of inertia is obeyed.
- 7 If you try to push your stalled car North, your stalled car exerts a force back on you pointing toward the
- West.
  - South.
  - North.
  - East.
- 8 An airplane with a mass of 10,000kg is rolling down a runway and experiences an unbalanced upward force of 20,000N. Because of this, the airplane must be
- accelerating down the runway at  $0.5\text{m/s}^2$ .
  - accelerating down the runway at  $2\text{m/s}^2$ .
  - taking off with an upward acceleration of  $0.5\text{m/s}^2$ .
  - taking off with an upward acceleration of  $2\text{m/s}^2$ .
- 9 Suppose that the weight of a block is 10N. How much work does the force of gravity do on the block when the block moves a distance of 2 meters along a level surface?
- 10J.
  - 40J.
  - 200J.
  - 0J.
- 10 When you step on the gas in your car, the wheels push against the ground and the ground pushes back. The force that makes the car accelerate is exerted by
- the car wheels.
  - your foot.
  - the car engine.
  - the ground.
- 11 If the force on an object triples while the object moves a given distance, the work that the force does on the object goes up by a factor of
- 9.
  - 27.
  - 2.
  - 3.
  - 4.

## 12 Newton's First Law, the Law of Inertia

- a. is just a special case of his second law.
- b. defines the reference frame for the other laws.
- c. is unrelated to Newton's other laws.

## 13 A ten newton weight is hung from the ceiling with the pulley system shown here. The force that must be exerted on the end of the string to hold the weight in equilibrium is



- a. 10 N.
  - b.  $3\frac{1}{3}$  N.
  - c. 5 N.
  - d. 20 N.
- 14 If two objects are subjected to the same interactions (other than gravity), one expects that the object with smaller mass will accelerate
- a. less than the other object.
  - b. more than the other object.
  - c. the same as the other object.
- 15 Suppose that you climb a flight of stairs while carrying a pail of water with a mass of 10kg. If the top of the stairs is 3 meters higher than the bottom, the potential energy of the pail increases by
- a. 30J.
  - b. 300J.
  - c. 100J.
  - d. 10J.
- 16 Anti-lock brakes on a car are designed to make it impossible to apply the brakes so strongly that the car wheels stop turning and simply drag on the pavement. This system obviously helps to keep the car under control during a panic stop. Which of the following statements about stopping distance would you expect to be true?
- a. The system always increases stopping distance because it limits how strongly the brakes can be applied.
  - b. The system has no effect on stopping distance.
  - c. The system can decrease stopping distance by preventing sliding.

- 17 The chemical potential energy of 0.1kg of gasoline is higher than the carbon dioxide and water that result from burning it by roughly 4,000,000 joules. If you burn 0.1kg of gasoline in a 2000kg automobile and drive up a long hill, what is the absolute maximum increase in vertical distance that you can achieve?
- 2500m.
  - 200m.
  - 4, 000, 000m.
  - 2000m.
- 18 Two men carry identical packages from the front lawn of a building to the building's second floor that is 3 meters higher than the front lawn. Fred walks up the stairs. David pushes his wheelchair up the handicapped access ramp that is four times as long as the stairs. If the upward force that Fred exerts on his package does 32Nm of work, how much work does the upward force that David exerts on his package do?
- 32Nm.
  - 128Nm.
  - 8Nm.
  - 16Nm.
  - cannot be determined from the information given.
- 19 A snow-blower shoots snow at the rate of 0.1 kg/s and an initial velocity of 20 m/s. The resulting force that pushes back on the blower is
- 2 N.
  - 0.005 N.
  - 0.1 N.
  - 200 N.
  - 20 N.
- 20 Suppose that you weigh an object by hanging it from a rope that has a spring-scale that reads the amount of tension. Suppose, in addition, that you do this on a moving elevator. Under which of the following circumstances would you expect the scale to read more than the actual weight?
- Elevator moving downward at constant velocity.
  - Elevator moving upward at constant velocity.
  - Elevator moving downward and slowing to a stop.
  - Elevator moving upward and slowing to a stop.
- 21 An airplane is rolling down a runway with its engines at full throttle. The engines are generating a forward thrust of 30, 000N. There is also a drag force of 10, 000N due to air friction. The total force on this airplane is
- 20, 000N forward.
  - 10, 000N upward.
  - 10, 000N backward.
  - 30, 000N forward.
  - 40, 000N forward.

- 22 Suppose that the nozzle of a fire hose emits a stream of water at a velocity of 30 m/s and a rate of 10 kg/s. Assuming that the water in the hose is moving at 10 m/s, how much force must the nozzle exert on the water?
- 0.
  - 300 N.
  - 100 N.
  - 200 N.
- 23 A joule is equal to
- 1N·s.
  - 1N·m.
  - 1kg·m/s.
  - 1N.
  - 1kg·m.
- 24 The statement that all of the laws of physics are the same in all inertial reference frames is called
- the universality principle.
  - the principle of relativity.
  - the anthropic principle.
  - the principle of equivalence.
  - Newton's first law of motion.
- 25 A horse is pulling a cart. Work is done on the cart by
- the force that the ground exerts on the horse.
  - the force that the cart exerts on the horse.
  - the force of friction that the ground exerts on the cart.
  - all of the forces mentioned here.
  - none of the forces mentioned here.
- 26 A 1000 kg car travels north with a speed of 30 m/s. A 2000 kg truck is traveling south with a speed of 20 m/s. Taking north as the positive velocity direction, the total momentum of these two vehicles is
- +30,000 kg m/s.
  - 10,000 kg m/s.
  - +10,000 kg m/s.
  - 40,000 kg m/s.
  - +70,000 kg m/s.

## Answer Key: Fall 2007 PHX2D

- 1 Choice a. (400J.)
- 2 Choice b. (A rocket rising at a constant rate.)
- 3 Choice e. (mass.)
- 4 Choice c. (decreases by 100,000J.)
- 5 Choice c. (20 N.)
- 6 Choice b. (An object's resistance to acceleration depends only on the object and not at all on its surroundings.)
- 7 Choice b. (South.)
- 8 Choice d. (taking off with an upward acceleration of  $2\text{m/s}^2$ .)
- 9 Choice d. (0J.)
- 10 Choice d. (the ground.)
- 11 Choice d. (3.)
- 12 Choice b. (defines the reference frame for the other laws.)
- 13 Choice b. ( $3\frac{1}{3}$  N.)
- 14 Choice b. (more than the other object.)
- 15 Choice b. (300J.)
- 16 Choice c. (The system can decrease stopping distance by preventing sliding.)
- 17 Choice b. (200m.)
- 18 Choice a. (32Nm.)
- 19 Choice a. (2 N.)
- 20 Choice c. (Elevator moving downward and slowing to a stop.)
- 21 Choice a. (20,000N forward.)
- 22 Choice d. (200 N.)
- 23 Choice b. (1N·m.)
- 24 Choice b. (the principle of relativity.)
- 25 Choice c. (the force of friction that the ground exerts on the cart.)
- 26 Choice b. ( $-10,000\text{ kg m/s}$ .)

## Solutions

- 1 Module 020 Potential Energy: Question 4.2
- 2 Module 016 The Law of Force and Mass: Question 4.1
- 3 Module 015 Mass, Measure of Inertia: Question 3.2
- 4 Module 020 Potential Energy: Question 3.2
- 5 Module 017 Some Forces: Question 1.2
- 6 Module 015 Mass, Measure of Inertia: Question 2.2
- 7 Module 018 Action and Reaction: Question 1.3
- 8 Module 016 The Law of Force and Mass: Question 2.1
- 9 Module 019 Work: Question 4.2
- 10 Module 018 Action and Reaction: Question 2.1
- 11 Module 019 Work: Question 2.3
- 12 Module 014 The Law of Inertia: Question 1.1
- 13 Module 018 Action and Reaction: Question 3.2
- 14 Module 015 Mass, Measure of Inertia: Question 1.3
- 15 Module 020 Potential Energy: Question 2.1
- 16 Module 017 Some Forces: Question 2.3
- 17 Module 020 Potential Energy: Question 5.1
- 18 Module 019 Work: Question 1.2
- 19 Module 018 Action and Reaction: Question 4.3
- 20 Module 017 Some Forces: Question 4.1
- 21 Module 016 The Law of Force and Mass: Question 3.1
- 22 Module 016 The Law of Force and Mass: Question 5.1
- 23 Module 019 Work: Question 5.4
- 24 Module 014 The Law of Inertia: Question 3.3
- 25 Module 020 Potential Energy: Question 1.3
- 26 Module 018 Action and Reaction: Question 5.1