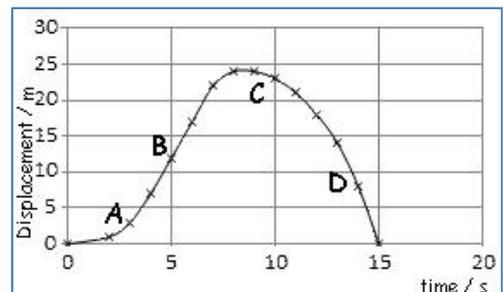


1. A rocket moves through empty space in a straight line with constant speed. It is far from the gravitational effect of any star or planet. Under these conditions, the force that must be applied to the rocket in order to sustain its motion is
  - A. equal to its weight
  - B. equal to its mass
  - C. dependent on how fast it is moving
  - D. zero
  
2. The weight of an object of mass 10 kg on earth is
  - A 10 N
  - B 10 kg
  - C 100 N
  - D 100 kg
  
3. You are standing in a moving bus, facing forward, and although no one touches you, you suddenly fall forward. You can infer from this that the bus
  - A. slowed down
  - B. sped up
  - C. turned right at the same speed
  - D. turned left at the same speed
  
4. You are standing in a moving bus, facing forward, and although no one touches you, you suddenly fall to the right. You can infer from this that the bus
  - A. slowed down
  - B. sped up
  - C. turned right at the same speed
  - D. turned left at the same speed
  
5. If the sum of all the forces acting on a moving object is zero, the object will
  - A slow down and stop
  - B change the direction of its motion
  - C accelerate uniformly
  - D continue moving with constant velocity
  
6. The tendency of an object to resist any change of motion is known as
  - A force
  - B mass
  - C inertia
  - D gravity
  
7. You are standing in a moving bus, facing forward, and you suddenly fall forward as the bus comes to an immediate stop. What force caused you to fall forward?
  - A. There is no force leading to your fall
  - B. The normal reaction force due to contact with the floor of the bus
  - C. The force due to friction between you and the floor
  - D. The force of gravity

8. A constant net force acts on an object. Describe the motion of the object.
- A. constant acceleration
  - B. constant speed
  - C. constant velocity
  - D. increasing acceleration
9. The acceleration of an object is inversely proportional to
- A. the net force acting on it
  - B. its position
  - C. its velocity
  - D. its mass
10. The acceleration of an object is directly proportional to
- A. the net force acting on it
  - B. its position
  - C. its velocity
  - D. its mass
11. A net force  $F$  accelerates a mass  $m$  with an acceleration  $a$ . If the same net force is applied to mass  $2m$ , then the acceleration will be
- A.  $4a$
  - B.  $2a$
  - C.  $a/2$
  - D.  $a/4$
12. A net force  $F$  acts on a mass  $m$  and produces an acceleration  $a$ . What acceleration results if a net force  $2F$  acts on mass  $4m$ ?
- A.  $a/2$
  - B.  $8a$
  - C.  $4a$
  - D.  $2a$
13. If you blow up a balloon with helium, and then release it, the balloon will fly upward. This is an illustration of
- A. Newton's first law
  - B. Newton's second law
  - C. Newton's third law
  - D. Newton's law of Gravitation

14. In the displacement vs time graph on the right, which section of the graph best represents constant velocity?

- A      B      C      D



15. Two cars collide head-on. At every moment during the collision, the magnitude of the force the first car exerts on the second is exactly equal to the magnitude of the force the second car exerts on the first. This is an example of
- A. Newton's first law
  - B. Newton's second law
  - C. Newton's third law
  - D. Newton's law of Gravitation
16. If you exert a force  $F$  on an object, the force which the object exerts on you will
- A. depend on whether or not the object is moving
  - B. depend on whether or not you are moving
  - C. depend on the relative masses of you and the object
  - D. always be  $-F$
17. Action-reaction forces
- A. sometimes act on the same object
  - B. always act on the same object
  - C. may be at right angles
  - D. always act on different objects
18. Action-reaction forces are
- A. equal magnitude and point in the same direction
  - B. equal magnitude but point in opposite directions
  - C. unequal magnitude, point in the same direction
  - D. unequal magnitude, point in opposite directions
19. A 20-ton truck collides head-on with a 1-ton car and causes a lot of damage to the car. The force on truck is
- A. greater than force on the car
  - B. equal to the force on the car
  - C. smaller than the force on the car
  - D. zero
20. An object of mass  $m$  sits on a flat table. The Earth pulls on this object with force  $mg$ , which we will call the action force. What is the reaction force?
- A. The table pushing up on the object with force  $mg$
  - B. The object pushing down on the table with force  $mg$
  - C. The table pushing down on the floor with force  $mg$
  - D. The object pulling upward on the Earth with force  $mg$
21. A child's toy is suspended from the ceiling by means of a string. The Earth pulls downward on the toy with its weight force of 8.0 N. If this is the "action force," what is the "reaction force"?
- A. The string pulling up on the toy with an 8N force
  - B. The ceiling pulling up on the string with an 8N force
  - C. The string pulling down on the ceiling with an 8N force
  - D. The toy pulling up on the Earth with an 8N force

22. A bat hits a ball with a force of 2400 N. The ball hits the bat with a force
- A. slightly less than 2400 N
  - B. exactly 2400 N
  - C. slightly more than 2400 N
  - D. close to 0 N
23. Your bat hits the ball bowled to you with a 1500-N instantaneous force. The ball hits the bat with an instantaneous force, whose magnitude is
- A. somewhat less than 1500 N
  - B. somewhat greater than 1500 N
  - C. equal to 1500 N
  - D. essentially zero
24. Mass and weight
- A. both measure the same thing
  - B. are exactly equal
  - C. are two different quantities
  - D. are both measured in kilograms
25. The acceleration due to gravity is lower on the Moon than on Earth. Which of the following is true about the mass and weight of an astronaut on the Moon's surface, compared to Earth?
- A. Mass is less, weight is same
  - B. Mass is same, weight is less
  - C. Both mass and weight are less
  - D. Both mass and weight are the same