

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

Answer D. (Newton's 1st Law)

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

Answer D ($W = mg$; $W = 10\text{kg} \times 10\text{ms}^{-2}$; $W = 100\text{N}$).

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

Answer A. (Newton's 1st Law)

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

Answer D. (Newton's 1st Law)

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

Answer D. (Newton's 1st Law)

6. The tendency of an object to resist any change of motion is known as
- A force
 - B mass
 - C inertia
 - D gravity

Answer C

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

Answer A. (Newton's 1st Law)

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

Answer A. (Newton's 2nd Law $a = F/m$)

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

Answer D. (Newton's 2nd Law $a = F/m$)

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

Answer A. (Newton's 2nd Law $a = F/m$)

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. $a/4$

Answer C (Newton's 2nd Law $a = F/m$; if m doubles then a is halved).

Mathematical Solution:

$$a = F/m \text{ \& } a' = F/m'$$

$$a/a' = (F/m)/F/m'$$

$$a/a' = (Fm'/Fm)$$

$$a/a' = (m'/2m')$$

$$a/a' = \frac{1}{2}$$

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. $2a$

Answer A (Newton's 2nd Law $a = F/m$; if m quadruples then a is quartered and if F doubles then a is doubled).

Mathematical Solution:

$$a = F/m \text{ \& } a' = F'/m'$$

$$a/a' = (F/m)/F'/m'$$

$$a/a' = (Fm'/F'm)$$

$$a/a' = (2F'm'/F'4m')$$

$$a/a' = \frac{1}{2}$$

13. If you blow up a balloon with helium, and then release it, the balloon will fly upward. This is an illustration of

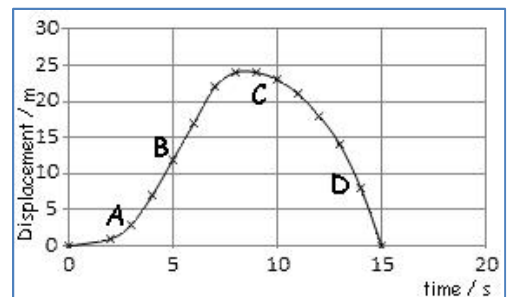
- A. Newton's first law
- B. Newton's second law
- C. Newton's third law
- D. Newton's law of Gravitation

Answer A (there is a net upward force on the balloon due to the upthrust from the air).

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

- A
- B
- C
- D

Answer B (In a displacement time graph the slope is velocity. So in the region B there is a constant slope and hence velocity.



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

Answer C

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 $-F$

Answer D

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

Answer D

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

Answer B

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

Answer B. (Newton's 3rd Law)

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

Answer D. (Newton's 3rd Law)

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

Answer D. (Newton's 3rd Law)

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

Answer B. (Newton's 3rd Law)

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

Answer C. (Newton's 3rd Law)

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

Answer C. ($W=mg$)

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

Answer B. ($W=mg$ and g on the Moon is $1/6 g$ on Earth)