Newton’s 2nd Law

Name: __________________________

Date: ______________

1. The graph shown represents the relationship between velocity and time for a 2.0-kilogram cart that is initially at rest and starts moving northward.

What is the acceleration of the cart shown at \( t = 8 \) seconds?

(1) 0 m/s\(^2\)  (2) 10 m/s\(^2\)  (3) 20 m/s\(^2\)  (4) −20 m/s\(^2\)

2. A locomotive starts from rest and accelerates at 0.12 meter per second\(^2\) to a speed of 2.4 meters per second in 20 seconds. This motion could best be described as

(1) constant acceleration and constant velocity
(2) increasing acceleration and constant velocity
(3) constant acceleration and increasing velocity
(4) increasing acceleration and increasing velocity

3. Net force \( F \) causes mass \( m_1 \) to accelerate at rate \( a \). A net force \( 3F \) causes mass \( m_2 \) to accelerate at rate \( 2a \). What is the ratio of mass \( m_1 \) to mass \( m_2 \)?

(1) 1 : 3  (2) 2 : 3  (3) 1 : 2  (4) 1 : 6

4. The accompanying diagram shows a child pulling a 50.-kilogram friend on a sled by applying a 300.-newton force on the sled rope at an angle of 40.\(^\circ\) with the horizontal.

The vertical component of the 300.-newton force is approximately

(1) 510 N  (2) 230 N  (3) 190 N  (4) 32 N
5. A 6-newton force and an 8-newton force act concurrently on a box located on a frictionless horizontal surface. Which top-view diagram shows the forces producing the smallest magnitude of acceleration of the box?

(1)  
(2)  
(3)  
(4)  

6. A 2,400-kilogram car is traveling at a speed of 20. meters per second. Compared to the magnitude of the force required to stop the car in 12 seconds, the magnitude of the force required to stop the car in 6.0 seconds is

(1) half as great 
(2) twice as great 
(3) the same 
(4) four times as great 

7. The accompanying diagram shows a block on a horizontal frictionless surface. A 100.-newton force acts on the block at an angle of 30.° above the horizontal.

What is the magnitude of force F if it establishes equilibrium?

(1) 50.0 N  
(2) 86.6 N  
(3) 100. N  
(4) 187 N 

8. A 5-newton force directed east and a 5-newton force directed north act concurrently on a point. The resultant of the two forces is

(1) 5 N northeast 
(2) 10. N southwest 
(3) 7 N northeast 
(4) 7 N southwest
9. In an automobile collision, a 44-kilogram passenger moving at 15 meters per second is brought to rest by an air bag during a 0.10-second time interval. What is the magnitude of the average force exerted on the passenger during this time?

(1) 440 N  (2) 660 N  
(3) 4400 N  (4) 6600 N  

10. Two concurrent forces have a maximum resultant of 45 newtons and a minimum resultant of 5 newtons. What is the magnitude of each of these forces?

(1) 0 N and 45 N  
(2) 5 N and 9 N  
(3) 20 N and 25 N  
(4) 0 N and 50 N  

11. During a collision, an 84-kilogram driver of a car moving at 24 meters per second is brought to rest by an inflating air bag in 1.2 seconds. The magnitude of the force exerted on the driver by the air bag is approximately

(1) $7.0 \times 10^1$ N  (2) $8.2 \times 10^2$ N  
(3) $1.7 \times 10^3$ N  (4) $2.0 \times 10^3$ N  

12. Which pair of forces acting concurrently on an object will produce the resultant of greatest magnitude?

(1) \[ \vec{F}_1 = 6.0 \text{ N} \rightarrow \]  (2) \[ \vec{F}_2 = 4.0 \text{ N} \rightarrow \]
(3) \[ \vec{F}_3 = 4.0 \text{ N} \leftarrow \]  (4) \[ \vec{F}_4 = 4.0 \text{ N} \uparrow \]
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