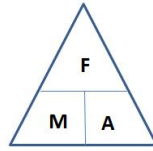


Newton's 2nd Law Problems



Name _____ Class _____ EN _____

Problems 1-4: Use $a=F/m$

1. The force of gravity between the moon and an object near its surface is much smaller than the force of gravity between Earth and the same object near the Earth's surface. A bowling ball with a mass of 7.51kg is pulled downward with an unbalanced force of 12.2N. What is the acceleration of the falling bowling ball on the moon?
2. Assume that a catcher in a professional baseball game exerts a force of 65.0N to stop the ball. If the baseball has a mass of 0.145 kg, what is its acceleration as it is being caught?

3. A type of elevator called a cage is used to raise and lower miners in a mine shaft. Suppose the cage carries a group of miners down the mine shaft. If the unbalanced force on the cage is 60.0N, and the mass of the loaded cage is 1500 kg, what is the acceleration of the cage?

4. A 214 kg boat is sinking in the ocean. The force of gravity that draws the boat down is partially offset by the buoyant force of the water, so that the net unbalanced force on the boat is 1310N. What is the acceleration of the boat?

Problems 5-8: Use $m=F/a$

5. The tallest man-made structure at present is the Warszawa Radio mast in Warsaw, Poland. This radio mast rises 646 m above the ground, nearly 200m more than the Sears Tower in Chicago. Suppose a worker at the top of the mast accidentally knocks a tool off the tower. If the force acting on it is 3.6N, and its acceleration is 9.8 m/s², what is the tool's mass?

6. The whale shark is the largest of all fish and can have the mass of three adult elephants. Suppose that a crane is lifting a whale shark into a tank for delivery to an aquarium. The crane must exert an unbalanced force of 2500 N to lift the shark from rest. If the shark's acceleration equals 1.25m/s², what is the shark's mass?

7. A house is lifted from its foundations onto a truck for relocation. The unbalanced force lifting the house is 2850 N. This force causes the house to move from rest to an upward speed of 0.15m/s in 5.0s. What is the mass of the house?

8. Because of a frictional force, a force of 2.8N must be applied to a textbook in order to slide it along the surface of a wooden table. The book accelerates at a rate of 0.11 m/s². What is the mass of the book?

Problems 9-12: Use $F=ma$

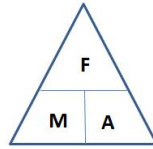
9. In drag racing, acceleration is more important than speed, and therefore drag racers are designed to provide high accelerations. Suppose a drag racer has a mass of 1250kg and accelerates at a constant rate of 16.5 m/s². How large is the unbalanced force acting on the racer?

10. The force that stops a jet plane as it lands on the flight deck of an aircraft carrier is provided by a series of arresting cables. These cables act like extremely stiff rubber bands, stretching enough to keep from slowing the plane down too suddenly. A Hornet jet with a mass of 13,000kg lands with an acceleration of 27.6 m/s². How large is the unbalanced force that the arresting cables exert on the plane?

11. A 5,220,000kg luxury cruise ship is moving at its top speed as it comes into port. The ship then undergoes an acceleration equal to 0.357 m/s² until it comes to rest at its anchorage. How large must the unbalanced force acting on the ship be in order to bring the ship to rest at the proper location?

12. The giant sequoia redwood trees of the Sierra Nevada mountains in California are said never to die from old age. Instead, an old tree dies when its shallow roots become loosened and the tree falls over. Removing a dead mature redwood from a forest is no easy feat, as the tree can have a mass of nearly 2000000kg. Suppose a redwood with this mass is lifted with an overall upward acceleration of 0.85 m/s². How large is the unbalanced force?

Newton's 2nd Law Problems



KEY

Name _____ Class _____ EN _____

Problems 1-4: Use $a=F/m$

1. The force of gravity between the moon and an object near its surface is much smaller than the force of gravity between Earth and the same object near the Earth's surface. A bowling ball with a mass of 7.51kg is pulled downward with an unbalanced force of 12.2N. What is the acceleration of the falling bowling ball on the moon?

$$1.62 \text{ m/s}^2$$

2. Assume that a catcher in a professional baseball game exerts a force of 65.0N to stop the ball. If the baseball has a mass of 0.145 kg, what is its acceleration as it is being caught?

$$448.28 \text{ m/s}^2$$

3. A type of elevator called a cage is used to raise and lower miners in a mine shaft. Suppose the cage carries a group of miners down the mine shaft. If the unbalanced force on the cage is 60.0N, and the mass of the loaded cage is 1500 kg, what is the acceleration of the cage?

$$0.04 \text{ m/s}^2$$

4. A 214 kg boat is sinking in the ocean. The force of gravity that draws the boat down is partially offset by the buoyant force of the water, so that the net unbalanced force on the boat is 1310N. What is the acceleration of the boat?

$$6.12 \text{ m/s}^2$$

Problems 5-8: Use $m=F/a$

5. The tallest man-made structure at present is the Warszawa Radio mast in Warsaw, Poland. This radio mast rises 646 m above the ground, nearly 200m more than the Sears Tower in Chicago. Suppose a worker at the top of the mast accidentally knocks a tool off the tower. If the force acting on it is 3.6N, and its acceleration is 9.8 m/s^2 , what is the tool's mass?

$$0.37 \text{ kg}$$

6. The whale shark is the largest of all fish and can have the mass of three adult elephants. Suppose that a crane is lifting a whale shark into a tank for delivery to an aquarium. The crane must exert an unbalanced force of 2500 N to lift the shark from rest. If the shark's acceleration equals 1.25 m/s^2 , what is the shark's mass?

$$2,000 \text{ kg}$$

7. A house is lifted from its foundations onto a truck for relocation. The unbalanced force lifting the house is 2850 N. This force causes the house to move from rest to an upward speed of 0.15m/s in 5.0s. What is the mass of the house?

95,000 kg

8. Because of a frictional force, a force of 2.8N must be applied to a textbook in order to slide it along the surface of a wooden table. The book accelerates at a rate of 0.11 m/s². What is the mass of the book?

25.45 kg

Problems 9-12: Use $F=ma$

9. In drag racing, acceleration is more important than speed, and therefore drag racers are designed to provide high accelerations. Suppose a drag racer has a mass of 1250kg and accelerates at a constant rate of 16.5 m/s². How large is the unbalanced force acting on the racer?

20,625 N

10. The force that stops a jet plane as it lands on the flight deck of an aircraft carrier is provided by a series of arresting cables. These cables act like extremely stiff rubber bands, stretching enough to keep from slowing the plane down too suddenly. A Hornet jet with a mass of 13,000kg lands with an acceleration of 27.6 m/s². How large is the unbalanced force that the arresting cables exert on the plane?

358,800 N

11. A 5,220,000kg luxury cruise ship is moving at its top speed as it comes into port. The ship then undergoes an acceleration equal to 0.357 m/s² until it comes to rest at its anchorage. How large must the unbalanced force acting on the ship be in order to bring the ship to rest at the proper location?

1,863,540 N

12. The giant sequoia redwood trees of the Sierra Nevada mountains in California are said never to die from old age. Instead, an old tree dies when its shallow roots become loosened and the tree falls over. Removing a dead mature redwood from a forest is no easy feat, as the tree can have a mass of nearly 2000000kg. Suppose a redwood with this mass is lifted with an overall upward acceleration of 0.85 m/s². How large is the unbalanced force?

1,700,000 N