

# Linear

[Science](#), [Physics](#)



Review Complete the statement or answers the question. Which problems would NOT be a part of physics? A theory is A scientific hypothesis may turn out to be right or it may turn out to be wrong. If it is a valid hypothesis, there must be a test for proving that it is To test a scientific hypothesis you would Which of the following statements is not true? Which of the following is a reason to express scientific findings mathematically? Which has greater linear speed, a horse near the outside rail of a merry-go-round or a horse near the inside rail? A ladybug rests on the bottom of a tin can that is being whirled horizontally on the end of a string. Since the ladybug, like the can, moves in a circle, there must be a force on it. What exerts this force? People in the future may well live inside a rotating space structure that is more than 2 km in diameter. Inside the structure, people on the inside of the outer edge will experience 1 g while people halfway to the axis will experience As the rotational speed of a space habitat increases, the weight of people inside A car travels in a circle with constant speed. The net force on the car To weigh less in the Northern Hemisphere, you should go The centripetal force exerted on stunt motorcyclist Biker Bob while riding on the inner vertical surface of a circular track is Stunt motorcyclist Biker Bob rides his bike inside a futuristic rotating space station—a giant rotating donut-shaped structure in space. The normal support force feels like weight to him. As he rides his bike in the same direction that the station rotates, the normal force Stunt motorcyclist Biker Bob rides his bike inside a futuristic rotating space station—a giant rotating donut-shaped structure in space. The normal support force feels like weight to him. As he rides his bike in the opposite direction to the station's rotation, the normal force Suzie Spacewalker hovers in space beside a

rotating space station in outer space. Both she and the center of mass of the space station are at relative rest. If the space station is in Earth orbit, then Suzie A game room in a rotating space habitat is located in a 0.25-g region. If a person can jump 0.5-m high in a 1-g region, how high can the same person jump in the game room? Suppose you are in a car that is going around a curve. The speedometer reads a constant 30 miles per hour. Which of the following is NOT true? A car starts from rest and after 7 seconds it is moving at 42 m/s. What is the car's average acceleration? In the absence of air resistance, objects fall at constant Suppose an object is in free fall. Each second the object falls If you drop a feather and a coin at the same time in a tube filled with air, which will reach the bottom of the tube first? Consider drops of water leaking from a water faucet. As the drops fall they Suppose you take a trip that covers 180 km and takes 3 hours to make. Your average speed is Suppose a car is moving in a straight line and steadily increases its speed. It moves from 35 km/h to 40 km/h the first second and from 40 km/h to 45 km/h the next second. What is the car's acceleration? A ball is thrown straight up. At the top of its path its instantaneous speed is A ball is thrown straight up. At the top of its path its acceleration is A car accelerates at  $2 \text{ m/s}^2$ . Assuming the car starts from rest, how much time does it need to accelerate to a speed of 20 m/s? If you drop a feather and a coin at the same time in a vacuum tube, which will reach the bottom of the tube first? If a projectile is fired straight up at a speed of 30 m/s, the total time to return to its starting point is about The vertical height attained by a basketball player who achieves a hang time of a full one second is about Which has more momentum, a large truck moving at 30 miles per hour or a small truck

moving at 30 miles per hour? If the momentum of an object changes and its mass remains constant, A table tennis ball launcher is fired. Compared to the force on the ball, the force on the launcher is A collision is considered elastic if Suppose a girl is standing on a pond where there is no friction between her feet and the ice. In order to get off the ice, she can Two objects, A and B, have the same size and shape, but A is twice as heavy as B. When they are dropped simultaneously from a tower, they reach the ground at the same time, but A has a higher A cannon fires a cannonball. The speed of the cannonball will be the same as the speed of the recoiling cannon A karate expert executes a swift blow and splits a cement block with her bare hand. describe the forces and magnitudes . A moving freight car runs into an identical car at rest on the track. The cars couple together. Compared to the velocity of the first car before the collision, the velocity of the combined cars after the collision is A piece of putty moving with 2 units of momentum strikes and sticks to a heavy bowling ball that is initially at rest. After the putty sticks to the ball, both are set in motion with a combined momentum that is The force that accelerates a rocket into outer space is exerted on the rocket by Suppose an astronaut in outer space wishes to toss a ball against a very massive and perfectly elastic concrete wall and catch it as it bounces back. If the ball is as massive as the astronaut, then Superman is at rest in space when he throws an asteroid that has more mass than he does. Which moves faster, Superman or the asteroid? A cannonball shot from a long-barrel cannon travels faster than one shot from a short-barrel cannon because the cannonball receives a greater A small economy car (low mass) and a limousine (high mass) are pushed from rest across a parking lot, equal

distances with equal forces. The car that receives the greater impulse is the

A 5.0-kg chunk of putty moving at 10.0 m/s collides with and sticks to a 7.0-kg bowling ball that is initially at rest. The bowling ball with its putty passenger will then be set in motion with a momentum of

The astronomer Copernicus publicly stated in the 1500s that Earth Galileo found that a ball rolling down one inclined plane would roll how far up another inclined plane?

After a cannonball is fired into frictionless space, the amount of force needed to keep it going equals

If the force of gravity suddenly stopped acting on the planets, they would

Friction One object has twice as much mass as another object. The first object also has twice as much

Compared to its weight on Earth, a 10-kg object on the moon will weigh

You would have the largest mass of gold if your chunk of gold weighed 1 N on

Which has more mass, a kilogram of feathers or a kilogram of iron? How much does a 3.0-kg bag of bolts weigh? A bag of sports equipment has a mass of 10.0 kilograms and a weight of

How does acceleration of an object change in relation to its mass?

It is

The acceleration produced by a net force on an object is

A heavy person and a light person parachute together and wear the same size parachutes. Assuming they open their

When a woman stands with two feet on a scale, the scale reads 280 N. When she lifts one foot, the scale reads

Suppose the force of friction on a sliding object is 25 N. The force needed to maintain a constant velocity is

A book weighs 4 N. When held at rest in your hands, the net force on the book is

A girl pulls on a 10-kg wagon with a constant force of 20 N. What is the wagon's acceleration?

The terminal speed for a person parachuting (with the chute open) is about

If you pull horizontally on a desk with a force of 150 N and the desk doesn't move, the friction force must be

150 N. Now A block is at rest on an incline. The force of friction necessary to prevent the block from sliding increases when the incline angle is A speeding truck locks its brakes and it skids to a stop. If the truck's total mass were doubled, its skidding distance would be You are on a frozen pond, and the ice starts to crack. If you lie down on the ice and begin to crawl, this will A 20-N falling object encounters 4 N of air resistance. The magnitude of the net force on the object is You pull horizontally on a 50-kg crate with a force of 450 N and the friction force on the crate is 250 N. The acceleration of the crate is A high school student hits a nail with a hammer. During the collision, there is a force As a ball falls, the action force is the pull of Earth's mass on the ball. What is the reaction to this force? A person is attracted towards the center of Earth by a 440-N gravitational force. The force with which Earth is attracted toward the person is An unfortunate bug splatters against the windshield of a moving car. Compared to the force of the car on the bug, the force of the bug on the car is If a horse pulls on a wagon at rest, the wagon pulls back equally on the horse. Can the wagon be set into motion? A large truck and a small car traveling at the same speed have a head-on collision. The vehicle to undergo the greater change in velocity will be Earth pulls on the moon, and similarly the moon pulls on Earth. This is evidence that the Nellie Newton holds an apple in her hand. If action is Earth pulling on the apple, then reaction is A force is exerted on the tires of a car to accelerate the car along the road. The force is exerted by the A rocket is able to accelerate in the vacuum of space when it fires its engines. The force that propels the rocket is the force As a 600-N woman sits on the floor, the floor exerts a force on her of You drive past a farm, and you see a cow pulling a

plow to till a field. You have just learned about Newton's third law, and you wonder how the cow is able to move forward if the plow is exerting an equal and opposite force on the cow. Which of the following explains the movement of the cow and plow? If you exert a force of 12,000 N on a 3,000 kg car and a 6,000 kg truck that are both originally at rest, what will be the resulting accelerations of the objects? A vector is a quantity that has What would be considered a projectile? In the absence of air friction, the vertical component of a projectile's velocity doesn't change as the projectile moves. A ball is thrown into the air at some angle. At the very top of the ball's path, its velocity is In the absence of air resistance, the angle at which a thrown ball will go the farthest is A ball thrown in the air will never go as far as physics ideally would predict because A cannonball is launched from the ground at an angle of 30 degrees above the horizontal and a speed of 30 m/s. Ideally (no air resistance) the ball will land on the ground with a speed of After a rock that is thrown straight up reaches the top of its path and is starting to fall back down, its acceleration is (neglecting air resistance) An airplane flying into a head wind loses ground speed, and an airplane flying with the wind gains ground speed. If an airplane flies at right angles to the wind, then ground speed is Jose can jump vertically 1 meter from his skateboard when it is at rest. When the skateboard is moving horizontally, Jose can jump Which best approximates the resultant of a pair of 6-unit vectors at right angles to each other? In Chapter 2, you learned about "hang time," the time a jumper's feet are off the ground in a vertical jump. If the jumper runs horizontally and has the same vertical component of takeoff velocity, hang time will be A vertical pole standing against a wall topples to

the ground and the center of the pole has a speed of 13 m/s as it hits. With what speed does the far end of the pole hit the ground? At the outer edge of a rotating space habitat, 130 m from its center, the rotational acceleration is  $g$ . What is the rotational acceleration at a distance of 65 m from the center of the habitat? What is the average speed of a cheetah that runs 88 m in 5 seconds? A bicycle travels 15 km in 30 minutes. What is its average speed? What is the average acceleration of a car that goes from rest to 60 km/h in 8 seconds? A jet on an aircraft carrier can be launched from 0 to 40 m/s in 2 seconds. What is the acceleration of the jet? An apple falls from a tree and 0.5 second later hits the ground. How fast is the apple falling when it hits the ground? You toss a ball at 5 m/s straight upward. How much time will the ball take to reach the top of its path? What vertical distance can a person with a 0.7 s hang time jump? How much time does a car with an acceleration of 5 m/s<sup>2</sup> take to go from 5 m/s to 40 m/s? Starting from rest, a car undergoes a constant acceleration of 6 m/s<sup>2</sup>. How far will the car travel in the first second? If a projectile fired beneath the water, straight up, breaks through the surface at a speed of 13 m/s, to what height above the water will it ascend? A stone is dropped from a cliff. After it has fallen 10 m, what is the stone's velocity? What is the average momentum of a 50-kg skateboarder who covers 400 m in 50 s? A cement truck of mass 16,000 kg moving at 15 m/s slams into a cement wall and comes to a halt. What is the force of impact on the truck? A 10-kg cement block moving horizontally at 6 m/s plows into a bank of sand and comes to a stop in 2 s. What is the average impact force on the bank? An 8-kg blob of clay moving horizontally at 2 m/s hits a 3-kg blob of clay at rest. What is the speed of the two blobs stuck



together immediately after the collision? A 40-kg football player leaps through the air to collide with and tackle a 50-kg player heading toward him, also in the air. If the 40-kg player is heading to the right at 9 m/s and the 50-kg player is heading toward the left at 2 m/s, what is the speed and direction of the tangled players? A 5-kg blob of clay moving horizontally at 4 m/s has a head-on collision with a 4-kg blob of clay that moves toward it at 2 m/s. What is the speed of the two blobs stuck together immediately after the collision? A 10-kg bowling ball moving at 4 m/s bounces off a spring at about the same speed that it had before bouncing. What is the change in momentum of the bowling ball? A loaded freight car has 5 times as much mass as an empty freight car. If the loaded car coasts at 5 m/s and collides with and attaches to the empty car at rest, what will be the speed of both cars after collision? A 50-kg cart moving at 100 km/h collides head-on with an approaching 50-kg cart moving at 10 km/h (in the opposite direction). If the two carts stick together, what will be their speed? A 30-kg girl and a 50-kg boy face each other on friction-free roller skates. The girl pushes the boy, who moves away at a speed of 3 m/s. What is the girl's speed? A 70-kg free-floating astronaut fires 0.10-kg of gas at a speed of 30 m/s from her propulsion pistol. What is the astronaut's recoil speed? Assume that a 15-kg ball moving at 8 m/s strikes a wall perpendicularly and rebounds elastically at the same speed. What is the amount of impulse given to the wall? How much (in newtons) does a 10.0-kg bag of grass seed weigh? How much (in newtons) does 0.60 kg of salami weigh? On the surface of Jupiter, the acceleration due to gravity is about 3 times that on Earth. How much would a 0.40-kg rock weigh on Jupiter? You push with 27 N on a 10-kg chest, and there is a 7-N force of

friction. How fast will the chest accelerate? An unbalanced force of 30 N gives an object an acceleration of  $6.0 \text{ m/s}^2$ . What force would be needed to give it an acceleration of  $1.0 \text{ m/s}^2$ ? A certain unbalanced force gives a 20-kg object an acceleration of  $2.0 \text{ m/s}^2$ . What acceleration would the same force give a 30-kg object? A net force of 1.0 N acts on a 4.0-kg object, initially at rest, for 4.0 seconds. What is the distance the object moves during that time? Suppose that you exert 300 N horizontally on a 50-kg crate on a factory floor, where friction between the crate and the floor is 100 N. What is the acceleration of the crate? A 20-kg block of cement is pulled upward (not sideways!) with a force of 400 N. What is the acceleration of the block? Bronco the skydiver, whose mass is 80 kg experiences 200 N of air resistance. What is the acceleration of his fall? If you push off the ground with a force of 350 N when you jump upward, what force pushes Earth downward? A pair of blocks, one 2 times as massive as the other, are connected by a compressed spring. When the spring is released, the blocks fly apart. Compared to the heavier block, how many times as fast does the lighter block accelerate? Two people have a tug-of-war on low-friction ice. One person has 2 times the mass of the other. Compared to the lighter person, how many times as fast does the heavier person accelerate? A fighter punches a sheet of paper in midair, and brings it from rest up to a speed of 40 m/s in 0.08 s. What is the force of impact on the paper if the mass of the paper is 0.01 kg? What engine thrust (in newtons) is required for a rocket of mass 35 kg to leave the launching pad? A package falls out of a helicopter that is traveling horizontally at 70 m/s. It falls into the water below 8.0 seconds later. Assuming no air resistance, what is the horizontal

distance it travels while falling? Kyle throws a ball horizontally from the top of a building that is 5.0 m high. He hopes the ball will reach a swimming pool that is at the bottom of the building, 12.0 m horizontally from the edge of the building. If the ball is to reach the pool, with what initial speed must Kyle throw it with? An airplane whose airspeed is 295 km/h flies parallel to the direction of a wind with a speed of 40.0 km/h. What are the two possible speeds of the plane relative to the ground? Consider an escalator at an angle of  $45^\circ$  above the horizontal that moves with a velocity of 2.0 m/s. What is the horizontal component of the escalator's velocity? A ball is thrown horizontally from the top of a tall cliff. Neglecting air drag, what vertical distance has the ball fallen 2.0 seconds later? A snowball rolls off the edge of a horizontal roof at a velocity of 3.0 m/s. What is the speed of the snowball 1.0 s later? A ball is thrown upward. Its initial vertical component of velocity is 20 m/s and its initial horizontal component of velocity is 12 m/s. What is the ball's speed 1.0 s later? A ball is thrown upward. Its initial vertical component of velocity is 30 m/s and its initial horizontal component of velocity is 10 m/s. What is the ball's speed 4 s later? A ball is thrown upward. Its initial vertical component of velocity is 30 m/s, and its initial horizontal component of velocity is 10 m/s. What are the horizontal and vertical components of the ball's velocity 5 s later? In a standing jump, the hang time of a certain athlete is 0.8 second. What is her hang time when she jumps the same height