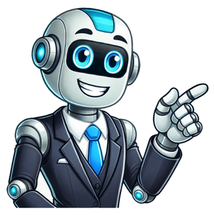
I'm not a robot



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The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Hi I have a ball, and I'm lifting this ball upward with +work, and gravity is doing -work, Net Work= zero. But how is it, that I can still move the ball. When read that explanation I think of the ball or any object not moving at all :S So how can I figure this puzzle out :O? SteamKing The work you are doing in lifting the ball is converted into additional potential energy of the ball. This does not mean that the ball cannot move. I have a ball, and I'm lifting this ball upward with +work, and gravity is doing -work, Net Work= zero. But how is it, that I can still move the ball. That's a very odd way to define "net work". Any process involving energy conversion -- which is the entire point of the field of thermodynamics -- utilizes a conservation of energy statement to equate the input and output work, either in the form of Win-Wout=0 or Win=Wout. But, I suppose if we're being pedantic anyway, there is an easy way out of this one. The rise in height represents potential energy, not work. So in this case you really have Win-Eout=0. That's a very odd way to define "net work". Any process involving energy conversion -- which is the entire point of the field of thermodynamics -- utilizes a conservation of energy statement to equate the input and output work, either in the form of Win-Wout=0 or Win=Wout. But, I suppose if we're being pedantic anyway, there is an easy way out of this one. The rise in height represents potential energy, not work. So in this case you really have Win-Eout=0. I was watching a lecture in Physics by UCBerkley and there was an example of the total net work done on a "chalk", where the professor was lifting it above the ground doing +Work, and gravity is doing -Work on the chalk thus the Net Work = 0. So I was a bit confused. The work you are doing in lifting the ball is converted into additional potential energy of the ball. This does not mean that the ball cannot move. Ok, the work I'm doing on the ball is being converted to PE, that means their should be no motion :S Since the motion is caused from the work I put in... That ball should stop, and if I release it all the work I put in is converted from PE > KE + losses due to resistance. PhanthomJay Ok, the work I'm doing on the ball is being converted to PE, that means their should be no motion :S Since the motion is caused from the work I put in... That ball should stop, and if I release it all the work I put in is converted from PE > KE + losses due to resistance. Not sure what you mean here. The net work done by all forces acting on an object is equal to the kinetic energy change of that object. If the net work is zero, that means there is no kinetic energy change. That means that once the object being lifted is in motion, it moves up at constant speed. You can look at another example without PE, like pushing a block along a rough level surface. If the pushing force is 10 N and the value of the opposing kinetic friction force is 10 N, then there is no net work being done, but for sure, the block is moving. At constant speed. I think net work will be zero as according to law of conservation of energy. Not sure what you mean here. The net work done by all forces acting on an object is equal to the kinetic energy change of that object. If the net work is zero, that means there is no kinetic energy change. That means that once the object being lifted is in motion, it moves up at constant speed. You can look at another example without PE, like pushing a block along a rough level surface. If the pushing force is 10 N and the value of the opposing kinetic friction force is 10 N, then there is no net work being done, but for sure, the block is moving. At constant speed. Since the force's cancel out. And that block has no "change" in KE, I assume it still has KE but not changing? I'm not used to "net work" I never considered the -Work done on a object as +Work is applied. D H I was watching a lecture in Physics by UCBerkley and there was an example of the total net work done on a "chalk", where the professor was lifting it above the ground doing +Work, and gravity is doing -Work on the chalk thus the Net Work = 0. That's correct, assuming the piece of chalk is at rest initially and at rest after being lifted to some height. Suppose the piece of chalk starts at rest, the professor lifts it upwards a bit, and then stops. The initial and final kinetic energy of the piece of chalk with respect to the ground are both zero. This means there's no net change in kinetic energy. Per the work-energy theorem, the net work done on the piece of chalk is thus zero. Compare that to the situation where the piece of chalk is still being lifted upwards. The initial kinetic energy is still zero, but the kinetic energy at the point in time of interest (chalk moving upward) is non-zero. Now we do have a change in kinetic energy, requiring a non-zero net work between the halk moving state and chalk at rest state. PhanthomJay Since the force's cancel out. yes, while in motion at constant velocity, the pulling force on the chalk upward is balanced by the weight of the chalk downward. Or in the case of the block being pulled on a level surface at constant velocity, the pulling force to the right is balanced by the friction force to the left. No net force means no net work. And that block has no "change" in KE, I assume it still has KE but not changing? Correct. As long as it is moving at constant velocity, its initial and final KE are the same, so there is no change during the motion. I'm not used to "net work" I never considered the -Work done on a object as +Work is applied. Net work is sometimes called total work. Work can be positive or negative. The pull force on the chalk moving up at constant speed does positive work, mgh. The gravity force does negative work, - mgh. The total work is 0. Or in the second example, the pull force does positive work , fd. The friction force does negative work, - fd. The total work is 0. I am sorry to bring up an old thread, but this question is bothering me. So, what is the total energy of the system? Is it only the potential energy of gravity? If so, why isn't the energy done by the person lifting the chalk up considered? jtbell So, what is the total energy of the system? Assuming "the system" is the piece of chalk, the total energy is its kinetic energy (##\frac{1}{2}mv^2##) plus its gravitational potential energy (mgh) why isn't the energy done by the person lifting the chalk up considered? The work done by the person lifting the chalk goes into changing its gravitational potential energy (by changing its h), or into changing its kinetic energy (by changing its v), or some of both. $$KE_{initial} + PE_{initial} + W = KE_{final} + PE_{final}\\W = (KE_{final} - KE_{initial}) + (PE_{final} - PE_{initial})\\W=\Delta KE + \Delta PE$$. Basically, the constant KE will be converted to PE, right? PhanthomJay I am sorry to bring up an old thread, but this question is bothering me. So, what is the total energy of the system? Is it only the potential energy of gravity? If so, why isn't the energy done by the person lifting the chalk up considered? Energy can neither be created nor destroyed, just transformed into different types. Basically, the constant KE will be converted to PE, right? No. Suppose the chalk starts from rest and is lifted up a bit to point B, at which point it continues to be lifted up at constant speed to point C, and then finally stopped at point D. For simplicity, consider the motion between B and C only, where KE remains constant , but the PE changes. So since KE doesn't change, then how can it be transformed to PE? The change in PE is due to the external work done on the system (chalk) by the person doing the lifting. Looking again at the conservation of energy equation [itex]W_{nc} =\Delta KE+\Delta PE[/itex], where [itex]W_{nc}[/itex] is the work done by non-conservative forces (work done by the lifter in this case). Since there is no KE change here, then the above equation reduces to [itex]W_{nc} =\Delta PE[/itex]. So it is the work done by the lifter that changes the PE of the chalk. Rearranging the above equation, [itex] \Delta PE - W_{nc} = 0[/itex], or since total energy of an isolated system can never change per conservation of energy laws, then [itex] \Delta PE + \Delta E_{other} = 0[/itex], where the system is now defined as the lifter-chalk system and [itex] \Delta E_{other} [/itex] represents the change in forms energy other than PE and KE , that is, chemical/heat energy of the lifter ([itex]W_{nc} = -\Delta E_{other}[/itex]). That is perhaps the 'missing energy' you are wondering about? Sentence Examples As the electrons are free to move they do so until they find positions where they feel no net force. Conversely, if a body is not accelerated, there is no net force acting on it. The result is to generate a net force that tends to straighten out the curve into a cylindrical tube. The farther away a quark moves, the more gluons appear, each contributing to the net force. The net forces acting on each column are summed to derive the net force and torque acting on the assemblage of columns. Thus, the net force applied to a body produces a proportional acceleration. In reality, the magnetic field felt by a compass needle is essentially uniform over the length of a compass needle and as a result the net force on the needle is zero. The F in Newton's second law refers to the net force acting on an object. For a body to be in equilibrium, there must be no net force acting on it. Because the piston seal area is greater than the main seat sealing area, the net force on the piston is downward, keeping the valve tightly closed. If the sails are properly oriented with respect to the wind, then the net force on the sails will move the vessel forward. The curved path demands this observer to recognize a leftward net force on the ball. Due to symmetry and charge neutrality, a polarizable particle in a uniform electric field will experience no net force. The net force on a particle is thus equal to the rate of change of the momentum of the particle with time. Thus, a condition necessary for the uniform motion of a particle relative to an inertial reference frame is that the total net force acting on it is zero. Dielectrophoresis is a phenomenon in which a spatially non-uniform electric field exerts a net force on the field-induced dipole of an uncharged particle. This means that an equal melt pressure on both ends will result in a net force driving the piston backward and closing off flow through the valve. Because the air pressure decreases with the speed of air, this difference in flowing speed leads to a net force that tends to slightly bend the trajectory of a football. Any net force is equal to the rate of change of the momentum. The ball travels in the air, and there is no net force upon it. Show More Sentences The FTC has been effective in bringing civil actions against spammers with its Northeast Net Force. Welcome to the Physics Library. This Living Library is a principal hub of the LibreTexts project, which is a multi-institutional collaborative venture to develop the next generation of open-access texts to improve postsecondary education at all levels of higher learning. The LibreTexts approach is highly collaborative where an Open Access textbook environment is under constant revision by students, faculty, and outside experts to supplant conventional paper-based books. Campus BookshelvesBookshelvesLearning Objects Home is shared under a not declared license and was authored, remixed, and/or curated by LibreTexts. This page defines the net force acting on a system. Main Idea The net force acting on a system (such as a particle, collection of particles, or rigid body) is defined as the vector sum of all of the forces acting on the system. People are interested in net force because a net force acting on a system affects its motion. More specifically, a nonzero net force causes the system's Linear Momentum to change over time in the direction of the net force, as described by Newton's Second Law: the Momentum Principle. For a system of constant mass, this change in momentum takes the form of Acceleration in the direction of the net force. Conversely, a net force of 0 acting on a system means that, according to Newton's Second Law, the system is travelling with a constant momentum. For a system of constant mass, this means that the system is travelling at constant speed, which may be zero or nonzero. The fact that motion is possible with a net force of 0 may be be counter-intuitive, but recall that Newton's First Law states that objects in motion stay in motion unless a (nonzero net) force acts on it. For example, consider a rock thrown in empty space. It will travel at a constant speed in a straight line forever unless it encounters something that can exert a force on it. The effects of a net force do not depend on the forces comprising it. For example, if the forces [math]\displaystyle{ f_1 = \lt 1, 1, 0 \gt }[/math] N and [math]\displaystyle{ f_1 = \lt 1, -1, 0 \gt }[/math] N act on a system, the net force would be [math]\displaystyle{ F_{net} = \lt 1, 0, 0 \gt }[/math] N. Similarly, if the forces [math]\displaystyle{ f_1 = \lt 2, 0, 0 \gt }[/math] N and [math]\displaystyle{ f_1 = \lt -1, 0, 0 \gt }[/math] N act on a system, the net force would also be [math]\displaystyle{ F_{net} = \lt 1, 0, 0 \gt }[/math] N. In both cases, the net force is the same, so momentum of the system will be affected in the same way for both net forces. A Mathematical Model By definition, [math]\displaystyle{ \vec{F}_{net} = \sum_i \vec{f}_i }[/math] Sometimes the individual force vectors are simply given in component form. In this case, recall that to add the force vectors, their corresponding components of the vectors should be added to yield the components of the resultant vector. At least as often, the individual force vectors are not given in component form but have known magnitudes and directions. In this case, coordinate axes should be chosen and the forces should be decomposed into components along those axes. If it is possible to predict the direction of the net force using physical intuition, the axes should be chosen so that one of them is parallel to this net force. Otherwise, The axes should be chosen so that as many forces as possible are parallel to them an axis, reducing the need to decompose them. Recall that some forces, such as tension and the normal force, do not have readily available magnitudes; their magnitudes must be found based on the magnitudes of other forces. A Computational Model Fortunately, vector addition is very easy in computer programming languages such as vPython. As long as the individual forces acting on a particle are calculated as vectors, when they are added together, vPython will add their components to find the resultant vector. Finding the net force is an essential part of the Iterative Prediction process, which is used in most physics simulations. Below is an excerpt from a vPython program that uses iterative prediction to simulate the motion of a ball on a spring. The seven lines shown are responsible for the three steps of iterative prediction. This program simulates the motion of a ball on a string. #1 Fspring = -k*s #2 Fgravmag = mball * g #3 Fgrav = Fgravmag * vector(0,-1,0) #4 Fnet = Fspring+Fgrav #5 pball = pball + Fnet * deltat #6 vball = pball / mball #7 ball.pos=ball.pos+vball*deltat Here, the spring force and the gravitational force are found using formulas (lines 1-3). Then, they are added together to get the net force on the ball (line 4). The net force is then used to update the momentum of the ball (line 5). In line 6 the velocity is updated based on the new momentum, and line 7 the position is updated based on the new velocity. Without net force calculations, tracing an object's path would be impossible. Examples 1. (Simple) When calculating net force, it is useful to construct a free body diagram. A free body diagram is a physical representation of the external forces applied to a system. Often, arrows are used to represent forces. In this example, forces are displayed acting on a box. The first box is being suspended by a rope (but it is not quite at equilibrium), so its free body diagram looks like this: What is the net force acting on this box? Solution: Assume that down is the negative y direction, and you can easily write vector representations of the forces and add them up to find the sum, which is the net force: [math]\displaystyle{ Fnet = (0, 1200, 0) }[/math]N[math]\displaystyle{ + (0, -800, 0) }[/math]N [math]\displaystyle{ Fnet = (0, 400, 0) }[/math]N The second box is falling, but it has significant air resistance: What is the net force acting on this box? Solution: [math]\displaystyle{ Fnet = (0, 600, 0) }[/math]N[math]\displaystyle{ + (0, -800, 0) }[/math]N [math]\displaystyle{ Fnet = (0, -200, 0) }[/math]N The third box is on the ground and is sliding to the right, but slowing down because of friction. It has both x-component forces and y-component forces. It is important to put these in the right place in the vector coordinates. What is the net force acting on this box? Solution: [math]\displaystyle{ Fnet = (0, 50, 0) }[/math]N[math]\displaystyle{ + (0, -50, 0) }[/math]N[math]\displaystyle{ + (-20, 0, 0) }[/math]N [math]\displaystyle{ Fnet = (-20, 0, 0) }[/math]N 2. (Simple) Two external forces N and N, act on a system. What is the net force acting on the system? Answer: N Explanation: The net force is the vector sum of its constituent forces. [math]\displaystyle{ \vec{F}_{net} = \vec{F}_{1} + \vec{F}_{2} }[/math] [math]\displaystyle{ \vec{F}_{net} }[/math] =