

$$x = x_i + vt + \frac{1}{2}at^2 \quad v_f^2 = v_i^2 + 2ad \quad v_f = v_i + at$$

$$w = mg \quad F_g = \frac{Gm_1m_2}{r^2}$$

$$g = 9.8m/s^2 \quad G = 6.67 \times 10^{11}(Nm^2/kg^2)$$

$$F = ma \quad F_f = \mu N$$

$$\tau = Fr \sin \theta \quad a_c = \frac{v^2}{r} \quad F_c = \frac{mv^2}{r}$$

$$p = mv \quad \text{Impulse} = F \times t$$

$$F \times t = \Delta(mv)$$

$$W = Fd \quad P = \frac{W}{t}$$

$$\text{Eff} = \frac{\text{Work}_{out}}{\text{Work}_{in}} \quad \text{Eff} = \frac{\text{Power}_{out}}{\text{Power}_{in}}$$

$$KE = \frac{1}{2}mv^2 \quad PE = mgh \quad PE = \frac{1}{2}kx^2$$

Review the following chapters:

Chapter 1: A Physics Toolkit

Chapter 2: Representing Motion

Chapter 3: Accelerated Motion

Chapter 4: Forces in One Dimension

Chapter 5: Forces in Two Dimensions

Chapter 6: Motion in Two Dimensions

Chapter 7 section 2: Using the Law of Universal Gravitation

Chapter 8 section 2 and 3: Rotational Dynamics and Equilibrium

Chapter 9: Momentum and Its Conservation

Chapter 10: Energy, Work, and Simple Machines

Chapter 11: Energy and Its Conservation

Please define the following terms:

Physics

Dimensional analysis

Significant digits

Scientific method

Hypothesis

Scientific law

Scientific theory

Measurement

Precision

Accuracy

Independent variable

Dependent variable

Line of best fit

Direct relationship

Quadratic relationship

Inverse relationship

Motion diagram

Particle model

Coordinate system

Origin

Position

Distance

Magnitude

Vector

Scalar

Resultant

Time interval

Displacement

Position-time graph  
Instantaneous position  
Average velocity  
Average speed  
Instantaneous velocity

Velocity-time graph  
Acceleration  
Average acceleration  
Instantaneous acceleration  
Free fall  
Acceleration due to gravity

Force  
Free-body diagram  
Net force  
Newton's second law  
Newton's first law  
Inertia  
Equilibrium  
Apparent weight  
Weightlessness  
Drag force  
Terminal velocity  
Interaction pair  
Newton's third law  
Tension  
Normal force

Component  
Vector resolution  
Kinetic friction  
Static friction  
Coefficient of kinetic friction  
Coefficient of static friction

Projectile  
Trajectory  
Uniform circular motion  
Centripetal acceleration  
Centripetal force

Gravitational force  
Law of universal gravitation

Lever arm  
Torque  
Moment of inertia

Center of mass

Impulse

Momentum

Impulse-momentum theorem

Closed system

Isolated system

Law of conservation of momentum

Work

Energy

Kinetic energy

Work-energy theorem

Joule

Power

Watt

Machine

Effort force

Resistance force

Mechanical advantage

Ideal mechanical advantage

Efficiency

Compound machine

Kinetic energy

Gravitational potential energy

Reference level

Elastic potential energy

Law of conservation of energy

Mechanical energy

Thermal energy

Elastic collision

Inelastic collision

Some other things to remember:

Parallax

Calibration

Margin of uncertainty

Free body diagram

Weight

What does the graph look like for a:

Linear

Inverse

Parabolic

Quadratic

What does the length of a displacement vector represent?

What information can you find out from a position-time graph?

What is the area under a velocity-time graph?

What is the area under a force-time graph?

### Problems

A bicyclist maintains a constant velocity of 8.0 m/s for a distance of 880 m. How long does it take the bicyclist to travel this distance?

If a runner accelerates from 5 m/s to 13 m/s in 8 s, her average acceleration is \_\_\_\_\_.

A car's velocity decreases from 32.0 m/s to 20.0 m/s over a period of 9.0 s. What is the car's average acceleration?

If a sprinter accelerates from rest at a constant rate of 4.0 m/s<sup>2</sup>, how fast will she be running after 8.0 s?

A pebble falls from a bridge into the river below. If the pebble falls for 7.20 s, what is its velocity when it hits the water?

A car with an initial displacement of 11.0 m and an initial velocity of 19.0 m/s accelerates at an average rate of 0.60 m/s<sup>2</sup> for 2.0 s. What is the car's displacement after 2.0 s?

A racing cyclist is traveling at 15.3 km/h when she speeds up with a constant acceleration of 0.77 m/s<sup>2</sup>. What is her velocity after 3.00 s?

If the ball's initial horizontal velocity is 3.9 m/s, how far from the building is the ball when it hits the ground?

In a penalty kick, a soccer player kicks the ball from ground level with an initial velocity of 20.0 m/s, 23.0° above the horizontal. Assume that air resistance is negligible. What is the maximum height,  $y_{\max}$ , of the soccer ball?

What is the flight time of the soccer ball in the previous problem?

The cars on an amusement-park ride travel at a constant velocity of 8.0 m/s on a circular track that has a radius of 6.0 m. What is the magnitude of each car's centripetal acceleration?

If each car in the previous problem has a mass of 160.0 kg, what is the net centripetal force acting on each car?

A clown in a circus act swings a 4.7-kg metal ball attached to a 82.0-cm nylon string in a horizontal circle above her head, making one revolution in 0.93 s. What is the tension force,  $FT$ , exerted on the string by the ball?

The resultant of a 10-N force acting on an object to the right and a 40-N force acting on the object to the left is \_\_\_\_\_.

An object at rest on a horizontal surface has a weight of 300 N. In order to move the box a minimum force of 40 N is required. The coefficient of static friction is \_\_\_\_\_.

Two horizontal forces, one 160.0 N and the other 300.0 N, are exerted in opposite directions on a boat on a lake. What is the net horizontal force on the boat?

Two dogs play tug-of-war with a rope toy that has a mass of 0.60 kg. If one dog pulls on the toy with a force of 150.0 N, and the other dog pulls in the opposite direction with a force of 118.0 N, what is the horizontal acceleration of the toy?

What is the force of gravity on a person who has a mass of 56.0 kg?

A 56.0-kg boy rides in an elevator that accelerates upward at  $1.72 \text{ m/s}^2$ . What is the net force exerted on the boy?

Two teams, the Fifes and the Drums, are playing tug-of-war. Each team has 4 members. Both teams exert a force of 2012 N on the rope. The rope is not moving. What is the net force on the rope?

Two people are paddling together in a canoe. Each exerts a horizontal force of 338 N toward the back of the canoe. What is the net horizontal force on the canoe?

Refer to item above. If the combined weight of the canoe and the two paddlers is 187 kg, what is the acceleration of the canoe?

If you exert 30.0 N of horizontal force while pushing a 9.2-kg box across the floor at a constant velocity, what is the coefficient of kinetic friction between the floor and the box?

The frictional force of a 3.0-kg block of wood on a wooden table is 6.8 N. If you push the block with a force of 13.8 N, what is its acceleration across the table?

A skier is at rest on a hill sloped at  $50.0^\circ$ . The coefficient of kinetic friction between the snow and the skis is 0.18. The skier starts skiing downhill. How fast is the skier going after 5.0 s?

A planet has a mass of  $6.0 \times 10^{24} \text{ kg}$ , which is about eight times the mass of its single moon. If the distance between the planet and the moon is about  $3.2 \times 10^5 \text{ km}$ , what is the gravitational pull of the planet on the moon?

A 8 kg ball is traveling at 15 m/s. What is its kinetic energy?

A ball of mass 0.6 kg has 108 J of kinetic energy. What is the velocity of the ball?

A ball traveling at 20 m/s has 1800 J of kinetic energy. What is the mass of the ball?

Jorge tightens a bolt on his bicycle with a wrench that is 0.40 m long. If he pulls perpendicularly on the end of the wrench with a force of 180 N, how much torque does he apply?

Salma, who has a mass of 52 kg, and Josh, who has a mass of 63 kg, are trying to balance a seesaw. Salma's position is 0.3 m from the pivot point. How far should Josh sit from the pivot point to balance Salma?

Given Josh's distance from the pivot point in order to balance Salma, what must be his moment of inertia?

Two skaters, Elena and Tara, face each other on the ice. Elena has a mass of 56.4 kg, and Tara has a mass of 38.3 kg. Both are motionless until they push away with a force of 43 N. Then Elena has a velocity of 1.2 m/s. What is Tara's velocity?

A 0.088-kg ball strikes a wall with a velocity of 32.1 m/s. The wall stops the ball in 0.26 s. What force does the wall exert to stop the ball?

A 925-kg car is moving along a straight highway with a velocity of 94 km/h. The driver applies the brakes and reduces the car's speed to 32 km/h in 9.5 s. What is the impulse on the car?

A 2400-kg car is traveling at 22 m/s when it crashes into the rear end of a 1450-kg car traveling at 20 m/s in the same direction on ice. The two cars become stuck together and slide on the ice. How fast do the two cars move together immediately after the collision?

A child holds onto a string attached to a toy boat and exerts a force of 12.0 N to pull the boat a distance of 5.2 m along a straight shoreline. If the child holds the string at a  $25.0^\circ$  angle with the horizontal, how much work does she do on the toy boat?

How much power would be developed if the work were done in 3.5 s?