Physics Variable Descriptions and Measurement

Variable	Definition	Metric Units	Instrument used to measure or steps to calculate quantity
Mass (m)	Measurement of the amount of stuff in object	grams	Directly measure with balance
Length, distance (d), Displacement (**x**), diameter	Measurement of the size of object or how far an object has moved or how far a force is applied to an object	meters	Directly measure with meter stick or ruler
Volume (V)	Measurement of the amount of space object takes up	Liters or cubic centimeters	Directly measure with graduated cylinder for liquids, water displacement or mathematical formula for solids
Time (t), period (T)	Measurement of sequence of events or how long it takes for something to occur or how long a force is applied to an object	second	Directly measure using stopwatch or video camera shutter speed
Temperature	Measurement of average kinetic energy contained inside an object	Degrees Celsius	Directly measure with thermometer
Angle (θ)	Measurement of how far away one surface or object is from being parallel or perpendicular to another surface or object	Degrees	Directly measure with protractor
Velocity (**v**), speed	Measurement of how fast an object moves	cm/s, m/s	1) Measure distance object travels w/ ruler or meter stick 2) Measure time it takes for object to travel that distance with stopwatch or video camera 3) Calculate velocity using equation $v = \Delta \mathbf{x} / \Delta t$

Acceleration (**a**)	Measurement of how fast an object speeds up, slows down or changes direction. **a**= $(v_f-v_0) / (\Delta t)$	cm/s/s, m/s/s	1) Find the initial velocity of the object using the steps for finding a velocity 2) Find the final velocity of the object using the steps for finding the velocity 3) Measure the time interval (Δt) for the velocity to change using a stopwatch or video camera 4) Calculate the acceleration of the object using the equation **a**= $(v_f-v_0) / \Delta t$
Force (**F**)	A push or pull, Examples include friction, tension of string, resistive force of fluid and gravity	Kg m/s^2, Newton	Directly measure using spring scale or amount of stretching of rubber band
Momentum (**p**)	Quantity of motion = mass x velocity	Kg m/s, Ns	1) Measure mass of object with balance 2) Measure velocity of object using steps listed for velocity 3) Calculate the momentum of the object using the formula **p** = m**v**
Gravitational potential energy (PE_g)	Stored energy due to a gravitational field; Near planet's surface PE_g = mg Δh where m=mass, g the acceleration of gravity=9.8 m/s/s near Earth's surface and Δh = change in height object undergoes	Joules, Nm, Kg m^2/s^2, g m^2/s^2	1) Measure mass of object with balance 2) Measure the change in height (Δh) the object undergoes with a meter stick or ruler. Upward is positive, downward is negative. 3) Calculate the gravitational potential energy of the object using the formula PE_g = mg Δh
Kinetic Energy (KE)	Energy object has due to its motion. KE =1/2 mv^2 where m=mass and v = velocity of the object	Joules, Nm, Kg m^2/s^2, g m^2/s^2	1) Measure mass of object with balance 2) Measure velocity of object using steps listed for velocity 3) Calculate the kinetic energy of the object using the formula KE =1/2 m$\mathbf{v^2}$
Work (W)	Work = Force x distance object moves in direction of force applied to it	Joules, Nm, Kg m^2/s^2, g m^2/s^2	1) Measure force on object using spring scale 2) Measure distance object moves in direction of force using ruler or meter stick. 3) Calculate the work done using the equation W= Fd.