مدونة المناهج السعودية

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الموقع التعليمي لجميع المراحل الدراسية

في المملكة العربية السعودية

* Based quantities: Assumed to be independent of each other.
* Derived quantities: Defined in terms of base quantities via equations.

* Conversion Factors: is the ratio of units that equals unity.

scalar * Distance: sum of all distance regardless of direction

vector * Average velocity: The ratio of displacement that occurs during a particular time interval to that interval.

scalar * Average speed: The ratio of total distance that occurs during a particular time interval to that interval.

* When an object's velocity changes (magnitude or direction) we say the particle undergoes an acceleration.

vector * Average acceleration: is the ratio of a change in velocity to the time interval in which the change occurs.

* Constant acceleration does not mean the velocity is Constant, it means the velocity changes with constant rate.

* Constant acceleration does not mean $a = 0$, If $a = 0$
$\therefore$ V is constant

* Free fall is the motion of an object under influence of Gravity and ignoring any other effects such as air resistance.

* All object in free fall accelerate downward at the same rate, and is independent of the object's mass, density or shape.

* If a particle moving in the $+x$ direction with increasing speed, Its velocity and acceleration are both positive.

* If a particle is thrown vertically upward, It's displacmet positive during rising and negative during falling.
* If the sign of the velocity and acceleration of a particle are opposite, then the speed decrease.
* When an object is thrown vertically upward ↑, while it's rising the velocity is upward and its acceleration is downward.
* Speed is the magnitude of instantaneous velocity.
* The free fall motion is an example of motion along a straight line with constant acceleration.
* The component of a vector is the projection of the vector on an axis.
* The magnitude of $\vec{A} \cdot \vec{B}$ is maximum when the angle between $\vec{A}$ and $\vec{B}$ is 90° (False)
* The value of $i \cdot (\hat{j} \times \hat{k})$ is zero (False)
* a_x and a_y are vector component of $\vec{a}$ (False)
* The magnitude of the unit vector equals 1.
* Vector quantites: Follow certain rules of addition and multiplication.
* Scalar quantities: Follow the rules of ordinary algebra.
* resolving the vector is the process of finding the component.
* Components: is the projection of the vector on an axis.
* unit vector: is a vector of magnitude 1 and points in a particular direction.
* Dot product will produce a scalar.
* Vector product will produce a new vector.

* **projectile motion** is the motion of a particle that is launched with an initial velocity $\vec{V}_o$.

* During projectile motion flight the particles horizontal acceleration is zero and its vertical acceleration is the free fall acceleration $-g$.

* In projectile motion, the horizontal motion and the vertical motion are independent of each other.

* projectile path (trajectory) is parabolic.

* **Horizontal Range** is the horizontal distance from the launch point to the point at which the particle returns to the launch height.

* **Uniform circular motion**: A particle is in uniform circular motion if it travels around a circle or circular arc at constant speed.

* **period**: is the time for a particle go around the circle once.

* A stone thrown from the top of a tall building follows the path that is parabolic.

* Two projectiles are in flight at the same time The acceleration of one relative to the other is zero.

* A ball is thrown at v_o and angle α_o above the horizontal and returned to its initial height The path of the ball is called Trajectory the horizontal component of the balls velocity is unchanged at the maximum height V_y is zero.

* In the projectile motion, the vertical velocity V_y Changes continuously.
* The maximum range of a projectile is at launched angle $\theta = 45^\circ$
* In the projectile motion the horizontal velocity V_x remains constant because $a_x = 0$.
* A particle moves at constant speed in a circular path. The instantaneous velocity and instantaneous acceleration vectors are perpendicular to each other.
* Newtonian mechanics does not apply to A very large speed and the scale of atomic structure
* Newton's First Law: If no force acts on a body ($F_{net} = 0$) the body's velocity cannot change, that is, the body cannot accelerate.
* 1 Newton is the force that accelerates a body of 1 kg with an acceleration of magnitude 1.

vector * Forces are vector quantities they combine according to the vector rules.

scalar * Mass is an intrinsic characteristic of a body that relates a Force F applied on the body the resulting acceleration a.

* Newton's second Law: The net force on a body is equal to the product of the body's mass and its acceleration.

* The acceleration component along a given axis is caused only by sum of the force components along that same axis, and not by force component along any other axis.
* If the net force on the body is zero, the body's acceleration is zero.
* Gravitational force: It is the force that the earth exerts on any object. It is directed toward the center of the earth.
* Normal Force: when a body presses against a surface deforms and pushes on the body with a normal force perpendicular to the contact surface.
* Friction: The force that opposes the motion.
* Tension: This is the force exerted by a rope or a cable attached to an object.
* The weight W of a body is equal to the magnitude F_g of the gravitational force on the body.
* weight is changeable, It depends on g.
* Tension is always directed along the rope and it is always pulling the object and has the same value along the rope.
* Newton's Third law: when 2 bodies interact by exerting forces on each other, the forces are equal in magnitude and opposite in direction.
* Action and reaction are called third-law force pair.

* The direction of the acceleration of a body is The same direction of the net force.
* Friction Forces is the force on a body when the body slides or attempts to slide along a surface.
* The friction force is always parallel to the surface and directed so as to oppose the sliding.
* No motion, $\vec{f}_s$: is the static Friction.
* Constant velocity: $\vec{F} = \vec{f}_k$
* Acceleration, $\vec{f}_k$: is the kinetic friction.
* If the body at rest: $\vec{f}_s = \vec{F}_{app}$
* If the body slides: $\vec{f}_k < \vec{F}_{app}$
* If the body with constant velocity: $\vec{F} = \vec{f}_k$
* Coefficient of static/kinetic friction:
  - They are dimensionless.
  - must be determined experimentally.
  - Their values depend on the properties of the body and the surface.
* Energy: is a scalar quantity associated with the state (or condition) of one or more object.
* Energy conserved: Energy can be transformed from one type to another and transferred from one object to another but the total amount is always the same.
* Kinetic energy: is energy associated with the state of motion of an object.
* Work: W is energy transferred to (+ work) or from (- work) an object by means of a force acting on the object.

* **Work done:** energy transferred to the object by the force.

* **Doing work:** Is the act of transferring the energy.

* A Force does **positive work** when it has a vector component in the **same direction** as the displacement, and it does **negative work** when it has a vector component in the **opposite direction**. It does **zero work** when it has no such vector component.

* $\phi = 90^\circ \Rightarrow W = 0$

* $\phi < 90^\circ \Rightarrow W = +ve$

* $\phi > 90^\circ \Rightarrow W = -ve$

* **Work - kinetic energy theorem:** Change in the kinetic energy of a particle = net work done on the particle.

or

Kinetic energy after the net work is done = Kinetic energy before the net work + the net work

* Work W_s is positive if the block ends up closer to the relaxed position ($x=0$) than it was initially. It is negative if the block ends up farther away from $x=0$. It is zero if the block ends up at the same distance from $x=0$. $x_i > x_f \Rightarrow W_s = +$, $x_f > x_i \Rightarrow W_s = -$

* **Power:** The time rate at which work is done by a force is said to be the power due to the force. If a force does an amount of work W in an amount of time Δt, the average power.

* Potential energy is energy that is associated with the configuration of a system in which a conservative force acts.

* Gravitational potential energy is the potential energy associated with a system consisting of earth and a nearby particle.

* Elastic potential energy is the energy associated with the state of compression or extension of an elastic object

* Mechanical energy: E_{mec} of a system is the sum of its potential energy U and the kinetic energy K

* Conservation of mechanical energy: the sum of K and U for any state of a system

=

the sum of K and U for any other state of the system

* In an isolated system where only conservative forces cause energy changes, The KE and U can change but their sum E_{mec} of the system cannot change.

* The center of mass is the point that moves as though ① All of the system's mass were concentrated there and ② all external forces were applied there.

* The time rate of change of the momentum of a particle is equal to the net force acting on the particle and is in the direction of that force.

* $\vec{F}_{net} = \frac{d\vec{P}}{dt}$ and $\vec{F}_{net} = m\vec{a}$ are equivalent expressions of Newton's second law of motion for a particle.

* The linear momentum of a system of particles is equal to the product of the total mass M of the system and the velocity of the center of mass.
* If no net external force acts on a system of particle the total linear momentum $\vec{P}$ of the system cannot change.
* Law of conservation of linear momentum :

total linear momentum at some initial time t_i = total linear momentum at som later time t_f

* If the component of the net external force on an closed system is zero along an axis, then the component of the linear momentum of the system along that axis cannot change.