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Physics (Quick Study Academic)

WORLD'S #1 ACADEMIC OUTLINE

Quick Study Academic

PHYSICS

WHAT IS PHYSICS ALL ABOUT?

Physics works to understand the natural phenomena that occur in our universe, a description of a natural phenomenon uses many specific names, definitions and units. Physics is a quantitative science.

Units

Units are the standard for measurement. Mass is the measure of the amount of matter, the standard unit for mass is kg. 1 kg = 1000 g. Density is a property of matter, and as such, it occupies space.

Velocity

The measure of motion describes the position of the particle and velocity for elapsed time, v .

Acceleration

The rate of change of the velocity with time $a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$.

Position

Position is the absolute value of the velocity, scalar quantity.

Equations of Motion for One Dimension (1-D)

Equations of motion describe the future position (x) and velocity (v) of a body in terms of the initial velocity (v_0), position (x_0) and acceleration (a).

For constant acceleration, the position is related to the time and acceleration by the following equation of motion: $x = v_0 t + \frac{1}{2} a t^2$

For uniform acceleration, the velocity vs. time is given by the following: $v = v_0 + a t$

If the acceleration is a function of time, the equation must be solved using $a(t)$

Basics

Base Quantity

Length	L	Meter - m
Mass	M	Kilogram - kg
Temperature	T	Kelvin - K
Time	T	Second - s
Electric Current	I	Ampere - A (C/s)

Unit

Other physical quantities are derived from these basic units. Prefixes denote fractions or multiples of units, many valuable symbols are Greek letters.

Math Skills

Many physical concepts are only understood with the use of algebra, statistics, trigonometry, and calculus.

CLASSICAL MECHANICS

A. Classical or Newtonian Mechanics

The position of a body is given by an equation of motion, the position, velocity and acceleration are related to the mass of the body, and the force applied to the body. Force is the measure of the amount of mass, the standard unit for mass is kg. 1 kg = 1000 g. Density is a property of matter, and as such, it occupies space.

Newton's 1st Law: A body remains at rest or in uniform motion unless a force acts on it.

Newton's 2nd Law: Force and acceleration determine the motion of a body and predict future position and velocity $F = m a$ OR $\Sigma F = m a$.

Newton's 3rd Law: Every action is countered by an opposing action.

B. Types of Forces

1. A Body Force acts on the entire body, with the force acting at the center of mass.

2. A gravitational force, F_g pulls an object toward the center of the Earth, $F_g = mg$.

3. Weight = F_g gravitational force

4. Mass is a measure of the quantity of material, measured in kg and other measures.

5. Surface forces act on the body's surface.

Friction, F_f , is proportional to the force normal to the part of the body in contact with a surface, $F_f = \mu_s n$.

6. Static friction resists the movement of a body.

7. Dynamic friction slows the motion of a body.

For an object on a horizontal surface:

$$F_g = F_n$$

$$F_f = \mu_s F_n$$

8. Circular Motion

1. Motion along a circular path using polar coordinates, (r, θ)

2. Key Variables:

r	Meter	The distance from the rotation center (center of mass).
θ	Radian	The angle between r and the (x) axis.
ω	Radians/second	The angular velocity.
α	Radians/second ²	The angular acceleration.
v	Meter	The circular motion arc $s = \theta r$ (in rad).

3. Tangential acceleration & velocity: $v_t = r\omega$, $a_t = r\alpha$

4. Centripetal acceleration: $a_c = \frac{v^2}{r}$ is directed toward the rotational center.

B. Newton's Laws of Motion

Newton's Laws are the core principles for describing the motion of classical objects in response to forces. The SI unit of force is the Newton, N. 1N = 1kg m/s², the kg unit is the dyne, 1 dyne = 1g cm/s².

C. Kinetic Energy & Work

1. Kinetic energy, K : Kinetic energy is the energy of motion, mass, m and velocity, v . $K = \frac{1}{2}mv^2$.

2. Work: Work is the transfer of energy in the form of force.

3. Momentum, p : Momentum is a property of motion, defined as the product of mass and velocity: $p = mv$.

4. Work (W): Work is a force acting on a body moving a distance, for a constant force, F , and a body moving a path, s , $W = F \cdot s$ or $(W = F \cdot v \cdot t)$.

5. Power (P): Power is energy expended per unit time, $P = \frac{W}{t}$, $W = F \cdot s$, $s = v \cdot t$.

6. Work = $\frac{1}{2}mv^2$

7. Work = $\frac{1}{2}mv^2 - \frac{1}{2}m v_0^2$

8. Work = $F \cdot d \cos(\theta)$

9. Work = $F \cdot d \cos(0)$

10. Work = $F \cdot d$

11. Work = $F \cdot d \cos(90)$

12. Work = $W = P \cdot t$

13. Power = $P = W/t$

14. Power = $P = F \cdot v \cos(\theta)$

15. Power = $P = F \cdot v \cos(0)$

16. Power = $P = F \cdot v$

17. Potential Energy & Energy Conservation

1. The total energy of a system, E , is the sum of kinetic, K , & potential energy, P , $E = K + P$.

2. Potential energy arises from the interaction with a potential force or external force.

3. Potential energy is energy of position, $U(x)$, the form of U depends on the force generating the potential.

Gravitational: $U_{grav} = mgh$

Electric field: $U_{elec} = \frac{q_1 q_2}{4\pi \epsilon_0 r}$

4. If there are no other forces acting on the system, E is constant and the system is called conservative.

E. Collisions & Linear Momentum

1. Types of Collisions

- 2. Elastic:** conservative energy
- 3. Inelastic:** energy is lost as heat or deformation

4. Relativity: Mass & Energy with velocity v in Frame S, in Frame S' the velocity is v' , if V' is the velocity of Frame S' relative to S, therefore $v' = V' + v$.

5. Elastic Collision

Conservative Energy: $\sum \frac{1}{2} m_i v_i^2 = \sum \frac{1}{2} m_i v_i'^2$

Conservative Momentum: $\sum m_i v_i = \sum m_i v_i'$

6. Impulse: $\Delta p = F \cdot \Delta t$

7. Impulse = Change in momentum: $\Delta p = p_f - p_i$

8. Impulse is also the momentum change: $\Delta p = p_f - p_i$



Synopsis

Reference and outline to concepts in physics.

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Customer Reviews

Good tool. A bit of an overkill for me. Not by any fault to the study guide, it was simply far more than I needed for a calculus based first year physics class.

Physics was one subject I need a tutor. This explain what I struggle with in the subject. A great tool.

These items are wonderful to tuck in a textbook or in a three ring binder for a quick handy reference guide. The information is commonly available, but this is an ideal study aid.

BarCharts are a great little reference. I would not recommend them as a study aid, but as a quick reference, they are great! I have used them for Chem, Physics, Electronics and Math. They are great for what they are.

I brought this to aid me in my Physics class. This pamphlet has all the formulas I will need for an intro class. It is very is to read and not hard to understand.

I love these. My kids use them for AP classes. It is really helpful. This is for class next year but the

ones i have gotten in the past have been very beneficial.

Good to access basic information. Good to have available when your studying late at night as a review.

Fast shipping, great quality.

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