

Study Guide (Midterm I)

1. Intro and Math Concepts

A. Units and SI

1. Precisely describe quantities.
2. SI units (m, kg, s, K, A, cd, mole)
3. Metric System: Prefixes
tera 10^{12} giga 10^9 mega 10^6 kilo 10^3 centi 10^{-2} milli 10^{-3} micro 10^{-6} nano 10^{-9} pico 10^{-12}
4. Precision and significant figures.
Unit conversion doesn't change precision, ALWAYS use scientific expression.

B. Units conversion:

1. Do not add or subtract quantities with **different** units.
2. Multiplying or dividing is okay.
3. Orders of magnitude,

C. Read and draw graphs.

Plot with graphic paper or Excel.

2. Scalars and Vectors

A. Definition of a vector.

What's the difference of a scalar and a vector?

Notation of the vector. \vec{V} , unit vector \hat{e}_v

What math rules does the scalar algebra have to follow?

What about the vector algebra?

B. Vector calculation (Adding/subtracting two vectors):

Graphically: (parallel shifting, triangle)

Project into components: How to project a vector into components? What is the magnitude of a vector? (*READ YOUR QuickStudy® Guide*)

Subtracting

3. Kinematics (motions):

A. Displacement, speed and velocity, acceleration.

1. How are they defined? What are their units? What is average velocity (acceleration) and instant velocity (acceleration)?
2. What are position vs time graphs, velocity vs time graphs, and acceleration vs time graphs? What is the relation between those graphs?
3. Special case: for the constant acceleration:

$$v = v_0 + at$$

$$x = x_0 + v_0t + \frac{1}{2}at^2$$

$$v^2 - v_0^2 = 2a(x - x_0)$$

4. Applications:

Free fall, projectile motion, uniform circular motion

5. Relative motions

4. Newton's Law and forces:

A. Newton's 1st, 2nd.

Definition, physical meaning, and application

B. Forces:

Drawing free body diagram.

Special forces: tension, normal force.

Dynamic problems: sliding along inclines, force balancing.