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# Physics Equations & Answers (Quick Study Academic)



## MATHEMATICAL CONCEPTS

<b>A. Vector Algebra</b> 1. Vector: Directly representable quantities using a, $\vec{a}$ , $\vec{b}$ , $\vec{c}$ , components ( $a_x, a_y, a_z$ ) a. Unit vector: $\hat{a}$ along $a$ , $\hat{b}$ along $b$ , $\hat{c}$ along $c$ b. Vector: $\vec{a} = a_x \hat{a} + a_y \hat{b} + a_z \hat{c}$ c. Graph of $\vec{a} = a_x \hat{a} + a_y \hat{b} + a_z \hat{c}$ 2. Addition of vectors $\vec{A} + \vec{B}$ , odd components: $\vec{A} + \vec{B} = (A_x + B_x) \hat{a} + (A_y + B_y) \hat{b} + (A_z + B_z) \hat{c}$ 3. Simple Addition and Length Calculations: $\vec{A} + \vec{B} = \sqrt{A_x^2 + B_x^2}$ $\vec{A} + \vec{B} = \sqrt{A_y^2 + B_y^2}$ $\vec{A} + \vec{B} = \sqrt{A_z^2 + B_z^2}$ $\vec{A} + \vec{B} = \sqrt{A_x^2 + B_x^2 + A_y^2 + B_y^2 + A_z^2 + B_z^2}$ Note: $ \vec{A} + \vec{B}  =  \vec{A} - \vec{B} $	<b>B. Cross or Vector Product</b> a. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$ (commute) b. Angle between $\vec{A}$ and $\vec{B}$ : vector $\vec{a}$ is perpendicular to $\vec{A} \times \vec{B}$ $\vec{a} \times \vec{B} = (a_x \hat{a} + a_y \hat{b} + a_z \hat{c}) \times (B_x \hat{a} + B_y \hat{b} + B_z \hat{c})$ c. Simple Vector Product: $\vec{A} \times \vec{B} = A_x B_x + A_y B_y + A_z B_z$ d. Cross Product: $\vec{A} \times \vec{B} = \sqrt{A_x^2 + B_x^2}$ e. Cross Product: $\vec{A} \times \vec{B} = \sqrt{A_y^2 + B_y^2}$ f. Cross Product: $\vec{A} \times \vec{B} = \sqrt{A_z^2 + B_z^2}$ Note: $ \vec{A} \times \vec{B}  =  \vec{A}   \vec{B}  \sin \theta$ g. Cross Product: $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = -\vec{A} \times \vec{B}$ $\sin \theta = \sqrt{1 - \cos^2 \theta} = \sqrt{1 - (A \cdot B)^2 / (A^2 B^2)} = \sqrt{1 - (A^2 + B^2 - A \cdot B)^2 / (A^2 B^2)}$
<b>B. Trigonometry</b> 1. Basic relationships for a triangle: $\alpha, \beta, \gamma$ $\sin \alpha = \frac{a}{c}$ $\cos \alpha = \frac{b}{c}$ $\tan \alpha = \frac{a}{b}$ $\csc \alpha = \frac{c}{a}$ $\sec \alpha = \frac{c}{b}$ $\cot \alpha = \frac{b}{a}$ 2. Sine Rule: $\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} = \frac{c}{\sin \gamma}$ 3. Cosine Rule: $c^2 = a^2 + b^2 - 2ab \cos \gamma$ $a^2 = b^2 + c^2 - 2bc \cos \alpha$ $b^2 = a^2 + c^2 - 2ac \cos \beta$	<b>C. The Right-Hand Rule</b> gives the orientation of $\vec{A} \times \vec{B}$ : a. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = -\vec{A} \times \vec{B}$ b. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = \vec{C}$ $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = \vec{C}$ c. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = \vec{C}$ d. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = \vec{C}$ e. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = \vec{C}$ f. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = \vec{C}$ g. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A} = \vec{C}$



## **Synopsis**

Essential tool for physics laws, concepts, variables and equations, including sample problems, common pitfalls and helpful hints.

## **Book Information**

Series: Quick Study Academic

Pamphlet: 6 pages

Publisher: QuickStudy; Lam Crds edition (February 14, 2006)

Language: English

ISBN-10: 1423201906

ISBN-13: 978-1423201908

Product Dimensions: 8.5 x 11 x 0.1 inches

Shipping Weight: 0.3 ounces (View shipping rates and policies)

Average Customer Review: 4.6 out of 5 stars 67 customer reviews

Best Sellers Rank: #12,689 in Books (See Top 100 in Books) #6 in Books > Science & Math > Physics > Mathematical Physics #14 in Books > Science & Math > Reference #46 in Books > Textbooks > Science & Mathematics > Physics

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Well made and designed.

GREAT

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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.

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