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# Physics Equations & Answers (Quick Study Academic)

| BASICS                    |               |                                         | FUNDAMENTAL PHYSICAL CONSTANTS |              |                                                  | CONVERSION FACTORS AND ALTERNATE UNITS |                                                           |
|---------------------------|---------------|-----------------------------------------|--------------------------------|--------------|--------------------------------------------------|----------------------------------------|-----------------------------------------------------------|
| Base Units                | Symbol        | Unit                                    | Base Units                     | Symbol       | Unit                                             | Unit                                   | Description                                               |
| Length                    | L             | Meter (m)                               | Mass of electron               | $m_e$        | $9.11 \times 10^{-31}$ kg                        | Angle                                  | degrees $360^\circ = 2\pi$ rad                            |
| Mass                      | M             | Kilogram (kg)                           | Mass of proton                 | $m_p$        | $1.67 \times 10^{-27}$ kg                        | Energy                                 | Erg $1 \text{ erg} = 10^{-7} \text{ J}$                   |
| Temperature               | T             | Kelvin (K)                              | Avogadro Constant              | $N_A$        | $6.02 \times 10^{23} \text{ mol}^{-1}$           | Energy                                 | Erg $1 \text{ erg} = 10^{-7} \text{ J}$                   |
| Time                      | t             | Second (s)                              | Elementary charge              | e            | $1.60 \times 10^{-19} \text{ C}$                 | Energy                                 | Kilowatt Hour $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$ |
| Electric Current          | I             | Ampere (A)                              | Faraday constant               | F            | $96,485 \text{ C/mol}$                           | Force                                  | Dyne $1 \text{ dyne} = 10^{-5} \text{ N}$                 |
| Derived Units             | Symbol        | Unit                                    | Speed of light                 | c            | $3 \times 10^8 \text{ m/s}$                      | Volume                                 | Cubic meter $1 \text{ m}^3 = 10^3 \text{ L}$              |
| Acceleration              | a             | $\text{m/s}^2$                          | Molar Gas Constant             | R            | $8.314 \text{ J/mol}^\circ\text{K}$              | Volume                                 | Cubic meter $1 \text{ m}^3 = 10^3 \text{ L}$              |
| Ang. Accel.               | a             | $\text{rad/s}^2$                        | Boltzmann Constant             | k            | $1.38 \times 10^{-23} \text{ J/K}$               | Pressure                               | Dyn $1 \text{ dyn} = 10^{-5} \text{ Pa}$                  |
| Ang. Momentum             | L             | $\text{kg m}^2/\text{s}$                | Gravitational Constant         | G            | $6.67 \times 10^{-11} \text{ m}^3/\text{kg s}^2$ | Length                                 | Angstrom $1 \text{ \AA} = 10^{-10} \text{ m}$             |
| Ang. Velocity             | $\omega$      | $\text{rad/s}$                          | Permeability of Space          | $\mu_0$      | $4\pi \times 10^{-7} \text{ N/A}^2$              |                                        |                                                           |
| Angle                     | $\theta$      | radian                                  | Permittivity of Space          | $\epsilon_0$ | $8.85 \times 10^{-12} \text{ F/m}$               |                                        |                                                           |
| Capacitance               | C             | Farad (F)                               |                                |              |                                                  |                                        |                                                           |
| Charge                    | Q             | Coulomb (C)                             |                                |              |                                                  |                                        |                                                           |
| Density                   | $\rho$        | $\text{kg/m}^3$                         |                                |              |                                                  |                                        |                                                           |
| Displacement              | x             | meter (m)                               |                                |              |                                                  |                                        |                                                           |
| Electric Field            | E             | V/m                                     |                                |              |                                                  |                                        |                                                           |
| Electric Flux             | $\Phi_E$      | V m                                     |                                |              |                                                  |                                        |                                                           |
| Electromotive Force (EMF) | $\mathcal{E}$ | Volt (V)                                |                                |              |                                                  |                                        |                                                           |
| Energy                    | E, U, K       | Joule (J) $\text{kg m}^2/\text{s}^2$    |                                |              |                                                  |                                        |                                                           |
| Entropy                   | S             | J/K                                     |                                |              |                                                  |                                        |                                                           |
| Force                     | F             | Newton (N) $\text{kg m/s}^2$            |                                |              |                                                  |                                        |                                                           |
| Frequency                 | f             | Hertz (Hz) $\text{s}^{-1}$              |                                |              |                                                  |                                        |                                                           |
| Heat                      | Q             | Joule (J)                               |                                |              |                                                  |                                        |                                                           |
| Magnetic Field            | B             | Tesla (T) $\text{kg}/\text{A m}^2$      |                                |              |                                                  |                                        |                                                           |
| Magnetic Flux             | $\Phi_B$      | Weber (Wb) $\text{kg m}^2/\text{A s}^2$ |                                |              |                                                  |                                        |                                                           |
| Momentum                  | p             | $\text{kg m/s}$                         |                                |              |                                                  |                                        |                                                           |
| Power                     | P             | Watt (W) $\text{J/s}$                   |                                |              |                                                  |                                        |                                                           |
| Pressure                  | P             | Pascal (Pa) $\text{N/m}^2$              |                                |              |                                                  |                                        |                                                           |
| Resistance                | R             | Ohm ( $\Omega$ ) $\text{V/A}$           |                                |              |                                                  |                                        |                                                           |
| Temperature               | T             | Kelvin (K)                              |                                |              |                                                  |                                        |                                                           |
| Velocity                  | v             | m/s                                     |                                |              |                                                  |                                        |                                                           |
| Volume                    | V             | $\text{m}^3$                            |                                |              |                                                  |                                        |                                                           |
| Wavelength                | $\lambda$     | meter (m)                               |                                |              |                                                  |                                        |                                                           |
| Work                      | W             | Joule (J) $\text{N m}$                  |                                |              |                                                  |                                        |                                                           |

  

| MATHEMATICAL CONCEPTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <b>1. Vector Algebra</b><br>a. Vector: Directed line segment having magnitude and direction.<br>b. Unit vector: A vector of unit length in the direction of a vector A.<br>c. Length of A: $ A  = \sqrt{A_x^2 + A_y^2}$<br>d. Addition of vectors A & B: add components.<br>$A + B = (A_x + B_x, A_y + B_y)$<br>e. Sample Addition and Length Calculations:<br>$A = 3\hat{i} + 4\hat{j}$ , $B = 5\hat{i} + 12\hat{j}$<br>$A + B = 8\hat{i} + 16\hat{j}$<br>$ A + B  = \sqrt{8^2 + 16^2} = \sqrt{320} = 17.9$<br>f. Subtraction: $A - B = (A_x - B_x, A_y - B_y)$<br>$A - B = 3\hat{i} + 4\hat{j} - 5\hat{i} - 12\hat{j} = -2\hat{i} - 8\hat{j}$<br>$ A - B  = \sqrt{(-2)^2 + (-8)^2} = \sqrt{68} = 8.25$<br>g. Dot product: $A \cdot B =  A  B \cos\theta$<br>$A \cdot B = (3\hat{i} + 4\hat{j}) \cdot (5\hat{i} + 12\hat{j}) = 15 + 48 = 63$<br>$\cos\theta = \frac{A \cdot B}{ A  B } = \frac{63}{5 \times 4} = 3.15$<br>$\theta = \cos^{-1}(3.15)$ (Not possible, check calculation)<br>h. Cross product: $A \times B =  A  B \sin\theta \hat{n}$<br>$A \times B = (3\hat{i} + 4\hat{j}) \times (5\hat{i} + 12\hat{j}) = 36\hat{k} - 20\hat{k} = 16\hat{k}$<br>$ A \times B  = 16$ | <b>2. Trigonometry</b><br>a. Sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$<br>b. Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$<br>c. Area of triangle: $\frac{1}{2}bc\sin A$<br>d. Vector projection: $A \cdot B =  A  B \cos\theta$<br>e. Sample Vector Product:<br>$A = 3\hat{i} + 4\hat{j}$ , $B = 5\hat{i} + 12\hat{j}$<br>$A \cdot B = 15 + 48 = 63$<br>$ A  = 5$ , $ B  = 13$<br>$\cos\theta = \frac{63}{5 \times 13} = 0.969$<br>$\theta = \cos^{-1}(0.969) = 5.7^\circ$<br>f. The Right hand rule gives the orientation of vector $A \times B$ . |



## Synopsis

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

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This study guide is a nice reference to have in my backpack for physics class. Seeing examples of mathematical concepts and theories really helps me learn the material, and the pamphlet format of these study guides is convenient and accessible for referencing when needed.

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.

Well made and designed.

GREAT

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