

| quantity, law                        | unit             | formula                                                                                       |
|--------------------------------------|------------------|-----------------------------------------------------------------------------------------------|
| Position ( $\vec{a}$ constant)       | m                | $\vec{r} = \vec{r}_0 + \vec{v}_0 t + \frac{1}{2} \vec{a} t^2$                                 |
| Velocity ( $\vec{a}$ constant)       | m/s              | $\vec{v} = \vec{v}_0 + \vec{a} t$                                                             |
| Momentum                             | kgm/s            | $\vec{p} = m\vec{v}$<br>$p = \frac{E}{c}$                                                     |
| Impulse                              | Ns               | $\vec{I} = \vec{F} \Delta t$                                                                  |
| Newton's second law                  |                  | $\sum \vec{F}_i = m\vec{a}$                                                                   |
| Kinetic frictional force             | N                | $F_\mu = \mu N$                                                                               |
| Torque                               | Nm               | $\vec{M} = \vec{r} \times \vec{F}$                                                            |
| Moment of inertia                    | kgm <sup>2</sup> | $J = \sum m_i r_i^2$                                                                          |
| Magnetic force                       | N                | $\vec{F} = q\vec{v} \times \vec{B}$<br>$\vec{F} = I\vec{\ell} \times \vec{B}$                 |
| Work                                 | J                | $W = \vec{F} \cdot \Delta \vec{r}$                                                            |
| Energy                               | J                | $E_p = mgh$<br>$E_k = \frac{1}{2} m v^2$<br>$E = hf$<br>$E = mc^2$<br>$E = \frac{1}{2} C U^2$ |
| Heat                                 | J                | $Q = cm\Delta T$                                                                              |
| Power                                | W                | $Q = Lm$<br>$P = \frac{W}{\Delta t}$<br>$P = UI$                                              |
| Electric field                       | V/m              | $\vec{E} = \frac{\vec{F}}{q}$                                                                 |
| Potential difference ( $E$ constant) | V                | $U = Ed$                                                                                      |
| ( $R$ constant)                      |                  | $U = RI$<br>$U = \frac{Q}{C}$                                                                 |

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|---------------------|-------------------|---------------------------------------|
| Induced emf         | V                 | $e = -N \frac{\Delta \Phi}{\Delta t}$ |
| Capacitance         | F                 | $C = \epsilon_0 \kappa \frac{A}{d}$   |
| Resistance          | $\Omega$          | $R = \rho \frac{\ell}{A}$             |
| Magnetic field      | A/m               | $\vec{H} = \frac{\vec{B}}{\mu}$       |
| Magnetic flux       | Wb                | $\Phi = \vec{A} \cdot \vec{B}$        |
| Density             | kg/m <sup>3</sup> | $\rho = \frac{m}{V}$                  |
| Amount of substance | mol               | $n = \frac{m}{M}$                     |
| Pressure            | Pa                | $p = \frac{F}{A}$<br>$p = \rho gh$    |
| Activity            | Bq                | $A = A_0 e^{-\lambda t}$              |
| Half-life           | s                 | $T_{1/2} = \frac{\ln 2}{\lambda}$     |

|  |                     |                     |                     |                     |                     |                                     |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------------------------|
|  |                     | ${}^{14}_7\text{N}$ | ${}^{15}_7\text{N}$ | ${}^{16}_7\text{N}$ | ${}^{17}_7\text{N}$ | ${}^{18}_7\text{N}$                 |
|  |                     | 99.634              | 0.366               | 7.13 s              | 4.173 s             | 624 ms                              |
|  |                     |                     |                     | $\beta^- \alpha$    | $\beta^- \text{ n}$ | $\beta^- \text{ n}, \beta^- \alpha$ |
|  | ${}^{12}_6\text{C}$ | ${}^{13}_6\text{C}$ | ${}^{14}_6\text{C}$ | ${}^{15}_6\text{C}$ | ${}^{16}_6\text{C}$ |                                     |
|  |                     |                     | 5730 a              | 2.449 s             | 0.747 s             |                                     |
|  |                     | 98.90               | 1.10                | $\beta^-$           | $\beta^-$           | $\beta^- \text{ n}$                 |
|  | ${}^{10}_5\text{B}$ | ${}^{11}_5\text{B}$ | ${}^{12}_5\text{B}$ | ${}^{13}_5\text{B}$ | ${}^{14}_5\text{B}$ |                                     |
|  |                     |                     | 20.2 ms             | 17.4 ms             | 13.8 ms             |                                     |
|  | 19.9                | 80.1                | $\beta^- 3\alpha$   | $\beta^- \text{ n}$ | $\beta^-$           |                                     |