

Particle Data

from D. Griffiths :

“Introduction to Elementary Particles”, 2nd edition

Mass in MeV/c², lifetime in seconds, charge in units of the proton charge

Leptons (spin 1/2)

Generation	Flavor	Charge	Mass*	Lifetime	Principal Decays
first	e (electron)	-1	0.510999	∞	-
	ν _e (e neutrino)	0	0	∞	-
second	μ (muon)	-1	105.659	2.19703 × 10 ⁻⁶	eν _e ν̄ _e
	ν _μ (μ neutrino)	0	0	∞	-
third	τ (tau)	-1	1776.99	2.91 × 10 ⁻¹³	eν _e ν̄ _e , μν _μ ν̄ _μ , π ⁻ ν _τ
	ν _τ (τ neutrino)	0	0	∞	-

*Neutrino masses are extremely small, and for most purposes can be taken to be zero; for details see Chapter 11.

Quarks (spin 1/2)

Generation	Flavor	Charge	Mass*
first	d (down)	-1/3	7
	u (up)	2/3	3
second	s (strange)	-1/3	120
	c (charm)	2/3	1200
third	b (bottom)	-1/3	4300
	t (top)	2/3	174000

*Light quark masses are imprecise and speculative; for effective masses in mesons and baryons, see Chapter 5.

Mediators (spin 1)

Force	Mediator	Charge	Mass*	Lifetime	Principal Decays
Strong	g (8 gluons)	0	0	∞	-
Electromagnetic	γ (photon)	0	0	∞	-
Weak	W [±] (charged)	±1	80,420	3.11 × 10 ⁻²⁵	e ⁺ ν _e , μ ⁺ ν _μ , τ ⁺ ν _τ , cX → hadrons
	Z ⁰ (neutral)	0	91,190	2.64 × 10 ⁻²⁵	e ⁺ e ⁻ , μ ⁺ μ ⁻ , τ ⁺ τ ⁻ , q \bar{q} → hadrons

Baryons (spin 1/2)

Baryon	Quark Content	Charge	Mass	Lifetime	Principal Decays
N	p	1	938.272	∞	-
	n	0	939.565	885.7	pν̄ _e
Λ	uds	0	1115.68	2.63 × 10 ⁻¹⁰	pπ ⁻ , nπ ⁰
Σ ⁺	uus	1	1189.37	8.02 × 10 ⁻¹¹	pπ ⁰ , nπ ⁺
Σ ⁰	uds	0	1192.64	7.4 × 10 ⁻²⁰	Λγ
Σ ⁻	dds	-1	1197.45	1.48 × 10 ⁻¹⁰	nπ ⁻
Ξ ⁰	uss	0	1314.8	2.90 × 10 ⁻¹⁰	Λπ ⁰
Ξ ⁻	dss	-1	1321.3	1.64 × 10 ⁻¹⁰	Λπ ⁻
Λ _c ⁺	udc	1	2286.5	2.00 × 10 ⁻¹³	pKπ, Λππ, Σππ

Baryons (spin 3/2)

Baryon	Quark Content	Charge	Mass	Lifetime	Principal Decays
Δ	uuu, uud, udd, ddd	2,1,0,-1	1232	5.6 × 10 ⁻²⁴	Nπ
Σ*	uus, uds, dds	1,0,-1	1385	1.8 × 10 ⁻²³	Λπ, Σπ
Ξ*	uss, dss	0,-1	1533	6.9 × 10 ⁻²³	Ξπ
Ω ⁻	sss	-1	1672	8.2 × 10 ⁻¹¹	ΛK ⁻ , Ξπ

Pseudoscalar Mesons (spin 0)

Meson	Quark Content	Charge	Mass	Lifetime	Principal Decays
π [±]	u \bar{d} , d \bar{u}	1,-1	139.570	2.60 × 10 ⁻⁸	μν _μ
π ⁰	(u \bar{u} - d \bar{d})/√2	0	134.977	8.4 × 10 ⁻¹⁷	γγ
K [±]	u \bar{s} , s \bar{u}	1,-1	493.68	1.24 × 10 ⁻⁸	μν _μ , ππ, πππ
K ⁰ , \bar{K}^0	d \bar{s} , s \bar{d}	0	497.65	$\left\{ \begin{array}{l} K_S^0: 8.95 \times 10^{-11} \\ K_L^0: 5.11 \times 10^{-8} \end{array} \right.$	ππ
					πeν _e , πμν _μ , πππ
η	(u \bar{u} + d \bar{d} - 2s \bar{s})/√6	0	547.51	5.1 × 10 ⁻¹⁹	γγ, πππ
η'	(u \bar{u} + d \bar{d} + s \bar{s})/√3	0	957.78	3.2 × 10 ⁻²¹	ηππ, ργ
D [±]	c \bar{d} , d \bar{c}	1,-1	1869.3	1.04 × 10 ⁻¹²	Kππ, Kμν _μ , Keν _e
D ⁰ , \bar{D}^0	c \bar{u} , u \bar{c}	0	1864.5	4.1 × 10 ⁻¹³	Kππ, Keν _e , Kμν _μ
D _s [±]	c \bar{s} , s \bar{c}	1,-1	1968.2	5.0 × 10 ⁻¹³	ηρ, φππ, φρ
B [±]	u \bar{b} , b \bar{u}	1,-1	5279.0	1.6 × 10 ⁻¹²	D [*] ℓν _ℓ , Dℓν _ℓ , D [*] πππ
B ⁰ , \bar{B}^0	d \bar{b} , b \bar{d}	0	5279.4	1.5 × 10 ⁻¹²	D [*] ℓν _ℓ , Dℓν _ℓ , D [*] ππ

Vector Mesons (spin 1)

Meson	Quark Content	Charge	Mass	Lifetime	Principal Decays
ρ	u \bar{d} , (u \bar{u} - d \bar{d})/√2, d \bar{u}	1,0,-1	775.5	4 × 10 ⁻²⁴	ππ
K*	u \bar{s} , d \bar{s} , s \bar{d} , s \bar{u}	1,0,-1	894	1 × 10 ⁻²³	Kπ
ω	(u \bar{u} + d \bar{d})/√2	0	782.6	8 × 10 ⁻²³	πππ, πγ
ψ	c \bar{c}	0	3097	7 × 10 ⁻²¹	e ⁺ e ⁻ , μ ⁺ μ ⁻ , 5π, 7π
D*	c \bar{d} , c \bar{u} , u \bar{c} , d \bar{c}	1,0,-1	2008	3 × 10 ⁻²¹	Dπ, Dγ
Υ	b \bar{b}	0	9460	1 × 10 ⁻²⁰	e ⁺ e ⁻ , μ ⁺ μ ⁻ , τ ⁺ τ ⁻

“If I could remember the names of all these particles I would be a botanist” *Enrico Fermi*