QUARKS

The u-, d-, and s-quark masses are estimates of so-called "current-quark masses," in a mass-independent subtraction scheme such as $\overline{\text{MS}}$ at a scale $\mu \approx 2$ GeV. The c- and b-quark masses are the "running" masses in the $\overline{\text{MS}}$ scheme. For the b-quark we also quote the 1S mass. These can be different from the heavy quark masses obtained in potential models.

u

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

$m_u = 1.7$–3.3 MeV Charge $= \frac{2}{3}\ e$ $I_z = +\frac{1}{2}$
$m_u/m_d = 0.35$–0.60

d

$I(J^P) = \frac{1}{2}(\frac{1}{2}^+)$

$m_d = 4.1$–5.8 MeV Charge $= -\frac{1}{3}\ e$ $I_z = -\frac{1}{2}$
$m_s/m_d = 17$ to 22
$\overline{m} = (m_u+m_d)/2 = 3.0$–$4.8$ MeV

s

$I(J^P) = 0(\frac{1}{2}^+)$

$m_s = 101^{+29}_{-21}$ MeV Charge $= -\frac{1}{3}\ e$ Strangeness $= -1$
$m_s\ /\ ((m_u + m_d)/2) = 22$ to 30

c

$I(J^P) = 0(\frac{1}{2}^+)$

$m_c = 1.27^{+0.07}_{-0.09}$ GeV Charge $= \frac{2}{3}\ e$ Charm $= +1$

b

$I(J^P) = 0(\frac{1}{2}^+)$

Charge $= -\frac{1}{3}\ e$ Bottom $= -1$

$m_b(\overline{\text{MS}}) = 4.19^{+0.18}_{-0.06}$ GeV
$m_b(1\text{S}) = 4.67^{+0.18}_{-0.06}$ GeV

t

$I(J^P) = 0(\frac{1}{2}^+)$

Charge $= \frac{2}{3}\ e$ Top $= +1$

Mass $m = 172.0 \pm 0.9 \pm 1.3$ GeV [a] (direct observation of top events)
Full width $\Gamma < 13.1$ GeV, CL = 95%
$\Gamma(W\,b)/\Gamma(W\,q(q = b,\, s,\, d)) = 0.99^{+0.09}_{-0.08}$

***t* DECAY MODES**		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$W\,q(q = b,\, s,\, d)$				–
$W\,b$				–
$\ell\,\nu_\ell$ anything		[b,c] (9.4±2.4) %		–
$\gamma\,q(q{=}u,c)$		[d] $< 5.9 \times 10^{-3}$	95%	–
$\Delta T = 1$ weak neutral current (*T1*) modes				
$Z\,q(q{=}u,c)$	*T1*	[e] < 3.7 %	95%	–

b′ (4*th* Generation) Quark, Searches for

Mass $m >$ 190 GeV, CL = 95% ($p\overline{p}$, quasi-stable b')
Mass $m >$ 199 GeV, CL = 95% ($p\overline{p}$, neutral-current decays)
Mass $m >$ 128 GeV, CL = 95% ($p\overline{p}$, charged-current decays)
Mass $m >$ 46.0 GeV, CL = 95% ($e^+\,e^-$, all decays)

t′ (4*th* Generation) Quark, Searches for

Mass $m >$ 256 GeV, CL = 95% ($p\overline{p}$, $t'\overline{t}'$ prod., $t' \rightarrow W\,q$)

Free Quark Searches

All searches since 1977 have had negative results.

NOTES

[a] Based on published top mass measurements using data from Tevatron Run-I and Run-II. Including also the most recent unpublished results from Run-II, the Tevatron Electroweak Working Group reports a top mass of 173.1 ± 0.6 ± 1.1 GeV. See the note "The Top Quark' in the Quark Particle Listings of this *Review*.

[b] ℓ means e or μ decay mode, not the sum over them.

[c] Assumes lepton universality and W-decay acceptance.

[d] This limit is for $\Gamma(t \rightarrow \gamma\,q)/\Gamma(t \rightarrow W\,b)$.

[e] This limit is for $\Gamma(t \rightarrow Z\,q)/\Gamma(t \rightarrow W\,b)$.