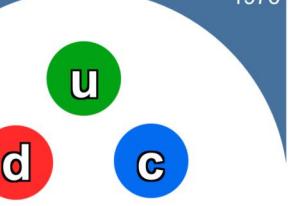
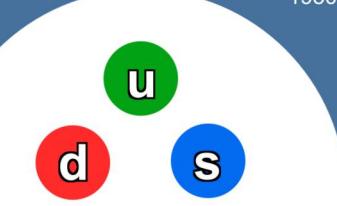
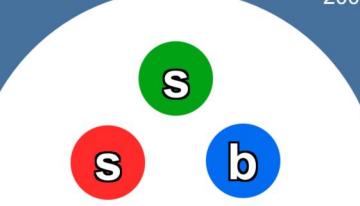
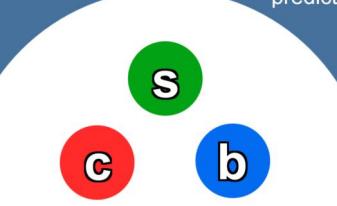
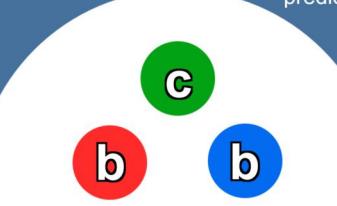
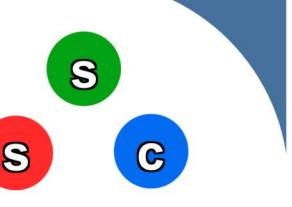
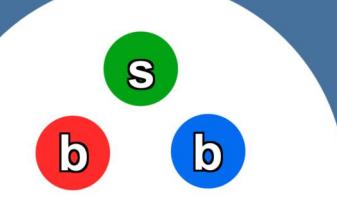
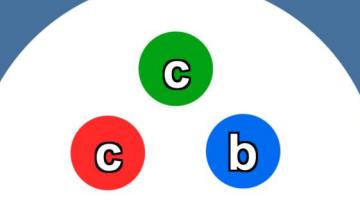
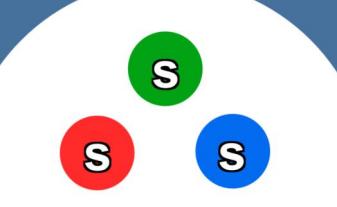
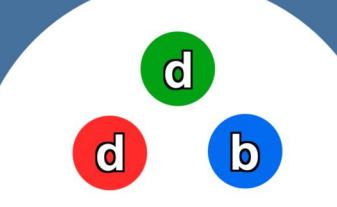
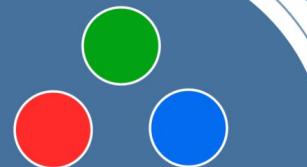
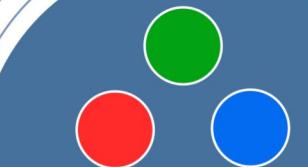


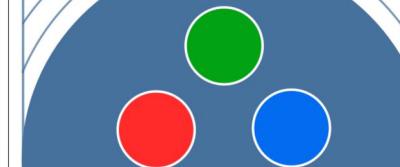
<p>14</p> <p>$+1e$ 2286.46 MeV/c2 2.0×10^{-13} s 1976</p>  <p>Charmed Lambda (Λ_c^+) $(\bar{u}dc)$</p> <p>The lightest baryon with a charm; could be detected using nuclear emulsion, a modified photographic plate where individual particle tracks are measured using a microscope.</p>	<p>12</p> <p>$0e$ 1115.683 MeV/c2 2.632×10^{-10} s 1950</p>  <p>Lambda (Λ) $(\bar{u}ds)$</p> <p>First detected as produced by cosmic rays in photographic emulsions flown in a balloon at 21,000 m, its much longer lifetime than expected helped define "strangeness".</p>	<p>22</p> <p>$-1e$ 6046 MeV/c2 1.64×10^{-12} s 2008</p>  <p>Bottom Omega (Ω_b^-) $(\bar{ss}\bar{b})$</p> <p>One of the heaviest baryons observed. Discovery was first claimed in 2008, but with a mass much higher than expected; detected in 2009 with the expected mass.</p>	<p>24</p> <p>$0e$ Unknown Unknown predicted</p>  <p>Charmed Bottom Omega (Ω_{cb}^0) $(\bar{s}cb)$</p> <p>This predicted baryon would help physicists understand the interplay between charm, bottom, and strange quarks inside a single particle.</p>	<p>28</p> <p>$-1e$ $\sim 10,000$ MeV/c2 Unknown predicted</p>  <p>Charmed Double Bottom Omega $(\bar{c}\bar{bb})$</p> <p>Exotic triply-heavy state. Predicted by quantum chromodynamics (QCD) but yet to be experimentally confirmed.</p>
<p>20</p> <p>$0e$ 2695.2 MeV/c2 6.9×10^{-14} s 1984</p>  <p>Charmed Omega (Ω_c^0) $(\bar{ss}c)$</p> <p>Produced in high-energy collisions, its short lifetime and rare decays make it a valuable tool for testing the behavior of the weak force in baryons.</p>	<p>26</p> <p>$\sim 10,200$ MeV/c2 Unknown predicted</p>  <p>Double Bottom Omega (Ω_{bb}^-) $(\bar{s}\bar{bb})$</p> <p>With two bottom quarks and a strange quark, this baryon is predicted to be extremely stable against strong decays, decaying only via the weak force.</p>	<p>26</p> <p>$\sim 8,000$ MeV/c2 Unknown predicted</p>  <p>Double Charmed Bottom Omega (\bar{ccb})</p> <p>A baryon with two charm quarks and one bottom, its observation would be a milestone for multi-heavy-quark physics and QCD.</p>	<p>20</p> <p>$-1e$ 1672.45 MeV/c2 0.821×10^{-10} s 1964</p>  <p>Omega (Ω^-) (\bar{sss})</p> <p>Its existence, mass and decay products confirmed the quark model before quarks were even widely accepted.</p>	<p>18</p> <p>$-1e$ 5816 MeV/c2 $\sim 10^{-23}$ s 2006</p>  <p>Bottom Sigma (Σ_b^-) (\bar{ddb})</p> <p>Among the heaviest Sigma baryons, about six times heavier than protons, while strange sigma baryons are only slightly heavier than protons.</p>



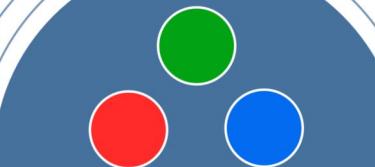
Baryon



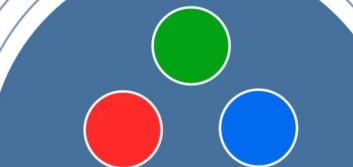
Baryon



Baryon



Baryon



Baryon



Baryon



Baryon



Baryon



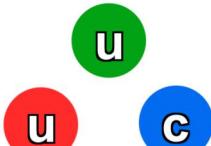
Baryon



Baryon

12

$+2e$
2454 MeV/c 2
 $\sim 10^{-23}$ s
1976



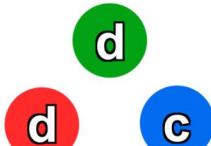
Charmed Sigma
(Σ^{++}_c)

(uuc)

important for studying the dynamics of charm quarks inside baryons and for testing predictions of quantum chromodynamics (QCD) in the heavy quark sector.

16

$0e$
2454 MeV/c 2
 $\sim 10^{-23}$ s
1976



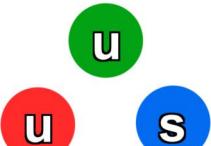
Charmed Sigma
(Σ_c^0)

(ddc)

Its properties, such as mass and lifetime, help refine theoretical models of baryon structure and the strong interaction.

10

$+1e$
1189.37 MeV/c 2
 0.8018×10^{-10} s
1953



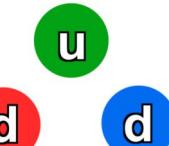
Sigma (Σ^+)

(uus)

The Σ^+ baryon played a key role in the development of the quark model and the understanding of strangeness in particle physics.

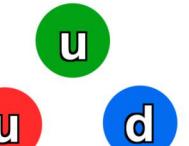
0

$0e$
939.565 MeV/c 2
880 s
1932



Neutron (n)

Stable inside nuclei but decays with a half-life of about 15 minutes when free.

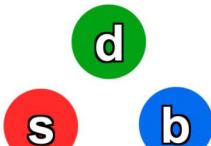


Proton (p)

Constitutes the nucleus of every atom and is stable under normal conditions.

20

$-1e$
5797 MeV/c 2
 1.56×10^{-12} s
2007



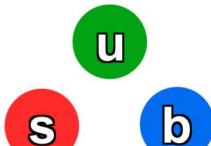
Bottom Xi (Ξ^-_b)

(dsv)

the first known particle made of quarks from all three quark generations.

18

$0e$
5791 MeV/c 2
 1.57×10^{-12} s
2007



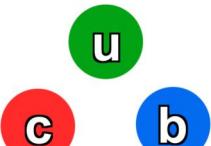
Bottom Xi (Ξ^0_b)

(usv)

The Ξ^-_b sits at the crossroads of three quark generations. It offers insight into how the strong force handles both strangeness and bottomness in a single particle.

20

$+1e$
6051 MeV/c 2
Unknown predicted

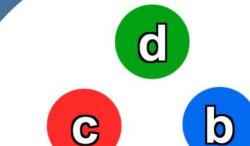


Charmed Bottom Xi
(Ξ^+_{cb})

(ucb)

The existence of this baryon would allow new tests of heavy quark symmetry and flavor interactions.

22



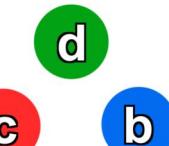
Charmed Bottom Xi
(Ξ^0_{cb})

(dcv)

A heavy hybrid of charm and bottom flavors, this baryon helps physicists probe the boundary between the known and unknown.

16

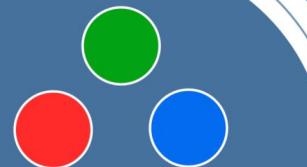
$+1e$
2468 MeV/c 2
 4.42×10^{-13} s
1983



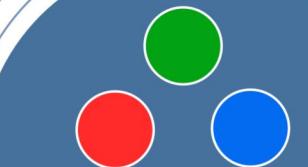
Charmed Xi (Ξ^+_c)

(usc)

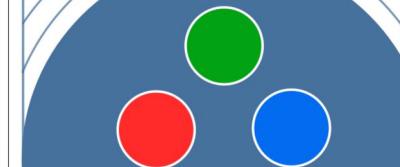
These particles provide valuable insight into heavy-quark dynamics and the structure of matter.



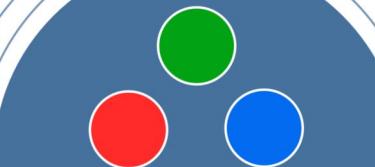
Baryon



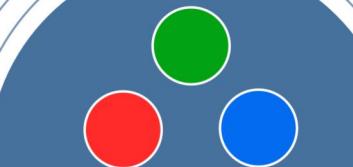
Baryon



Baryon



Baryon



Baryon



Baryon



Baryon



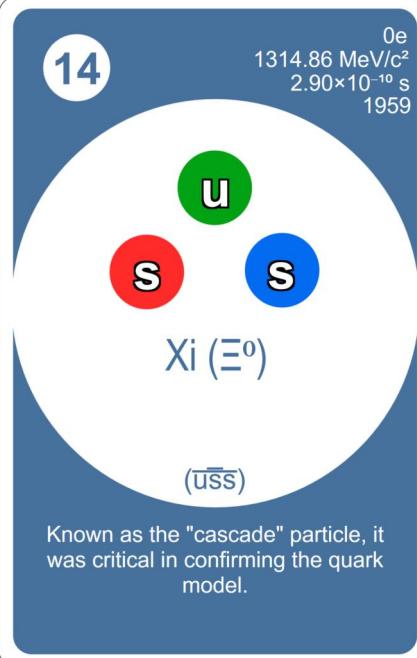
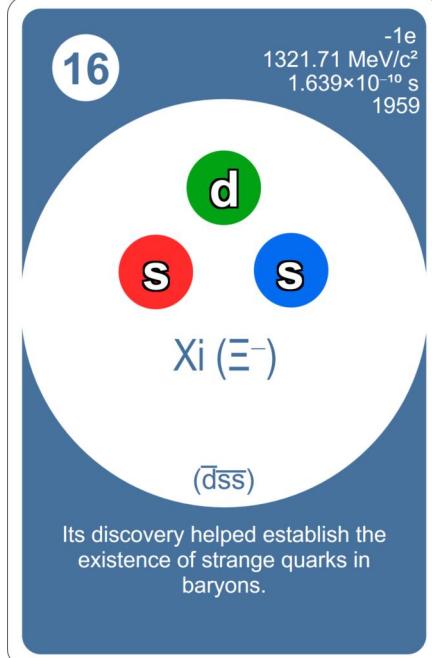
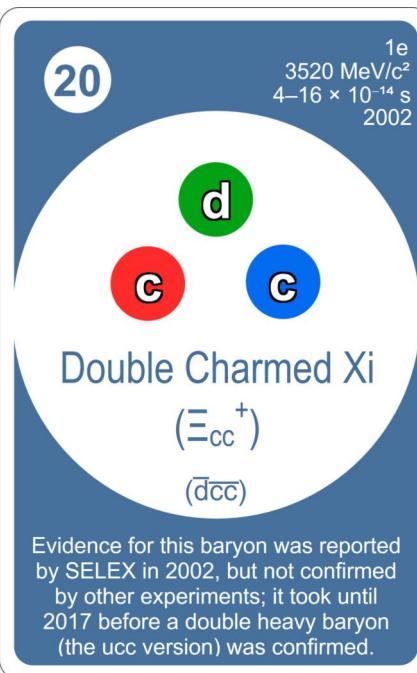
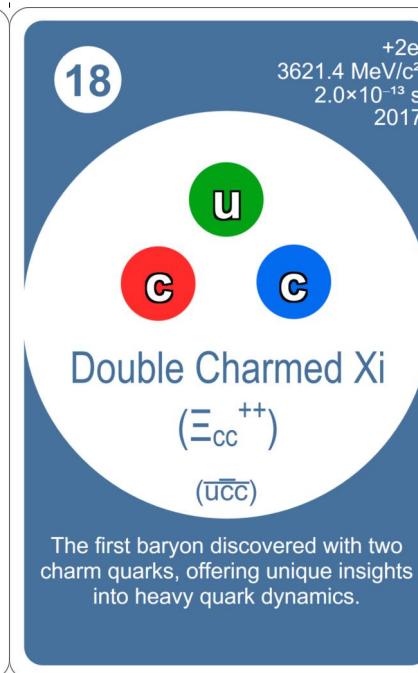
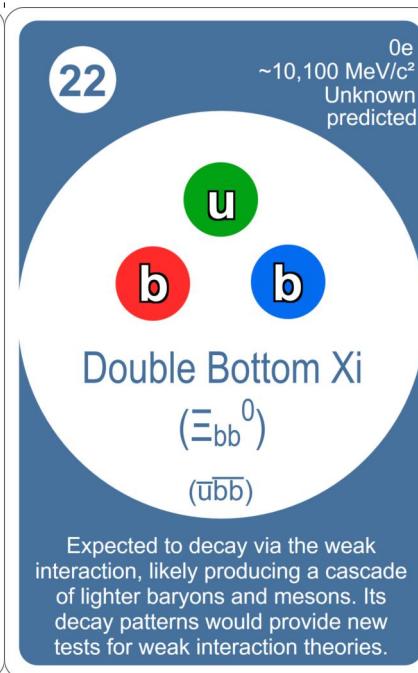
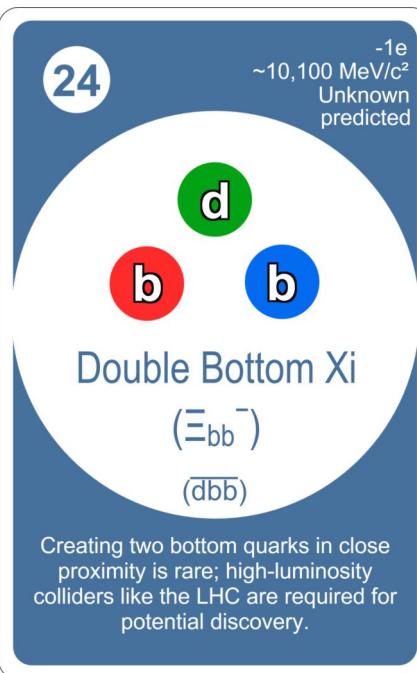
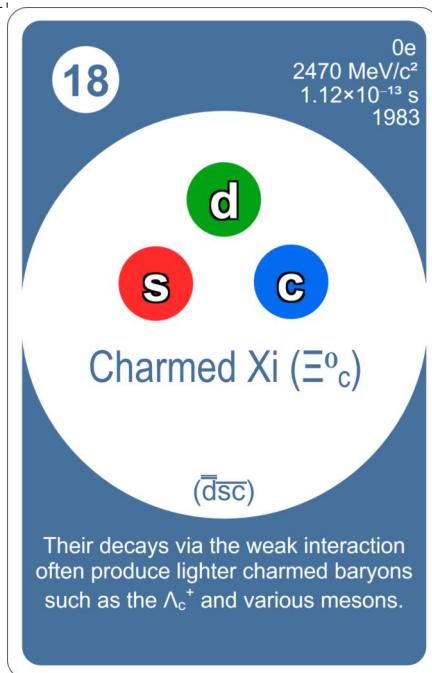
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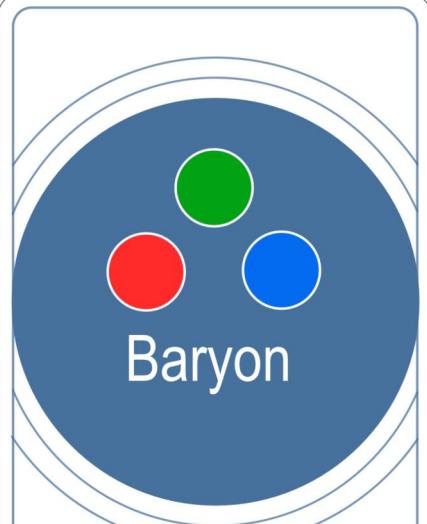


Baryon



Baryon





Baryon



Baryon



Baryon



Baryon



Baryon



Baryon



Baryon

15

$0e$
5280 MeV/c 2
 1.519×10^{-12} s
1983



Anti B Meson

 \bar{B}^0

The antiparticle of B^0 , \bar{B}^0 participates in quantum mixing and CP violation studies, offering insights into why the universe favors matter over antimatter.

17

$0e$
5367 MeV/c 2
 1.509×10^{-12} s
1983

Anti B_s Meson \bar{B}_s^0

Flavor oscillations, transforming into B_s^0 and back, and its extremely rare decays into pairs of muons make it a sensitive probe for studying physics beyond the Standard Model.

13

$+1e$
5279 MeV/c 2
 1.638×10^{-12} s
1983



B Meson

 B^+

Its decay patterns provide crucial tests of the Standard Model and help refine our understanding of quark mixing.

13

$-1e$
5279 MeV/c 2
 1.638×10^{-12} s
1983



B Meson

 B^-

This B meson decays differently than its antimatter counterpart (a CP violation). This rare behaviour helps the investigation of why the universe contains more matter than antimatter.

15

$0e$
5280 MeV/c 2
 1.519×10^{-12} s
1983



B Meson

 B^0

B^0 is renowned for its ability to oscillate into its own antiparticle. This phenomenon, known as $B^0-\bar{B}^0$ mixing, is a key probe of CP violation in the universe.

17

$0e$
5367 MeV/c 2
 1.509×10^{-12} s
1983

 B_s Meson B_s^0

The B_s^0 meson is a neutral particle whose ultra-rare decays—such as into two muons—are powerful tools for searching for new physics beyond the Standard Model.

19

$+1e$
6274 MeV/c 2
 0.507×10^{-12} s
1998



Charmed Bottom Meson
 B_c^+

A unique meson made of two different heavy quarks. It decays through both quarks, providing a rare testing ground for weak interaction dynamics across heavy flavours.

19

$-1e$
6274 MeV/c 2
 0.507×10^{-12} s
1998



Charmed Bottom Meson
 B_c^-

Its discovery confirmed predictions about heavy quark bound states and decay mechanisms.

13

$-1e$
1870 MeV/c 2
 1.040×10^{-12} s
1976



Anti D Meson

 D^-

The antiparticle of the D^+ , mirroring its decay behavior but playing a crucial role in studying matter-antimatter asymmetry.

11

$0e$
1865 MeV/c 2
 4.101×10^{-13} s
1976



Anti D Meson

 \bar{D}^0

The antiparticle of the D^0 , it participates in quantum mixing phenomena and provides a window into the mechanisms behind charm quark transitions and CP violation.



Meson



Meson



Meson



Meson



Meson



Meson



Meson



Meson



Meson



Meson

<p>13</p>  <p>D Meson</p> <p>D^+</p> <p>The first meson discovered containing a charm quark; Its relatively longer lifetime among charm mesons makes it a key player in precision decay studies.</p>	<p>11</p>  <p>D Meson</p> <p>D^0</p> <p>A neutral meson known for D^0-\bar{D}^0 mixing, offering a subtle window into CP violation beyond the Standard Model. Despite its charm, it decays weakly and swiftly.</p>	<p>15</p>  <p>Strange D Meson</p> <p>D_s^+</p> <p>Combining charm and strangeness, the D_s^+ decays faster than its lighter cousins — a signature of the strong phase space it commands.</p>	<p>15</p>  <p>Strange D Meson</p> <p>D_s^-</p> <p>The strange-charmed antiparticle of the D_s^+, often produced in high-energy collisions. Its decay channels probe the structure of weak interactions.</p>	<p>21</p>  <p>Bottom Eta Meson</p> <p>η_b</p> <p>A low-energy, spin-0 particle, it helps physicists test how the strong force behaves between very heavy quarks.</p>
<p>17</p>  <p>Charmed Eta Meson</p> <p>η_c</p> <p>The lightest bound state of charm and anticharm quarks, important for testing QCD predictions.</p>	<p>11</p>  <p>Anti Kaon</p> <p>\bar{K}^0</p> <p>Does not have an independent lifetime because neutral kaons (K^0 and \bar{K}^0) only exist as quantum mechanical mixtures of two weak eigenstates: the short-lived K_s^0 and long-lived K_L^0.</p>	<p>9</p>  <p>Kaon</p> <p>K^+</p> <p>The first particle to reveal the "strangeness" quantum number, leading to major advances in particle physics.</p>	<p>9</p>  <p>Kaon</p> <p>K^-</p> <p>Played a central role in the discovery of CP violation in the 1960s.</p>	<p>11</p>  <p>Kaon</p> <p>K^0</p> <p>The discovery that K_L^0 (long-lived state of the K^0 and \bar{K}^0 mixture) can decay into two pions revealed CP violation, a fundamental asymmetry between matter and antimatter.</p>



Meson



Meson



Meson



Meson



Meson



Meson



Meson



Meson



Meson



Meson

130e
1019 MeV/c²
 1.55×10^{-22} s
1962**Phi Meson** ϕ

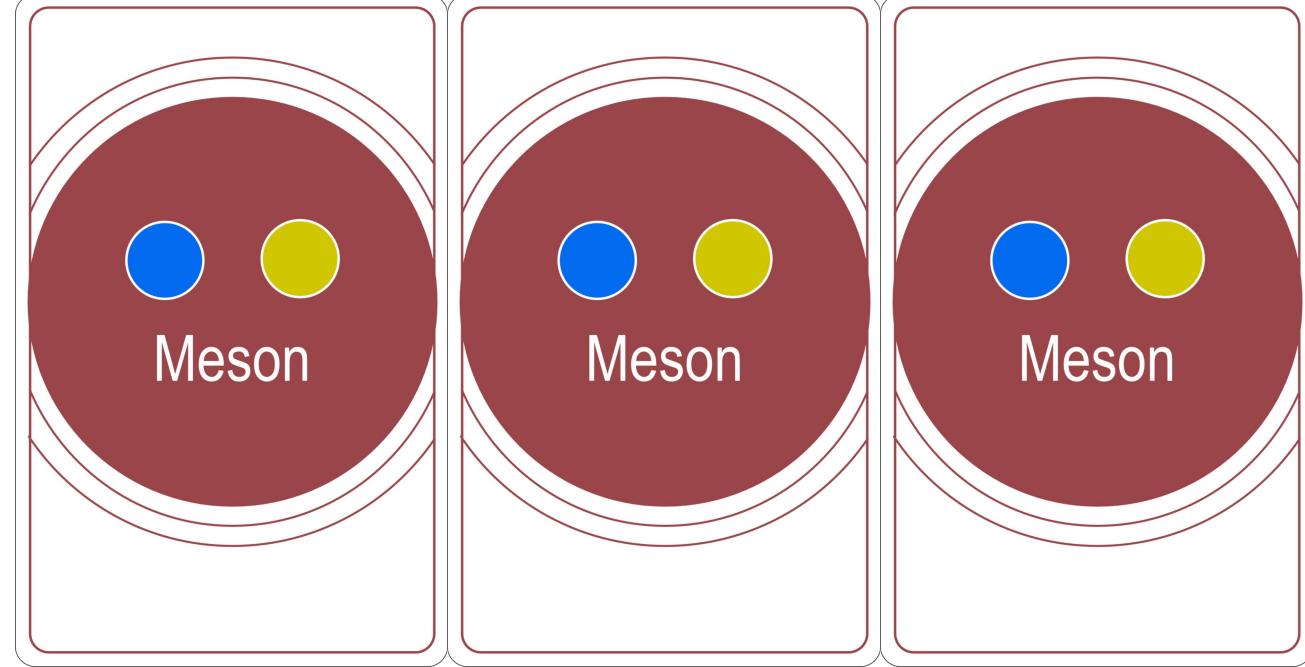
A vector meson (with a spin of 1) that is long-lived for its mass class. With its clean decay into kaons, the ϕ is a key probe of the strong force and strange quark interactions.

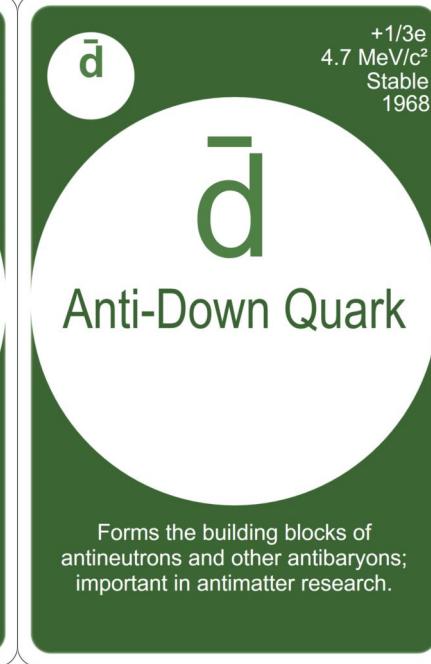
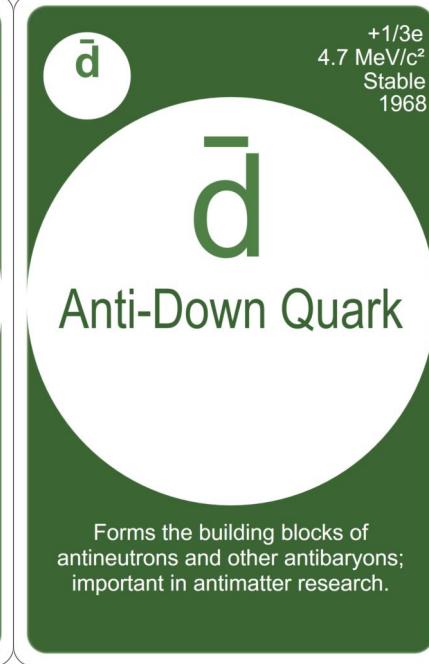
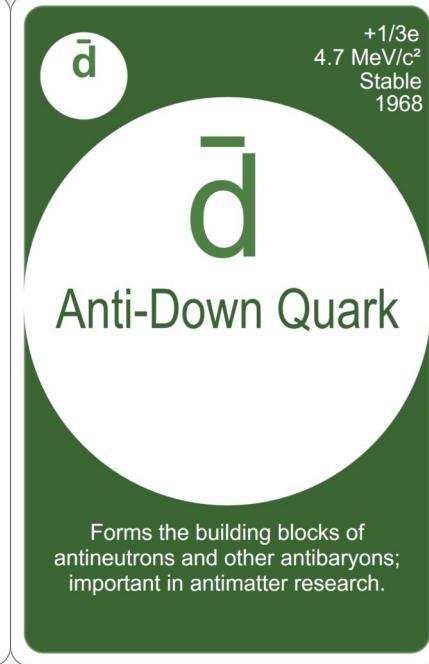
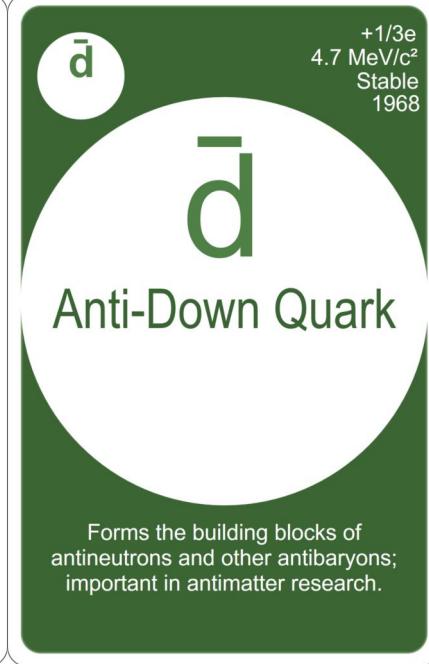
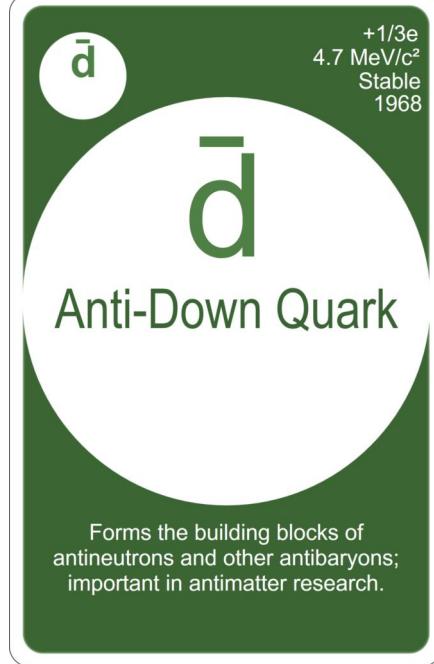
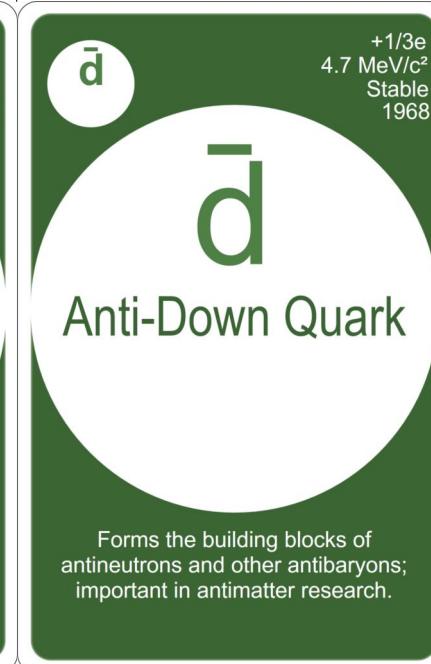
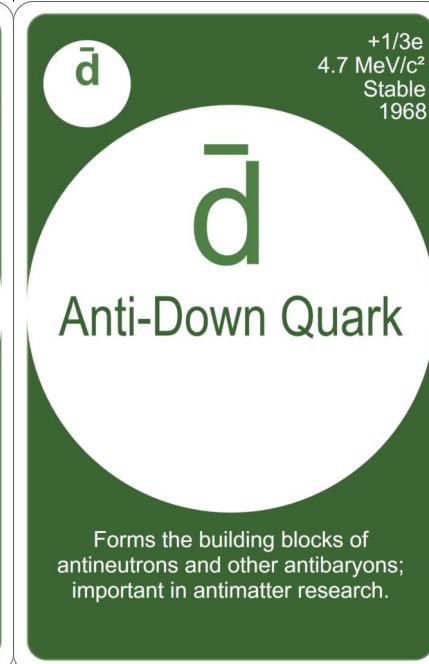
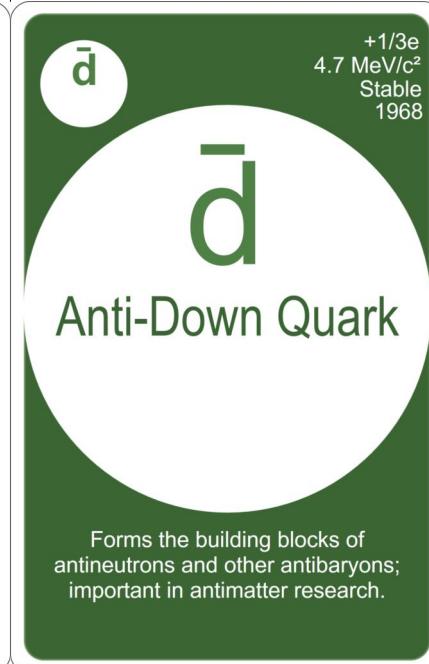
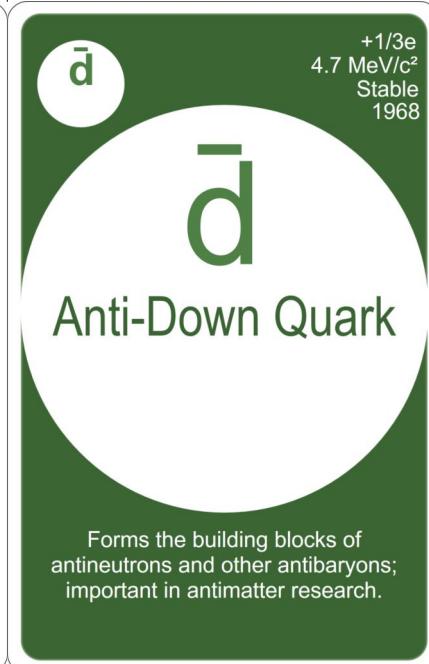
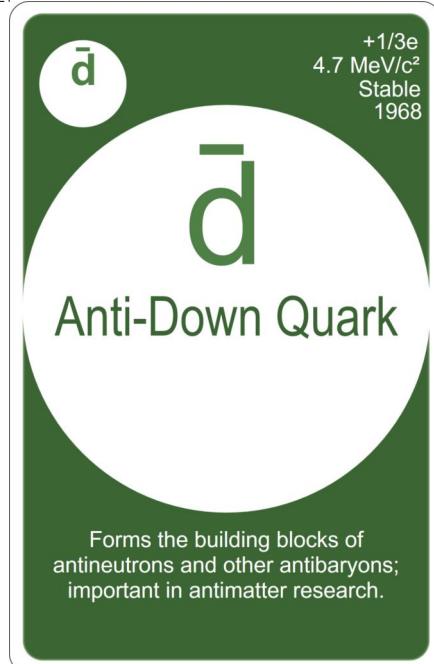
7+1e
139.57 MeV/c²
 2.603×10^{-8} s
1947**Pion** π^+

A cornerstone of weak interactions. As the primary product of many decays, the π^+ plays a central role in tracing energy through particle cascades.

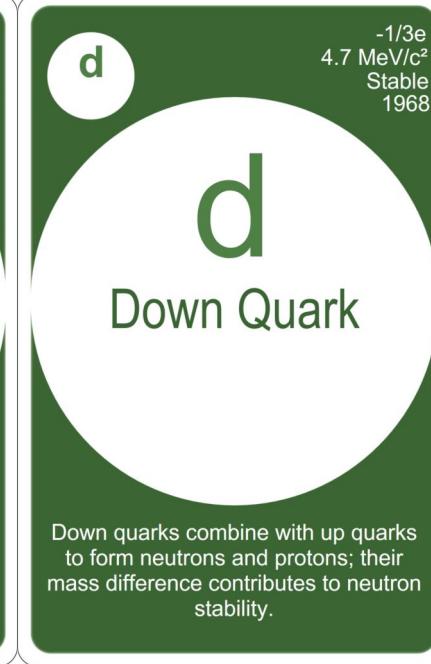
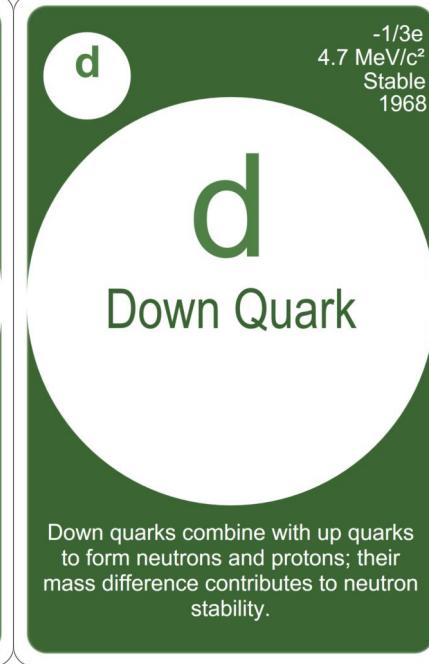
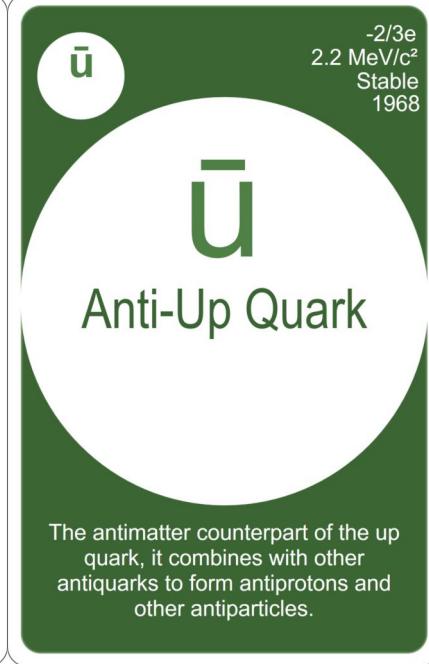
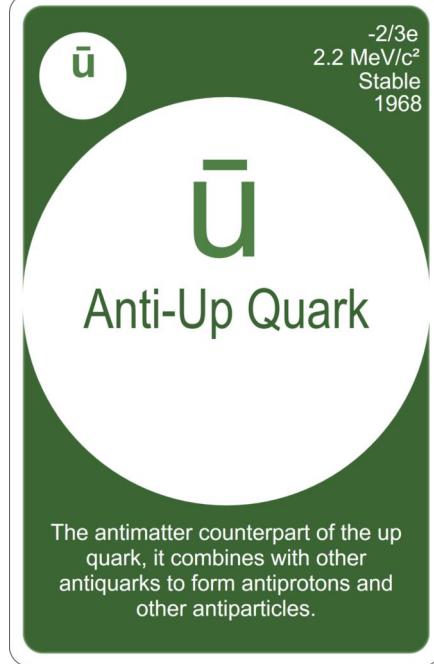
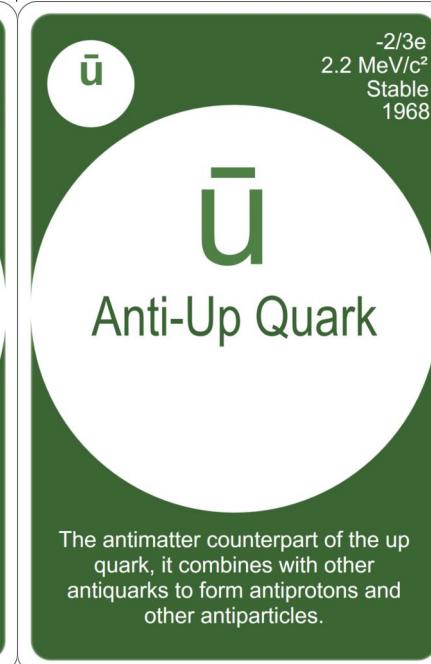
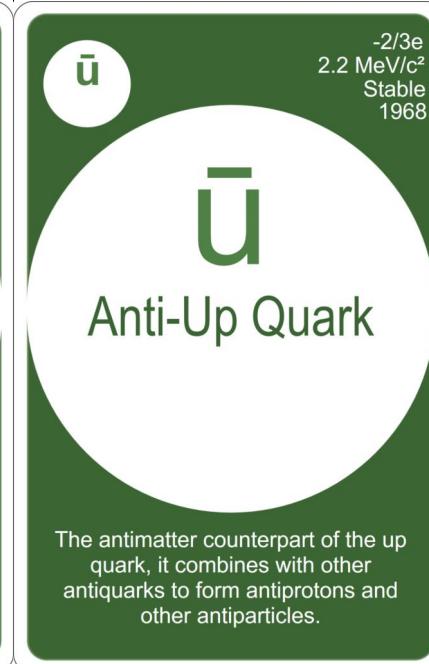
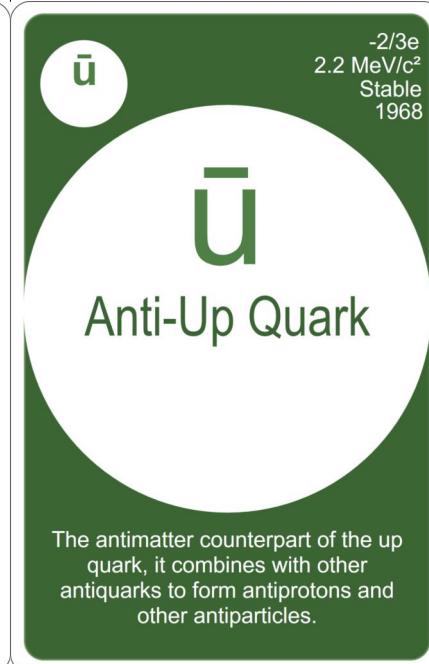
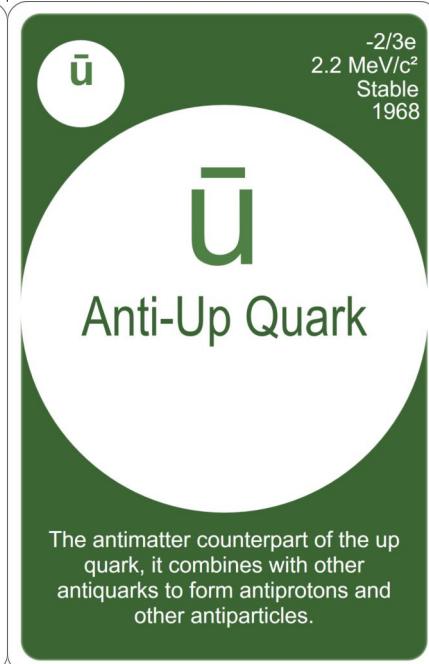
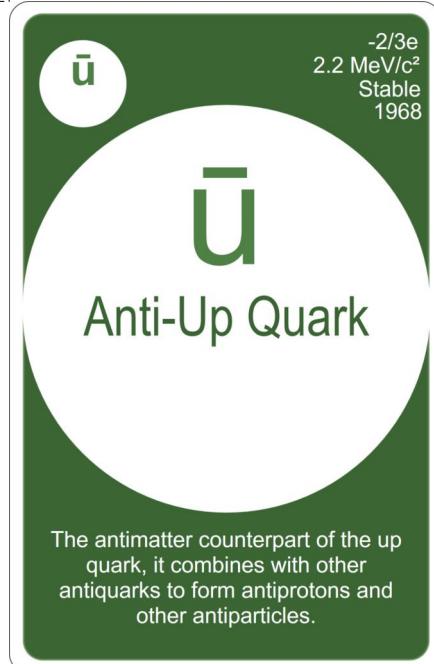
7-1e
139.57 MeV/c²
 2.603×10^{-8} s
1947**Pion** π^-

The π^+ 's antimatter twin, with identical mass but opposite charge. Often captured by nuclei, its decays have shaped our understanding of weak forces.

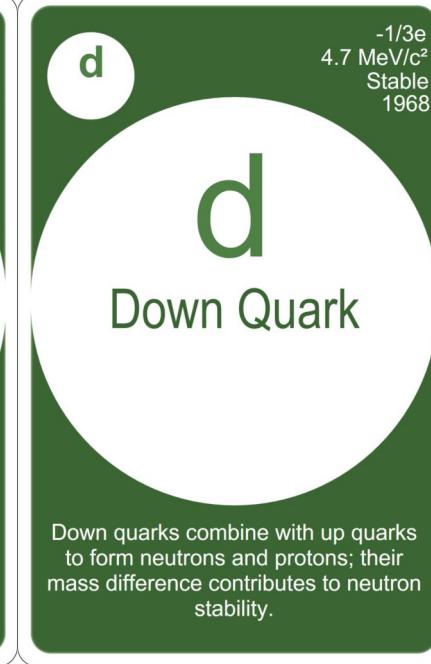
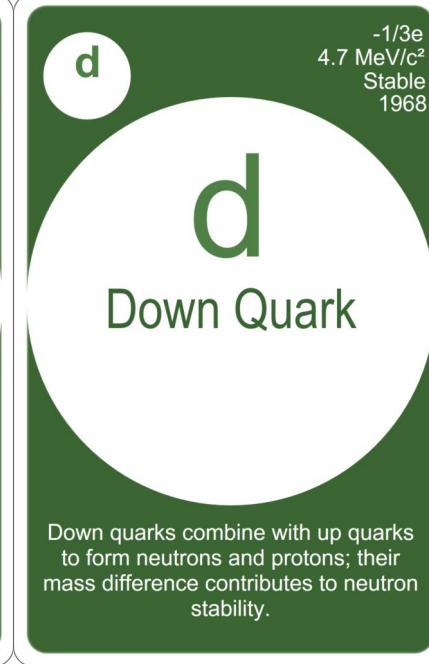
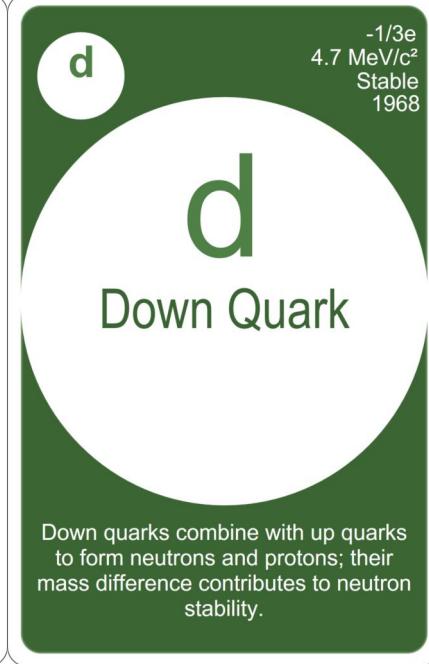
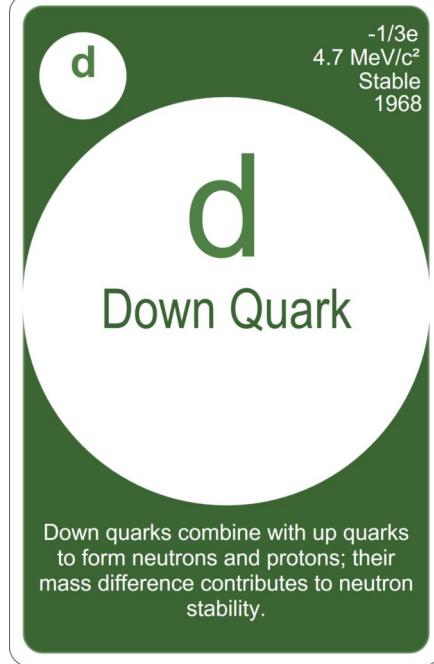
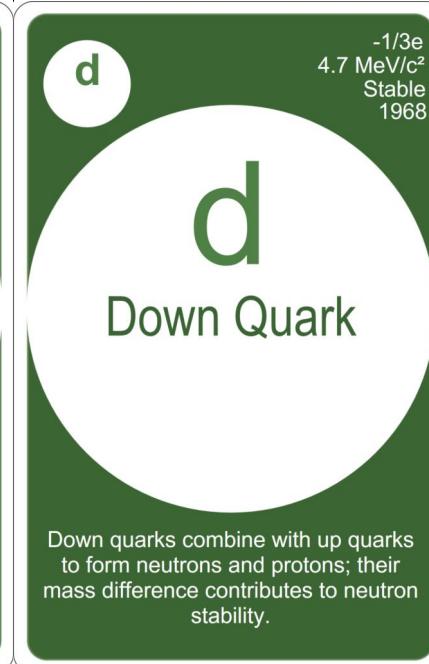
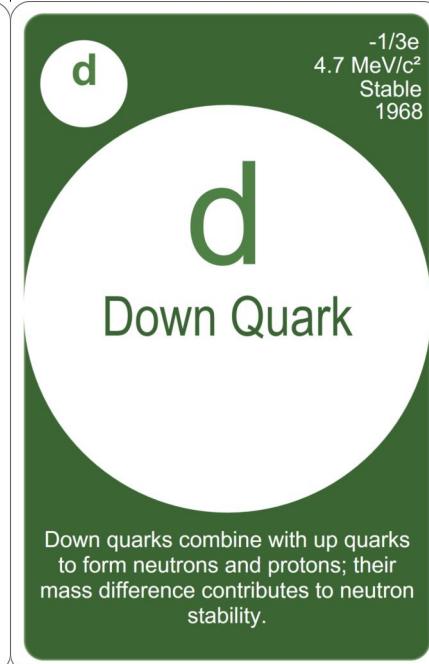
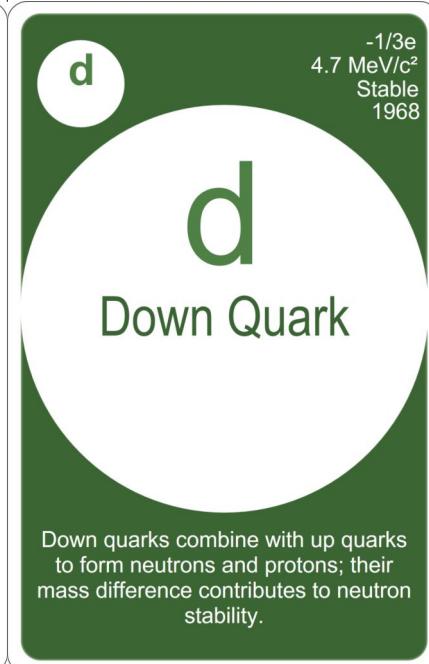
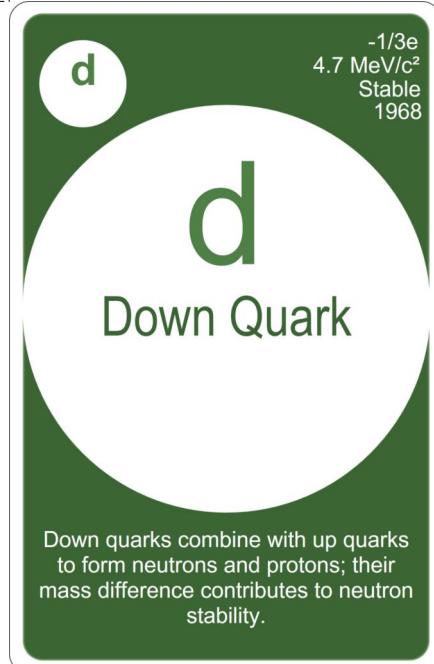




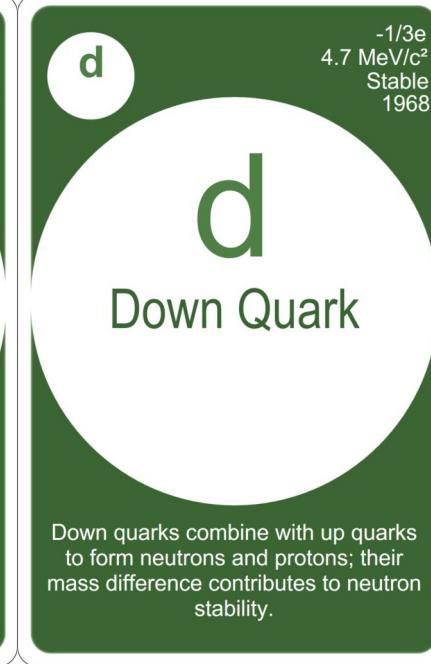
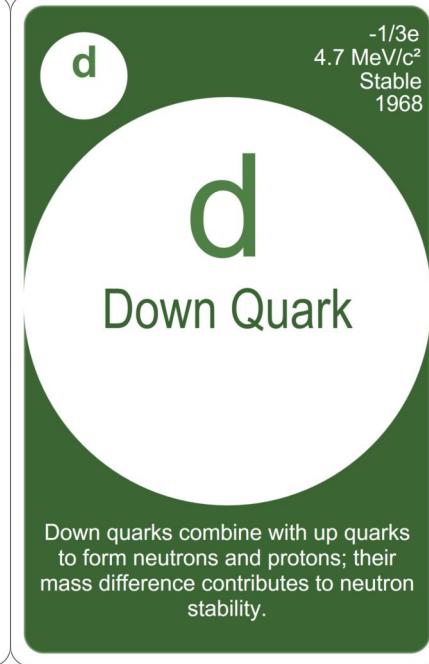
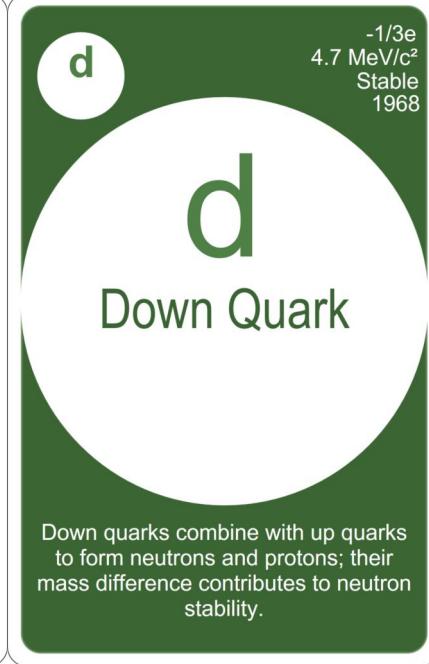
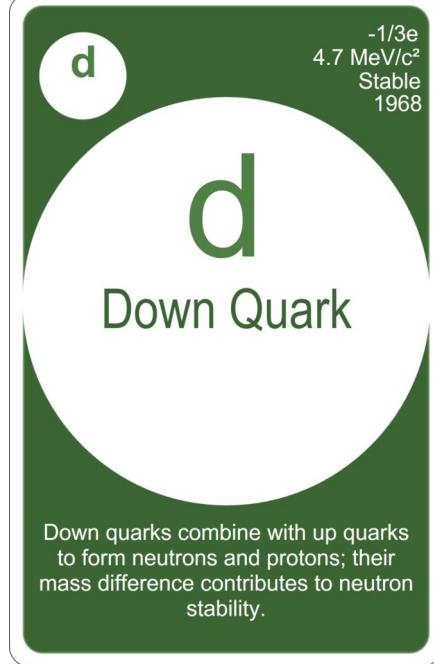
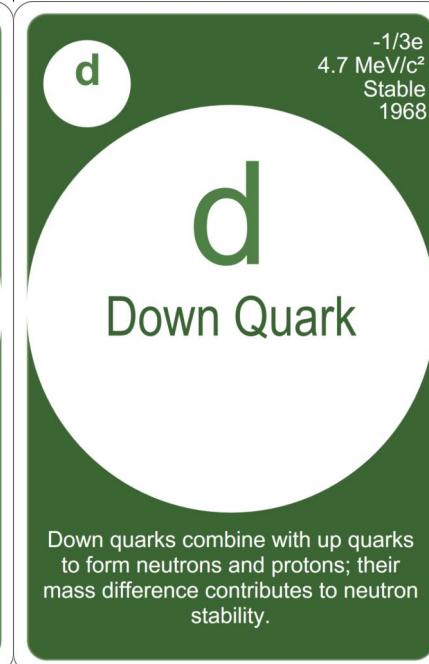
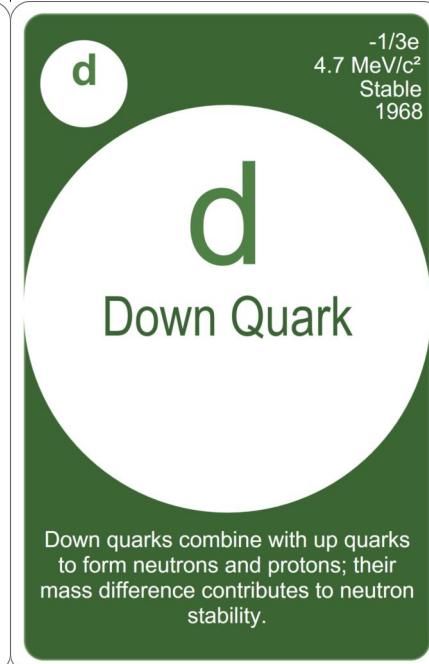
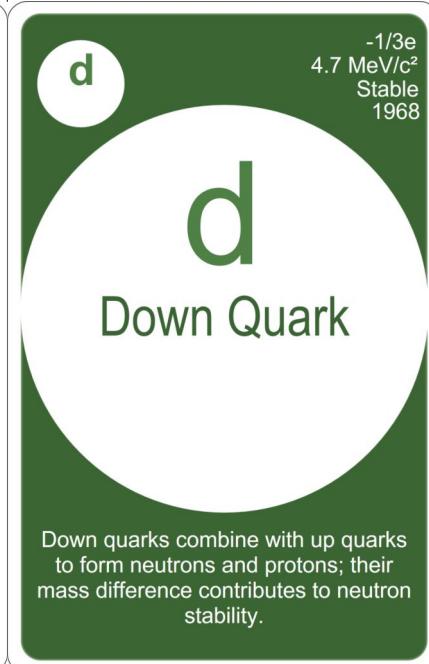
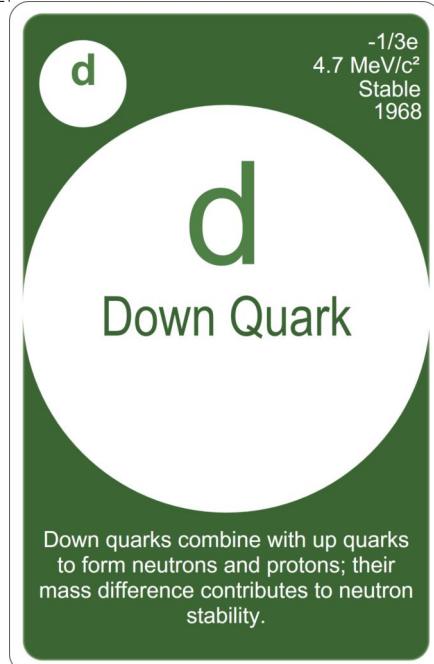
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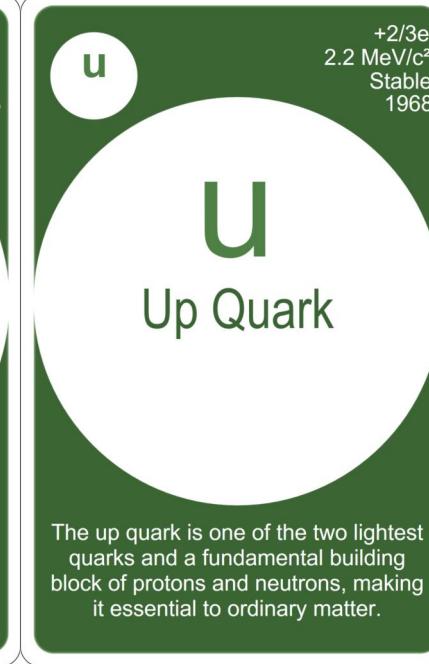
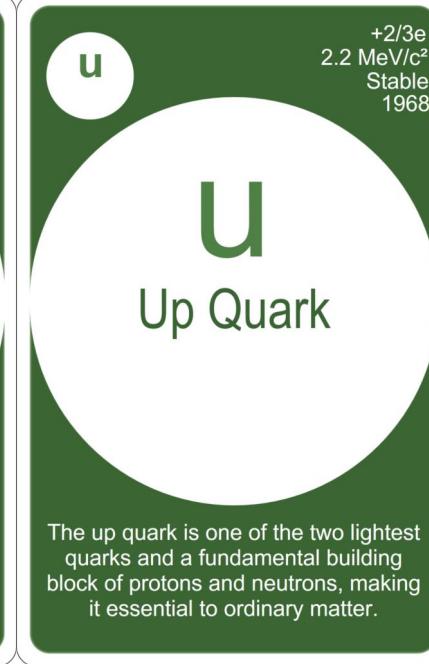
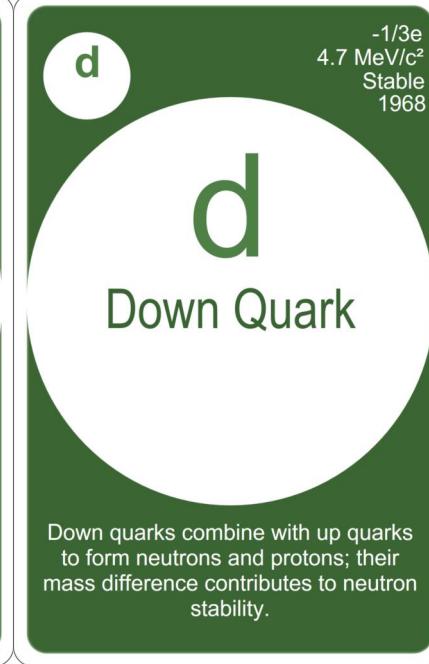
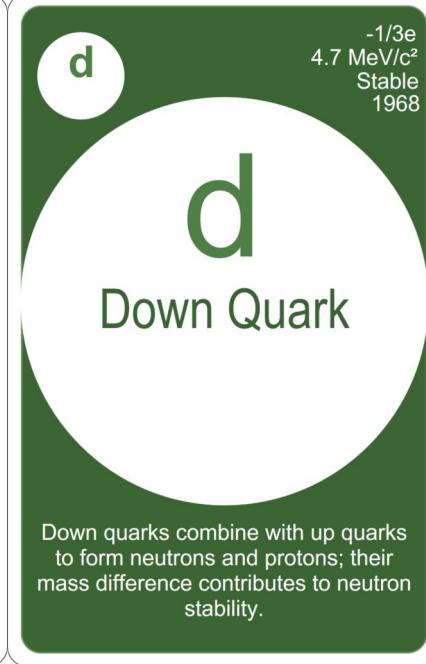
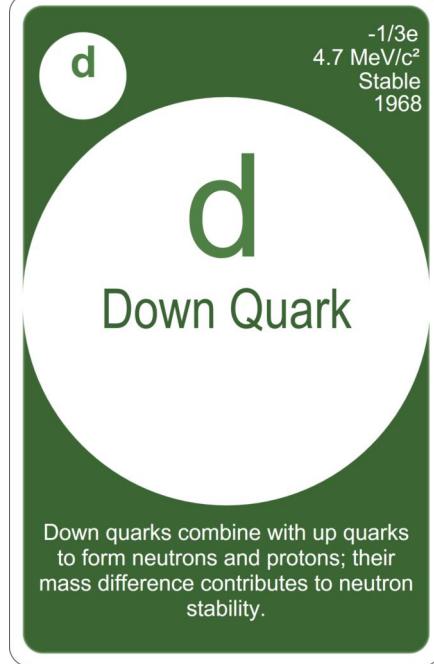
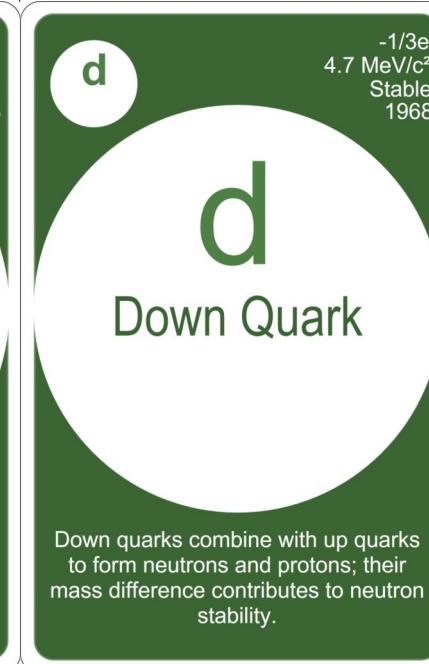
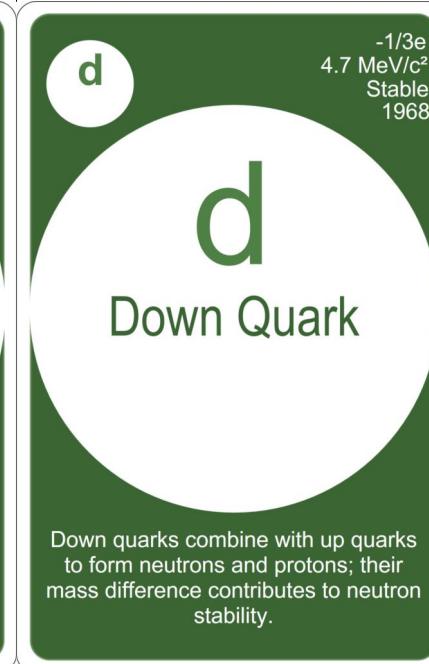
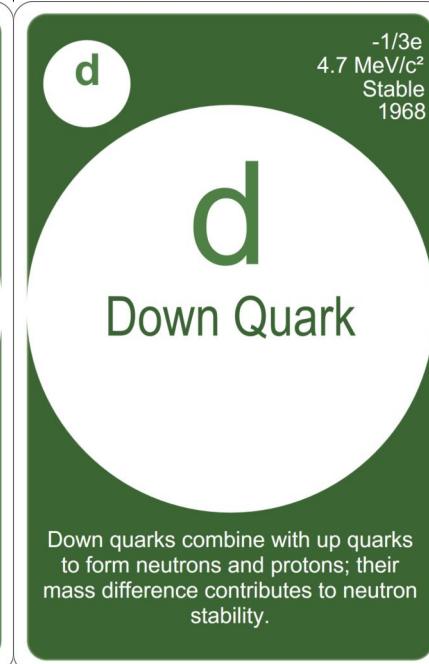
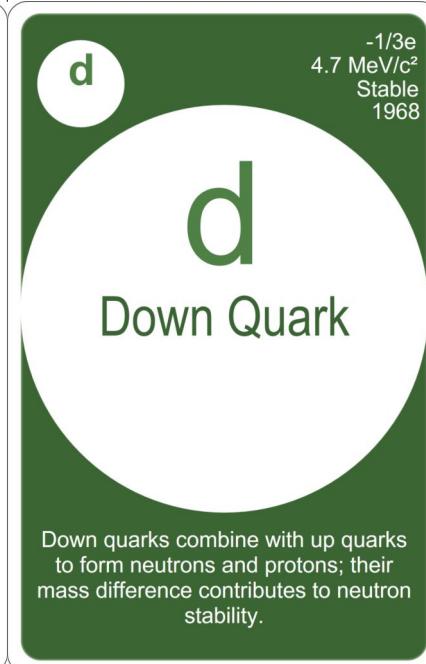
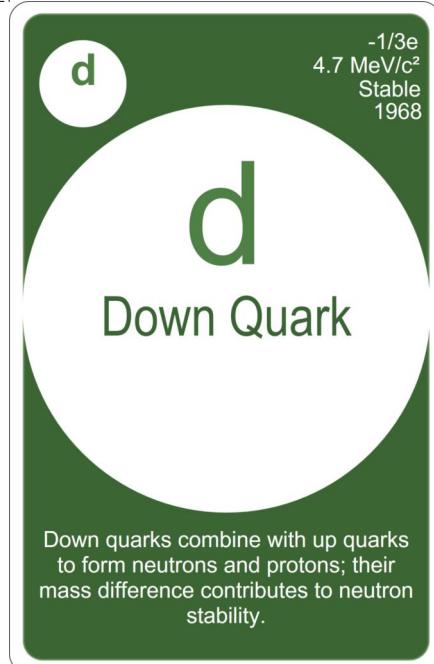
Quark



Quark



Quark



Quark

u

U

Up Quark

+2/3e
2.2 MeV/c²
Stable
1968

u

U

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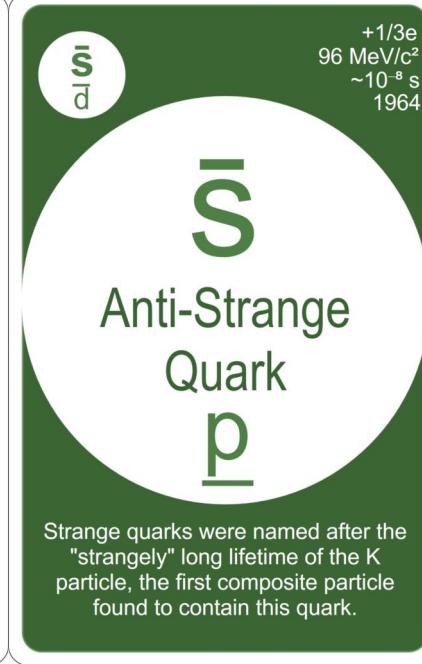
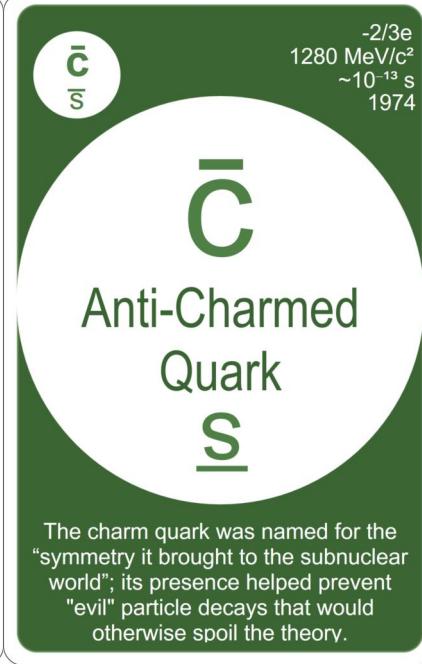
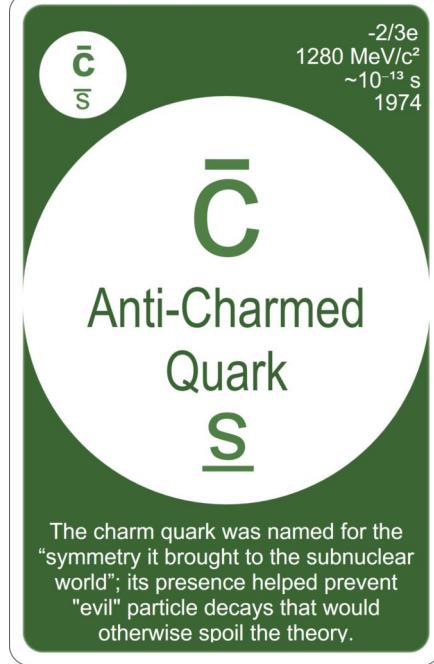
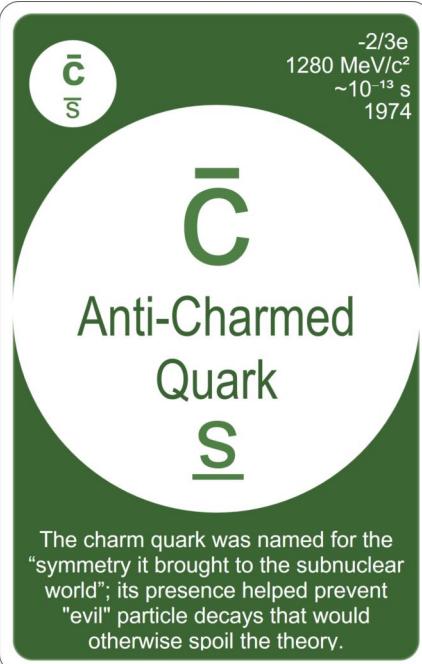
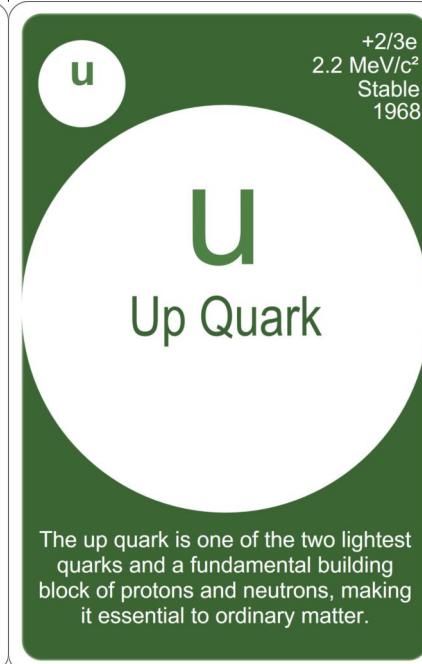
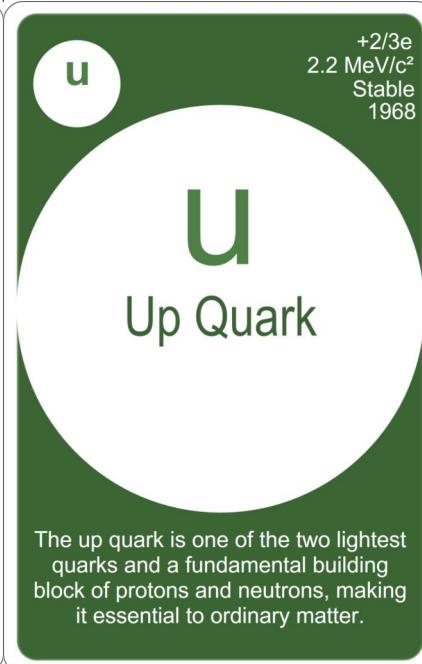
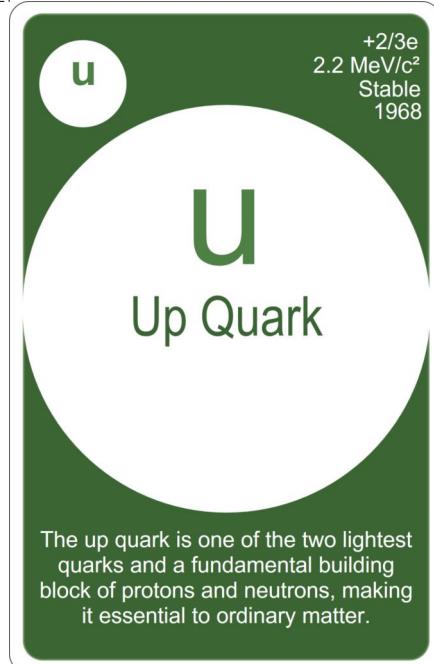
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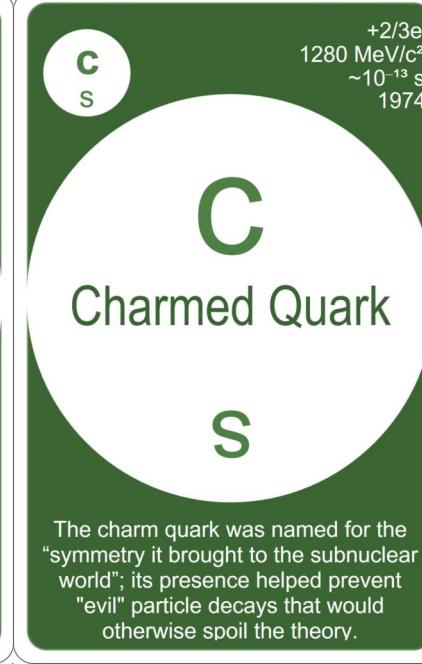
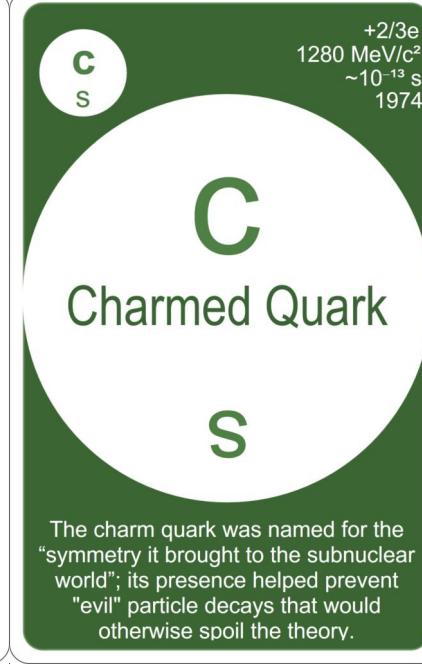
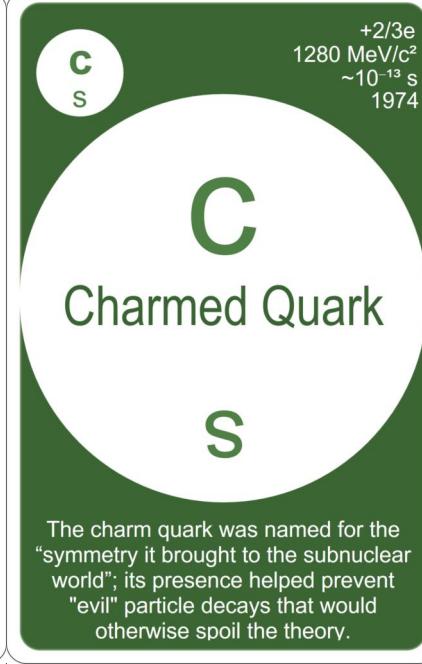
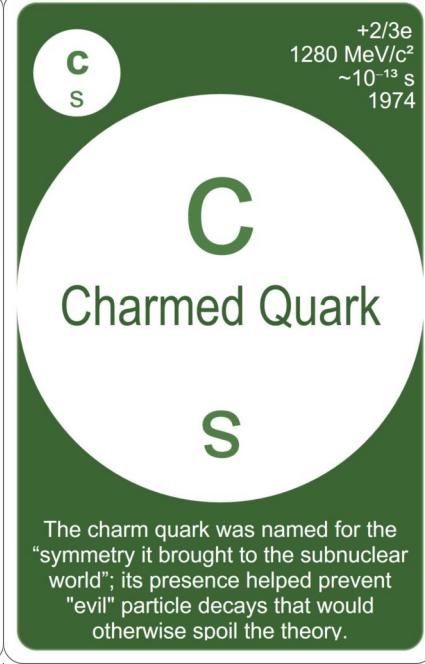
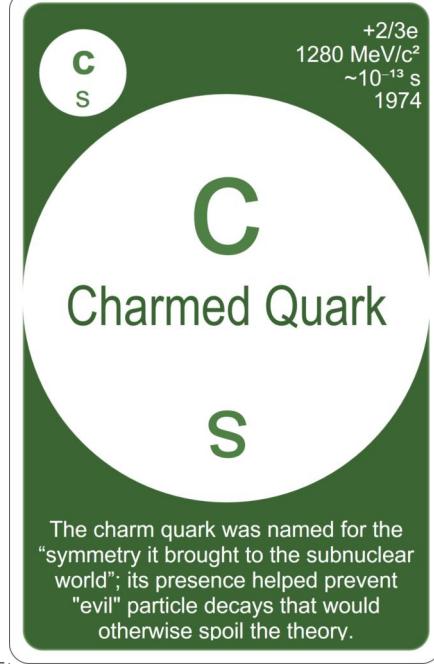
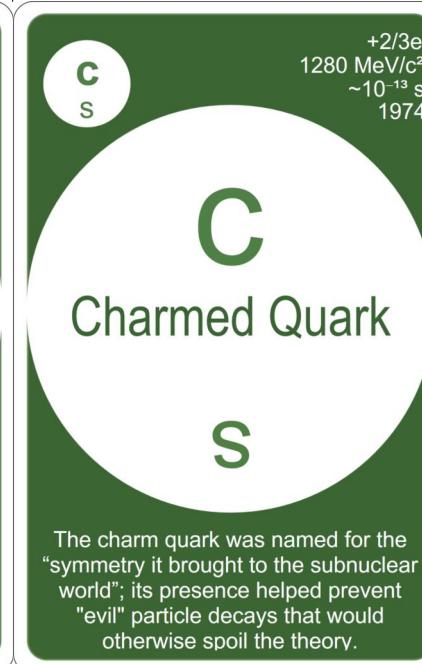
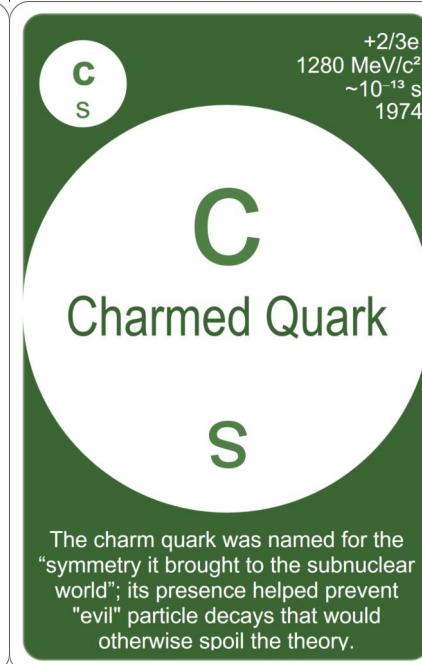
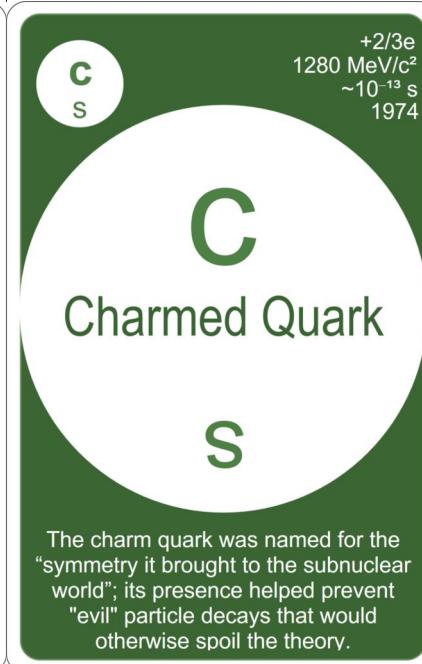
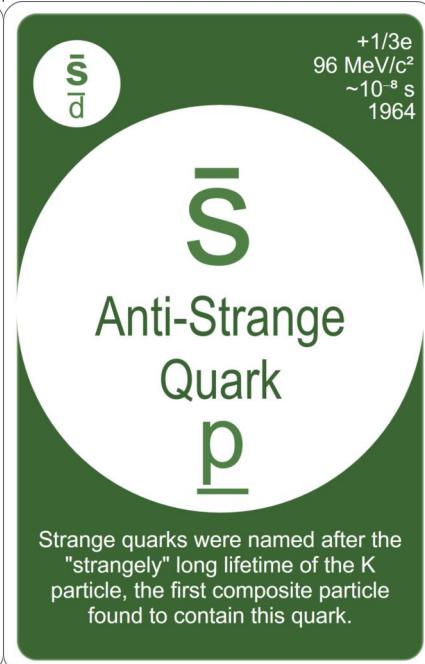
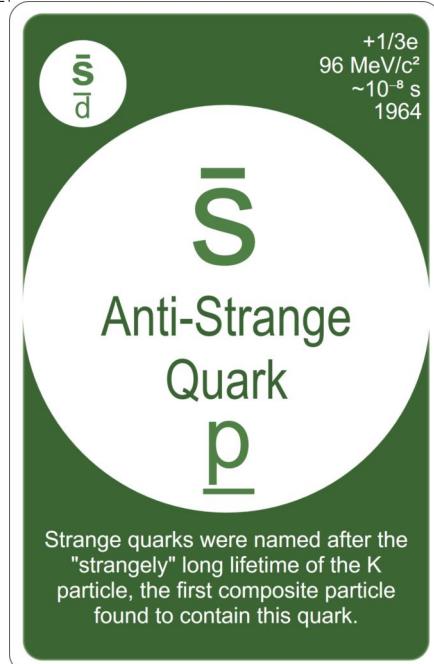
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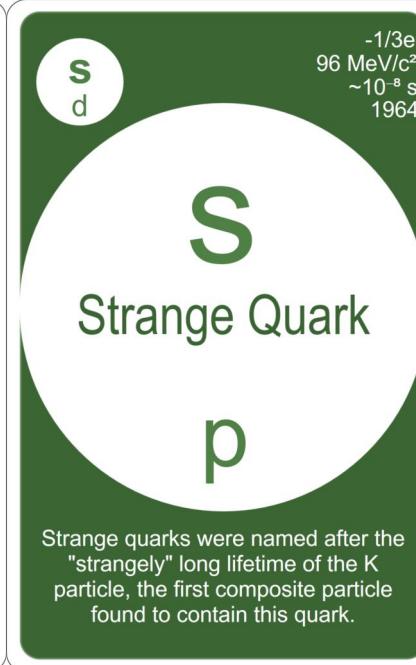
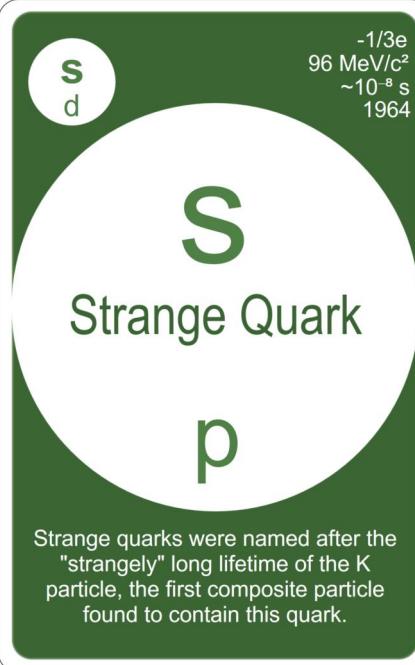
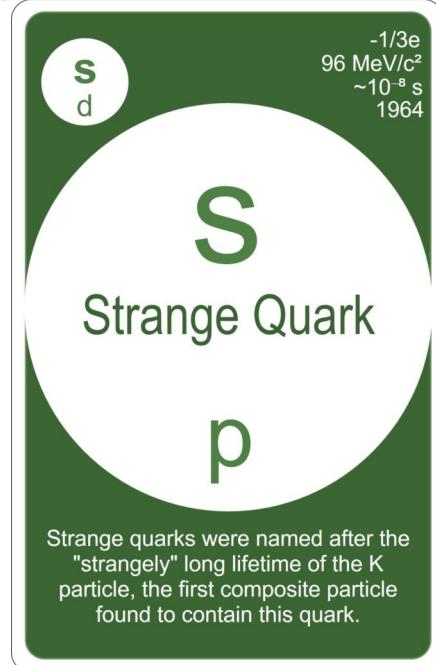
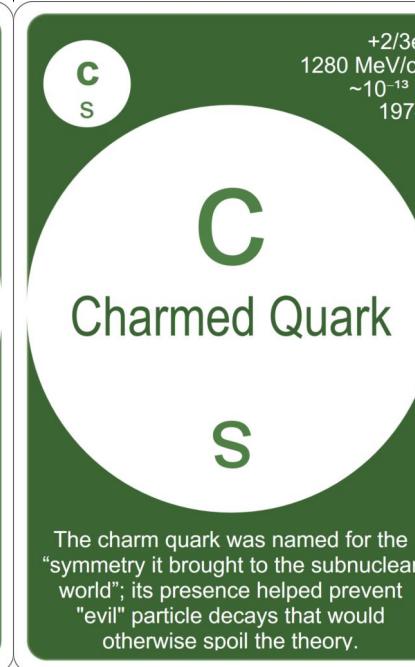
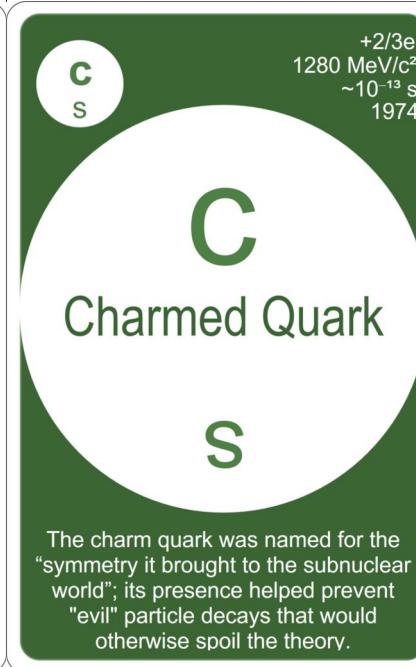
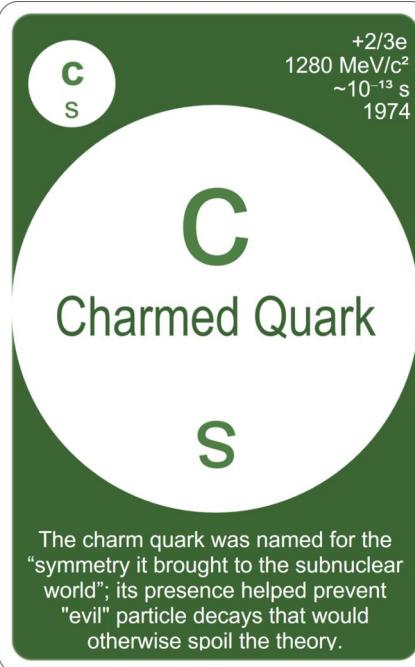
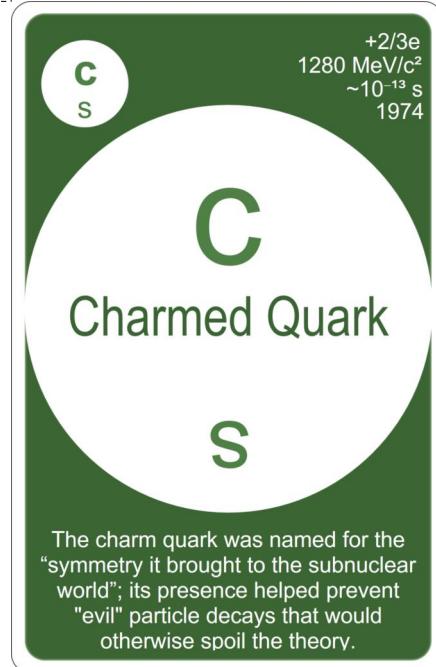
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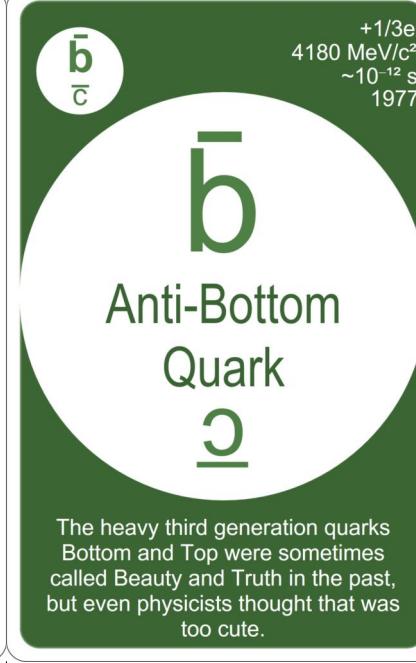
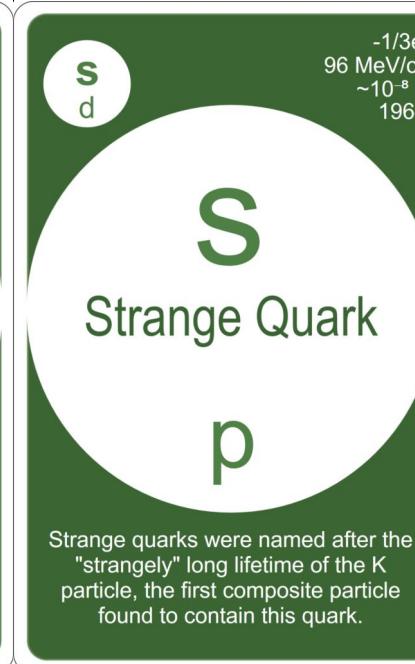
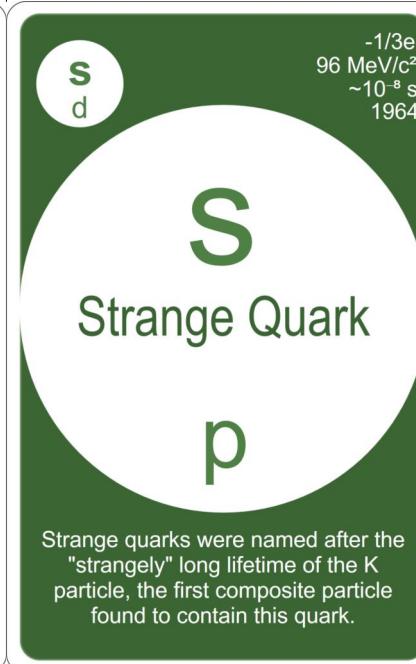
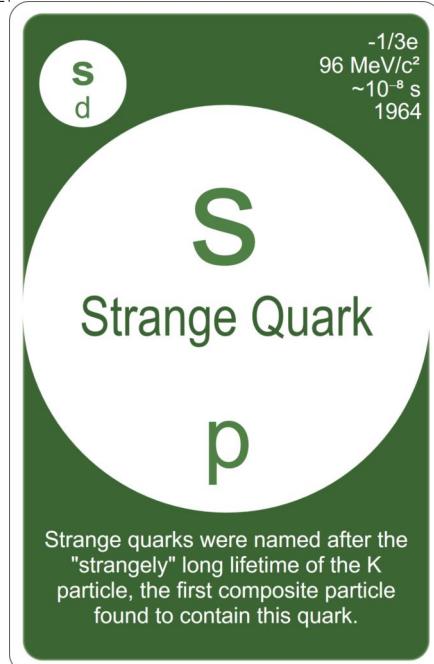
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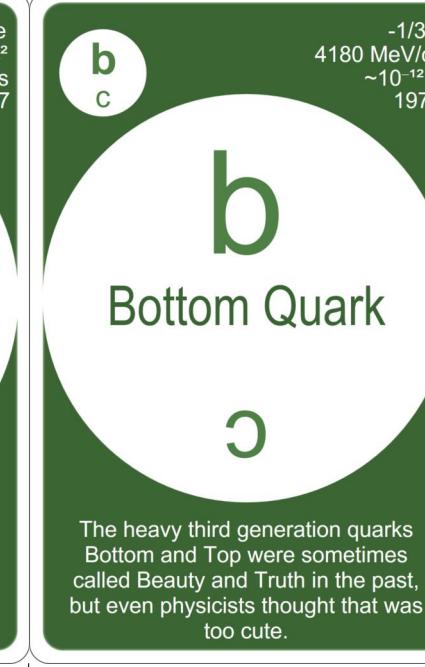
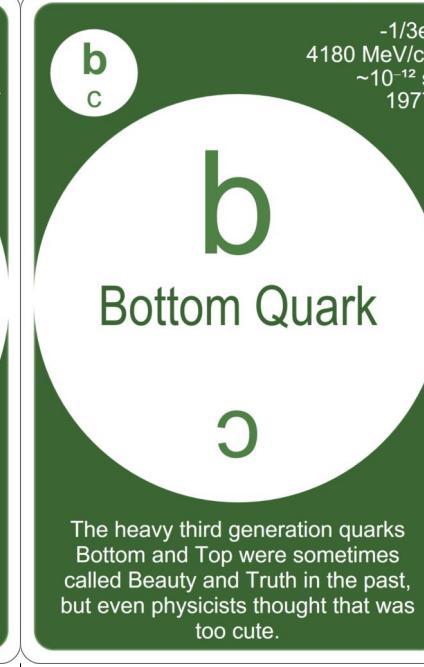
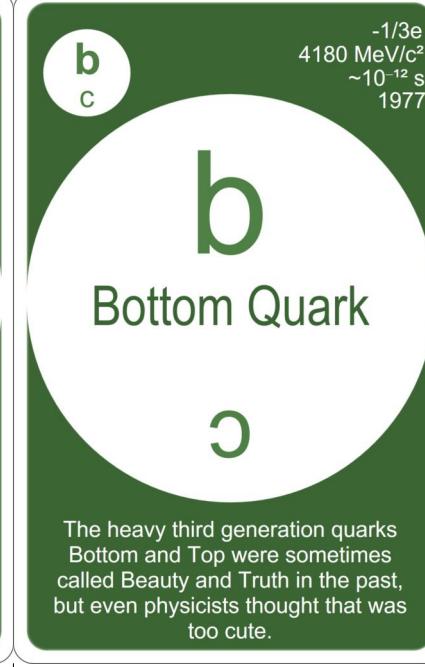
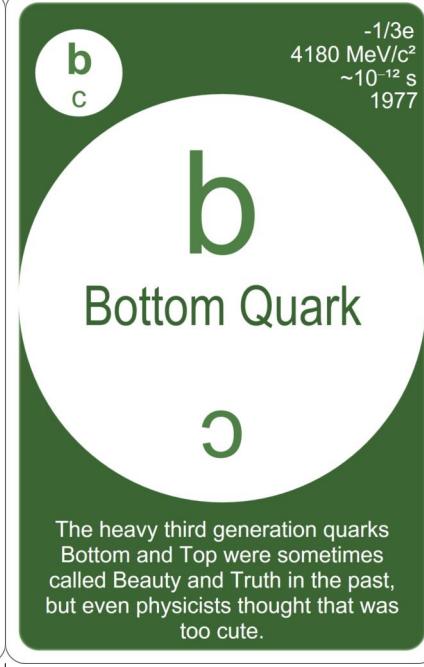
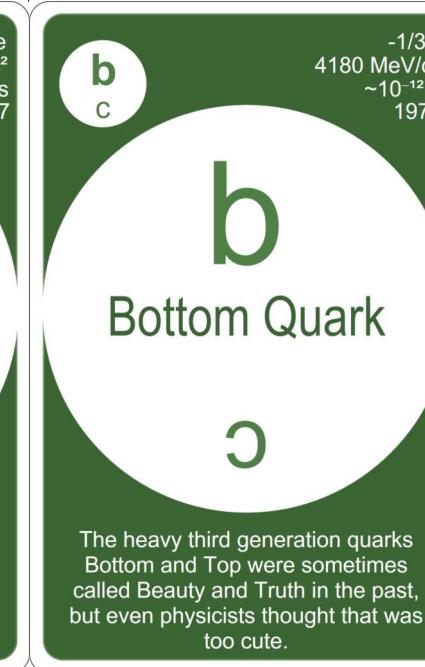
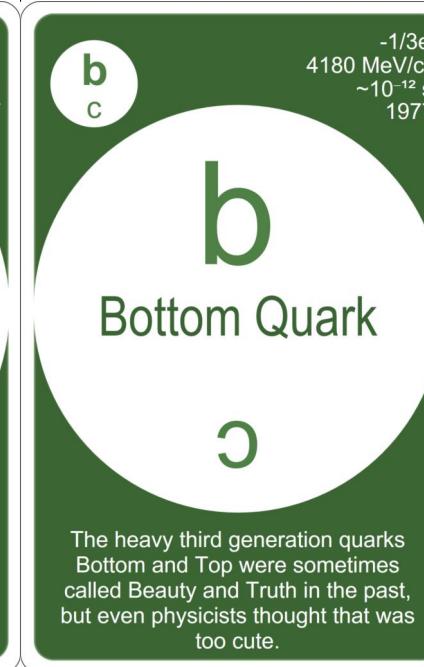
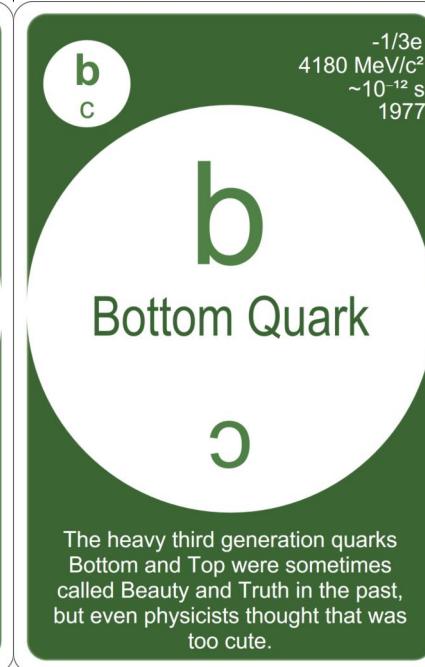
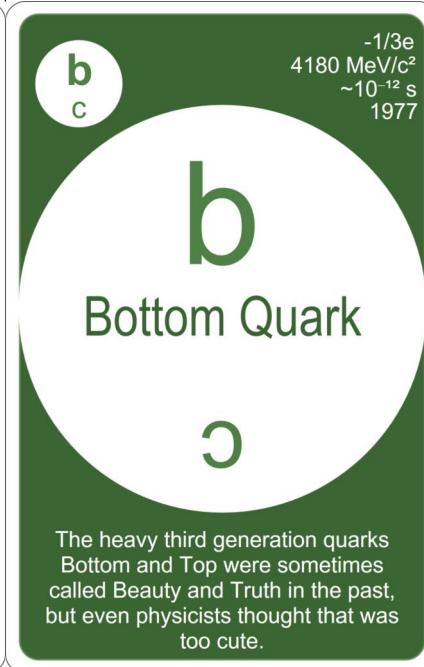
Quark



Quark



Quark



Quark

b
c

b

Bottom Quark

c

The heavy third generation quarks
Bottom and Top were sometimes
called Beauty and Truth in the past,
but even physicists thought that was
too cute.

-1/3e
4180 MeV/c²
 $\sim 10^{-12}$ s
1977

t
bsd

t

Top Quark

psq

The top quark is the heaviest known
elementary particle and decays so
quickly it does not form hadrons,
providing unique insights into the
Standard Model.

+2/3e
173100 MeV/c²
 $\sim 5 \times 10^{-25}$ s
1995

t
bsd

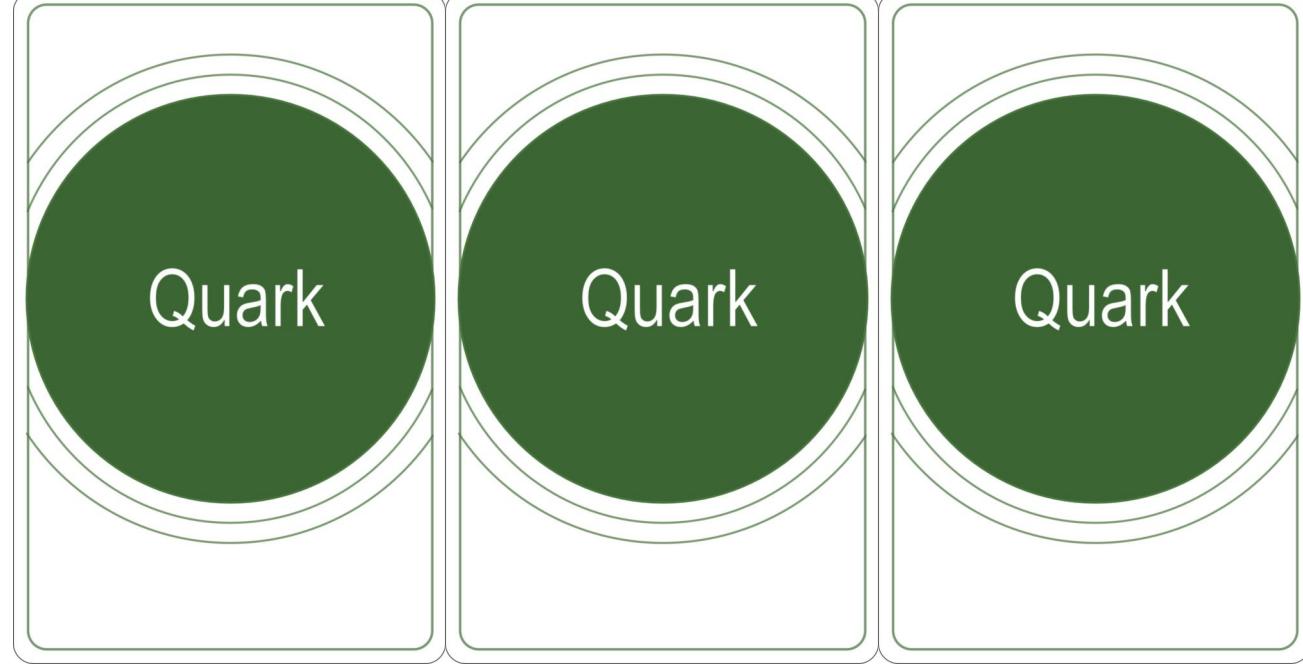
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1995



Quark

Quark

Quark

