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Problem 56.18 (RHK)

We have to determine the identity of the baryons formed from the following combinations of quarks: (a) ddu; (b) uus; (c) ssd. We have to check the answers with reference to the baryon octet.

Solution:

Properties of the fundamental quarks are as given in the following table:



<i>Quark</i>	<i>Symbol</i>	<i>Charge (e)</i>	<i>Spin</i>	<i>Baryon Number</i>	<i>Strangeness</i>
Up	u	$+\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	0
Down	d	$-\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	0
Strange	s	$-\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	-1

We note that all the three combinations ddu, uus, and ssd have baryon number 1 ($\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$) and a spin of $\frac{1}{2}, \frac{3}{2}$. We consider the baryon with spin $\frac{1}{2}$.

(a) ddu

From the table we note that the charge of ddu is 0

($-\frac{1}{3} - \frac{1}{3} + \frac{2}{3} = 0$) and its strangeness is 0. Therefore, it represents a neutron n.

(b) uus

From the table we note that the charge of uus is e and its strangeness is -1 . Therefore, uus represents Σ^- .

(c) ssd

From the table we note that the charge of ssd is $-e$ and its strangeness is -2 . Therefore, ssd represents Ξ^- .

