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| 98 | a) | <p>neutron is udd / proton is uud;</p> <p>quarks are: up down strange top bottom charm;</p> <p>either up / u has $Q = (+)2/3$, $B = (+)1/3$, $S = 0$;</p> <p>or down / d has $Q = -1/3$, $B = (+)1/3$, $S = 0$;</p> <p>quarks are fundamental particles; (1)</p> <p>for every quark there is an antiquark; (1)</p> <p>antiquarks have opposite values of Q, B and S (compared to quark) (1)</p> <p>quarks are held together by strong force / gluons (1)</p> <p>Q, B and S are conserved in (quark) reactions (1)</p> <p>any 2 2 [5]</p> | <p>1</p> <p>1</p> <p>1</p> |
| | (b)(i) | <p>charge: $1 + (-1) \rightarrow 0 + 0 + (-1) + X_Q$ so $X_Q = (+)1$</p> <p>baryon number: $1 + 0 \rightarrow 1 + 0 + 0 + X_B$ so $X_B = 0$</p> <p>strangeness: $0 + 0 \rightarrow 0 + 0 + 0 + X_S$ so $X_S = 0$</p> <p>if working not shown: 3 right gets 3/3, 2 right gets 1/3, 1 right gets 0/3</p> <p>has <u>NO</u> strangeness gets 0/1</p> <p>has <u>NO</u> baryon number gets 0/1</p> | <p>1</p> <p>1</p> <p>1 [3]</p> |
| | (ii) | <p>π^+ particle / antiparticle to π^- / meson with quark composition of (up + not-down)</p> <p>do not allow positron</p> | <p>1 [1]</p> |

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