

Chapter 14 Particle interactions. Revision Questions page 397-399 – Multiple Choice Answers

Q	Ans	Explanation																																			
1	D	Composites of three quarks are called baryons but composites of three antiquarks, such as the antistrange quark, are called antibaryons. The force holding the quarks or antiquarks together is the gluon. There is no such thing as an antigluon.																																			
2	C	$3q$ gives $B = +1$, no leptons gives $L = 0$																																			
3	A	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Reactant</th> <th>→</th> <th colspan="2">Products</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td></td> <td>Ξ^0</td> <td>→</td> <td>p</td> <td>π^-</td> <td></td> </tr> <tr> <td>Components</td> <td>usc</td> <td></td> <td>uud</td> <td>$\bar{d}u$</td> <td></td> </tr> <tr> <td>Baryon No. B</td> <td>+1 (baryon)</td> <td>=</td> <td>+1 (baryon)</td> <td>0 (meson)</td> <td>B is conserved</td> </tr> <tr> <td>Lepton No. L</td> <td>0 (non-lepton)</td> <td>=</td> <td>0 (non-lepton)</td> <td>0 (non-lepton)</td> <td>L is conserved</td> </tr> </tbody> </table> <p>Conclusion: As both baryon number and lepton number are conserved, the reaction is allowable.</p>		Reactant	→	Products		Result		Ξ^0	→	p	π^-		Components	usc		uud	$\bar{d}u$		Baryon No. B	+1 (baryon)	=	+1 (baryon)	0 (meson)	B is conserved	Lepton No. L	0 (non-lepton)	=	0 (non-lepton)	0 (non-lepton)	L is conserved					
	Reactant	→	Products		Result																																
	Ξ^0	→	p	π^-																																	
Components	usc		uud	$\bar{d}u$																																	
Baryon No. B	+1 (baryon)	=	+1 (baryon)	0 (meson)	B is conserved																																
Lepton No. L	0 (non-lepton)	=	0 (non-lepton)	0 (non-lepton)	L is conserved																																
4	B	The gluon is the force particle for the strong nuclear force. The other options are wrong: A (there are many bosons and not all apply to the weak force); C (a meson is a particle not a force); D (a quark is a fundamental particle not a force).																																			
5	A	Reactants: up quark $B = +\frac{1}{3}$, antidown quark $B = -\frac{1}{3}$. Total $B = 0$ Products: antimuon $B = 0$, muon neutrino $B = 0$. Total 0.																																			
6	D	An incoming matter particle has its arrow pointing towards the right, and an antiparticle towards the left. Only diagram D meets this criterion.																																			
7	B	$3\bar{q}$ gives a $B = -1$; $3\bar{q}$ gives a $L = 0$ (not a lepton)																																			
8	D	Anti-neutrinos are antileptons so have a baryon number of 0. They have a lepton number of -1 as they are an antiparticle.																																			
9	C	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Reactant</th> <th>→</th> <th colspan="3">Products</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td></td> <td>Σ^-</td> <td>→</td> <td>Λ^0</td> <td>e^+</td> <td>$\bar{\nu}_e$</td> <td></td> </tr> <tr> <td></td> <td>dds</td> <td></td> <td>uds</td> <td>positron</td> <td>electron antineutrino</td> <td></td> </tr> <tr> <td>B</td> <td>+1 (baryon)</td> <td>=</td> <td>+1 (baryon)</td> <td>0 (antilepton)</td> <td>0 (lepton)</td> <td>B is conserved</td> </tr> <tr> <td>L</td> <td>0 (non-lepton)</td> <td>=</td> <td>0 (non-lepton)</td> <td>-1 (antilepton)</td> <td>-1 (lepton)</td> <td>L not conserved</td> </tr> </tbody> </table> <p>Conclusion: Baryon number conserved, confirming it is but lepton number is not. The reaction is not allowable.</p>		Reactant	→	Products			Result		Σ^-	→	Λ^0	e^+	$\bar{\nu}_e$			dds		uds	positron	electron antineutrino		B	+1 (baryon)	=	+1 (baryon)	0 (antilepton)	0 (lepton)	B is conserved	L	0 (non-lepton)	=	0 (non-lepton)	-1 (antilepton)	-1 (lepton)	L not conserved
	Reactant	→	Products			Result																															
	Σ^-	→	Λ^0	e^+	$\bar{\nu}_e$																																
	dds		uds	positron	electron antineutrino																																
B	+1 (baryon)	=	+1 (baryon)	0 (antilepton)	0 (lepton)	B is conserved																															
L	0 (non-lepton)	=	0 (non-lepton)	-1 (antilepton)	-1 (lepton)	L not conserved																															

10	C		Reactant	→	Products		Result
			π^+	→	μ^+	γ	
		Components	$u\bar{d}$		antimuon	boson	
		Baryon No. B	0 (meson)	=	0 (non-baryon)	0 (non-baryon)	B is conserved
		Lepton No. L	0 (non-lepton)	=	-1 (anti-lepton)	0 (non-lepton)	L is conserved
		Conclusion: Baryon number is conserved but lepton number is not. Conservation of lepton number is violated, and the reaction is forbidden.					

Downloaded from seniorphysics.com/nepq