

Question number	Answer	Notes	Marks
13 (a) (i)	77		1
(ii)	115		1
(b)	(nuclei with) same number of protons / same atomic number / same element ; different numbers of {neutrons / nucleons} / different mass number;	ACCEPT: atoms / elements for nuclei REJECT: molecules / substances for nuclei IGNORE: electrons	2
(c)	192; 78;		2
(d)	alpha not penetrating enough (of the tumour) / ionises before reaching whole tumour ; gamma too penetrating / travels straight through / too weakly ionising / OWTTE ; beta will penetrate the tumour but no further / stays in tumour and doesn't affect horse / ionises within tumour (but no further) / OWTTE ;	IGNORE: doesn't penetrate skin IGNORE: bald 'weak' or 'strong' IGNORE: general properties of alpha, beta and gamma	3
(e) (i)	C		1
(ii)	activity decreases over time ; relate activity to situation e.g. C remains sufficiently active (over the treatment) / A and B not effective over period of treatment / A and B would need source to be replaced / D continues to be radioactive / cause damage (after treatment) ;	ACCEPT: calculation of period of activity IGNORE: bald 'weak' or 'strong'	2

Total 12 marks