

Question number	Answer	Notes	Marks
4 (a)	becquerel(s) / Bq;	allow recognisable spellings allow if written in table	1
(b) (i)	vertical axis labelled “activity” AND horizontal axis labelled “time in years”;	ignore unit on vertical axis	1
(ii)	smooth curve of best fit drawn;	curve should pass within 1 small square of each data point condone curve starting at second point	1
(iii)	evidence of working on graph or in working space; half-life = 5.6 (years);	e.g. lines shown on graph or evidence of halving 8000 etc. allow range of 5.4-5.8	2
(iv)	3 half-lives; (3 × 5.6 =) 16.8 (years);	allow 16.2-17.4 (years) allow ecf from (iii)	2
(c)	both have same number of protons; cobalt-60 has one more neutron;	allow RA ignore references to atomic/mass numbers	2
(d)	nucleus loses a neutron; nucleus gains a proton;	“neutron becomes a proton” scores both marks condone plurals e.g. neutrons, protons	2
(e)	any four from: Hazards (max. 2 marks) MP1. radiation from them can cause cancer / cell damage / damage to organisms / people; MP2. radiation is highly penetrating; MP3. risk of theft / eq; MP4. remain radioactive for some time; MP5. risk of contamination of land/water; Precautions (max. 2 marks) MP6. need for shielding; MP7. use of machines to remove from reactor; MP8. need for security (to prevent public access/protect from hijacking/eq); MP9. need to be suitably protected against damage; MP10. special facilities required, not landfill; MP11. relatively short half-life means that very long-term storage is not necessary;	e.g. lead, concrete etc. e.g. from earthquakes, overheating etc. e.g. stored underground/underwater, measures to avoid leakage	4

Total for Question 4 = 15 marks