

# Half Life 1 MS

## QUESTION 1

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	count is (roughly) the same gamma is not affected by magnetic field or alpha and beta are deflected by a magnetic field (1) count would go down significantly (1)	accept magnet for magnetic field	1 1
b)	time taken for number of nuclei to halve or time taken for count rate to fall to half (its initial value)	do not accept time for radioactivity to halve  do not accept time for nuclei to halve	1
c)	not enough time to take measurements / make observations before level of radiation became insignificant		1 1
Total marks			5

## QUESTIONS 2

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	k		1
b)	56	accept 50 - 60 inclusive	1
c)	k		1

d)	to inject... tracer		1
Total marks			4

### QUESTION 3

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	(atoms / elements with) the same number of protons but different numbers of neutrons	accept (atoms / elements with) different mass number but same atomic number	1
a)ii)	substances that give out radiation	accept alpha, beta or gamma for radiation accept an unstable nucleus that decays radioactive decay takes place is insufficient	1
b)	85	$\pm 2$ years allow 1 mark for showing correct method on the graph	2
c)i)	a helium nucleus	accept 2 neutrons and 2 protons accept ${}^4\text{He}$ do not accept helium atom	1
c)ii)	the rate of decay (of plutonium) decreases  less heat produced	accept fewer (plutonium) nuclei (to decay) accept radioactivity decreases do not accept energy for heat	1  1

d)i)	(outside the body) alpha (particles) cannot penetrate into the body (inside the body) (heat produced from decay) damages / kills cells / tissues	accept causes cancer for damages / kills cells / tissues accept highly toxic	1  1
d)ii)	any one from: worried same could happen again an accident may cause radiation to be spread around the Earth / atmosphere idea of soil contamination resulting from accident / release of radioactive material idea of negative effect on health resulting from accident / release of radioactive material	accept any sensible suggestion	1
Total marks			10

#### QUESTION 4

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	alpha particles cannot pass through... or alpha particles can pass through a very thin sheet of paper / card	do not accept gamma particles . . . credit answers where correct  amendments are made to boxed statement	1
b)i)	horizontal and vertical line drawn at correct positions on the graph	accept a cross drawn at 4500 / 500 on the curve or two pairs of lines drawn, for	1

		example, at 600 and 300 accept a horizontal line drawn at 500 on its own do not accept vertical lines only	
b)ii)	4500 million years		1
b)iii)	half-life too long  no (measurable) change in count rate	do not accept simply its half-life is 4500 million years do not accept have not got the equipment do not accept it's harmful (to children) if neither of the above points scored, accept not enough time to measure it for 1 mark	1  1
Total marks			5

### QUESTION 5

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	4500 million years	do not accept 4500 years	1
b)	curve starting at 100 000 with a correct general shape passing through (4500, 50 000) and (9000, 25 000)	allow 1 mark for points plotted or line passing through (4500, 50 000) and (9000, 25 000)	1  1
Total marks			3