Do not write outside the box

0 6 A student modelled radioactive decay by rolling some dice in a tray.

Dice that landed on the number six were removed from the tray.

The removed dice represent nuclei that have decayed.

0 6 . 1 Why is rolling dice a suitable model for radioactive decay?

[1 mark]

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0 6 . 2 The student rolled 144 dice and removed all those that landed on the number six.

The student rolled the remaining dice and again removed all those that landed on the number six.

When the student had rolled the dice 20 times there were 9 dice left.

Calculate the most likely number of times that the student had rolled the dice before the number of dice had halved.

You should show how you work out your answer.

[3 marks]

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Answer = ______________________ rolls of the dice

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0 6 . 3 The number of times the dice have to be rolled to halve the original number of dice in the tray represents the half-life.

Figure 7 shows an eight-sided dice and a six-sided dice.

Figure 7

The student now used eight-sided dice to model radioactive decay. Dice that landed on the number six were again removed from the tray.

The half-life represented by rolling eight-sided dice is likely to be different from the half-life represented by rolling six-sided dice.

Explain how.

[2 marks]

0 6 . 4 A teacher has two radioactive sources, **A** and **B**.

Source **A** has a longer half-life than source **B**.

What can be deduced about the nuclei in source **A** compared with the nuclei in source **B**?

Do **not** refer to isotopes in your answer.

[1 mark]

7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	both are random processes	allow rolling dice is a random process allow radioactive decay is a random process	1	AO1 6.4.2.3
06.2	144 →72 → 36 →18 → 9 4 half lives $\frac{20}{4}$ = 5 (rolls of the dice)	allow the probability of not getting a 6 is 5/6 allow 144 × $(5/6)^4$ = 69 allow 69 is closest to 72 so 4 (rolls of the dice) some credible working must be shown to gain this mark	1 1 1	AO2 6.4.2.3
06.3	a dice with 8 sides will have a smaller chance of decay (in one roll) so dice with 8 sides have a greater half-life	allow answers in terms of the 6-sided dice or in terms of more or fewer sides. allow the 8 sided dice has a 1/8 chance of decay, whereas the 6 sided dice has a 1/6 chance of decay	1 1	AO1 6.4.2.3
06.4	nuclei in source **A** are more stable than nuclei in source **B**	allow nuclei in source A are less likely to decay (in a given time period)	1	AO1 6.4.2.3
Total			**7**	