Nuclear decay equations: Teacher solutions

Education in Chemistry
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Differentiated worksheets, ages 14–16, 16+
This activity accompanies the above article 'The hunt is on'.

Nuclear decay equations 1

(a) Complete the nuclear equations for a decay of the following isotopes by adding in the products

$^{210}_{86}Rn$	⟶	$^{206}_{84}\mathbf{Po}$	+	$^{4}_{2}\mathbf{He}$
$^{230}_{90}Th$	⟶	$^{226}_{88}\mathbf{Ra}$	+	$^{4}_{2}\mathbf{He}$
$^{10}_{4}Be$	⟶	$^{6}_{2}\boldsymbol{He}$	+	$^{4}_{2}\boldsymbol{He}$
$^{238}_{88}Ra$	⟶	$^{234}_{86}\boldsymbol{Rn}$	+	$^{4}_{2}\boldsymbol{He}$
$^{238}_{94}Pu$	⟶	$^{234}_{92}\boldsymbol{U}$	+	$^{4}_{2}\boldsymbol{He}$

(b) Complete the nuclear equations for β decay of the following isotopes by adding in the products

$^{40}_{19}K$	⟶	$^{40}_{20}\mathbf{Ca}$	+	$^{0}_{-1}\mathbf{e}$
$^{234}_{90}Th$	⟶	$^{234}_{91}\mathbf{Pa}$	+	$^{0}_{-1}\mathbf{e}$
$^{8}_{4}Be$	⟶	$^{8}_{5}\mathbf{B}$	+	$^{0}_{-1}\mathbf{e}$
$^{79}_{34}Se$	⟶	$^{79}_{35}\mathbf{Br}$	+	$^{0}_{-1}\mathbf{e}$
$^{85}_{36}Kr$	⟶	$^{85}_{37}\mathbf{Rb}$	+	$^{0}_{-1}\mathbf{e}$

(c) Complete the nuclear equations by adding in the isotope that decays and the type of decay

Type of decay				
β	$^{125}_{38}\mathbf{Sb}$	⟶	$^{125}_{39}Y$ +	$^{0}_{-1}e$
α	$^{242}_{96}\mathbf{Cm}$	⟶	$^{238}_{94}Pu$ +	$^{4}_{2}He$
α	$^{209}_{83}\mathbf{Bi}$	⟶	$^{205}_{81}Tl$ +	$^{4}_{2}He$

Nuclear decay equations 2

Complete the nuclear decay equations by adding in the products formed.

	Type of decay					
1	β	$^{40}_{19}K$	⟶	$^{40}_{20}\mathbf{Ca}$	+	$^{0}_{-1}\mathbf{e}$
2	α	$^{210}_{86}Rn$	⟶	$^{206}_{84}\mathbf{Po}$	+	$^{4}_{2}\mathbf{He}$
3	α	$^{230}_{90}Th$	⟶	$^{226}_{88}\mathbf{Ra}$	+	$^{4}_{2}\mathbf{He}$
4	β	$^{234}_{90}Th$	⟶	$^{234}_{91}\mathbf{Pa}$	+	$^{0}_{-1}\mathbf{e}$
5	α	$^{10}_{4}Be$	⟶	$^{6}_{2}\mathbf{He}$	+	$^{4}_{2}\mathbf{He}$
6	β	$^{8}_{4}Be$	⟶	$^{8}_{5}\mathbf{B}$	+	$^{0}_{-1}\mathbf{e}$
7	β	$^{79}_{34}Se$	⟶	$^{79}_{35}\mathbf{Br}$	+	$^{0}_{-1}\mathbf{e}$
8	α	$^{210}_{84}Po$	⟶	$^{206}_{82}\mathbf{Pb}$	+	$^{4}_{2}\mathbf{He}$
9	β	$^{85}_{36}Kr$	⟶	$^{85}_{37}\mathbf{Rb}$	+	$^{0}_{-1}\mathbf{e}$
10	β	$^{90}_{38}Sr$	⟶	$^{90}_{39}\mathbf{Y}$	+	$^{0}_{-1}\mathbf{e}$
11	α	$^{238}_{88}Ra$	⟶	$^{234}_{86}\mathbf{Rn}$	+	$^{4}_{2}\mathbf{He}$
12	α	$^{238}_{94}Pu$	⟶	$^{234}_{92}\mathbf{U}$	+	$^{4}_{2}\mathbf{He}$
13	β	$^{125}_{38}Sb$	⟶	$^{125}_{39}\mathbf{Y}$	+	$^{0}_{-1}\mathbf{e}$
14	α	$^{242}_{96}Cm$	⟶	$^{238}_{94}\mathbf{Pu}$	+	$^{4}_{2}\mathbf{He}$
15	α	$^{209}_{83}Bi$	⟶	$^{205}_{81}\mathbf{Tl}$	+	$^{4}_{2}\mathbf{He}$

This can be graded out of 30 marks.

Nuclear decay equations 3

Complete the equations by adding in the type of decay, the isotope undergoing decay and/or the products. Each equation has one or more parts missing.

Type of decay					
β	$^{40}_{19}K$	→	$^{40}_{20}Ca$	+	$\mathbf{^{0}_{-1}e}$
α	$\mathbf{^{210}_{86}Rn}$	→	$^{206}_{84}Po$	+	$^{4}_{2}He$
α	$^{230}_{90}Th$	→	$\mathbf{^{226}_{88}Ra}$	+	$^{4}_{2}He$
β	$\mathbf{^{234}_{90}Th}$	→	$^{234}_{91}Pa$	+	$^{0}_{-1}e$
α	$^{10}_{4}Be$	→	$\mathbf{^{6}_{2}He}$	**+**	$\mathbf{^{4}_{2}He}$
β	$^{8}_{4}Be$	→	$^{8}_{5}B$	+	$^{0}_{-1}e$
β	$^{79}_{34}Se$	→	$\mathbf{^{79}_{35}Br}$	+	$\mathbf{^{0}_{-1}e}$
α	$\mathbf{^{210}_{84}Po}$	→	$^{206}_{82}Pb$	+	$\mathbf{^{4}_{2}He}$
β	$^{85}_{36}Kr$	→	$^{85}_{37}Rb$	+	$\mathbf{^{0}_{-1}e}$
β	$^{90}_{38}Sr$	→	$\mathbf{^{90}_{39}Y}$	**+**	$\mathbf{^{0}_{-1}e}$
α	$\mathbf{^{238}_{88}Ra}$	→	$^{234}_{86}Rn$	+	$^{4}_{2}He$
α	$\mathbf{^{238}_{94}Pu}$	→	$^{234}_{92}U$	+	$^{4}_{2}He$
β	$^{125}_{38}Sb$	→	$\mathbf{^{125}_{39}Y}$	**+**	$\mathbf{^{0}_{-1}e}$
α	$^{242}_{96}Cm$	→	$\mathbf{^{238}_{94}Pu}$	**+**	$\mathbf{^{4}_{2}He}$
α	$^{209}_{83}Bi$	→	$\mathbf{^{205}_{81}Tl}$	+	$^{4}_{2}He$

There are 25 missing pieces of information for pupils to fill in so this could be graded as a mark out of 25.