8(a)	(radioactive) substance introduced into the body
	substance absorbed by the tissues being studied
8(b)(i)	$P = 15$ **and** $R = 0$
	$Q = 7$ **and** $S = (+)1$
8(b)(ii)	(electron) neutrino
8(c)(i)	number of nuclear disintegrations per unit time
8(c)(ii)	decay constant $= \ln 2 / (2.04 \times 60)$
	$= 5.66 \times 10^{-3}\ s^{-1}$
8(c)(iii)	$N = (2.85 \times 10^{-6}) / (15 \times 1.66 \times 10^{-27})$
	$A = \lambda N$
	rate $= (5.66 \times 10^{-3}) \times (2.85 \times 10^{-6}) / (15 \times 1.66 \times 10^{-27})$
	$= 6.48 \times 10^{17}\ s^{-1}$
8(d)(i)	gamma photons
8(d)(ii)	positron collides with electron (in body)
	annihilation results in their masses becoming photon energy

9(a)	number of nuclear disintegrations per unit time
9(b)	activity is proportional to the number of undecayed nuclei
	activity = (–) rate of change of number of undecayed nuclei
	N is proportional to the rate of change of N (so exponential variation)
9(c)(i)	$120 = 180 \exp(-\lambda \times 8.4)$
	$\lambda = 0.048\ min^{-1}$
9(c)(ii)	half-life = ln 2 / 0.048 = 14 min
9(c)(iii)	line with negative gradient throughout, starting at (0, 180)
	curve with negative gradient passing through (8.4, 120)
	curve with decreasing negative gradient, from $t = 0$ to $t = 24$ min, passing through (14, 90)

10(a)	(decay is) not affected by external / environmental factors
10(b)(i)	half-life of X = $2T$ **and** half-life of Y = $3T$
	both samples show decay constant, in terms of $1 / T$, equal to ln 2 / half-life (decay constant of X = $\ln 2 / 2T$ and decay constant of Y = $\ln 2 / 3T$ if both half-lives correct)
	both samples show N_0, in terms of AT, equal to initial activity / decay constant (N_0 for X = $8AT / \ln 2$ and N_0 for Y = $3AT / \ln 2$ if both decay constants correct) (Fully correct table: [ ] half-life / decay constant / A_0 / N_0 X: $2T$ / $\ln 2 / 2T$ / $4A$ / $8AT / \ln 2$ Y: $3T$ / $\ln 2 / 3T$ / A / $3AT / \ln 2$)
10(b)(ii)	correct substitution of A_0 and λ into $A_0 \exp(-\lambda t)$ for sample X or sample Y
	$4A \exp(-t \ln 2 / 2T) = A \exp(-t \ln 2 / 3T)$
	$t = 12T$
10(c)	*Any two points from:* • (radiation) emitted in all directions, not just in direction of detector • some radiation absorbed by air / sample / window of detector • some radiation may not register even though it reaches detector

Fully correct table (10(b)(i)):

	half-life	decay constant	A_0	N_0
X	$2T$	$\ln 2 / 2T$	$4A$	$8AT / \ln 2$
Y	$3T$	$\ln 2 / 3T$	A	$3AT / \ln 2$

9(a)	number of nuclear disintegrations per unit time
9(b)	activity is proportional to the number of undecayed nuclei
	activity = (–) rate of change of number of undecayed nuclei
	N is proportional to the rate of change of N (so exponential variation)
9(c)(i)	$120 = 180 \exp(-\lambda \times 8.4)$
	$\lambda = 0.048\ min^{-1}$
9(c)(ii)	half-life = ln 2 / 0.048 = 14 min
9(c)(iii)	line with negative gradient throughout, starting at (0, 180)
	curve with negative gradient passing through (8.4, 120)
	curve with decreasing negative gradient, from $t = 0$ to $t = 24$ min, passing through (14, 90)