8(a)	packet / quantum of <u>energy</u>
	of electromagnetic radiation
8(b)(i)	electron(s)
8(b)(ii)	X labelled – **and** Y labelled +
8(c)(i)	0.032 MeV
8(c)(ii)	momentum = E / c
	momentum = $(0.032 \times 1.60 \times 10^{-13}) / (3.00 \times 10^{8})$ $= 1.7 \times 10^{-23}$ N s
8(c)(iii)	$E = hf$ **and** $\lambda = c / f$
	$\lambda = hc / E$ $= (6.63 \times 10^{-34} \times 3.00 \times 10^{8}) / (0.032 \times 1.60 \times 10^{-13})$
	$\lambda = 3.9 \times 10^{-11}$ m
8(d)	discussion of bone and soft tissue
	discussion of different attenuation (coefficients) **or** discussion differences in penetration / transmission / absorption
	<u>transmitted intensities</u> (by bone and tissue) are very different (leading to good contrast images)

10(a)	ultrasound production:	vibrating quartz crystal
	X-ray production:	electrons hitting metal target
	ultrasound detected wave:	reflected
	X-ray detected wave:	transmitted
10(b)(i)	$I = I_0 \exp(-\mu x)$	
	$\ln(0.72) = -6.2\mu$ $\mu = 0.053\ \text{cm}^{-1}$	
10(b)(ii)	$I / I_0 = \exp(-9.3 \times 0.053)$ $(= 0.61)$	
	percentage attenuated $= 100 \times (1.00 - 0.61)$ $= 39\%$	

10(a)(i)	electrons
10(a)(ii)	electrons are decelerated / stopped on impact with the target
	(kinetic) energy lost by electrons emitted as (X-ray) photons
10(a)(iii)	$eV = hc / \lambda$
	$\lambda = (6.63 \times 10^{-34} \times 3.00 \times 10^{8}) / (1.60 \times 10^{-19} \times 5800)$
	$= 2.14 \times 10^{-10}$ m
10(b)	$I = I_0 \exp(-\mu x)$
	$I_T / I_0 = \exp(-(1.4 \times 2.8))$ $= 0.020$
	% absorbed $= (1.000 - 0.0198) \times 100$ $= 98\%$