Question			Expected Answer	Mark	Additional Guidance
1	(a)		The application of a p.d. across a material / crystal causes an expansion / contraction / vibration (ora)	B1	**Allow**: reference to 'current' instead of p.d / e.m.f
	(b)		Any <u>two</u> from: • <u>Pulses</u> of ultrasound (sent into the body) • Wave / ultrasound / pulse / signal is <u>reflected</u> (at boundary of tissue) • Time of delay used to determine depth / thickness • The fraction of <u>reflected</u> signal is used to identify the tissue	B1 × 2	**Allow**: The <u>reflected</u> signal / ultrasound /amplitude / intensity is used to identify the tissue
			A-scan in one direction only / range or distance or depth finding	B1	
			B-scan uses a number of sensors or a sensor in different positions / angles (to build up a 2D/3D image)	B1	**Not**: 'B-scan is many A-scans'
	(c)	(i)	$Z = \rho c$; density $\rightarrow$ kg m^{-3} <u>and</u> speed $\rightarrow$m s^{-1} (Hence $Z \rightarrow$ kg m^{-2} s^{-1})	M1 A0	
		(ii)	fraction = $\frac{(7.14-1.72)^2}{(7.14+1.72)^2}$ fraction = 0.37(4)	C1 A1	**Allow**: 37 %
		(iii)	(Acoustic) impedances of media are similar / identical No / reduced reflection (at boundary) Or The gel allows maximum transmission of ultrasound (into the body)	B1 B1	**Allow**: 'The Zs are the same'
		(iv)	$v = f\lambda$ wavelength = $\frac{1590}{1.2\times10^6} (= 1.33\times10^{-3}$ m) (Any subject) wavelength = 1.33 (mm)	C1 A1	**Allow**: 1 mark for '4080/1.2 × 10^6 = 3.4 mm'
		(v)	Small wavelength means finer detail can be seen / greater resolution	B1	
			Total	13	

Question			Expected Answer	Mark	Additional Guidance
2	**(a)**		Any <u>five</u> from: 1. Intensifier used as X-ray would pass through film 2. Intensifie converts X-ray <u>photon</u> to many visible (light) <u>photons</u> (which are absorbed by film) 3. *Lower exposure / fewer X-rays needed 4. Iodine / barium (used as contrast material) 5. *High Z number / large attenuation coefficient / large absorption coefficient (used to improve image contrast) 6. Contrast media are ingested / injected into the body 7. *Sca shows <u>outline</u> / <u>shape</u> of soft tissue QWC mark is acquired from clear expression of any of the marking points 3, 5 or 7	B1 × 5	
	(b)		X-rays produce visible light or In photoelectric effect electrons are emitted	B1	
	(c)	**(i)**	Any <u>two</u> from: • Simple X-ray is one directional / produces single image • CT image(s) taken at different angles / X-ray tube is rotated • Computer processes data / image constructed from many slices	B1 × 2	
		(ii)	Any <u>two</u> from: 1. X-ray image is 2D / CT scan produces 3D image 2. Greater detail / definition / contrast with CT scan / 'soft tissues can be seen' 3. Image can be rotated	B1 × 2	
			Total	10	