

10(a)	product of density and speed
	speed of sound in medium (and density of the medium)
10(b)	ultrasound waves cause crystal to vibrate
	vibrations (of crystal) cause induced e.m.f. (across crystal)
10(c)(i)	intensity reflection coefficient = $(40.4 - 1.48)^2 / (40.4 + 1.48)^2$
	= 0.86
10(c)(ii)	Z values are very similar
	(almost) all the ultrasound will be transmitted or (almost) none of the ultrasound will be reflected

10(a)	alternating p.d. (applied to crystal) makes crystal vibrate
	when frequency of applied p.d. equals natural frequency of crystal, crystal resonates
	natural frequency of crystal is in ultrasound range
10(b)(i)	product of density and speed
	speed is speed of ultrasound in medium (and density of medium)
10(b)(ii)	(α is close to) 0 when Z_1 and Z_2 are equal
	(α is close to) 1 when Z_1 and Z_2 are very different
10(c)	$I = I_0 \exp(-\mu x)$
	$\ln(I/I_0) = -\mu x$
	$\ln 0.62 = -\mu \times 2.1$
	$\mu = 0.23 \text{ cm}^{-1}$

8(a)(i)	specific acoustic impedance = $1200 \times 1400 = 1.68 \times 10^6 \text{ kg m}^{-2} \text{ s}^{-1}$
8(a)(ii)	density of air shown in table as 1.29
	speed of sound in tissue shown in table as 1540
8(b)(i)	intensity reflection coefficient = $(Z_1 - Z_2)^2 / (Z_1 + Z_2)^2$
	= $(1680000 - 440)^2 / (1680000 + 440)^2$
	= 0.999
8(b)(ii)	intensity reflection coefficient = $(Z_1 - Z_2)^2 / (Z_1 + Z_2)^2$
	= $(1680000 - 1680000)^2 / (1680000 + 1680000)^2$
	= 0
8(c)	without gel, (almost) all of the (incident) ultrasound is reflected (from skin)
	with gel, (almost) all of the (incident) ultrasound is transmitted (into the body)

9(a)	piezo-electric crystal
	(ultrasound) wave causes shape change / vibrations (of crystal)
	shape change / vibrations causes e.m.f. (which is detected)
9(b)(i)	93 V
9(b)(ii)	$2.7 \times 10^7 \text{ rad s}^{-1}$
9(c)(i)	$\text{kg m}^{-2} \text{ s}^{-1}$
9(c)(ii)	$\rho = Z / c = 1.7 \times 10^6 / 1600$ $= 1100 \text{ kg m}^{-3}$
9(c)(iii)	intensity reflection coefficient ≈ 1 or Z_1 and Z_2 are very different
	almost no / no ultrasound transmitted (into air filled cavity)