

Table 1. Physical properties of tissues

Medium	Acoustic imp. $\times 10^{-6}$ (Pa \cdot s \cdot m $^{-1}$)	Speed of sound (m \cdot s $^{-1}$)
Air	0.0004	330
Blood	1.61	1550
Bone	7.8	3500
Fat	1.38	1450
Brain	1.58	1540
Muscle	1.7	1580
Vitreous humour	1.52	1520
Liver	1.65	1570
Kidney	1.62	1560

Questions:

- Which organs can be imaged well using ultrasound imaging, and why? Are there specific tissues or organs where ultrasound is *not* effective? (2p)
- For the object shown in Figure 1, qualitatively sketch the B-mode ultrasound image. Justify your drawing also with a few sentences. Ignore speckle or scatter and only consider signals backscattered from the tissue boundaries. The operating frequency of the system is 5 MHz. The acoustic impedance in the tumors is $1.5 \cdot 10^{-6}$ Pa \cdot s \cdot m $^{-1}$, the attenuation coefficient in the tumors 2.5 dB/cm, and the speed of sound in the tumors is 1200 m/s. See also table 1. (4p)

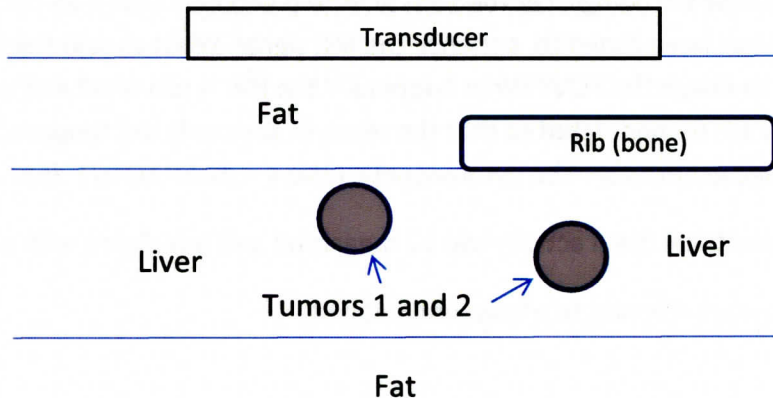


Fig. 1. Schematic of ultrasound imaging experiment for problem 5.