

24 Ultrasound – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
Ultrasound	超声波	_____
piezo-electric	压电	_____
transducer	换能器	_____

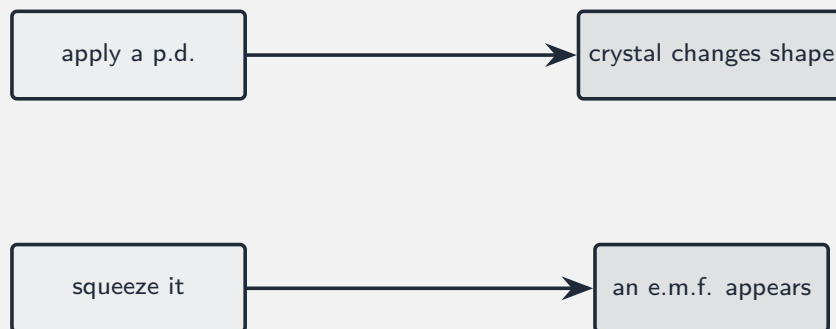
Recall

Ultrasound 超声波 is sound above 20 kHz —too high to hear. It is made and detected with a special crystal.

New ideas

Read these first. Each idea has a short worked example. Then do the Practice.

■ 1 The piezo-electric effect



A **piezo-electric** 压电 crystal works both ways: a p.d. changes its shape (to make vibrations), and squeezing it makes an e.m.f. (to detect them).

Worked example. Apply an alternating p.d. to the crystal and it vibrates in and out, sending out ultrasound. When a returning wave squeezes it, the crystal produces a small e.m.f. that the machine reads.

■ 2 The transducer



A **transducer** 换能器 uses this effect to *both* send and detect ultrasound —switching between vibrating and listening.

Worked example. The transducer sends a very short pulse, then immediately switches to "listen" mode and waits for the echo to come back before sending the next pulse.

Watch out: the *same* crystal both sends and receives —it switches between the two jobs many times each second, so one device does both.

Practice

Try these in order.

24.1 What is *ultrasound*? [1]

24.2 What happens to a *piezo-electric* crystal when you apply a p.d.? [1]

24.3 What happens when you squeeze the crystal? [1]

24.4 What does a *transducer* do? [1]

24.5 Does one transducer both send and detect, or do you need two? [1]

24.6 Explain why the piezo-electric effect is ideal for a device that must *both* produce and detect ultrasound. [2]

24.7 Challenge. Imaging uses ultrasound (above 20 kHz) rather than audible sound. Suggest why a higher frequency helps in seeing fine detail. [2]
