P5.1 Summary questions

1  a–2, b–3, c–1
2  a  A, C  
b  D, F  
c  time period  
d i  The displacement is at right angles to the direction of motion (left or right).  
ii  electromagnetic wave, wave on surface of water, earthquake wave  
e  Frequency is the number of waves per second, which you cannot show on a diagram.
3  a  wave speed = frequency × wavelength  
b  frequency = 1.5 Hz  
    wavelength = 10 m  
    wave speed = 1.5 Hz × 10 m  
    = 15 m/s  
c  The wavelength of waves in a ripple tank decreases as waves go from deep to shallow water. The speed decreases. They are refracted. As the waves approach the beach the water gets shallower and they are refracted.  
d  Use a motor to make lots of waves per second. Put a ruler in the tank. Take a strobe (flashing light) and turn it to a very high frequency. Decrease the frequency until the waves appear stationary – this is the frequency of the waves. Use the ruler to measure wavelength. Use the wave equation to calculate speed.
4  a  time for echo = 1.2 seconds  
    speed of sound = 330 m/s  
    distance = speed × time  
    = 330 m/s × 1.2 s  
    = 400 m (1 sig. fig.)  
The time for the echo is the time to the canyon wall and back to the middle of the canyon, so it equals the width of the canyon at that point.  
b  Some of it is reflected, and some is absorbed and heats up the walls.  
c  distance = 2 × 230 m = 460 m  
    speed = 1500 m/s  
    time = \frac{\text{distance}}{\text{speed}}  
    = \frac{460 \text{ m}}{1500 \text{ m/s}}  
    = 0.31 \text{ s (2 sig. fig.)}  
d  If it is above it at an angle the waves will be refracted as they enter the water. The distance calculated will not be an accurate measure of distance.
5  a  i  Sound is a vibration that moves through a medium (solid, liquid, or gas).  
     ii  Ultrasound is sound with a frequency higher than 20 000 Hz.  
      A doctor uses a device that emits ultrasound. The ultrasound hits boundaries inside the mother and can be reflected, transmitted, or refracted depending on the direction and the densities on either
side of the boundaries. Doctors use the reflections to build up a picture of the fetus.

iii Ultrasound has a higher frequency than audible sound, so a shorter wavelength, so you can focus it into a beam.

b i Both convert a sound wave into an electrical signal. The ear contains bones, membranes, and a fluid filled cochlea containing hairs. A microphone contains a coil of wire and magnets.

ii The hairs inside the cochlea respond to different frequencies according to their length – the shorter the hair, the higher the frequency that it detects. The hairs needed to detect ultrasound would be very short, and the human ear does not contain any that are short enough.

c The frequency defines the sound wave. When a sound wave enters a medium its wavelength can change because it slows down or speeds up, but the frequency stays the same.