Question	Answer	Mark
1(a)	Method 1: Long distance / distance in field measured with the tape One student fires pistol at one end (of this distance) Student at other end starts stop-watch on seeing smoke / light from pistol and st / ops stop-watch on hearing sound of pistol speed = (measured) distance / (measured) time Method 2: Distance of 50 m or more from a vertical wall measured with the tape Student 1 fires pistol at this distance from the wall Student 2 standing next to student 1 starts stop-watch on hearing pistol and stops stop-watch on hearing echo speed = 2 × (measured) distance / (measured) time	 **B1** **B1** **B1** **B1** **(B1)** **(B1)** **(B1)** **(B1)**
(b)(i)	v = fλ OR (λ =) v / f OR 1500 / 200 7.5 m	**C1** **A1**
(b)(ii)	1 (frequency) does not change 2 (speed) decreases	**B1** **B1**
		Total: 8

2 **(a) (i) 1.** Mark amplitude with **X** B1
2. Mark wavelength with **Y** B1

(ii) 1. Amplitude increases and wavelength stays the same B1
2. Amplitude stays the same and wavelength decreases B1

(b) v = (total) distance / time OR d / t OR 2d / t in any form C1
d = 1500 × 0.054 / 2 C
40 m OR 41 m A1

[Total: 7]

3 **(a) (i)** (compression is a) region of higher pressure
OR region where air layers/particles/molecules are closer B1

(ii) 1. distance between (two successive / adjacent) compressions B1

2. number of compressions (passing a point) per second / unit time
OR number of compressions emitted per second/unit time B1

(b) (i) (f =) v / λ OR 340 / 0.0085
40 000 Hz OR 40 kHz

(ii) frequency/pitch is above the upper threshold for human hearing / 20 kHz
OR it is ultrasound B1

(iii) (d =) vt in any form: words, symbols, numbers C1
41 m **or** 40.8 m A

[Total: 8]

4 **(a** (in compressions) pressure higher OR molecules / atoms / particles close(r) together / (more) tightly packed B1

(b) v = fλ in any form OR (λ =) v / f OR 340 / 850
= 0.40 m A1

(ii) distance (of compression A from barrier) = 2.5 × 0.40 OR 1.0 m C
time (to reach barrier) = 1 / 340 = 2.9 × 10^{3} s OR 2.9 ms

OR T (= 1 / f) = 1 / 850 OR 0.4 / 340 OR 1.2 × 10^{3} (C1)
(moves 2.5 wavelengths:) time = 2.5 / 850 = 2.9 × 10^{3} s OR 2.9 ms (A

(c) two circular arcs centred on mid-point of gap in barrier by eye B1
along centre line, arcs separated by the same distance as adjacent compressions approaching barrier B1

(d) (speed in water) greater OR numerical value greater than 340 m / s B

[Total: 8]

5 **(a** (region of) low(er) pressure OR where molecules are further apart B1

(b) **(i)** 0.19 m B1

(ii) *v* = *f*λ OR 7 800 × 0.19 OR 1 500 / 1 480 / 1 482 (m / s) OR 0.76 / 1 500 OR 1 / 7 800 OR 4 / 7 800 etc. ecf from **(i)** C1
5.1(28205) × 10^{4} s ecf from **(i)** A1

(c) **(i)** unchanged / stays the same / constant OR 7 800 Hz

(ii) increases B1

(d) three wavefronts (rarefactions) joined to those below B1
three wavefronts with their upper ends further to the right AND parallel B1

[Total: 8]

6 **(a** speed of sound in gas: 300 m / s B

speed of sound in solid: 3000 m / s B

(b) particles / molecules / atoms oscillate / vibrate
OR pressure variation / compressions / rarefactions / displacements move B1

in the direction of travel (of the wave / sound)

(c) **(i)** two complete wavelengths / cycles with shorter wavelength B1

wave drawn has greater amplitude B1

(ii) higher frequency / pitch B1

louder / higher volume B1

[Total: 8]