Note: Show all formulae & working steps!

1(a) $v = \dfrac{d}{t} = \dfrac{300}{0.90}$ = 330 m s⁻¹ (2 s.f.)   [1]

(b)   The flash <u>travels instantaneously from shooter to him</u>; the <u>time taken for flash to travel from shooter to him is negligible.</u>   [1]

Assumptions:
- *sound is produced at the same time as the flash seen by the student*
- *this is not about human reaction time!*

2(a)   Light from lightning reaches the eye much faster than the sound from the thunder because light travels much faster than sound in air.   [1]
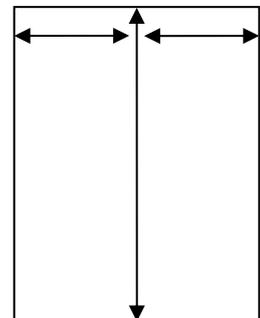
(b) $340 = \dfrac{d}{5.0}$ ➜ d = 1700 m (2 s.f.)   [1]

(c)   d = v t = 340 x 3.0 = 1020 m = 1000 m (2 s.f.)   [1]

(d) $v = \dfrac{(1700 - 1020)}{20 \times 60}$ = 0.567 ≈ 0.57 m s⁻¹   (2 s.f.)   [1]

OR 34 m/min or 2.0 km/h

3   [2]

(a) $v = \dfrac{2d}{t} = \dfrac{2 \times (17/2)}{50 \times 10^{-3}}$ ≈ 340 m s⁻¹   [1]

(b)   2L = vt => $L = \dfrac{vt}{2} = \dfrac{340 \times 160 \times 10^{-3}}{2}$
= 27.2 ≈ 27 m   [2]

Note: echo, need to take into account twice the distance travelled to and fro

4

(a) $v = \dfrac{d}{t}$
d = v t = 1500 x 0.20 = 300 m (distance echo travelled)
∴ depth of fish = 300/2 = 150 m

(b)   v = fλ
$\lambda = \dfrac{v}{f} = \dfrac{1500}{15 \times 10^3}$ = 0.10 m

5	Diagram	Reason
(a) sound of lower pitch	Fig. 5.1 [1]	It has a lower frequency [1]
(b) louder sound	Fig. 5.1	It has a larger amplitude [1]

Note: on CRO display, horizontal time axis: longer period T means lower frequency f

6(a)   Peak <u>voltage = height x gain</u>   = 2.0 cm x 1.0 V/cm

                                                  = 2.0 V   [2]

(b)   Period, <u>T = length x time base</u>   = 8.0 cm x 0.5 ms / cm

                                                  = 4.0 ms   [2]

(c)   <u>f = 1/T</u>   = 1/4.0 ms [1]

                                 = 250 Hz   [2]