Waves – Questions (1)

A Physics

Formulae (1) $D = vt$ (m, m/s, s)

(2) $v = f\lambda$ (m/s, Hz (s^{-1}), m)

Data Sound velocity...

in air 330 m/s

in water 1500 m/s

in steel 5000 m/s

Velocity of EM waves in air/vacuum 3×10^8 m/s

A. Waves

1. The wave machine in Bruce Willis's swimming pool sends out 5 complete waves in 8 s. The waves have an amplitude of 20 cm, and the distance between a crest and the next trough of 80 cm.

(a) What are the frequency and wavelength? (2)

(b) What is the waves' velocity? (2)

(c) Draw a labelled sketch of the waves (3)

2. A speaker cone vibrates with a frequency of 1320 Hz

(a) What is the wavelength of the sound waves? (2)

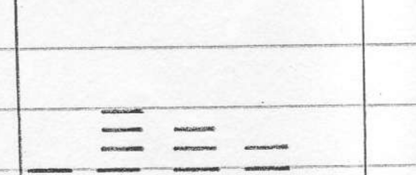
(b) What is the distance between a compression and the next rarefaction? (2)

3. A wave has a wavelength of 1 cm. What is its frequency if it is ...

(a) a sound wave in steel? (2)

(b) an EM wave in air? (2)

4. The frequency analyser on a HiFi shows this ⟶



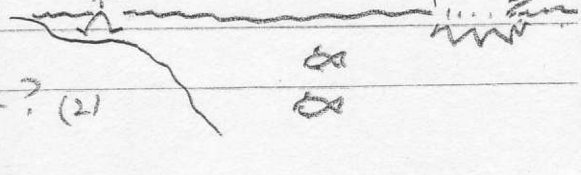
(a) Which frequencies are loudest, quietest? (2)

(b) What is the difference in wavelength between the lowest and highest frequencies? (4)

(c) How many 10 kHz waves will fit into a 350 Hz wave? (2)

Total /27

5. The person is catching fish with explosives. He feels the shock wave in the water 750 ms after the explosion. (a) How far away was the explosion? (2) (b) What is the delay in hearing the sound of the explosion? (2)



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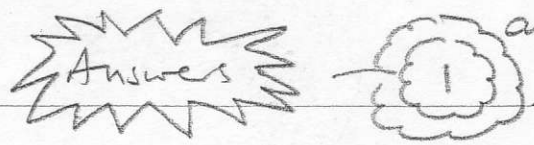
Waves – Answers

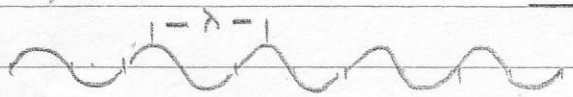


A Physics

1. (a) f = no. waves / sec = 0.625 Hz ①

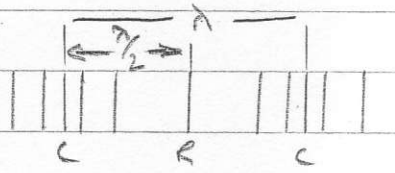
λ = crest-crest = 2 × 80 = 1.6 m ①

(b) $V = f\lambda$ ① = 0.625 × 1.6 = 1.00 m/s ①!

(c) 

5 waves ① λ ① amplitude ① [7]

2. (a) $V = f\lambda \rightarrow \lambda = V/f$ ① = 330/1320 = 0.25 ① m

(b) 

If λ (C to C) is 0.25 m

then C to R is $\lambda/2$ ① = 0.125 ① m [4]

3. (a) $V = f\lambda \rightarrow f = V/\lambda$ ①

key in: 5000 as "5 exp 3"

1 cm = 1/100 m = "1 exp −2"

(a) $f_{sound} = 5000 / 1\times10^{-2}$ = 500 000 Hz = 500 kHz ①

(b) $f_{em\ wave} = \frac{3\times10^{8}}{1\times10^{-2}}$ ① $= 3\times10^{10}$ ① Hz (it's a microwave)

{use standard form!}

[4]

{Give answers to same no. of s.f. as in Q. – or 1 more}

4. (a) loudest – 350 Hz ①

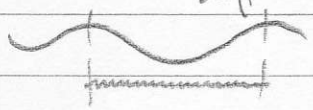
quietest – 10 kHz ①

(b) $V = f\lambda \rightarrow \lambda = V/f$ ①

lowest f: $\lambda = 330/70 = 4.71$ m ① (longest λ!)

highest f: $\lambda = 330/10\,000 = 0.033$ m ① (shortest λ)

difference = 4.68 m ① accept (4.7 m.) /4

(c) 

number = 4.71/0.033 ① = 143 ① (accept 140)

(or just calculate 10 000/70 = 142.8) [8]

{1 ms = 1/1000 = 10^{-3} sec}

5. (a) $D = Vt$ ① = 1500 × 750 × 10^{-3} = 1125 ① m

(b) Time it "hear" the explosion through the air

$t = D/V$ ① = 1125/330 = 3.41 sec ①

So time delay = 3.41 − 750 × 10^{-3} (= 0.750) = 2.66 sec

{accept either Q. ambiguous} [4]

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9.98

Total /27.