

Waves Answers

1)

Question	Answer	Marks
9(a)(i)	<u>infra-red</u>	B1
9(a)(ii)	frequency	B1
9(b)(i)	any two different applications from: <ul style="list-style-type: none"> • (medical) imaging OR detecting fractures in bone OR specific example e.g. CT scan /imaging teeth at dentist • detecting faults in metal • security imaging e.g. airport security checks of bags • cancer treatment 	B2
9(b)(ii)	any two from: <ul style="list-style-type: none"> • behind a screen OR lead apron • large distance from X-ray beam • monitoring of OR restricting exposure • low dosage OR limit exposure time • monitor frequency of x-ray sessions • other people not allowed in room when X-ray being taken • avoid when pregnant 	B2
9(b)(iii)	same speed	B1
		Total: 7

2)

- 9 (a)** line from microwaves to satellite communications B1
- line from infra-red waves to TV remote control B1
- (b)** any two from: B2
- X-rays may cause mutation of DNA/cells
 - X-rays are ionising
 - idea of unnecessary exposure
 - (sales assistants) exposed to large dose of X-rays
- [Total: 4]**

3)

- 8 (a)** for full marks the method described must work any four from: B4
- means of producing sharp sound
 - use of suitable reflecting surface
 - measure total distance travelled by sound
 - measurement of time for sound to travel measured distance.
 - use of speed = distance / time
- (b) (i)** circle around DE B1
- (ii)** circle around CF B1
- (iii)** higher amplitude drawn B1
- same wavelength drawn (by eye) B1
- [Total: 8]**

4)

- 5 (a) (i)** X-rays B1
- (ii)** Infra-red B1
- (b) (i)** $v = f\lambda$ in any form **OR** $v \div f$ **OR** $3.0 \times 10^8 \div (2.45 \times 10^9)$ C1
- 0.12m A1

Waves Answers

- 5) 5 (a) (i) (number of complete) vibrations (of the strip) per second/unit time B1
- (ii) maximum displacement of end of strip from mid-position
OR XY OR ZY OR XZ \div 2 B1
- (b) (i) $(t =) d \div v$ OR $2d \div v$ C1
- 0.20 s OR 0.2 s A1
- (ii) 0.60 s OR 0.6 s c.a.o. B1
- (c) (i) accept any value between 1.0 and 9.9×10^3 m/s B1
- (ii) accept any value between 1.0 and 9.9×10^3 m/s B1
- (d) $v = f\lambda$ in any form OR $v \div f$ C1
- correct evaluation from candidate's (c)(i) with unit, expect 0.016 m B1
- 6) 7 (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) $(f =) v / \lambda$ OR $340 / 0.0085$ C1
40 000 Hz OR 40 kHz A1
- (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 A1

[Total: 8]

Waves Answers

- 7) 6 (a) (in compressions) pressure higher OR molecules/atoms/particles close(r) together/(more) tightly packed B1
- (b) (i) $v = f\lambda$ in any form OR ($\lambda =$) v/f OR $340/850$ C1
 $= 0.40$ m A1
- (ii) distance (of compression A from barrier) = 2.5×0.40 OR 1.0 m C1
time (to reach barrier) = $1/340 = 2.9 \times 10^{-3}$ s OR 2.9 ms A1
- OR $T (= 1/f) = 1/850$ OR $0.4/340$ OR 1.2×10^{-3} (C1)
(moves 2.5 wavelengths:) time = $2.5/850 = 2.9 \times 10^{-3}$ s OR 2.9 ms (A1)
- (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 B1
- [Total: 8]**
- 8) 7 (a) pressure high/increased OR molecules/particles close(r/st) together) B1
- (b) (i) 1.7 m B1
- (ii) $v = f\lambda$ in any form OR ($f =$) v/λ OR $5/0.025$ C1
 200 Hz A1
- (c) three compressions at $23^\circ - 33^\circ$ to wall B1
constant and correct wavelength by eye
only scored if at $8^\circ - 48^\circ$ to wall B1
- (d) (wavelength) greater B1
change of speed correctly related to change of wavelength B1
- [Total: 8]**
- 9) 6 (a) (region of) low(er) pressure OR where molecules are further apart B1
- (b) (i) 0.19 m B1
- (ii) $v = f\lambda$ OR 7800×0.19 OR $1500/1480/1482$ (m/s) OR $0.76/1500$ OR $1/7800$ C1
OR $4/7800$ etc. ecf from (i) A1
 $5.1(28205) \times 10^{-4}$ s ecf from (i) A1
- (c) (i) unchanged/stays the same/constant OR 7800 Hz B1
- (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]**

Waves Answers

10)

- 8 (a)** speed of sound in gas: 300 m/s B1
speed of sound in solid: 3000 m/s B1
- (b)** particles / molecules / atoms oscillate / vibrate B1
OR pressure variation / compressions / rarefactions / displacements move B1
in the direction of travel (of the wave / sound) B1
- (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]