

Waves in Air-Fluids-Solids

Mark Scheme

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.6 Waves
Sub-Topic	Waves in Air-Fluids-Solids
Difficulty Level	Silver Level
Booklet	Mark Scheme

Time Allowed: 53 minutes

Score: /52

Percentage: /100

Grade Boundaries:

M1.(a) any **four** from:

- light waves are transverse whereas sound waves are longitudinal
- light waves travel faster than sound waves
- light waves have a higher frequency than sound waves
- light waves have a shorter wavelength than sound waves
- light waves have oscillations perpendicular (to the direction of energy transfer) whereas sound waves are parallel (to the direction of energy transfer)

4

(b) the baby can be seen in the dark

1

(c) wave speed = frequency \times wavelength

accept $v = f \lambda$

1

(d) $3 \times 10^8 = f \times 0.125$

1

$$f = 3 \times 10^8 / 0.125$$

1

$$f = 2.4 \times 10^9 \text{ (Hz)}$$

allow 2.4×10^9 with no working for 3 marks

1

[9]

M2.(a) (i) 440 (sound) waves produced in one second

accept vibrations / oscillations for waves

1

(ii) 0.773 (metres)

allow 2 marks for an answer that rounds to 0.773

allow 2 marks for an answer of 0.772

allow 2 marks for an answer of 0.772

allow 1 mark for correct substitution ie $340 = 440 \times \lambda$

3

(b) (sound is) louder

*do **not** accept the converse*

1

as amplitude is larger

waves are taller is insufficient

1

higher pitch / frequency

1

as more waves are seen

reference to wavelengths alone is insufficient

waves are closer together is insufficient

1

[8]

M3.(a) the oscillation / vibration (causing the wave)

a movement causes the wave is insufficient

1

for a transverse wave is perpendicular to the direction of energy transfer

accept direction of wave travel

1

and for a longitudinal wave is parallel to the direction of energy transfer

accept direction of wave travel

*if no marks awarded allow 1 mark for correctly linking
perpendicular with transverse and parallel with longitudinal
the marks may be scored by the drawing of two correctly
labelled diagrams*

1

(b) for radio waves:

accept converse for each mark

are transverse

1

travel at speed of light / higher speed

1

have greater frequencies

1

can travel through vacuum

accept sound waves are not electromagnetic for 1 mark

1

[7]

M4. (a) 10 600 (Hz)

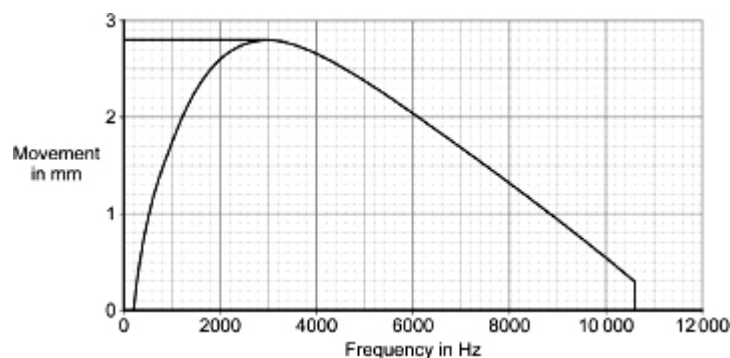
accept 10.6 kHz

1

(b) 3000 (Hz)

*allow 1 mark for a line drawn to show greatest
movement(allow only if frequency is between 2800 and
3200)*

accept other indication of correctly using the graph



2

(c) (No)

no marks for just the ticked box

reasons can score even if yes is ticked

(human hearing) range is 20 – 20 000 (Hz)

accept (most) people hear up to 20 000 (Hz) / 20 kHz

1

any **one** from:

- range on graph is within this range
- range on graph starts after 20 Hz
- range on graph is from to 200 – 10 600 (Hz)
- range on graph finishes before 20 000 Hz

1

(d) reliability

this answer only

1

(e) only 1 variable affects dependent variable / size of movement

accept 'results' for 'size of movement'

or there is only one independent variable

fair test is insufficient

*do **not** accept to control the experiment*

or to be able to compare (effect of different frequencies)

1

[7]

M5. (a) microphone

1

(c) (i) vertical line from any maxima or minima to axis
do **not** penalise minor errors but
do **not** allow unless intention is clear

1

(ii) loudness / volume / intensity / energy
do **not** accept noise

1

(c) 17

this answer only

1

(d) the greater the distance, the smaller the amplitude

accept volume / intensity / energy / loudness for amplitude

or there is a (strong) negative correlation between distance and amplitude **or** there is an inverse square relationship between distance and amplitude

*do **not** accept distance and amplitude are inversely proportional*

1

(e) 20 Hz

either order

1

20,000 Hz

accept 20 kHz provided unit has been clearly changed

1

[7]

M6. (a) (mechanical) vibration(s)

***not** just 'particles knocking into each other'
not reference to 'sound particles'*

1

(b) K

1

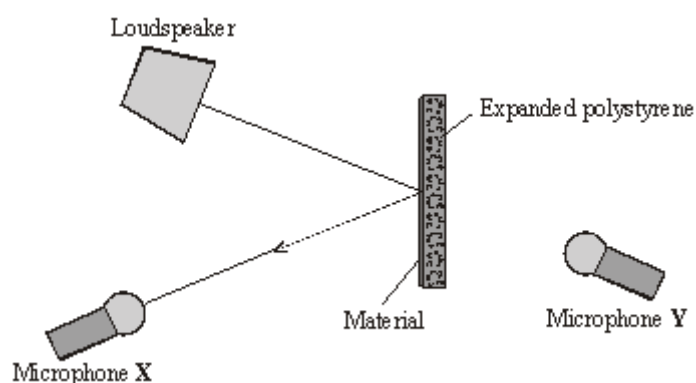
(c) (i) reflected by the material from loudspeaker to microphone X

1

shown by straight lines with angle of incidence = angle of reflection
(by eye) **and** at least one arrow in the correct direction

*do **not** credit if the direction is contradicted by any incorrect
arrow / may be shown by waves / wavefronts in the direction
of straight lines*

*ignore any sound to Y or which 'misses' the material
example*



1

(ii) any **one** from:

- so (the student) can compare results
- so only one (independent) variable

- to get reliable / accurate results
- because (the expanded) polystyrene absorbs some of the sound
*do **not** credit just 'so it's a fair test'*

1

(iii) **[A]** wood

1

[B] either 0.25 or 1/4 or 25 % or 15/60 or 1: 3
*do **not** credit 1 : 4*

1

(d) practical suggestion

1

appropriate reason / explanation

example line / panel the walls with wood / plasterboard /
increase the thickness of the plaster (on the walls) (1)
(this) will absorb / reflect (back) (most / some of) the sound
(1)

credit legal suggestions for attempting to limit the noise
made by the neighbours

example ask the neighbours to make less noise (1)
by limiting the time(s) music played (1)

*do **not** credit reference to 'sound particles' for second mark*

1

[9]

M7. (a) number of complete vibrations per second
for 1 mark

1

(b) (i) correct trace (more waves), *ignore amplitude*
for 1 mark

1

(ii) correct trace (higher amplitude), *ignore frequency*

for 1 mark

1

(c) (i) higher

for 1 mark

1

(ii) quieter

for 1 mark

1

[5]