AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



MARK SCHEME

4.6.1 WAVES IN AIR, FLUIDS AND SOLIDS (PACK 2)

SCORE	PERCENTAGE
/118	%

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Q1.

(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]

Q2.

(a) 20000

accept any unambiguous indication

1

(b) kilohertz

credit misspellings

credit '1000 hertz' or '1000 Hz'

accept 1000 oscillations/beats/waves <u>per second</u>

1

(c) (i) cleaning (e.g. something delicate such as a watch)

***or** quality control/flaw detection*

credit any appropriate extra Specification response e.g. sonar

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1

(ii) pre-natal (scanning)

*do **not** credit just 'scanning'/medical scanning/ scanning a baby*

credit any appropriate extra Specification response e.g. destruction of (kidney) stones or cleaning teeth

1

(d) 8 (μs)

1

(e) distance (1)

between the boundary and the detector (1)

accept 'between the boundary and the source'

accept any correct use of speed = distance/time

2

(f) examples

publish/tell doctors/the public (1) ... their evidence/results/research/data (1)

carry out more research/tests (1) ... to make sure/check reliability (1)

allow a wide variety of appropriate responses
valid point (1) appropriate example/qualification/expansion/etc. (1)

allow just 'stop using them/ultrasonic waves' (1)

allow using them (only) for industrial purposes (1)

2

[9]

Q3.

(a) (i)

correct order essential

(**A** =) a microphone

1

(**B** =) an oscilloscope

***or** cathode ray oscilloscope **or** CRO*

1

(ii) the amplitude

accept any unambiguous indication

1

(iii) quieter / softer

*do **not** accept less (which could refer to the amplitude, frequency or wavelength)*

1

(b) sound cannot travel through a vacuum / (empty) space / free space

accept there is no medium for the sound to travel through

1

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(because) there is / are nothing / no particles to vibrate

accept (because) there is / are nothing / no particles between them and the source (of the sound)

1

[6]

Q4.

(a) (i) same frequency / period / pitch / wavelength

ignore references to amplitude

1

(ii) differences in waveform / shape / quality

accept the diagrams are not identical

1

(b) (i) 20 000 Hz / hertz

or 20 kHz / kilohertz

*in both cases, if the **symbol** rather than the name is used, it must be correct in every detail*

1

(ii) material(s) / substance(s) (through which sound travels)

1

(iii) is absorbed

accept (some) sound (energy) is transformed / transferred <u>as</u> heat / thermal energy

1

is transmitted

accept is refracted
accept changes speed
accept changes velocity

*do **not** accept is diffracted*
*do **not** accept is diffused*
*do **not** accept is dissipated*

1

[6]

Q5.

(a) (i) 25 (%)

*do **not** accept ¼*

1

(ii) increases

1

(b) tick (✓) in top and bottom box

both required

1

(c) SHINY surfaces are good reflectors of infra-red radiation

accept white for shiny

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or black surfaces are POOR reflectors of infra-red radiation

accept bad for poor
accept insertion of 'not' before 'good' in statement

or black surfaces are good EMITTERS of infra-red radiation

or black surfaces are good ABSORBERS of infra red radiation

1

[4]

Q6.

(a) (mechanical) vibration(s)

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

1

(b) K

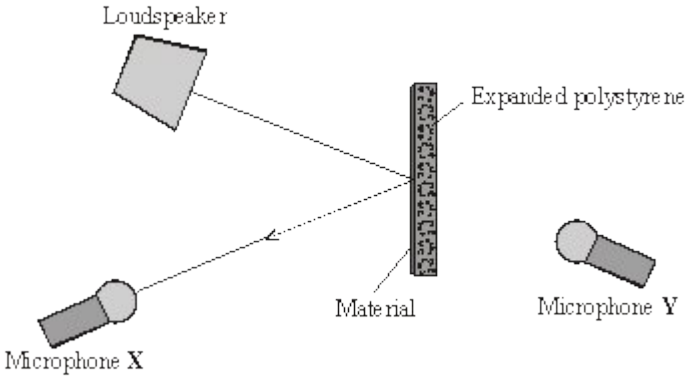
1

(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

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[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]

Q7.

(a) (i) **A**, **C** and **D**

any order but all three required and no others

1

(ii) **D** and **E**

either order but both required and no others

1

(b) (i) 20000 (Hz) to 20 (Hz)

accept '19980 (Hz)'

or vice-versa

1

(ii) frequency (of dog whistle) too high (for humans to hear) / frequency above 20000 Hz

accept 'it is ultrasound'

accept 'sound from the whistle is ultrasonic'

1

(c) (i) substance

1

reflection

correct order essential

1

(ii) detector

1

[7]

Q8.

(a) any **two** points:

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*do **not** credit features which are true of sound in general eg longitudinal waves*

- humans cannot hear ultrasound
- it has a very high frequency / pitch
  *do **not** credit just 'has a high frequency / pitch'*
- above the (upper) limit for humans / above 20 000 Hz

2

(b) (i) ultrasound / waves are reflected
...are bounced is insufficient, but
...echo is acceptable

1

Pulse **A** indicates / is the crack

Pulse **B** *i*ndicates / is the back (of the block or crack)
need to mention both A and B to get this mark

1

(ii) 90 (mm)
accept any answer in the range 88 – 92 (mm)

1

[5]

Q9.

(i) (partly) reflected when they hit a (boundary between two) different media or substance or tissue
accept named substances
*do **not** accept bounce back*

1

time taken for reflected wave (to return) is used to produce the image

1

(ii) any **one** from:

cleaning a delicate mechanism / jewellery
*do **not** accept cleaning*

welding plastics

cutting textiles

mixing emulsion paints

sonar

motion sensors (in burglar alarms)
*do **not** accept burglar alarms*

removing dental plaque

industrial quality control

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breaking up kidney stones

treating injuries

1

[3]

Q10.

(a) sound with a frequency above audible

do not accept answer in terms of λ

do not accept sound which cannot be heard unless obvious from context

accept above 20 kHz

1

(b) (i) to show detail **or** to give a clear image/picture

*accept the generators **or** transducers can be small*

accept so the beam does not spread out/beam in focus

***not** 'good picture'*

1

(ii) (much) smaller wavelength

allow higher frequency/pitch

1

(iii) no damage to living cells (provided low power)

accept the converse

*accept no damage to baby **or** not dangerous to baby*

1

(iv) any **two** forms

sex

stage of development

or specific examples

abnormalities

general health

potential problems (at birth)

accept specific examples e.g. umbilical cord around neck

size of head

accept multiple births

2

[6]

Q11.

(a) stop

accept any indication

cannot travel

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2

(b) middle box ticked

accept a tick next to the statement even if not in the box
*do **not** accept two ticks*

1

(c) (i) B

highest frequency

accept most waves (in box)
accept 'squashed together'
*do **not** accept 'squashed'*
accept 'close (together)'
accept shortest wavelength

2

(ii) D

largest amplitude

*accept tallest **or** highest wave*
*do **not** accept biggest wave*
*do **not** accept 'high' wave*

2

[7]

Q12.

(a) glass

1

air

must be in correct order

1

closer the particles faster the speed

answer must show a comparison

or

particles in glass closest in air furthest apart

accept the denser the material the faster the sound travels

or

sound travels faster in solids than gases

incorrect explanation negates credit

1

(b) (i) grasshopper

(ii) ultrasound

accept ultrasonic

1

(c) all of reflected pulse closer than given in original diagram

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accept a cluster of pulses ignore a reflected pulse in original position any pulse drawn to right of original negates credit

1

reflected pulse smaller than emitted but greater than 1 square high

accept cluster of pulses provided one part fulfils height criteria

2

[7]

Q13.

(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]

Q14.

D

gains 1 mark

but E (D + E = 1)

gains 2 marks

[2]

Q15.

- idea that (in words or on diagram)
- sound reflects / bounces off cliff
- returns the way it came / produces an echo

each for 1 mark

[2]

Q16.

(a) changes the sound wave(s)

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to a varying **or** changing (electric) potential difference **or** p.d. **or** voltage **or** current **or** to an irregular alternating current or a.c. **or** transfers sound energy to electrical energy (1) mark is vibrations **or** pulses **or** of sound **or** in air become electrical waves

*do not credit just 'to electricity' **or** 'to a.c'*

2

(b) (i) decrease **or** reduce the amplitude

accept less amplitude nothing else added

1

(ii) increase the frequency **or** decrease wavelength

accept higher frequency nothing else added

1

[4]

Q17.

Quality of written communication

correct use of **three** scientific terms from speed / velocity, reflection, density, time, boundary

1

any **three** from:

different tissues have different densities

ultrasound travels at different speeds / velocities in different tissues

reflection

accept bouncing back

from tissue boundaries

time taken to return

3

[4]

Q18.

(a) (i) cat

1

(ii) tuna

1

(b) (i) ultrasound

allow ultrasonic

1

(ii) cleaning / quality control / flaw detection / medical scanning / animal scaring / sonar

1

[4]

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Q19.

(a) (ultrasound) waves reflected

accept 'bounce off'

1

at boundary / from muscle

1

(b) (i) time

1

(ii) speed of (ultrasound) waves

1

[4]

Q20.

(a) Quality of written communication:
Correct use of 2 of the words, angle, critical, normal and reflection

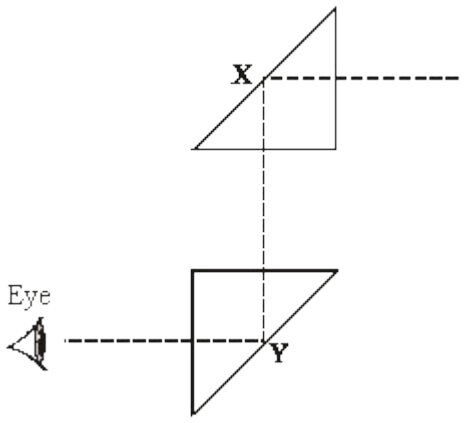
1

any **two** from

- light is reflected / bounces off
- if angle between ray and normal angle of incidence
- is greater than critical angle
- idea that no refraction bending if ray at 90°

2

(b)



*1 mark for reflection at **X** if ray would reach the lower prism*
*1 mark for subsequent reflection at **Y***
1 mark for subsequent ray emerging from prism in direction of front of eye
*accept dotted **or** dashed lines*
ignore any arrows

3

[6]

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Q21.

(a) 4

1

(b) 3

1

(c) 3

correct answer with no working = 2
allow 1 mark for f = number ÷ time
or correct working i.e., 12 ÷ 4
N.B. correct answer from incorrectly recalled relationship / substitution = 0

2

Hz / hertz

accept HZ, hz, hZ
allow waves / cycles per second
allow wps, w/s, cps, c/s

1

[5]

Q22.

(a) vibrates (owtte)

for one mark

1

(b) (i) higher

for one mark

1

(ii) louder

for one mark

1

(c) (i) ultrasonic (ultrasound)

for one mark

1

(ii) different frequency / wavelength / pitch

gains 1 mark

but

high frequency / pitch, higher frequency /pitch (lower frequency / pitch *wrong*)

gains 2 marks

2

[6]

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