GCSE
PHYSICS
AQA - COMBINED SCIENCE
MARK SCHEME

P6
WAVES
TEST 1
Mark schemes

(a) B 1

(b) A 1

(c) \[ \frac{2.5 \text{ (waves)}}{0.5 \text{ (s)}} \]

5(.0)(Hz) 1

(d) longitudinal 1

(e) timing (from seeing the blocks bang together and hearing the sound)
or risk of cancelling the timer

ignore human error unqualified
allow reaction time (of student B) 1

(f) student to stand further away (so there is a greater time lag to measure)

allow other correct methods, eg using echoes 1

(g) both are transverse waves
both can travel through a vacuum 1

(a) (i) (visible) light

accept visible 1

(ii) microwaves 1

(b) J 1

(c) (i) B 1

(ii) shorter than 1

(d) (i) To find out if using a mobile phone is harmful to health 1
any two from:

- (X has a) low(er) SAR value
  "it" refers to mobile phone
  accept has a low(er) rate

- (maximum) energy absorbed (by the head) is less
  accept energy emitted (by phone) is less
  accept radiation for energy

- (if mobiles are harmful) less likely to cause harm
  accept will not cause harm
  accept it is safer

(a) C (only)
(b) A (only)

(i) X-rays
infra red (rays)
radio (waves)
all three in correct order
allow 1 mark for 1 correct

(ii) to kill cancer cells

(iii) energy

(a) (i) 440 (sound) waves produced in one second
  accept vibrations / oscillations for waves

(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
(b) (sound is) louder

\[
\text{do not accept the converse}
\]

as amplitude is larger

\[
\text{waves are taller is insufficient}
\]

higher pitch / frequency

as more waves are seen

\[
\text{reference to wavelengths alone is insufficient}
\]

\[
\text{waves are closer together is insufficient}
\]

(a) accept ‘they’ as referring to microwaves

microwaves can travel through the atmosphere / ionosphere

\[
\text{accept not reflected by ionosphere}
\]

or

radio waves cannot (escape from the atmosphere)

\[
\text{allow cannot penetrate / travel through}
\]

\[
\text{ignore frequency / wavelength}
\]

\[
\text{ignore reference to speed of waves}
\]

(b) (i) straight continuous lines drawn to show microwave B reflected by satellite dish

\[
\text{reflected ray should be within limits of grey area}
\]
(ii) receiver drawn using rectangle symbol where microwaves A and B meet / cross over

  allow ecf from (b)(i)
  if (b)(i) not attempted no marks can be awarded for (b)(ii)
  if lines do not meet / cross over allow receiver where extended lines would meet
  allow any clear indication where receiver should be

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

  a movement causes the wave is insufficient

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

  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

(b) for radio waves:

  accept converse for each mark

  are transverse

  travel at speed of light / higher speed

  have greater frequencies

  can travel through vacuum

  accept sound waves are not electromagnetic for 1 mark
(a) sound waves are longitudinal

in longitudinal waves, the oscillations / vibrations are parallel to the direction of energy transfer

allow direction that the wave is travelling for direction of energy transfer

water waves are transverse

in transverse waves, the oscillations / vibrations are at 90 degrees to the direction of energy transfer

ignore references to wave speed, wavelength or frequency

an answer stating that sound waves travel in all directions but water waves don’t is insufficient.

(b) \[0.0083 = \frac{1}{ \text{frequency}}\]

\[\text{frequency} = \frac{1}{0.0083}\]

frequency = 120 (Hz)

an answer of 120(.481...) scores 3 marks
an answer of 0.12 scores 2 marks
| **Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account. | 5-6 |
| **Level 2:** Relevant points (reasons/causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear. | 3-4 |
| **Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical thinking. | 1-2 |
| No relevant content | 0 |

**Indicative content**

**equipment**
- a stopclock / stopwatch should be used to time the waves
- a metre rule should be used to measure distance

**determining the frequency of the waves**
- the frequency could be determined by finding the time for several waves to pass a point
- the frequency could be determined by finding the number of waves that pass a point in a fixed time
- frequency is the average time for one wave to pass a point
- frequency = \( \frac{\text{no. of waves}}{\text{total time for waves to pass}} \)

**determining the speed of the waves**
- the speed can be determined by measuring the distance travelled by a wave and the time taken to travel that distance
- the distance used to determine speed should be as long as possible
- speed = \( \frac{\text{distance}}{\text{time}} \)

**determining the wavelength of the wave**
- the wavelength can be calculated using the speed and frequency of the wave
- wavespeed = frequency \( \times \) wavelength
- wavelength = \( \frac{\text{wavespeed}}{\text{frequency}} \)
- wavelength = \( \frac{\text{distance}}{\text{time}} = \frac{\text{no. of waves}}{\text{second}} \)
(for both fibres) increasing the **wavelength** of light decreases and then increases the percentage / amount of light transmitted

*accept for 1 mark:*

*(for both fibres) increasing the **wavelength** (of light) to **5 (x 10^{-7}** metres), decreases the (percentage) transmission*

*(for both fibres) the minimum transmission happens at 5 (x 10^{-7} metres)*

*or*

*maximum transmission occurs at 6.5 (x 10^{-7} metres)*

*accept for a further 1 mark:*

*(for both fibres) increasing the **wavelength** of the light from 5 (x 10^{-7} metres) increases the amount of light transmitted*

*increasing wavelength (of light), decreases the percentage transmitted is insufficient on its own*

*the shorter fibre transmits a greater percentage of light (at the same wavelength)*

*accept for 1 mark:*

*Any statement that correctly processes data to compare the fibres*