

# MARK SCHEME

# GCSE

## PHYSICS

## AQA - COMBINED SCIENCE

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P6 - TEST 5

WAVES

Advanced

## Mark schemes

1.

$$v = f \times \lambda$$

$$1.5 \times 10^{10} \text{ (hertz)}$$

or

$$15\,000\,000\,000$$

allow 1 mark for correct substitution and transformation

$$(3 \times 10^8 / 0.02)$$

allow 1 mark for  $1.5 \times 10^8$

$$\text{or } 150\,000\,000$$

2

[2]

2.

(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  $5 \times 10^{-7}$  metres), decreases the (percentage) transmission

1

(for both fibres) the minimum transmission happens at  $5 \times 10^{-7}$  metres)

or

maximum transmission occurs at  $6.5 \times 10^{-7}$  metres)

accept for a further 1 mark:

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

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

1

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

1

[3]

3.

(i) (wave) speed = frequency  $\times$  wavelength

or any correctly transposed version

accept  $v = f \times \lambda$

or transposed version

accept  $m/s = 1 / s \times m$

or transposed version



but only if subsequently used correctly

1

(i) 325

1

metres per second

**or**  $m/s$  **or**  $0.325\text{ km/s}$  for 2 marks

1

[3]

4.

0.000294 or  $2.94 \times 10^{-4}$  (m)

a correct answer given to an incorrect number of significant figures gains 2 marks

eg  $2.939 \times 10^{-4}$  (m) **or**  $2.93 \times 10^{-4}$  (m)

**or** 0.0002939 (m) **or** 0.000293 (m)

**or**  $2.9 \times 10^{-4}$  (m) **or** 0.00029 (m)

**or**  $3 \times 10^{-4}$  (m) **or** 0.0003 (m)

allow 1 mark for correct substitution

$$1540 = 5\,240\,000 \times \lambda$$

**or**  $1540 = 5.24 \times 10^6 \times \lambda$

provided no subsequent step

**or** allow 1 mark for correct substitution and rearrangement

$$\lambda = \frac{1540}{5\,240\,000}$$

**or**

$$\lambda = \frac{1540}{5.24 \times 10^6}$$

provided no subsequent step

an answer of 2.94 gains one mark only

an answer given to an incorrect number of s.f. and including a rounding error gains one mark only

eg  $2.938 \times 10^{-4}$  (m)

3

[3]

5.

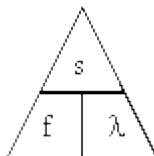
(i) speed = frequency  $\times$  wavelength

accept the equation rearranged

accept  $v$  **or**  $s = f \times \lambda$

do not allow  $w$  for wavelength

do not accept



unless subsequent calculation correct

1

(ii) 330 (m)

*allow 1 mark for*

$$\lambda = \frac{300\,000\,000}{909\,000}$$

*or 300 000 000 = 909 000 × λ*

*or answer of 330000(m) or 330033(m)*

2

[3]

6.

(i) all electromagnetic waves travel at the same speed through a vacuum, (so assume same speed in air)

*accept 'all parts of spectrum' for electromagnetic waves*

1

(ii) 1500 (m)

*allow 1 mark for correct transformation and substitution*

*allow 1 mark for using 200 000 Hz*

*answers 1 500 000 = 1 mark*

2

(iii) line drawn at correct position

*anywhere between 1000 and next section (10 000)*

*accept their value for (a)(ii) drawn in*

*the correct position*

1

[4]

7.

- Q is louder
- Q is higher (pitch/note but not frequency)  
*[if loudness and pitch both mentioned but direction wrong / absent credit 1 mark]*
- louder because bigger amplitude/height
- higher pitch because higher frequency/shorter wavelength/waves closer together
- factor of 2 mentioned w.r.t either  
*(NB converse answer for P)*  
*each • for 1 mark*

[5]

8.

(a) any **two** from:

- travel (at same speed) through a vacuum / space  
*do not accept air for vacuum*
- transverse
- transfer energy
- can be reflected
- can be refracted
- can be diffracted
- can be absorbed
- travel in straight lines

2

(b) can pass through the ionosphere

*accept atmosphere for ionosphere*

*do not accept air for ionosphere*

*accept travel in straight lines*

*accept not refracted / reflected / absorbed by the ionosphere*

1

(c)  $v = f \times \lambda$

$1.2 \times 10^6 / 1200\ 000$

*allow 1 mark for correct substitution*

*ie  $3.0 \times 10^8 = f \times 2.5 \times 10^2$*

2

hertz / Hz

*do not accept hz or HZ*

*accept kHz or MHz*

*answers 1.2 MHz or 1200 kHz gain all 3 marks*

*for full credit the unit and numerical value must be consistent*

1

[6]

9.

(a) (i) any **two** from:

- travel at the same speed (through a vacuum)  
*accept travel at the speed of light*  
*accept air for vacuum*
- can travel through a vacuum / space  
*do not accept air for vacuum*
- transfer energy
- can be reflected
- can be refracted
- can be diffracted
- can be absorbed
- can be transmitted
- transverse  
*accept any other property common to electromagnetic waves*  
*accept travel at the same speed through a vacuum for both marks*  
*do not accept both radiated from the Sun*

2

(ii) infra red

**both** required for the mark

radio(waves)

*accept IR for infra red*

1

(b) 2 400 000 000

*correct transformation and substitution gains 1 mark*

*ie  $\frac{300000000}{0.125}$  or  $\frac{300000000}{0.125}$*

*an answer of 24 000 000 gains 1 mark*

**either** 2 400 000 kHz

**or** 2 400 MHz scores **3** marks but the symbol only scores the 3<sup>rd</sup> mark if it is correct in every detail

2

hertz

*accept Hz*

*do not accept hz*

1

(c) (i) presented (scientific) evidence / data

*do an experiment / investigation is insufficient*

1

- (ii) to find out if there is a hazard (or not)  
*accept to find out if it is safe*  
*accept not enough evidence to make a decision*  
*not enough evidence is insufficient*

1

[8]

10.

- (a) in a longitudinal wave, the oscillations / vibrations are parallel to the direction of energy transfer

*allow direction of travel for energy transfer*

1

in a transverse wave, the oscillations / vibrations are perpendicular to the direction of energy transfer

*allow direction of travel for energy transfer*

*if no other mark scored allow 1 mark for (oscillations / vibrations of) longitudinal waves are parallel **and** (oscillations / vibrations of ) transverse waves are perpendicular*

*if no other mark scored allow 1 mark for transverse waves have peaks and troughs **and** longitudinal waves have compressions and rarefactions*

1

- (b)  $3.0 \times 10^8 = 4.8 \times 10^9 \times \lambda$

$$\text{allow } \lambda = \frac{3.0 \times 10^8}{4.8 \times 10^9}$$

*this mark may be awarded if the standard form values are incorrectly converted*

1

$$\lambda = 0.0625 \text{ (m)}$$

1

$$\lambda = 0.063 \text{ (m)}$$

**or**

$$\lambda = 6.3 \times 10^{-2} \text{ (m)}$$

*allow an answer to 2 sig figs that is consistent with their calculated value of  $\lambda$  and has required rounding*

1

*an answer of 0.063 (m) scores 3 marks*

(c) any **three** from:

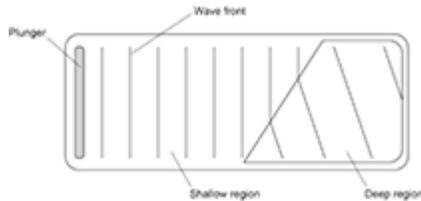
- (the car aerial) absorbs radio waves or energy
- electrons are made to vibrate (in the aerial)
- creating an alternating current (in the aerial circuit)
- the (signal) frequency is the same (as the radio wave)

3

[8]

11.

(a)



*lines should be further apart with the bottom of the wave fronts further to the right than the top*

1

(b) they will speed up

1

so wave (fronts) move further apart

1

(c) longitudinal waves:

- the oscillations are parallel to the direction of energy transfer
- show areas of compression and rarefaction

1

1

transverse waves:

- the oscillations / movement are perpendicular to the direction of energy transfer.

1

(d) place a floating object / plastic duck on the surface of the water

1

it will stay in the same place **or** only bob up and down if the water doesn't move

1

(e)  $0.42 = 1 / f$

1

$$f = 2.38$$

1

$$v = 2.38 \times 0.34$$

1

= 0.809

*allow 0.809 with no working shown for 4 marks*

1

*incorrect sig. figs max 3 marks*

m / s

*correct unit*

1

**[13]**