

# MARK SCHEME

# GCSE

## PHYSICS

## AQA - TRIPLE SCIENCE

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P6 - TEST 6

WAVES

Advanced

## Mark schemes

1.

(a) an idea used to explain observations and data

1

(b) different models may be appropriate in different situations

*allow one particular model may not be able to explain all observations*

1

(c) new (experimental) evidence / data

1

evidence cannot be explained using an existing model

**or**

predictions made using old model are shown to be incorrect

*allow old model based on data now shown to be incorrect*

1

new model explains new evidence

**or**

predictions made with new model are shown to be correct

1

a suitable example given

e.g. nuclear model of the atom replacing the plum pudding model

*allow tectonic plates replacing static land masses*

big bang theory replacing other theories for the creation of the universe

*allow heliocentric model of solar system replacing geocentric model*

1

(d) velocity / speed is slower in shallow water

1

so edge of wave (front) entering shallow water slows down

1

but the part of the wave (front) in deeper water continues at a higher speed (leading to a change in direction of the wave fronts)

*allow one part of the wave (front) changes speed before other parts*

*allow an answer in terms of wave (front) travelling from shallow to deep water*

1

(e) every point on the wave (front) enters / hits the shallow water at the same time

1

and so every point slows down at the same time

*allow changes speed for slows down*

*allow an answer in terms of wave (front) travelling from shallow to deep water*

1

[11]

2.

(a) (i) microwave

1

(ii) refraction

1

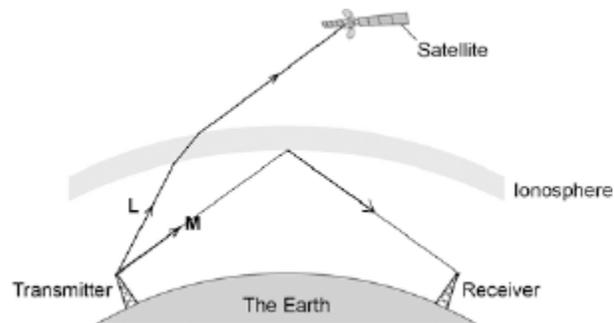
(b) (i) wave M continues as a straight line to the ionosphere and shown reflected

*accept reflection at or within the ionosphere*

1

correctly reflected wave shown as a straight line reaching the top of the receiver

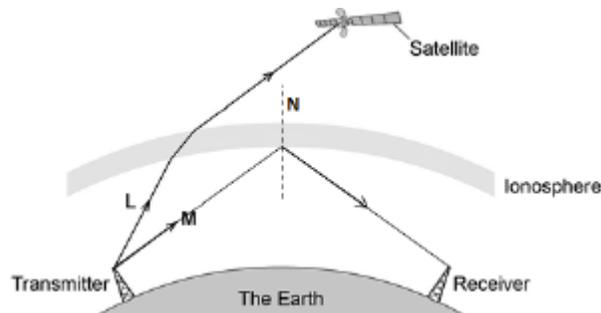
*if more than 2 rays shown 1 mark maximum*



*ignore arrows*

1

(ii) normal drawn at point where their **M** meets the ionosphere



1

- (c) any **two** from:
- transverse
  - same speed (through air)
- accept speed of light or  $3 \times 10^8 \text{ m/s}$*
- can be reflected
  - can be refracted
  - can be diffracted
  - can be absorbed
  - transfer energy
  - can travel through a vacuum
- an answer travel at the same speed though a vacuum scores 2 marks*
- can be polarised
  - show interference.
- travel in straight lines is insufficient*

2

[7]

3.

- (a) high frequency sound (waves)

1

with a frequency above limit of human hearing  
**or** with a frequency greater than 20 000 Hz

*above limit of human hearing*

*or greater than 20 000 Hz gains maximum 1 mark*

1

- (b)  $5(.0) \times 10^{-4} \text{ (m)}$   
**or**  
 0.0005 (m)

*$1500 = 3 \times 10^6 \lambda$  gains 2 marks*

*answer of 500 gains 2 marks*

*$1500 = 3.0 \lambda$  gains 1 mark*

3

- (c) it will run off the surface of the skin  
**or**  
 water is not a gel

*accept water would evaporate*

1

- (d) The width of the coupling agent

1

The width of the water

1

- (e) (i) A

1

- (ii) E

1

- (f) (i) **K**  
 reflection from skin  
*maximum 5 marks if no mention of reflection* 1
- very little reflection, so small peak 1
- L**  
 reflection from front of kidney 1
- large amount of reflection, so large peak 1
- M**  
 reflection from back of kidney 1
- smaller peak due to absorption of ultrasound in kidney  
**or**  
 smaller peak as further from source  
**or**  
 front of the kidney already reflected a lot, so there is now less to be reflected  
*reflection from a boundary gains 1 mark if no other mark given* 1
- (ii) 0.06 (m)  
**or**  
 $6(.0) \times 10^{-2}$   
*0.12 (m) gains 2 marks*  
*distance =  $1500 \times 8 \times 10^{-5} \times 0.5$  gains 2 marks*  
*distance =  $1500 \times 8 \times 10^{-5}$  gains 1 mark* 3

[19]

- 4.**
- 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]

- 5.** (i) 0.5 1

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

accept  $v = f \times \lambda$

accept  $s$  for  $v$

accept  $m/s = Hz \times m$

accept



providing subsequent method correct

1

(iii) 15.2 km

both numerical answer and unit are required for both marks

numerical answer and unit must be consistent

allow 1 mark for 15.2 with incorrect or no unit

allow 2 marks for an answer of 1.52 km if the answer to (b)(i) was given as 5

r 1 mark for correct transformation

or 1 mark for correct use of speed = distance/time

unit on its own gains no credit

2

[4]

6.

(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]

7.

(a)  $10^{-15}$  metres to  $10^4$  metres

1

(b) (i) any **one** from:

- (TV / video / DVD) remote controls  
*mobile phones is insufficient*
- (short range) data transmission  
*accept specific example, eg linking computer peripherals*
- optical fibre (signals)  
*do **not** accept Bluetooth*

1

(ii) 0.17

*an answer 17 cm gains 3 marks*

*an answer given to more than 2 significant figures that rounds to 0.17 gains 2 marks*

*allow 1 mark for correct substitution, ie  $3 \times 10^8 = 1.8 \times 10^9 \times \lambda$*

3

(c) (maybe) other factors involved

*accept a named 'sensible' factor, eg higher stress / sedentary lifestyle / overweight / smoking more / diet / hot office / age*

*not testing enough people is insufficient*

*unreliable data is insufficient*

1

[6]

8.

(a) (i) 3

1

(ii) 30 000 **or** 10 000 × their (a)(i) correctly calculated

1

(iii) any **two** from:

- frequency is above 20 000 (Hz)  
*accept the frequency is 30 000*
- frequency is above the upper limit of audible range
- upper limit of audible range equals 20 000 (Hz)  
*ignore reference to lower limit*
- it is ultrasound/ultrasonic

2

(b) (i) wave (partially) reflected

1

at crack to produce **A** and end of bolt to produce **B**

*accept at both ends of the crack*

1

- (ii) 0.075 (m) allow **2** marks for time = 0.0000125  
 allow **1** mark for time = 0.000025  
 answers 0.15 **or** 0.015 **or** 0.09 gain **2** marks  
 answers 0.18 **or** 0.03 gain **1** mark  
 the unit is not required but if given must be consistent with  
 numerical answer for the available marks

3

[9]

- 9.** (i) this mark only scores if a correct pair is chosen **and** a  
 correct reason given

**A and C**

*both required and none other*

**or**

**B and D**

*both required and none other*

only one (independent) variable

**or**

different shapes but the same colour

*accept only the shape changes*

1

- (ii) **B radiates** heat faster  
*converse answer in terms of A gains full marks*

1

**or**

B is a better emitter (of heat)

but B has a smaller (surface) area

**or**

B has a smaller (surface) area: volume ratio

*allow 2 marks for both lose the same quantity / amount of heat in  
 the same time*

**or both have same rate of heat loss**

*allow 1 mark for both lose the same quantity / amount of heat*

1

- (iii) any **one** from:

- transfer a lot of heat (too rapidly)
- water temperature drops too rapidly  
*accept (significantly) more heat will be lost from the first radiator*
- water too cold for the next radiator  
*mention of absorption of heat negates mark*

1

[4]

10.

(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 as 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]