

MARK SCHEME

GCSE

PHYSICS

AQA - COMBINED SCIENCE

P6 - TEST 4

WAVES

Intermediate

Mark schemes

1.

- (a) **use of infrared:**
remote controls
fibre optic (communications)

1

use of microwaves:
mobile/cell phones
accept mobiles
accept phone signals
satellite (communications/TV)
wi-fi
Bluetooth

1

- (b) any **two** from
- same speed
or
travel at the speed of light (in a vacuum)
 - transverse
accept a full description of a transverse wave
 - transfer energy (from one place to another)
 - can be reflected
 - can be refracted
 - can be diffracted
 - can be absorbed / transmitted
 - can travel through a vacuum/space
 - can be polarised
travels in straight lines is insufficient

2

[4]

2.

- (a) one of the areas where particles are spread out labelled R

1

- (b) parallel

1

- (c) 340 (m / s)

allow 1 mark for correct substitution
i.e. speed = 400×0.85 provided that no subsequent steps are shown

2

[4]

- 3.** (i) absorbed by water / water heated 1
- hot water heats (rest of) food / idea of particle vibration 1
- (ii) $300\,000\,000 / 3 \times 10^8$
- correct answer with no working = 2*
- allow 1 mark for $s = f \times w$ or correct working i.e., $10000 (000000) \times 0.03$*
- N.B. correct answer from incorrectly recalled relationship / substitution = 0* 2
- [4]**

- 4.** *idea that X-rays cause mutations*
- gains 1 mark*
- but** X-rays can cause/increase chance of mutations
- gains 2 marks*
- mutations usually harmful/produce abnormal growth
- serious effect on growing foetus/rapidly growing cells
- each for 1 mark*
- [4]**

- 5.** (a) amplitude marked as approximately half a wave height
- great precision is not required* 1
- wavelength marked as a trough to trough distance **or** a peak to peak distance
- accept an equivalent repeat distance anywhere on the wave* 1
- (b) the number of waves each second
- accept cycles per second accept 25 waves pass each second* 1
- (c) any **pair** from
- microwave cooking **or** communication **or** mobile phone
- radio communication **or** entertainment
- infra-red cooking **or** heating **or** remote control **or** security **or** night sights **or** thermal imaging
- accept sensible specific uses* 2
- [5]**

- 6.** (a) (i) a ray drawn leaving the block parallel to the incident ray
straight, continuous line judged by eye
*do **not** accept a ray of light with an arrow towards the block* 1
- (ii) normal 1
- (b) (i) a smooth curve drawn through the points 1
- (ii) as the angle of incidence increases the angle of refraction increases
allow correct description of their answer to (i)
ignore the angle of incidence is always larger than the angle of refraction 1
- it is a non-linear graph
or
 not directly proportional
allow a correct description of the graph / points 1
- [5]**
- 7.** (a) (i) a horizontal distance indicated and labelled
gains 1 mark
- but**
 horizontal distance indicated between identical points on adjacent waves (to within 3-4mm) and labelled
gains 2 marks 2
- (ii) peak ↔ trough indicated*
gains 1 mark
- but**
 peak / trough ↔ mean indicated*
- (* to within 1-2mm either end)
gains 2 marks
(allow 1 mark if both lines unlabelled or 2 marks if both lines accurately drawn and unlabelled) 2
- (b) • 1.5
- hertz / Hz **or** (waves / cycles) per second
for 1 mark each
(do not allow wavelength / hertz per second) 2

[6]

8.	<p>(a) (i) compare (the health of) mobile phone users with non-mobile phone users <i>must be an implied comparison between users and non-users</i> <i>any idea of doing an experiment negates the mark</i></p>	1
	<p>(ii) increase the sample size <i>accept use more people</i> <i>accept have a large sample size</i> <i>repeat the research / test is neutral</i></p>	1
	<p>(iii) ethical</p>	1
	<p>(b) (i) so the phones can be compared (fairly) <i>a fair test is insufficient</i> <i>accept different tests (may) give different results</i> <i>do not accept to make the results reliable, unless qualified</i> <i>eg all variables are controlled</i> <i>do not accept bias unless qualified</i></p>	1
	<p>(ii) yes all are below the legal limit / 2 (W/kg) or no and any one from:</p> <ul style="list-style-type: none"> • even absorbing a small amount of energy may be harmful <i>accept microwaves for energy</i> <i>accept emits energy absorbed by head / other parts of body</i> • no proof that small amounts of energy are not harmful <i>accept because the SAR value is not 0 (W/kg)</i> 	1
	<p>(c) any one from:</p> <ul style="list-style-type: none"> • to get an independent opinion • company scientists may be biased <i>accept company scientists may manipulate results</i> 	1
[6]		
9.	<p>(a) frequency</p>	1
	<p>(b) echo(es)</p>	1

(c) 340 (m/s)

allow 1 mark for correct substitution ie $25\,000 \times 0.0136$ provided no subsequent step

or

allow 1 mark for a correct calculation showing an incorrect value from conversion to hertz $\times 0.0136$

an answer of 0.34 gains 1 mark

2

(d) (a wave where the) oscillations are parallel to the direction of energy transfer

both marking points may appear as labels on a diagram

accept vibrations for oscillations

accept in same direction as for parallel to

allow direction of wave (motion) for direction of energy transfer

allow 1 mark for a correct calculation showing an incorrect value from conversion to hertz $\times 0.0136$

1

causing (areas of) compression and rarefaction

accept correct description in terms of particles

mechanical wave is insufficient

needs a medium to travel through is insufficient

1

[6]

10.

(a) any **three** from:

- same surface area of bag (exposed to sun)
allow same sized bag
- same volume / mass of water
allow same amount of water
- use same starting temperature of water
allow measure temperature at the start
- place all bags out at the same time
- place all bags out in same area / conditions
- same thickness of material / bag
- same type of material (for each bag)
- use IR lamp in a lab

3

(b) 0.1 (°C)

1

- (c) any **one** from:
- more cloudy
 - less sunny
- ignore less Sun*
- less sunlight
 - cooler day

1

- (d) 24.3 (°C)

1

- (e) black

1

(it has the) greatest (temperature) rise
allow it is the best absorber of IR (radiation)
ignore best emitter of IR (radiation)

1

reason only scores if black is given

[8]

11.

- (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]

12.

(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]