MARK SCHEME

GCSE

PHYSICS

AQA - COMBINED SCIENCE

P6 - TEST 3

WAVES

Intermediate

Mark schemes

1.

(i) X-rays or gamma rays

for 1 mark

1

(ii) passes through flesh;
stopped by bone/absorbed

for 1 mark each

2

[3]

2.

(a) **D**

1

(b) **C**

1

(c) **B**

1

[3]

3.

(a) (i) microwaves

1

(ii) can pass through the ionosphere

accept travels in a straight line

accept atmosphere for ionosphere

*do **not** accept air for ionosphere*

1

(b) higher the frequency, further the wave travels
(into the atmosphere before reflection)

1

(c) 15 000

*allow **1** mark for correct transformation and substitution*

ie $\frac{300\,000\,000}{20}$

*an answer of 15 000 000 only gains **1** mark*

allow both marks for an answer of 15 MHz (unit must be changed)

an answer of 15 gains no credit

2

[5]

4.

(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]

5. (a) any two successive peaks labelled **W**

accept any 2 points on same part of adjacent waves
correct by eye

1

half 'height' of wave labelled **A**

correct by eye
N.B. at least one of the answers must be labelled

1

(b) 0.2

correct answer with no working = 2
allow 1 mark for s = f x w or correct working i.e., 2 × 0.1
N.B. correct answer from incorrectly recalled relationship = 0

2

m/s (unit)

*independent mark do **not** allow mps **or** mHz*

1

[5]

6. (a) the <u>normal</u>

1

(b) v

1

(c) any **one** from:

- light has moved from glass to air / from air to glass

  accept light has changed medium

- speed of light has changed

  beware of contradictions for this marking point eg light has moved from glass to air and slowed down gets zero

- angle of incidence is less than the critical angle

  or *(angle) i < (angle) c* ***or*** *(angle) y is less than the critical angle*

- change in density (of medium)

  eg glass is more (optically) dense than air

1

(d) (i) ratio of v to y does not give the same answer (in every case)

or value of v doubles value of y does not double

1

or increments for v are the same but increments for y are not the same

allow for ***1*** *mark a calculation but no conclusion*
eg 30 → 60 19 → 35 (38)

1

(ii) as (angle) v increases, angle y increases

accept as the angle of incidence increases, the angle of refraction increases

or *there is a (strong) positive(non-linear) relationship between the variables*

or *ratio of sines is constant*

do ***not*** *accept angle y is not directly proportional to angle v*

1

(iii) no evidence outside this range

OWTTE

or when angle y is greater than the critical angle total internal reflection occurs

1

[7]

7. (a) (i) Ignore arrows on rays
perpendicular rays goes straight in and out
other ray refracts towards normal (not along)
emerges parallel incident ray (by sight) if refraction correct (ignore reflections)

for 1 mark each

3

(ii) emergent angle marked Y if emerges parallel to right of normal

for 1 mark

1

(b) straight ray to water surface refracts/bends
straight to eye/towards surface on right image correctly shown
or states the same mark prose only of diagram incomplete

any 3 for 1 mark each

3

[7]

8. (a) gamma rays above x-rays

for 1 mark

(b) upper radio wave boundary correct (10^{-1}m) (± 1mm)

for 1 mark

(c) visible radiation/light

- within the middle third of a wavelength band
- in the correct wavelength range (10^{-6} – 10^{-7}m)

each for 1 mark

(d) ultraviolet between *visible radiation and X-rays

for 1 mark

(e) microwaves above *radio waves and below *infra red
(*not necessarily immediately)

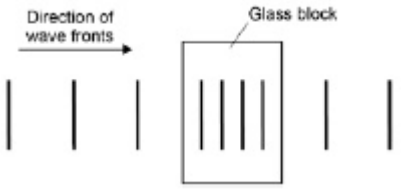
for 1 mark

(f) between 10^8Hz + 10^7Hz and nearer to 10^8Hz than to 10^7Hz

gains 1 mark

[7]

9. (a) at least two wave fronts drawn to the right of the glass block, parallel to the other wave fronts and with equal spacing compared with the wave fronts to the left of the glass block



1

(b) ray of light refracts towards the normal where it is incident on the glass block

1

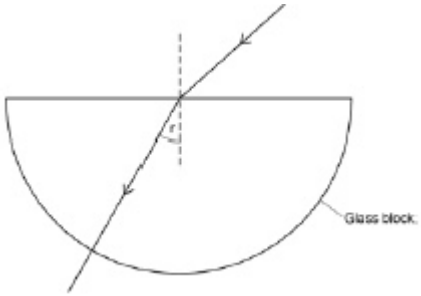
ray of light does not refract when it exits the glass block

1

a normal is drawn on where the ray is incident on the glass block

1

the angle of refraction is labelled



lines should be drawn with a ruler

1

(c) light travels more slowly (in the glass block than in the air)

1

so it changes direction

allow so it bends towards the normal

1

(d) the angle of incidence

1

the type of glass used

allow the glass block

1

(e) the <u>resolution</u> of a normal protractor is too big

1

so it could not measure the difference between results

allow so it could not read angles to 2 decimal places

1

(f) a longer wavelength gives a greater angle of refraction

1

(g) absorbed / reflected

1

[13]

10. (a) sound waves are longitudinal

1

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

1

water waves are transverse

1

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.

1

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

1

$\text{frequency} = \frac{1}{0.0083}$

1

frequency = 120 (Hz)

*an answer of 120(.481...) scores **3** marks*

*an answer of 0.12 scores **2** marks*

1

(c)

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 how many waves 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 = distance/time **determining the wavelength of the wave** • the wavelength can be calculated using the speed and frequency of the wave • wavespeed = frequency × wavelength • $\text{wavelength} = \frac{\text{wavespeed}}{\text{frequency}}$ • $\text{wavelength} = \frac{\left(\frac{\text{distance}}{\text{time}}\right)}{\left(\frac{\text{no. of waves}}{\text{second}}\right)}$	

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