Mark schemes

1 B

[1]

2 A

[1]

3 C

[1]

4 (a) transverse: vibration / displacement / disturbance not movement is perpendicular to direction of travel

B1

longitudinal: vibration / displacement / disturbance not movement is parallel to (same) direction of travel

B1

C1 for idea of transverse and longitudinal being perpendicular

(2)

(b) restriction of vibration / idea of how polarisation occurs

B1

single plane / same orientation – diagram may help

B1

(2)

(c) only transverse can be polarised / longitudinal cannot

B1

idea of being able to restrict vibration to single plane
or longitudinal not being perpendicular to motion
or longitudinal vibrating in direction of travel

B1

(2)

[6]

5 (a) Transverse

B1

(b) correct example of transverse wave
(e.g. light / electromagnetic / radio etc. allow photon b.o.d.)

B1

(c) [transverse] displacement vector perpendicular to energy direction [accept 'direction of motion']

B1

[longitudinal] vector parallel to energy direction

B1

polarisation is restriction of displacement vector to one plane OWTTE

[allow any or all marks on clear diagram]

B1

[5]

6

(a) (i) particle vibration (or disturbance or oscillation) **(1)**
same as (or parallel to) direction of propagation (or energy transfer) **(1)**

(ii) (particle vibration)
perpendicular to direction of propagation (or energy transfer) **(1)**

3

(b) variation in intensity between max and min (or light and dark) **(1)**
two maxima (or two minima) in 360° rotation **(1)**

2
QWC 1

[5]

7

(a) **maximum displacement** from equilibrium/mean position/mid-point/etc **(1)**

1

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

surface of water/water waves/in ripple tank **(1)**

rope **(1)**

slinky clearly qualified as transverse **(1)**

secondary ('s') waves **(1)**

max 1

(ii) transverse wave: oscillation (of medium) is perpendicular to wave travel

or transverse can be polarised

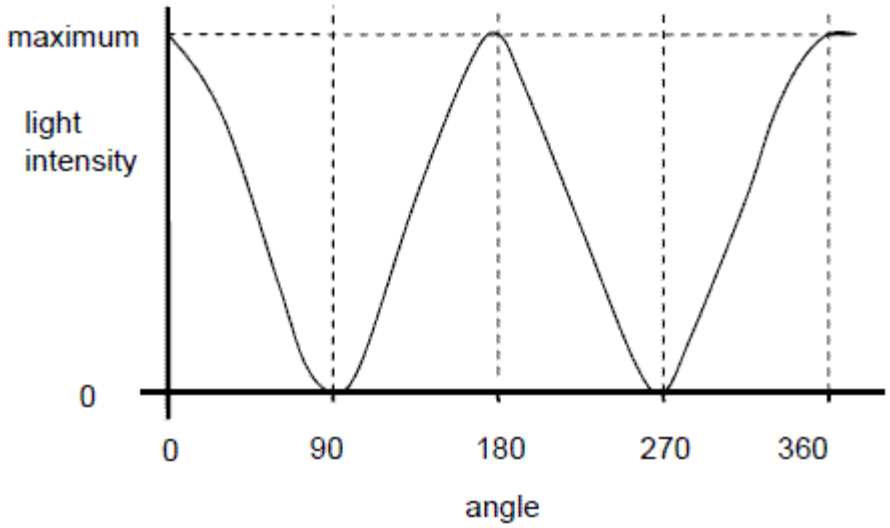
or **all** longitudinal require a medium **(1)**

1

(c) (i) vertical line on B ± 5° **(1)**

1

(ii)



max 0, 180, 360 + min 90, 270 **(1)**

and line reaches same minimum and maximum every time and reasonable shape **(1)**

2

(d) appropriate use **(1)**

reason for Polaroid filter being used **(1)**

eg

Polaroid glasses/**sun**glasses/ windscreens	to reduce glare
camera	reduce glare/enhance image
(in a) microscope	to identify minerals/rocks
polarimeter	to analyse chemicals/concentration or type of sugar
stress analysis	reveals areas of high/low stress/ other relevant detail
LCD displays	very low power/other relevant detail
3D glasses	enhance viewing experience, etc

2

[8]

Examiner reports

4

(a) Most candidates were able to show that they knew and understood the differences between transverse and longitudinal waves. Weaker candidates confused their answers by giving unclear statements such as *'…transverse waves move at right angles to their direction of travel whilst longitudinal move in a parallel direction'*.

(b) Answers were often unclear and candidates tended to focus on the polarisation of light waves, often going on to talk about the effect of crossed polaroids in their answers. Most candidates recognised that transverse waves can be polarised but there was some confusion about why longitudinal waves cannot.

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(a) Almost all candidates knew that transverse waves could be polarised.

(b) Almost all could give a clear, correct example of a wave that can be polarised.

(c) Explanations of why some waves can be polarised were weaker. Not only were the descriptions of the wave types muddled and poor, but many failed to describe clearly why longitudinal waves cannot be polarised. A large number would have helped themselves by drawing clear well *labelled* diagrams.

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Reluctance to memorise conventional definitions meant that many candidates were struggling to construct an answer in part (a). This usually caused a failure to express ideas sufficiently clearly for any marks to be awarded - for example "the waves move along in the same direction as the wave is travelling". Part (b) was generally very well answered, although there were references to coloured effects and/or fringes in some scripts. The most frequent mistake amongst more successful candidates was the notion that successive maxima of intensity occurred every 360° of rotation, rather than every 180°.

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In part (a), the strict definition of amplitude was expected. Candidates needed to say 'maximum displacement' and then indicate in some way that this was relative to the equilibrium position.

The majority, however, chose to define amplitude as the **distance** between the centre and the peak.

For part (b) (i), the majority of candidates could not give an example of a transverse wave other than electromagnetic waves. Most gave a form of electromagnetic radiation (most commonly 'light') or even sound. Common answers that were accepted included 'water waves', 'waves on strings' or 's-waves'.

Most candidates realised that a comparison between the direction of wave travel and the oscillation of the medium was a good way to answer part (b) (ii). It was common, however, for candidates to struggle to express this clearly. The most common error was to say that a transverse wave 'moves' perpendicular to the direction of wave travel rather than 'oscillation is perpendicular to direction of wave travel'.

The vast majority of candidates found part (c) (ii) very straight forward.

The majority of candidates had no problem with part (c) (ii). The exact shape of the line was not important as long as the maximum and minimum intensities appeared in the right place.

There were many very good answers to part (d), such as ‘sunglasses/ski goggles reduce glare from light reflected from water/snow’ and ‘a camera filter reduces unwanted reflections’. Common inadequate responses included saying that polarising sunglasses ‘reduce light intensity’ because the lenses are ‘darker’, or that polarising filters reduce UV.