Name: _____

Polarisation

Questions

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

Which of the following phenomena does **not** occur with sound waves?

☒ **A** diffraction

☒ **B** interference

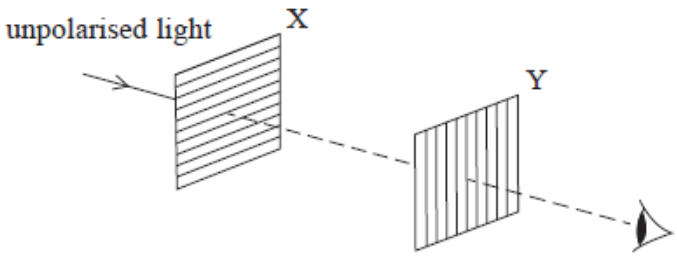
☒ **C** polarisation

☒ **D** refraction

(Total for question = 1 mark)

Q2.

A source of unpolarised light is viewed through two crossed polarising filters X and Y.



Which row in the table correctly describes the light emerging from the two filters?

(1)

	Light emerging from filter X	Light emerging from filter Y
☒ **A**	oscillates in every direction	oscillates in one direction
☒ **B**	oscillates in every direction	no light
☒ **C**	oscillates in one direction	oscillates in one direction
☒ **D**	oscillates in one direction	no light

(Total for question = 1 mark)

Q3. Light from a lamp passes through two polarising filters, P1 and P2, before reaching a

detector. The filters initially have their planes of polarisation parallel.

The intensity of light at the detector will be greatest if

☒ **A** P1 is rotated by 45° and P2 is rotated by 315° in the same direction.

☒ **B** P1 is rotated by 90° and P2 is rotated by 270° in the same direction.

☒ **C** P1 is rotated by 45° and P2 is rotated by 270° in the same direction.

☒ **D** P1 is rotated by 90° and P2 is rotated by 315° in the same direction.

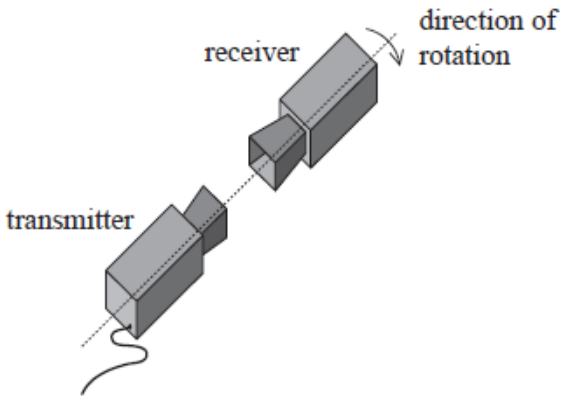
(Total for Question = 1 mark)

Q4.

Details supplied with a school microwave transmitter and receiver include the following information:

Transmitter supplies a 10 GHz polarised EM wave. Receiver detects EM waves in a single plane containing the direction of propagation, producing an audible output proportional to the microwave intensity.

The receiver and transmitter are initially set up, so that a maximum audible output is produced.



The receiver is rotated through 180° relative to the transmitter.

Describe what is heard as the receiver is rotated.

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(Total for question = 2 marks)

Q5.

Electromagnetic waves involve oscillating electric fields.

A student made the following notes about the polarisation of electromagnetic waves.
The notes contain a number of errors.

> *Electromagnetic waves are transverse, with oscillations parallel to the direction of motion.*
>
> *When they pass through a polarising filter all the components of the oscillations perpendicular to the filter's plane of polarisation are rotated.*
>
> *The oscillations of the polarised wave are all in the same plane which is perpendicular to the direction of energy transfer.*

Copy the passage, correcting the errors.

(4)

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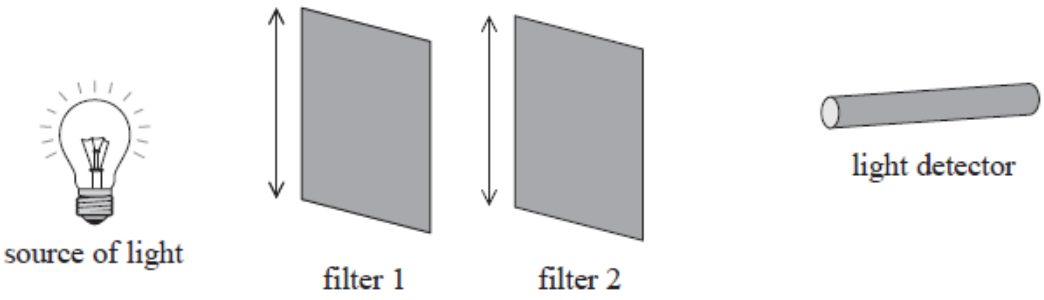
Q6.

The diagram shows apparatus used to investigate polarising filters.

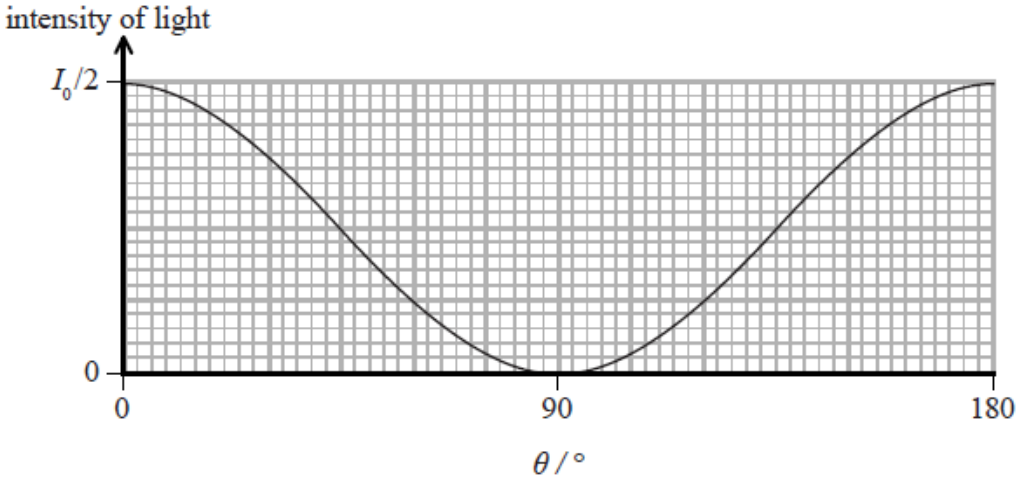


Light is incident on filter 1 and the intensity of the light is measured, using the light detector, when the filters are in the positions shown.

Filter 2 is then rotated and the intensity of light is measured for different angles of rotation θ.

The intensity of light measured with no filters present is I_0.

The results are shown on the graph.



Explain the effect of the filters on the intensity of light and why the intensity varies as shown.

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(Total for question = 6 marks)

Q7.

Iceland spar is a crystalline form of calcite. An incident ray of unpolarised light is separated into two plane polarised rays by a sample of Iceland spar. The two rays of polarised light follow different paths.

(a) Explain the difference between polarised and unpolarised light.

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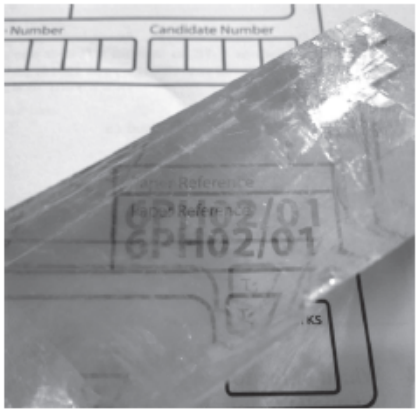
*(b) The photograph shows how the separate paths of light produce two images of an object behind the sample.



When a polarising filter is placed on the sample shown in the photograph only one image of 6PH02/01 is seen.

Explain why only one image is seen and describe what would be seen as the filter is rotated through 360°.

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(Total for question = 7 marks)

Q8.

(a) State what is meant by the principle of superposition of waves.

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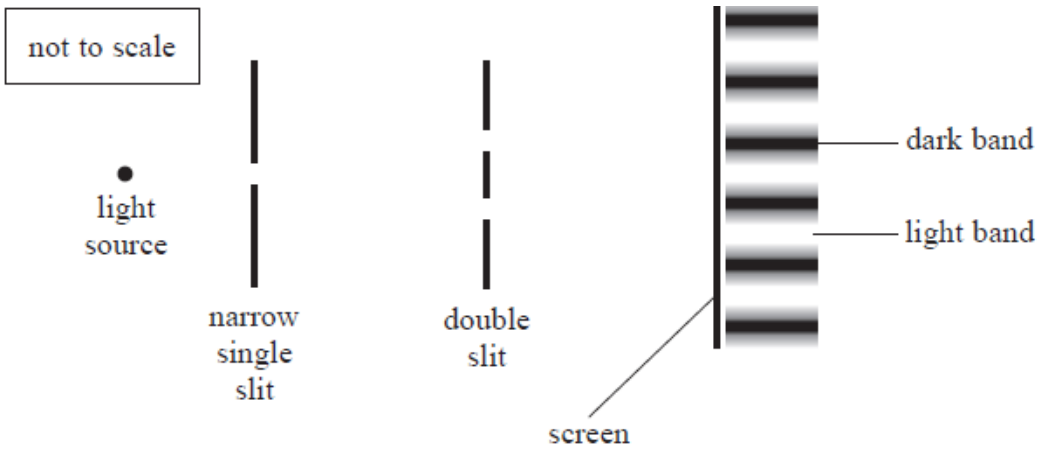
(b) The arrangement in the diagram demonstrates the effect of superposition. When a monochromatic light source is used, a series of dark and light bands is formed on the screen.



*(i) Explain how the dark and light bands are formed by light reaching the screen from the two slits of the double slit.

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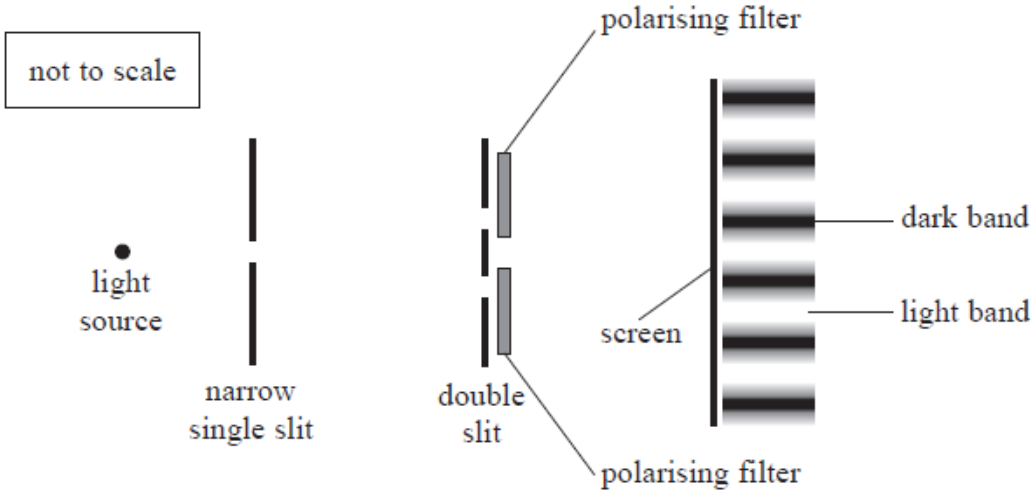
(ii) Polarising filters are placed behind the slits as shown. When the planes of polarisation are parallel, the pattern of light and dark bands is still seen.



If one polarising filter is rotated through 90° there are no dark bands and the screen is illuminated evenly.

Explain why there are no dark bands when one filter has a plane of polarisation at 90° to that of the other filter.

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Q9. Films made to be watched in three dimensions (3D) are produced by projecting two slightly different images on to the screen, one to be seen by each eye.

In one technique the images are polarised. The viewers wear special glasses where the lenses are replaced by two separate plane polarising filters.

(a) Explain what is meant by plane polarised light.

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(b) The light from the screen reaching each eye passes through a different filter so each eye sees a different image. The filter for one eye has a plane of polarisation of 45° and the filter for the other eye has a plane of polarisation of 135°.

Explain this choice of angles.

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(c) One complaint about 3D films seen through polarising filters is that they appear darker compared to ordinary films.

Suggest why this is the case.

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(d) 3D film viewing is no longer done with plane polarised glasses because these require the viewers to keep their heads exactly level for the whole film. Tilting of the head causes partial viewing of the left image by the right eye and vice versa.

Explain why one eye would see a faint image intended for the other eye if the head is tilted slightly.

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(Total for Question = 9 marks)