7. Waves

7.5 Polarisation

Paper 1

Question Paper

1 A plane polarised wave has amplitude *A*. The wave is incident normally on a polarising filter.

The transmission axis of the filter is at angle θ to the plane of polarisation of the incident wave.

What is the amplitude of the wave that emerges from the filter?

A $A\cos\theta$ **B** $A\cos^2\theta$ **C** $A^2\cos\theta$ **D** $A^2\cos^2\theta$

2 Which wave **cannot** be a longitudinal wave?

A a diffracted wave

B a polarised wave

C a reflected wave

D a stationary wave

3 Polarisation is associated with certain waves.

Which waves **cannot** be polarised?

A radio waves from a transmitter

B sound waves from a moving source

C ultraviolet rays from the Sun

D X-rays from an X-ray emitter

4 Radio waves can be polarised, but sound waves **cannot** be polarised.

Which statement gives the reason for this?

A Radio waves are generally of a higher frequency than sound waves.

B Radio waves are transverse waves, but sound waves are longitudinal waves.

C Radio waves can travel through a vacuum, but sound waves **cannot** travel through a vacuum.

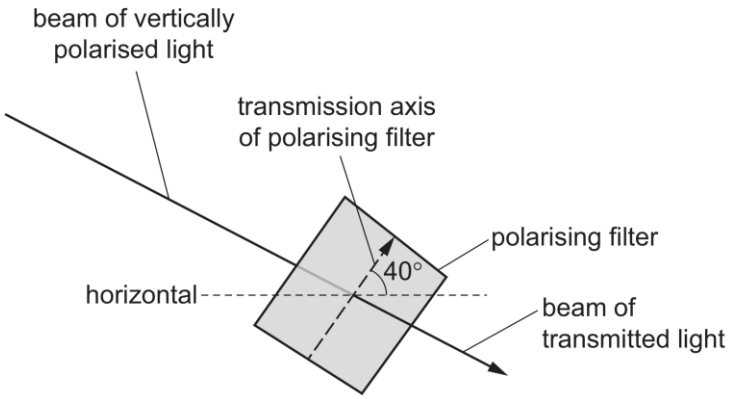
D Radio waves travel at a much higher speed than sound waves.

5 A horizontal beam of vertically polarised light of amplitude *A* is incident normally on a polarising filter. The transmission axis of the filter is at an angle of 50° to the vertical.

What is the amplitude of the light in the beam after it has passed through the filter?

A 0.17*A* **B** 0.41*A* **C** 0.64*A* **D** 0.80*A*

6 A vertically polarised beam of light is incident normally on a polarising filter. The transmission axis of the filter is at an angle of 40° to the horizontal.

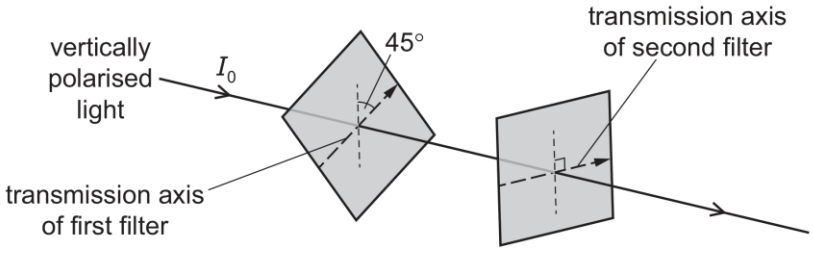


What is the ratio $\frac{\text{amplitude of transmitted beam}}{\text{amplitude of incident beam}}$?

A 0.41 **B** 0.59 **C** 0.64 **D** 0.77

7 A vertically polarised beam of light of intensity I_0 is incident normally on a polarising filter.

The transmission axis of the filter is at 45° to the vertical. The beam of light transmitted by this filter is then incident normally on a second filter. The transmission axis of the second filter is horizontal.

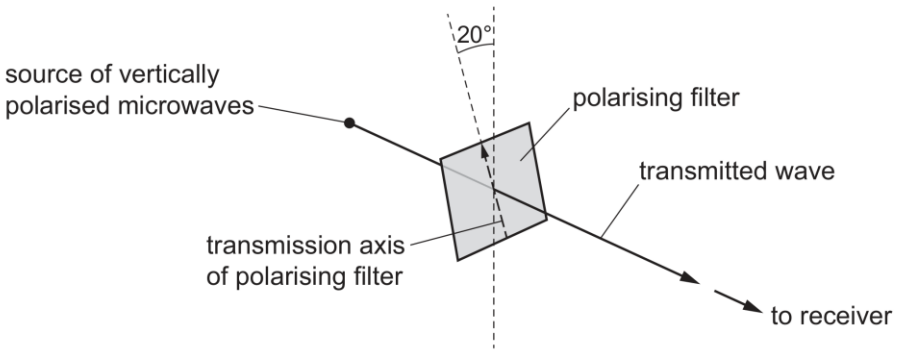


What is the intensity of the beam of light after transmission through the second filter?

A 0 **B** $\frac{1}{4}I_0$ **C** $\frac{1}{2}I_0$ **D** I_0

8 Vertically polarised microwaves are emitted from a source. The microwaves are detected by a receiver that is connected to a cathode-ray oscilloscope (CRO). The waveform displayed on the screen of the CRO has an amplitude of 2.6 cm.

A metal wire grid that acts as a polarising filter is now placed between the source and the receiver. The filter is orientated so that the plane of polarisation of the transmitted wave is at an angle of 20° to the vertical.



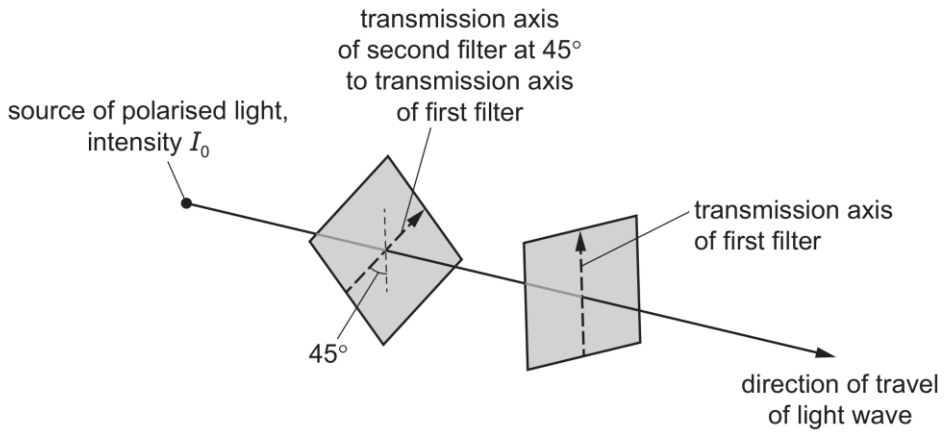
The distance between the source and receiver is unchanged. The settings on the CRO are also unchanged.

What is now the amplitude of the waveform displayed on the screen of the CRO?

A 0.30 cm **B** 0.89 cm **C** 2.3 cm **D** 2.4 cm

9 A plane polarised light wave of intensity I_0 is incident normally on a polarising filter. The initial intensity of the transmitted wave is 0.

A second polarising filter is then inserted between the source and the first filter. Its transmission axis is at 45° to the transmission axis of the first filter, as shown.



What is the intensity of the transmitted wave from the filter combination?

A 0 **B** $\frac{I_0}{8}$ **C** $\frac{I_0}{4}$ **D** $\frac{I_0}{2}$

10 Two polarising filters are placed next to each other so that their planes are parallel.

The first polarising filter has its transmission axis at an angle of 50° to the vertical.

The second polarising filter has its transmission axis at an angle of 20° to the vertical. The angle between the transmission axes of the two polarising filters is 30°.

A beam of vertically polarised light of intensity $8.0\,W\,m^{-2}$ is incident normally on the first polarising filter.

What is the intensity of the light that is transmitted from the second polarising filter?

A zero **B** $2.5\,W\,m^{-2}$ **C** $2.9\,W\,m^{-2}$ **D** $6.0\,W\,m^{-2}$