8.2 Transverse Waves: EM Spectrum & Polarisation

Question Paper

Course	CIE A Level Physics (9702) 2019-2021
Section	8. Waves
Topic	8.2 Transverse Waves: EM Spectrum & Polarisation
Difficulty	Hard

Time allowed: **20**

Score: **/14**

Percentage: **/100**

Question 1

The angle between a polariser and analyser is 30˚. The intensity of light transmitted by the analyser is greater that the intensity transmitted by the polariser.

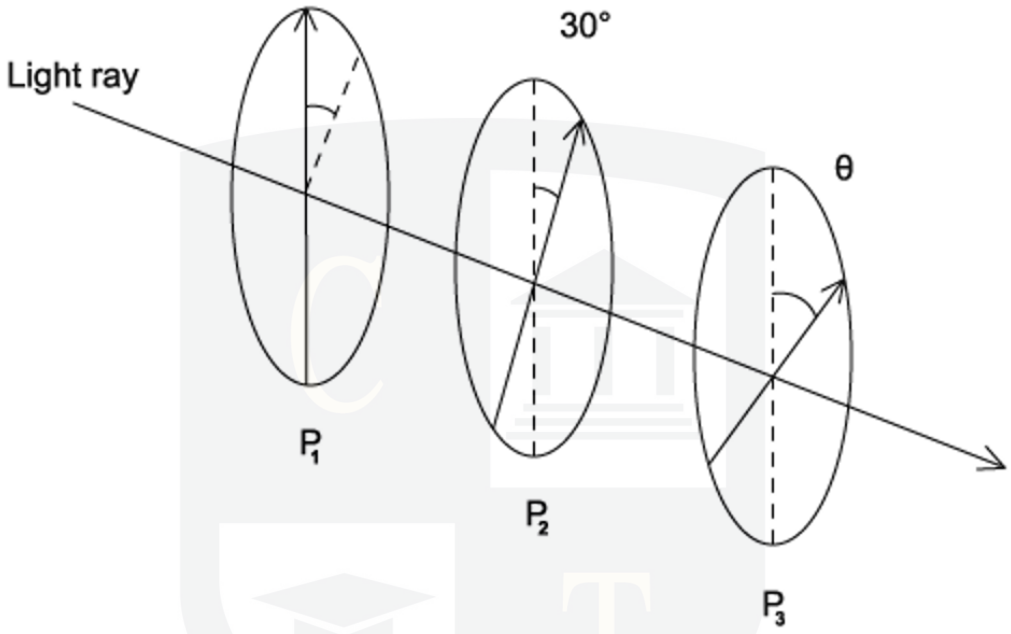
How much smaller is the intensity transmitted?

A $\frac{1}{2}$ **B** $\frac{3}{4}$ **C** $\frac{1}{4}$ **D** 0

[1 mark]

Question 2

The diagram below shows a ray of unpolarised light with an intensity of 72 W m^{-2} passing through three polarising films, P_1, P_2 and P_3.



The polarising axis of each polarising film is shown by an arrow. The polarising film P_1 and P_2 are fixed, with their axis of polarisation at 30˚ to one each other.

If the light emerging from the third filter has an intensity of 13.5 W m^{-2} what is angle θ?

A 60˚ **B** 90˚ **C** 30˚ **D** 45˚

[1 mark]

Question 3

Unpolarised light of intensity I_0 is incident on the first of two polarising sheets. Initially the planes of polarisation of the sheets are perpendicular.

Which sheet must be rotated and by what angle θ, so that light intensity $\frac{I_0}{4}$ can emerge from the second sheet?

	rotated sheet	angle θ of rotation
A	1 or 2	$cos^{-1}\frac{1}{2}$
B	1 or 2	$cos^{-1}\frac{\sqrt{2}}{2}$
C	2 only	$cos^{1}\frac{1}{2}$
D	1 only	$cos^{-1}\frac{\sqrt{2}}{2}$

[1 mark]

Question 4

A vertical aerial transmits radio waves that have been plane-polarised. The receiving aerial is tilted from the vertical at an angle θ. The emitted wave is in a plane perpendicular to the direction of arrival and arrive with an amplitude A.

Which of the following expressions is proportional to the power delivered by the aerial?

A $A\cos\theta$

B $A^2\cos^2\theta$

C Zero

D $A^2\sin^2\theta$

[1 mark]

Question 5

Unpolarised light is incident on a polariser. The light transmitted by the first polariser is then incident on a second polariser. The polarising axis of the second sheet is 60˚ to that of the first.

The intensity emerging from the second polariser is I_2.

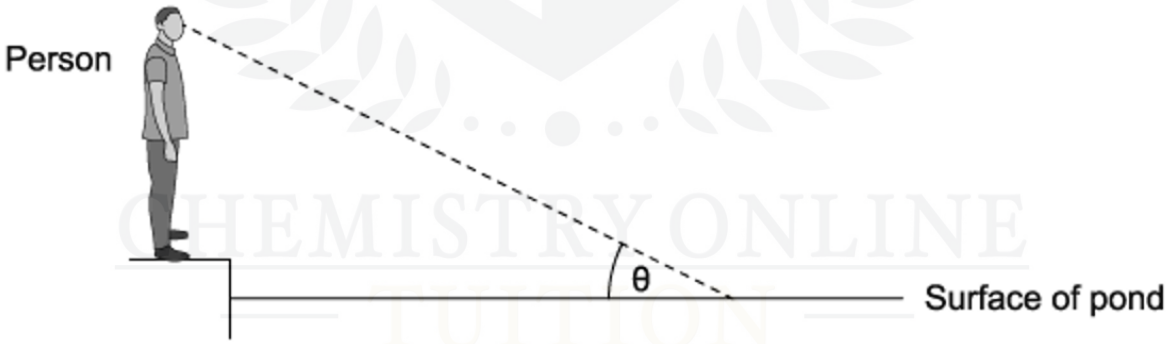
Which of the following gives the intensity incident on the first polariser?

A $\frac{I_2}{4}$ **B** $\frac{I_2}{8}$ **C** $8I_2$ **D** $4I_2$

[1 mark]

Question 6

A person wearing polarising sunglasses stands at the edge of a pond in bright sunlight.



The surface of the pond is flat, and the person has a line of sight to the surface of angle θ. The refractive index of the pond water is n.

What is the value of θ for which the light would be a minimum when it reaches the persons eye?

A $tan^{-1}\left(\frac{1}{n}\right)$ **B** $cos^{-1}\left(\frac{1}{n}\right)$ **C** $tan^{-1}(n)$ **D** $cos^{-1}(n)$

[1 mark]

Question 7

Plane-polarised light of amplitude *a* is passed through a polarising filter. The amplitude of the light emerging is *a* cos *θ*.

The intensity of the incident ray is *I*

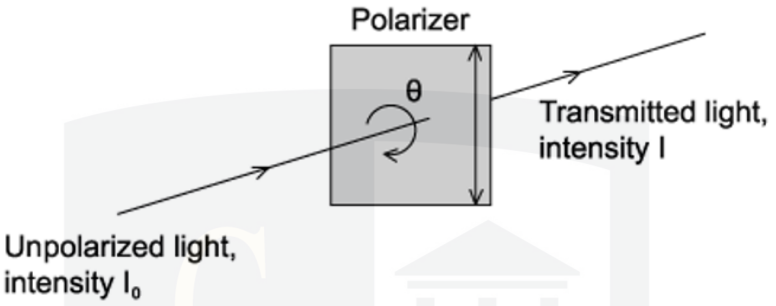
What is the intensity of the emerging light when *θ* is 60˚?

A 0.866 *I* **B** 0.750 *I* **C** 0.500 *I* **D** 0.250 *I*

[1 mark]

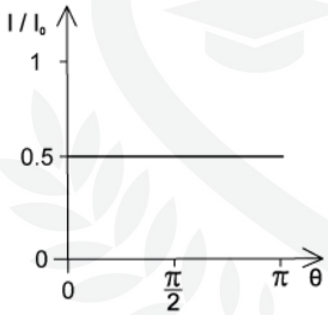
Question 8

Unpolarised light of intensity I_0 is incident on a polariser that has a vertical transmission axis, as shown in the diagram below.

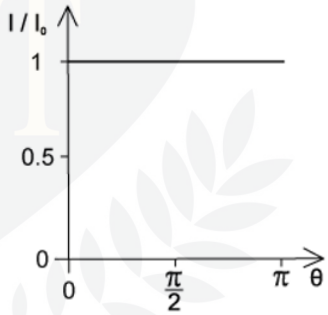


Which graph shows the intensity of the transmitted light?

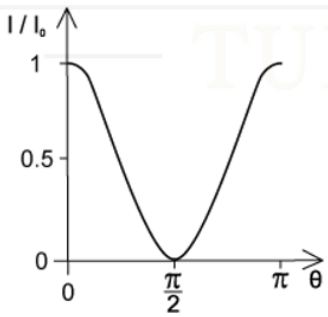
A



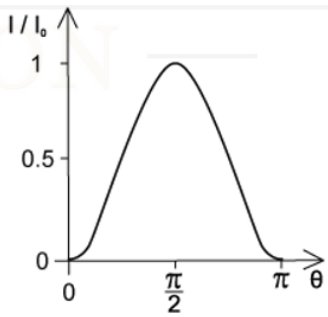
B



C



D



[1 mark]

Question 9

Unpolarised light is incident on the surface of a transparent medium. The reflected light is completely plane polarised.

Which option correctly describes the refracted light?

A partially plane polarised

B completely plane polarised parallel to the reflected light

C unpolarised

D completely plane polarised at right angles to the reflected light

[1 mark]

Question 10

A beam of unpolarised light is incident on the first of two parallel polarisers. The transmission axis of the two polarisers are initially parallel.

The first polariser is now rotated about the direction of the incident beam by an angle smaller than 90°.

Which row in the table describes the changes to the intensity and polarisation of the transmitted light?

	intensity	polarisation
A	no change	no change
B	no change	different
C	different	different
D	different	no change

[1 mark]

Question 11

The sun emits light of a particular wavelength λ_s. At any instant, there is a range of wavelengths from less than λ_s to greater than λ_s that can be observed on Earth. This is due to the Doppler effect.

Which of the following statements would explain this Doppler effect?

A the Sun is rotating

B the Sun is moving toward the Earth

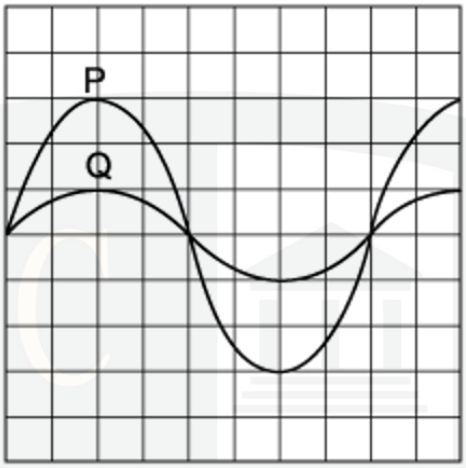
C the Sun is moving away from the Earth

D the Sun is moving at right-angles to a line joining the Sun and the Earth

[1 mark]

Question 12

Sound waves can be displayed on a cathode ray oscilloscope (C.R.O.). The graph below represents two waves seen on the screen. They are labelled P and Q as shown in the diagram



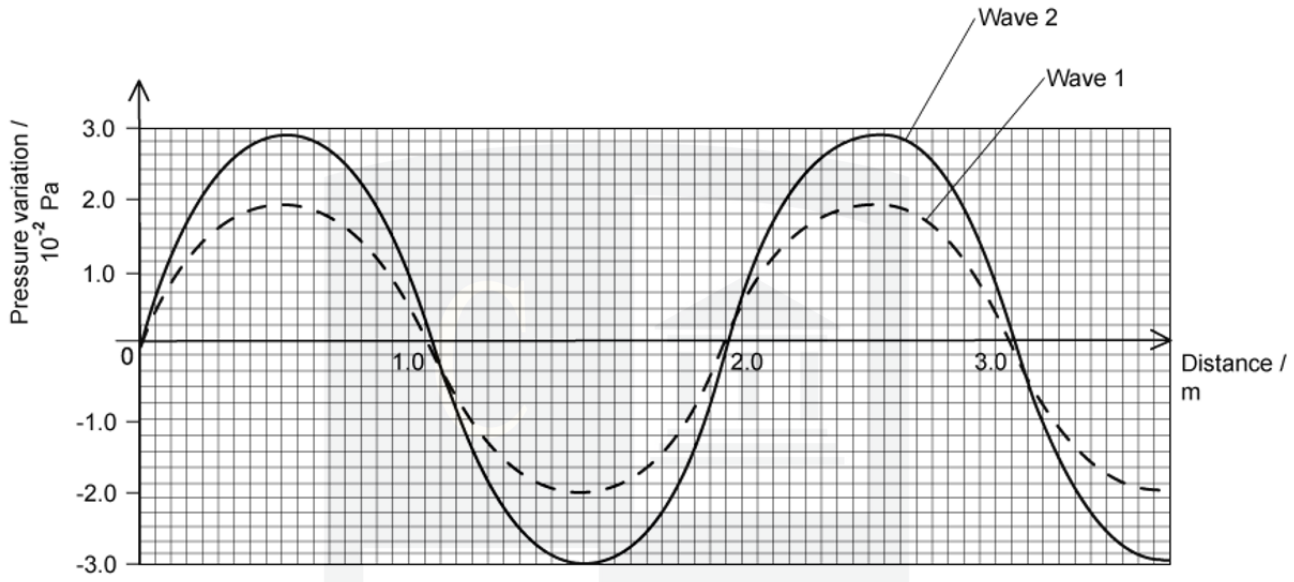
What is the ratio $\frac{intensity\ of\ sound\ wave\ P}{intensity\ of\ sound\ wave\ Q}$?

A $\frac{\sqrt{3}}{1}$ **B** $\frac{9}{1}$ **C** $\frac{1}{1}$ **D** $\frac{3}{1}$

[1 mark]

Question 13

The graph below shows two sound waves, the sound wave is a series of moving pressure variations.



Wave 1 has an intensity of 1.6×10^{-6} W m^{-2}, what is the intensity of wave 2?

A 3.6×10^{-6} W m^{-2}

B 2.4×10^{-6} W m^{-2}

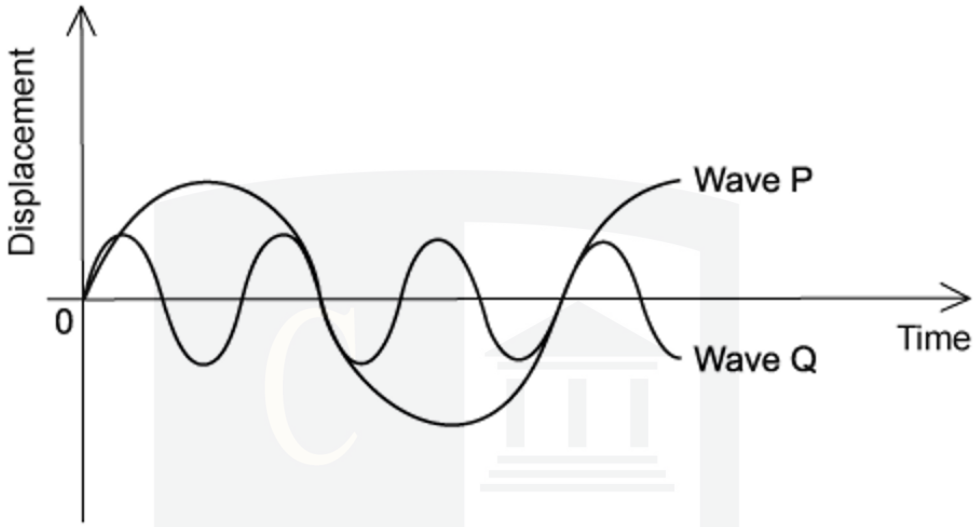
C 3.0×10^{-6} W m^{-2}

D 4.5×10^{-6} W m^{-2}

[1 mark]

Question 14

The graph shows two waves P and Q.



Wave P has an amplitude of 8 cm and a frequency 100 Hz.

What is the amplitude and the frequency of wave Q?

	amplitude / cm	frequency / Hz
A	4	300
B	4	33
C	2	300
D	2	33

[1 mark]