Additional Assessment Materials

Summer 2021

Pearson Edexcel GCE A Level Physics

Topic 5: Optics and Waves

Test 1

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

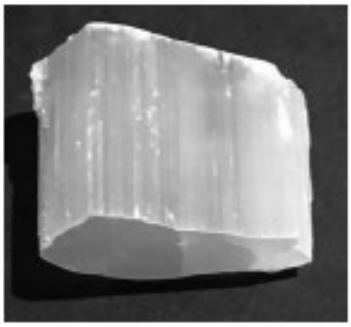
- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

1

12 The photograph shows a sample of the mineral selenite. Selenite is made up of many long, narrow crystals.



Selenite has a refractive index of 1.52

(a) Calculate the speed of light in selenite.

(2)

Speed of light in selenite = ...

(b) (i) State what is meant by critical angle.

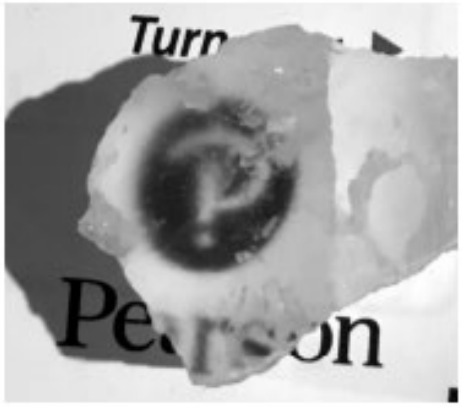
(1)

(ii) Calculate the critical angle for light in selenite.

(2)

Critical angle for light in selenite = ...

(c) Selenite can act as a collection of optical fibres, so that an image of writing beneath the mineral sample appears as if it is at the upper surface as shown.



Explain how light travels through a selenite crystal.

(2)

(Total for Question 12 = 7 marks)

2

15 The photograph shows an ultrasonic mouse repeller used in a house.

The mouse repeller produces ultrasound that repels mice but cannot be heard by humans.
The mouse hears ultrasound directly and by reflection from the walls.

The mouse repeller produces ultrasound of frequency 26.0 kHz.

speed of sound = 340 m s^{-1}

(a) Calculate the wavelength of the ultrasound produced.

(2)

Wavelength = ...

(b) State what is meant by superposition of waves.

(2)

(c) A student makes the following suggestion.

"If the ultrasound reflects off a wall directly opposite the mouse repeller a standing wave is formed, so there will be areas in the room where the mice will not hear the ultrasound."

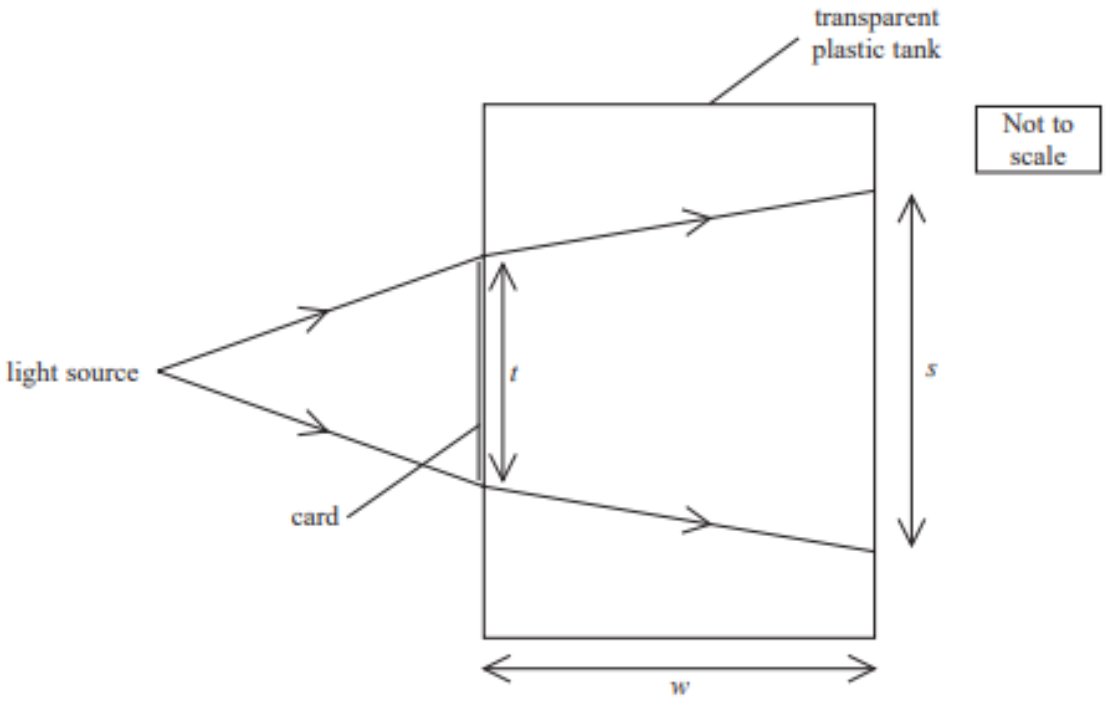
Evaluate this suggestion.

(6)

(Total for Question 15 = 10 marks)

3

12 The diagram shows a transparent tank, with thin plastic sides, that can be used to determine the refractive index of a transparent liquid.



A rectangle of opaque card is stuck on the side of the tank containing the liquid. A light source is placed in front of the tank and the width s of the shadow of the card, which is formed on the back of the tank, is measured. The width t of the card and the width w of the tank are also measured.

(a) The angle of incidence of the light as it enters the tank is 7.2°

Show that the refractive index of the liquid is about 1.4

$w = 35.0\,\text{cm}$
$t = 4.0\,\text{cm}$
$s = 10.2\,\text{cm}$

(3)

(b) Determine the speed of light in the liquid.

(2)

Speed of light = ...

(Total for Question 12 = 5 marks)

4

15 The photograph shows a guitar.

When a guitar string is plucked, a standing wave is created.

(a) Explain how a standing wave is created on the string.

(3)

(b) The diagram shows a standing wave on a guitar string.

The oscillating length of the guitar string is 66 cm.

(i) State the wavelength for this standing wave.

(1)

Wavelength = ...

(ii) Calculate the frequency of vibration for this standing wave.

tension in guitar string = 88.6 N

mass per unit length of guitar string = 4.47×10^{-3} kg m^{-1}

(3)

.....

.....

.....

.....

.....

.....

Frequency = ...

TOTAL FOR PAPER IS 29 MARKS