Reflection and refraction of light

Physics required practical | AQA GCSE Physics 8463 only (not Combined Science) | 14 questions, 36 marks

GCSE science required practicals

This practical online

Name: _____ **Date:** _____ **Score:** _____ / 36

Aim: To find out how light is reflected and refracted when it hits a glass block, by measuring the angles of reflection and refraction for different angles of incidence.

Equipment: Ray box with a single-slit cover and power supply; Rectangular glass block; Sheet of plain A3 paper; Sharp pencil; Ruler; Protractor; Heat-resistant mat for the ray box.

Results

Hamza aimed a ray of light at a glass block at different angles of incidence. He measured the angle of reflection once and the angle of refraction three times for each angle of incidence. All angles were measured from the normal with a protractor.

Angle of incidence in degrees	Angle of reflection in degrees	Angle of refraction trial 1 in degrees	Angle of refraction trial 2 in degrees	Angle of refraction trial 3 in degrees
10	10	7	6	7
20	21	13	14	13
30	30	20	19	20
40	40	25	31	26
50	51	31	30	31
60	60	35	36	35
70	69	39	39	38

Questions

1 Look at Hamza's investigation.

a. Name the independent variable.

b. Name one dependent variable.

c. Give one control variable and say why it must be kept the same. (3 marks)

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2 What is the normal, and where should it be drawn in this experiment? (2 marks)

3 Hamza marked each ray with two crosses placed as far apart as possible, rather than close together. Explain why. (2 marks)

4 Give one hazard in this experiment and explain how to reduce the risk. (2 marks)

5 Use the table to state the relationship between the angle of incidence and the angle of reflection. (2 marks)

6 Describe what the results show about how light refracts when it goes from air into glass. (3 marks)

7 Calculate the mean angle of refraction when the angle of incidence was 30°. Give your answer to 1 decimal place. (2 marks)

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8 Identify the anomalous result in the table and suggest one cause of it. (2 marks)

9 Calculate the mean angle of refraction for an angle of incidence of 40°, leaving out the anomalous result. Show your working. (3 marks)

10 **Higher tier**

For an angle of incidence of 60°, Hamza's angles of refraction were 35°, 36° and 35°. The uncertainty can be taken as half the range. Calculate the uncertainty in his result. (2 marks)

11 **Higher tier**

Explain, in terms of wave fronts, why a ray of light changes direction when it enters the glass block at an angle. (3 marks)

12 Hamza's ray of light was quite wide, so it was hard to see exactly where to put his crosses. Suggest an improvement and explain why it helps. (2 marks)

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13 Another pupil, Ellie, measured all her angles from the surface of the block instead of from the normal. What type of error is this, and how does it affect her results?

(2 marks)

14 Plan an investigation to compare how much light is refracted by glass, by Perspex and by water. You can use a rectangular glass block, a rectangular Perspex block and a thin-walled rectangular plastic box filled with water.

(6 marks)

End of questions | Total 36 marks | The answers sheet has the full method as revision notes.

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