

GCSE Physics

Worksheet: Reflection of waves

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Reflection of waves

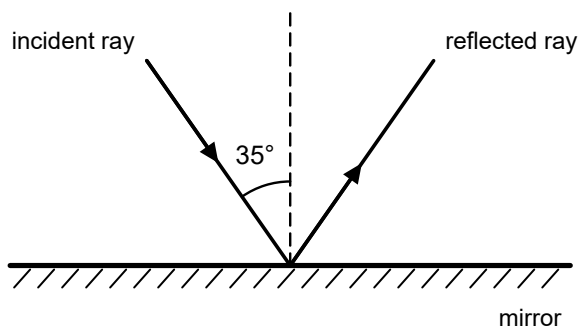
NAME _____ **CLASS** _____ **DATE** _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Figure 1 shows a ray of light being reflected by a plane mirror.

Figure 1



0 1 . 1

What is the name of the dashed line drawn at 90° to the mirror?

.....

.....

.....

[1 mark]

0 1 . 2

The angle of incidence is 35° .
What is the angle of reflection?

.....

.....

.....

Angle of reflection = $^\circ$

[1 mark]

0 1 . 3

When a wave meets a boundary between two different materials, the wave may be reflected.

Name **two** other things that can happen to the wave at the boundary.

.....

.....

.....

.....

[2 marks]

0 1 . 4

A sound wave in air meets a thick curtain. Most of the sound is absorbed by the curtain.

What is meant by **absorbed**?

.....

.....

[1 mark]

0 2

0 2 . 1

Which law is true whenever any wave reflects at a plane surface?

Tick (✓) **one** box.

The angle of incidence equals the angle of reflection

☐

The angle of incidence is always 90°

☐

The angle of reflection is always less than the angle of incidence

☐

The wave speeds up after reflecting

☐

[1 mark]

0 2 . 2

State what happens to the frequency of a wave when it reflects off a surface.

.....

.....

[1 mark]

0 2 . 3

A sound wave reflects off a hard, flat wall.
What name is given to a reflected sound that is heard as a distinct repeat of the original sound?

.....

.....

.....

[1 mark]

0 3

A student investigated the reflection of light by a plane mirror. The student used a ray box, a plane mirror, a protractor and a sheet of paper. Table 1 shows the results.

Table 1

Angle of incidence in degrees	Angle of reflection in degrees
20	21
30	30
40	39
50	56
60	61

0 3 . 1

Describe how the student should record the path of the reflected ray so that the angle of reflection can be measured.

.....

.....

.....

.....

[2 marks]

0 3 . 2

Identify the anomalous result in Table 1.

.....

.....

[1 mark]

0 3 . 3

What conclusion can the student make from the results?

.....

.....

[1 mark]

0 3 . 4

Explain why the student should use a narrow ray of light and do the investigation in a darkened room.

.....

.....

.....

.....

[2 marks]

0 3 . 5

The student replaces the mirror with a sheet of white paper. No clear reflected ray can be seen.
Explain why.

.....

.....

.....

.....

[2 marks]

.....

0 4

A periscope contains two plane mirrors, each fixed at 45° to the vertical, facing each other. Light from an object travels horizontally into the periscope, reflects off the top mirror, travels down the tube, and reflects off the bottom mirror to reach the eye, still travelling horizontally.

0 4 . 1

The light meets the top mirror at an angle of incidence of 45° .

State the angle of reflection at the top mirror.

.....

.....

.....

Angle of reflection = $^\circ$

[1 mark]

0 4 . 2

Explain why the light leaves the bottom mirror travelling in the same direction (horizontally) as it entered the top mirror, but displaced downwards.

.....

.....

.....

.....

.....

.....

[3 marks]

0 4 . 3

Each mirror in a cheap periscope reflects 90% of the light energy that reaches it. The rest is absorbed by the mirror.
Calculate the percentage of the light energy entering the periscope that reaches the eye.

.....
.....
.....
.....

Percentage = %

[2 marks]

0 5

A music teacher records students playing instruments in two rooms. Room A has bare concrete walls and a tiled floor. Room B has thick curtains, a carpet and soft foam panels on the walls.

0 5 . 1

The recording made in room A has echoes.
Explain why.

.....
.....
.....
.....

[2 marks]

0 5 . 2

Explain why there are fewer echoes in the recording made in room B.

.....
.....
.....
.....

[2 marks]

0 5 . 3

Some sound is transmitted through the walls of room B into the next room. Suggest **one** change that would reduce the amount of sound transmitted into the next room.

.....

.....

[1 mark]

0 5 . 4

The speed of sound in air is 340 m/s.
A student stands next to the microphone in room A and claps once. The recording shows that the echo from the far wall arrives 0.050 s after the clap. Calculate the distance between the student and the far wall.

.....

.....

.....

.....

.....

Distance = m

[3 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Physics · Worksheet: Reflection of waves · 30 marks

Question 1 (5 marks)

01.1 [1 mark]

Answer: The normal

- (the) normal (1)
-

01.2 [1 mark]

Answer: 35°

- 35 (°) (1)
-

01.3 [2 marks]

Answer: It may be absorbed or transmitted.

- (it may be) absorbed (1)
 - (it may be) transmitted (1)
-

Notes: Allow 'refracted' for transmitted.

01.4 [1 mark]

Answer: The energy carried by the wave is transferred to the curtain.

- the energy of the wave is transferred to (the energy store of) the curtain / the wave does not pass through or bounce off (1)
-
-

Question 2 (3 marks)

02.1 [1 mark]

Correct: The angle of incidence equals the angle of reflection

02.2 [1 mark]

Answer: It stays the same.

- it stays the same (does not change) (1)
-

02.3 [1 mark]

Answer: An echo

- echo (1)
-

Question 3 (8 marks)

03.1 [2 marks]

Answer: Mark two crosses along the reflected ray, join them with a ruler to the point on the mirror, then measure the angle to the normal with a protractor.

- mark (at least) two points / crosses along the centre of the reflected ray on the paper (1)
- join the points with a ruler back to the mirror and measure the angle between this line and the normal with the protractor (1)

03.2 [1 mark]

Answer: The 50° / 56° result.

- angle of incidence 50° / angle of reflection 56° (1)

03.3 [1 mark]

Answer: Angle of reflection = angle of incidence.

- the angle of reflection is equal to the angle of incidence (1)

03.4 [2 marks]

Answer: A narrow ray can be marked more accurately; the ray is easier to see in a dark room.

- a narrow ray makes it easier to find the centre of the ray / to mark its path accurately (1)
- a darkened room makes the ray easier to see (1)

03.5 [2 marks]

Answer: The paper's surface is rough, so light is scattered in many directions.

- the surface of the paper is rough (1)
 - so the light is reflected in many different directions / scattered (diffuse reflection) (1)
-

Question 4 (6 marks)

04.1 [1 mark]

Answer: 45°

- 45° (1)

04.2 [3 marks]

Answer: Each 45° mirror turns the ray through 90° ; because the mirrors are parallel, the two turns (down, then back to horizontal) cancel, so the final ray is parallel to the original ray, just displaced.

- at each 45° mirror the ray's direction is turned through 90° (1)
- the top mirror turns the horizontal ray to travel vertically downwards; the bottom mirror, at the same angle, turns it back to horizontal (1)
- because the two mirrors are parallel to each other, these two 90° turns cancel out, leaving the final ray parallel to (but displaced from) the original ray (1)

04.3 [2 marks]

Answer: 81%

- 0.90×0.90 (or 90% of 90%) (1)
- 81 (%) (1)

Notes: 80% (from subtracting 10% twice) scores 0.

Question 5 (8 marks)

05.1 [2 marks]

Answer: Hard surfaces reflect sound, and the reflected sound arrives after the direct sound.

- sound is reflected by the hard walls / floor (1)
 - the reflected sound reaches the microphone after the sound that travels directly (1)
-

05.2 [2 marks]

Answer: The soft materials absorb sound, so less is reflected.

- the soft materials / curtains / carpet / foam absorb (most of the) sound (1)
 - so less sound is reflected (1)
-

05.3 [1 mark]

Answer: Add a layer of sound-absorbing material inside the wall.

- make the walls thicker / add a layer of sound-absorbing material inside the wall / seal gaps around the doors and windows (1)
-

05.4 [3 marks]

Answer: 8.5 m

- distance travelled by the sound = $340 \times 0.050 = 17$ (m) (1)
- (the sound travels to the wall and back, so) divide by 2 (1)
- 8.5 (m) (1)

Notes: 17 (m) scores 1 mark.
