3.4 Waves: Light and Sound: 10-minute Pack

Calculator allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A pupil measures frequency of a sound by counting 15 wave peaks in 0.025 seconds.

(a) Frequency = number of waves / time. Calculate the frequency in Hz. **(3)**

.....

(b) State one source of experimental error in this measurement and how it could be reduced. **(1)**

.....

2 Extended response (6 marks). A student investigates how the angle of incidence affects the angle of reflection using a plane mirror. They shine a ray at different angles and measure the angle of reflection. Describe how to carry out a fair test, what results they should expect, and explain how those results support or contradict the law of reflection. Include variables to control and how to present the data.

(6)

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Mark scheme · 3.4 Waves: Light and Sound: 10-minute Pack

Question 1

(a) substitute f = 15 / 0.025	**M1**
(a) perform division 15 / 0.025 = 600	**M1**
(a) 600 Hz cao	**A1**

(a) Answer: **600 Hz**

(b) identify error and mitigation, e.g. timing error can be reduced by using electronic timing or counting more waves	**B1**

(b) Answer: **Timing reaction error; reduce it by using electronic timing or by counting more waves to increase measurement time.**

Question 2

Level 1 Simple description: limited steps for experiment; mentions one or two variables; vague expected results.	**1-2**
Level 2 Clear method with fair test: suggests controlling variables (mirror position, light source), suggests table of angle in and angle out and includes a basic explanation linking equal angles.	**3-4**
Level 3 Detailed method and analysis: step by step fair test, multiple controlled variables, precise measurement technique, a suggestion for graphing angle of incidence vs angle of reflection, clear explanation that results should give a straight line with slope 1 showing angles equal and discussion of anomalies.	**5-6**

Indicative content:

- Method: place plane mirror on a sheet, draw normal line, shine narrow ray at set incidence angles (e.g. 10, 20, 30, 40, 50 degrees), measure reflected angle with protractor and record.
- Control variables: same mirror, same light source, fixed distance from source to mirror, ensure protractor is aligned correctly.
- Presentation: table of angle in and angle out; plot angle of reflection (y) against angle of incidence (x).
- Expected results: angle of reflection equal to angle of incidence, points lie on y = x line; graph should be straight with gradient 1.
- Analysis: anomalies may occur due to parallax error or wide beam; suggest repeating measurements and calculating mean.

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