**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ date \_\_\_\_\_\_ hour \_\_\_**

**Exploring the world of optical devices: Thin Lens**

1. **Focal point.**

Find the position of the lens where a clear image of windows appears on the screen. Measure the length (f) between the lens and the screen.

|  |  |
| --- | --- |
| Focal length (f), cm | 6 |

1. **Thin lens formula**

Find the position of the lens, the screen and the object to obtain the magnification:

3x, x, 1x by filling in the formulas on the next page. Fill in the table.

Hint: use the thin lens formula  and 

f – focal length,

do – distance from the object to the lens,

di – distance from an image to the lens,

M – magnification of the lens.

1. 



1. 

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1. 

|  |  |  |  |
| --- | --- | --- | --- |
| **M** |  |  |  |
| **do, cm** | 8 | 18 | 12 |
| **di, cm** | 24 | 9 | 12 |



1. **Ray diagrams**

Draw two rays: one is passing through the center of the lens, another going parallel to the optical axis and then through the focal point. Draw it for the cases M = 3, M = , M = 1 Use the calculated parameters di, do from the table.

M = 3



M = 



M = 1



1. **Optical Experiment.**

Make an experiment using a meter stick, an available lens, a screen, an object frame (train) and a light source. Set the calculated parameters (di, do) from the table for each case of the magnification M. Make sure that you get the sharp image of the train. Measure the image height (hi) and object height (ho). Include the measured heights into the table. Calculate experimental magnification M (measured). Is the image upright or inverted?

|  |  |  |  |
| --- | --- | --- | --- |
| **M** |  |  |  |
| **hi, cm (measured)** |  |  |  |
| **ho, cm (measured)** |  |  |  |
| **M (measured)** | ~3 | ~0.5 | ~1 |
| **upright/inverted** | inverted | inverted | inverted |

1. **Write several sentences describing what you have learned.**

At the lesson we learned that a convex lens is a basic component of optical devices. The key parameter of the lens is a focal length (the distance at which parallel incident beam is converged into a point). Image formation in lenses can be described by the thin lens formula. We also learned how to get an image, find its position and magnification using geometrical method based on the intersection of two principal rays: one passing through the center of the lens, another – parallel and then through the focal point. With the help of the lens object can be zoomed in or zoomed out depending on the position of the object. We experimentally verified the discussed mathematical approaches.