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| **Worksheet for Lab Ray Tracing**  | **Name** |  |
| **Reflections and Refractions** |  |  |
|  | **Date** |  |

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|  | **Partner #1** |  |
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|  | **Partner #2** |  |

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| **Experiment #1 –Single Ray Reflection of a Plane Mirror:** |
| In the space below, place the paper under the mirror as indicated in the lab handout. Be sure to draw: |
| Glass front face of mirror, Reflecting rear face of mirror, the incident ray and any reflected rays. |
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| Explain the second fainter reflected ray: |  |
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| Remove the paper from the equipment and using a ruler and protractor and following the directions in the handout: draw the normal, Measure the angle of incidence and angle of reflection and note these values on the drawing below. |
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| **Experiment #2 –Reflection in a Circular, Concave Mirror:** |
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| In the space below, place the paper under the mirror as indicated in the lab handout. Be sure to draw: |
| Glass front face of mirror, Reflecting rear face of mirror, the incident rays and any reflected rays. |
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| Where the reflected rays cross is the focal point. Measure the distance from the focal point to the front edge of the mirror and write that both on the sketch below. That is the focal length of the mirror. |
|  |
| Remove the paper from the equipment and using a ruler and protractor and following the directions in the handout: for each ray draw the normal, Measure the angle of incidence and angle of reflection and note these values on the drawing below. |
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| **Experiment #3 – Reflection in a Circular, Convex Mirror:** |
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| In the space below, place the paper under the mirror as indicated in the lab handout. Be sure to draw: |
| Glass front face of mirror, Reflecting rear face of mirror, the incident rays and any reflected rays. |

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| Where do the diverging rays appear to come from? |  |
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| This point is the virtual focal length. Trace diverging rays back and measure the distance from the front surface of the glass to where the rays cross and mark that below. |
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| How does this focal length compare the one measured in experiment 2? |  |
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| **Experiment #4a – Refraction from a Clear Acrylic Lens Material 0° Angle of Incidence:** |
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| Draw the situation with the rectangular Acrylic slab and the single ray having an angle of incidence equal to 0°. |
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| Is there any refraction at either incident or emergent faces? |  |
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| What other condition (besides a ray passing from one medium to another) must be present for refraction to occur? |  |
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| **Experiment #4b – Refraction from a Clear Acrylic Lens Material not at 0° Angle of Incidence:** |
|  |
| Now position the light box and acrylic piece shown next in the handout. On the drawing draw in the following lines. Use the page following this one for the drawing: |
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| a) The path the incident ray would take without the lens. (dashed line) |
| b) The reflected ray from top surface. |
| c) The transmitted ray. (in the block) |
| d) The emergent ray. (out of the bottom of the block) |
| e) The normal to the emergent ray. |

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| Is the emergent ray parallel to the incident ray and its extension? |  |
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| Label the following angles on the drawing and record their values: |
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| a) $θ\_{i}=the angle of the inicident ray=$ |  |
| b) $θ\_{t}=the angle of the transmitted ray=$ |  |
| c) $θ\_{r}=the angle of the reflected ray=$ |  |

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| Index of Refraction for the acrylic slab$=$ |  |

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| **Experiment #4b – Refraction from a Clear Acrylic Lens Material not at 0° Angle of Incidence:** |
| Draw as carefully as you can on this page. |
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| **Experiment #5a – Total Internal Refraction 0° Angle of Incidence:** |
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| Draw the first sketch where the single ray of light strikes the curved surface at the center of the curved side and passes through the center of the flat side. |
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| Is there any refraction at either interface? If not, why not? |  |
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| **Experiment #5b – Total Internal Refraction not at 0° Angle of Incidence:** |
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| Draw the second sketch using the curved acrylic piece following directions in the handout. |
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| Record the critical angle of the acrylic medium: |  |

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| Find the index of refraction for the acrylic medium: |  |

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