

Reflection and Refraction

Spoken Tutorial Project

<https://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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Learning Objectives



Learning Objectives

- **Simulate reflection and refraction of a light ray**



Learning Objectives

- **Simulate reflection and refraction of a light ray**
- **Calculate the angles of reflection and refraction**



Learning Objectives

- Simulate reflection and refraction of a light ray
- Calculate the angles of reflection and refraction
- Change the medium and angle of incidence to verify **Snell's law**



Learning Objectives



Learning Objectives

- Calculate the value of critical angle



Learning Objectives

- Calculate the value of critical angle
- Verify **Huygens' principle**



System Requirements



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- **Ubuntu Linux OS v 16.04**



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- **Ubuntu Linux OS v 16.04**
- **Firefox Web Browser v 62.0.3**



Pre-requisites



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- Learner should be familiar with **Apps on Physics**



Pre-requisites

- Learner should be familiar with **Apps on Physics**
- For pre-requisites tutorials please visit this site
<https://spoken-tutorial.org>



Link for Apps on Physics



Link for Apps on Physics

<https://www.walter-fendt.de/html5/phen>



Apps on Physics



Apps on Physics

- **Refraction of Light**



Apps on Physics

- **Refraction of Light**
- **Reflection and Refraction of Light Waves**



Snell's Law of Refraction



Snell's Law of Refraction

$$\frac{\sin i}{\sin r} = n_{21}$$



Snell's Law of Refraction

$$\frac{\sin i}{\sin r} = n_{21}$$

n_{21} is the **refractive index** of second medium w.r.t first medium



Snell's Law of Refraction



Snell's Law of Refraction

- **Case 1: If $n_{21} > 1$, angle of refraction is less than angle of incidence**



Snell's Law of Refraction

- **Case 1:** If $n_{21} > 1$, angle of refraction is less than angle of incidence
- **Case 2:** If $n_{21} < 1$, angle of refraction is greater than angle of incidence



Critical Angle



Critical Angle

- $i_c = \sin^{-1}(n_2/n_1)$



Critical Angle

- $i_c = \sin^{-1}(n_2/n_1)$
- $i_c =$ **Critical angle**



Critical Angle

- $i_c = \sin^{-1}(n_2/n_1)$
- i_c = **Critical angle**
- n_1 = **Refractive index of first medium**



Critical Angle

- $i_c = \sin^{-1}(n_2/n_1)$
- i_c = **Critical angle**
- n_1 = **Refractive index of first medium**
- n_2 = **Refractive index of the second medium**



Tabular Column



Tabular Column

Formula for critical angle : $(i_c) = \sin^{-1}(n_2/n_1)$

Denser medium n_1	Rarer medium n_2	Refractive index		Critical angle (Measured)	Critical angle (Calculated)
		n_1	n_2		
Diamond	water				
Water	Air				
Crown glass N-K5	Air				
Flint glass LF5	water				
Rock salt	water				



Tabular Column



Tabular Column

Formula for critical angle : $(i_c) = \sin^{-1}(n_2/n_1)$

Denser medium n_1	Rarer medium n_2	Refractive index		Critical angle (Measured)	Critical angle (Calculated)
		n_1	n_2		
Diamond	water	2.42	1.33	33.3	33.2
Water	Air				
Crown glass N-K5	Air				
Flint glass LF5	water				
Rock salt	water				



Tabular Column



Tabular Column

Formula for critical angle : $(i_c) = \sin^{-1}(n_2/n_1)$

Denser medium n_1	Rarer medium n_2	Refractive index		Critical angle (Measured)	Critical angle (Calculated)
		n_1	n_2		
Diamond	water	2.42	1.33	33.3	33.2
Water	Air	1.33	1.0003		
Crown glass N-K5	Air				
Flint glass LF5	water				
Rock salt	water				



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Formula for critical angle : $(i_c) = \sin^{-1}(n_2/n_1)$

Denser medium n_1	Rarer medium n_2	Refractive index		Critical angle (Measured)	Critical angle (Calculated)
		n_1	n_2		
Diamond	water	2.42	1.33	33.3	33.2
Water	Air	1.33	1.0003	48.8	48.7
Crown glass N-K5	Air				
Flint glass LF5	water				
Rock salt	water				



Assignment



Assignment

Formula for critical angle : $(i_c) = \sin^{-1}(n_2/n_1)$

Denser medium n_1	Rarer medium n_2	Refractive index		Critical angle (Measured)	Critical angle (Calculated)
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Crown glass N-K5	Air				
Flint glass LF5	water				
Rock salt	water				



Assignment



Assignment

- **Change the refractive index values of both media as given in Refraction of Light App**



Assignment

- **Change the refractive index values of both media as given in Refraction of Light App**
- **Observe the formation of wavefront and give an explanation**



Summary



Summary

- Simulated reflection and refraction of a light ray
- Calculated the angles of reflection and refraction
- Changed the medium and angle of incidence to verify **Snell's law**



Summary

- Calculated the value of the critical angle
- Verified **Huygens' principle**



Acknowledgement

- These Apps were created by **Walter-fendt** and his team



About the Spoken Tutorial Project

- Watch the video available at https://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- It summarises the Spoken Tutorial project



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Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- Conducts workshops using spoken tutorials
- Gives certificates to those who pass an online test
- For more details, please write to contact@spoken-tutorial.org



Forum for specific questions

- Questions in THIS Spoken Tutorial?
- Visit <https://forums.spoken-tutorial.org>
- Choose the minute and second where you have the question
- Explain your question briefly
- The Spoken Tutorial project will ensure an answer

You will have to register to ask questions



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