STEM Program

Scouts AUSTRALIA

Milk Bottle Lamp

Light Waves and Refraction

Challenge scenario: Your patrol is out camping in the bush. It's really dark and you didn't pack a group lantern. Is there a way that you could make a camp lantern with resources from your personal gear and esky contents?

Suited to Section

Joey Scouts | Cub Scouts | Scouts | Venturer Scouts | Rover Scouts

Challenge Area

COMMUNITY | PERSONAL GROWTH | OUTDOORS | CREATIVE

Key SPICES Growth

SOCIAL | PHYSICAL | INTELLECTUAL | CHARACTER | EMOTIONAL | SPIRITUAL

Likely Scout Method Elements

COMMUNITY INVOLVEMENT | LEARNING BY DOING | NATURE AND THE OUTDOORS | PATROL SYSTEM

PERSONAL PROGRESSION | PROMISE AND LAW | SYMBOLIC FRAMEWORK | YOUTH LEADING, ADULTS SUPPORTING

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Plan

For this experiment you will need:

1. Head torch
2. Empty 2-3L milk or juice bottle (with lid)
3. Water
4. Small amount of milk

Do

Use these links to help you make your lantern:
https://www.youtube.com/watch?v=ydfeJQ2cWv0
https://www.instructables.com/DIY-Outdoor-Light/

1. Fill your milk bottle with water.
2. Add a small amount of milk (5mls).
3. Screw on the milk bottle lid.
4. Strap your head torch to the milk bottle with the light shining into the bottle.
5. Enjoy your impromptu lantern.

Review

1. What happened to the light from the head torch?
2. Did the lantern work?
3. Are there different parts of the bottle that worked better for placing the head lamp?

Variations

- For older scouts (9+ years) you might consider making this a challenge option
- Compare how different bottle materials impact the lantern. Is plastic or glass better?
- Compare different opacity of bottle – is clear or translucent better?
- Explore the differences in the lantern with no water, just clean water, water with milk or muddy water.
- Compare different quantities of milk added to the water. Does this make a difference?
- Decorate the bottle to create a shadow lamp for an event like ANZAC Day dawn service.

Safety Tips

- Once you have used milky water for the lamp do not drink this liquid as you could get sick from the bacteria that will grow as a result of the milk not being refrigerated.

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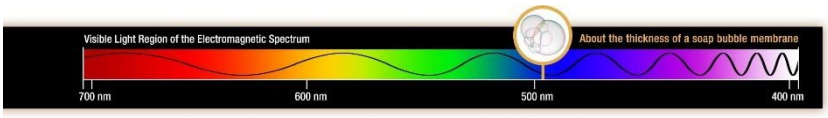
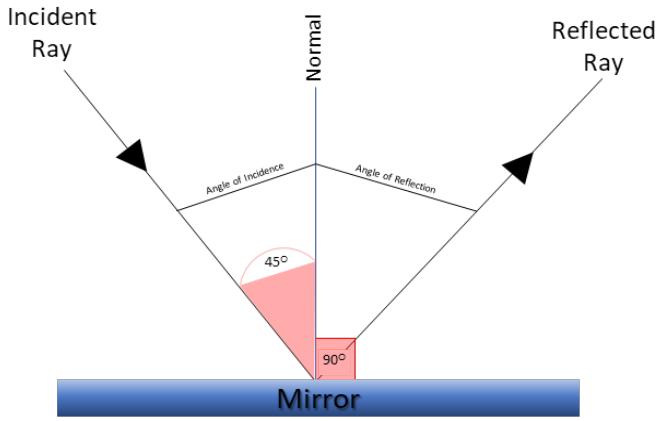
Why Does This Happen?

To understand how the lamp works you need to have some idea about how light works.
Light: A wave of energy that travels in a straight line



Scatter - The further a light beam gets from its source the wider and less bright the beam becomes.

Law of Reflection – light will reflect from a smooth surface at the angle it is projected at (angle of incident = angle of reflection). First described by the Ancient Greek mathematician Euclid around 300BCE



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Transparent – allows light through so you can see clearly e.g., glass window
Translucent – partially blocks light and scatters the light in different directions so you can't see clearly through e.g., frosted glass window
Opaque – blocks all light e.g., solid wall



Colloid – a mixture of substances in liquid where the substances mix evenly and do not sink to the bottom of a container.
Tyndall Effect - described by 19th-century physicist John Tyndall. This is when light is scattered by small particles mixed into an otherwise clear liquid (a colloid solution).
Scattering of light using milk https://www.youtube.com/watch?v=2zcKdlzxFzw

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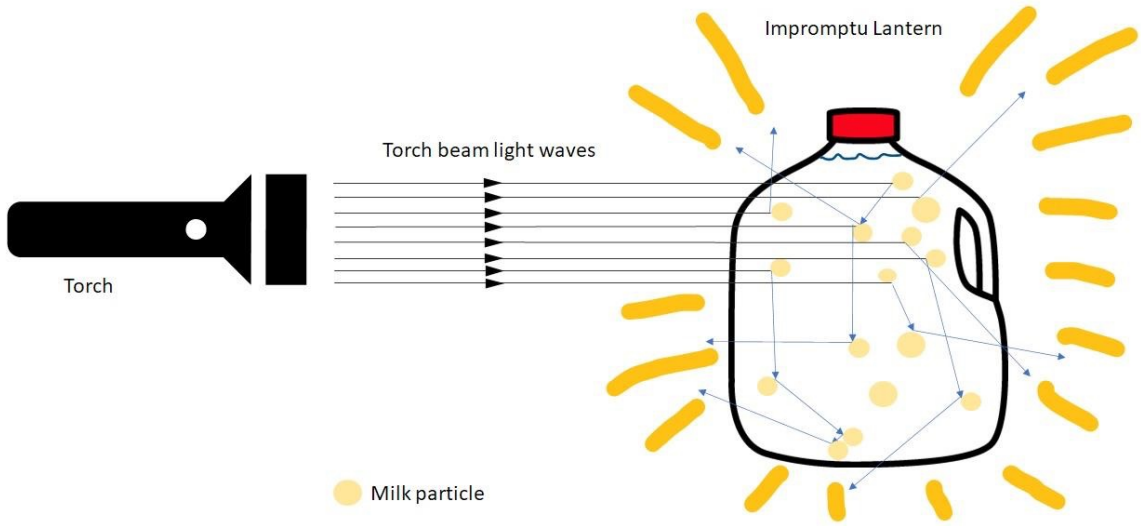
Why Does This Happen?

In the impromptu lantern the following occurs:

1. The combination of water with a small amount of milk is known as a colloid solution.
    i. Small particles are the milk
    ii. Clear liquid is water
2. Light waves from the head lamp are reflected by the small particles that are mixed into a clear liquid.
3. This causes the light waves to be reflected off the small particles (milk) surfaces.
4. This causes the light waves to scatter even further.
5. This makes the narrow headlamp light beam become a glowing milk bottle lantern.



SciScouts Physics of Waves

The SciScouts Physics of Waves is a National Science Week project, undertaken in collaboration with Fizzics Education. These instructions were prepared by Scouts for Scouts. This National Science Week project is supported by the Australian Government.

Scouting has always been strong on STEM skills. Maths to calculate catering quantities and navigate, the science of water purification, the physics of abseiling, and the engineering of pioneering structures – they all have their place. In the current program for our youth members, STEM and Innovation forms one of six Special Interest Areas that enable Scouts to set goals and pursue their own ideas.

SciScouts PHYSICS

Fizzics Education Since 2004 Innovative Science Shows & Workshops!

national science week 2022

An Australian Government Initiative

Inspiring AUSTRALIA