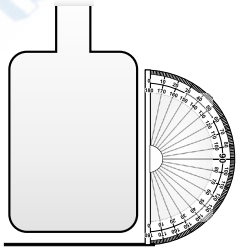
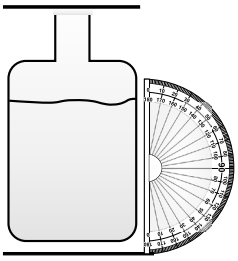
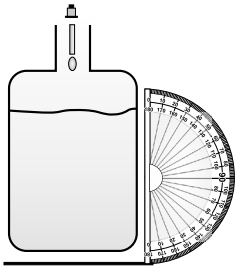
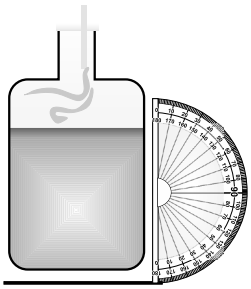
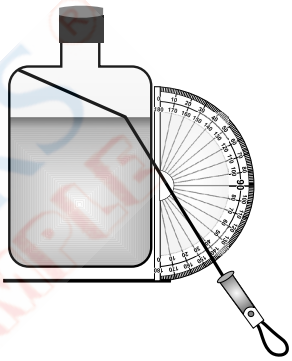
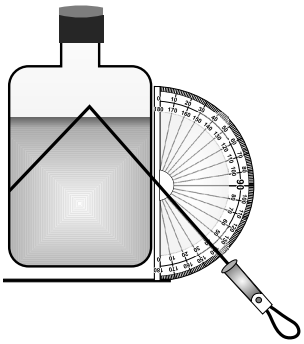
Art Integration

Subject	Physics
Chapter covered	Ray optics
Subject art integrated	Total internal reflection
Objective	To show that total internal reflection occurs only when light passes from denser to rarer medium and the angle of incidence is greater than a specific angle of incidence called critical angle.
Materials required	1. A flat, uniform, thin walled glass bottle; 2. A toy laser torch; 3. A protector; 4. A incense stick; 5. A little amount of milk; 6. Cellotape; 7. Dropper
Methodology of activity	A protector is attached at one side of the bottle with cellotape. 
	$\frac{3}{4}^{th}$ portion of the bottle is filled with water. 
	6-8 drops milk is dropped in water so that it becomes turbid. 

<table>
<tr><td rowspan="3">Methodology of activity</td><td>Opening the cap of the bottle, a lighted incense stick in inserted in the bottle so that the upper portion of the bottle gets filled with smoke.
The cap is closed.
  </td></tr>
<tr><td>Light from the laser torch is directed to the top surface of water.
The ray should pass through the point A of the protector.
Light is found to be refracted from denser medium (water) to rarer medium (air).
Angle of incidence is checked from the protector. It is about 300.
Angle of refraction observed seems to be greater than the angle of incidence.
  </td></tr>
<tr><td>Angle of incidence is slowly increased. The incident ray should pass through point A always.
When the angle of incidence is around 40 degree the ray is found to be reflected back into water.
This phenomenon is known as total internal reflection.
  </td></tr>
<tr><td>Learning outcome</td><td>(1) When light refracts from denser to rarer medium, Angle of refraction > angle of incidence.
(2) The value to critical angle of air-water pair of media is approximately 40 degree (The angle is not be very accurately notable since the rays are not very sharp)</td></tr>
<tr><td>Self evaluation and follow-up</td><td>Students sometimes want to know whether there is be any refracted portion of light during total internal reflection. This activity shows that there is no such portion and the reflection is really “total”.
By this activity, not only they understand the phenomenon well, they also starts realising innumerable incidents of refection and refraction happening around then continuously.
Students will be motivated and will slowly get rid of Physics-phobia.</td></tr>
<tr><td>Resources</td><td>Applications of total internal reflection</td></tr>
</table>

Art Integration

Subject	Physics
Chapter covered	WAVE OPTICS
Subject art integrated	Diffraction
Objective	To generate single slit diffraction pattern.
Materials required	

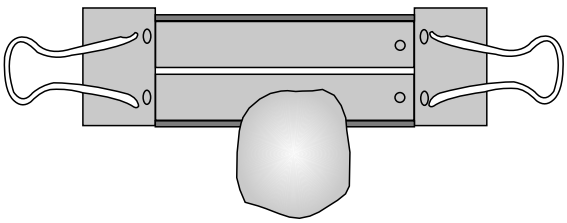
Sr. No.	Description	Quantity
1.	Blade of box-cutter knife	2
2.	Paper binder clip (large)	2
3.	Toy laser torch	1
4.	Large size potato	1

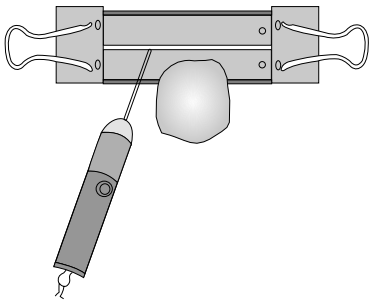
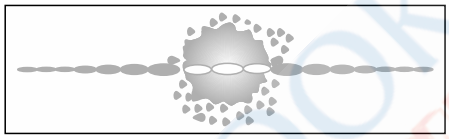
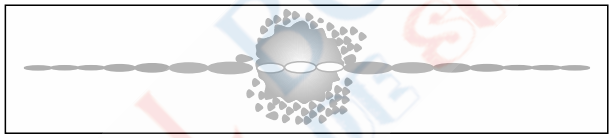
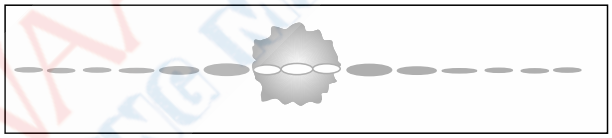
Methodology of activity

To form a narrow slit:

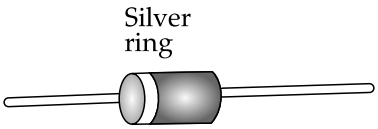
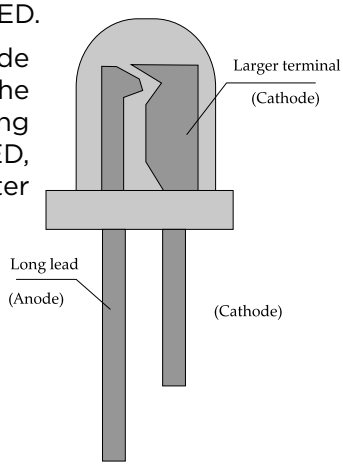
Two blades of box cutter knives are hold parallel with their sharp edges facing each other.
The distance between the edges should be less than 1mm.
The two ends of the knives are clamped with paper binders clips so that they do not move.

To prepare a stand: The potato is cut into two pieces. Flat end of one half is kept on a table.
The slit formed by the knife blades is pushed into it so that it remains steady and vertical.



Methodology of activity	The whole assembly is kept in a dark room in front of a white wall. Laser beam is thrown on the slit from the laser torch. 
	Adjusting the distance from the wall and slit width, a diffraction pattern is obtained on the screen. 
	Further reducing the slit width, the fringe width increases. 
	Increase in distance from the wall, the fringe width increases. 
Learning outcome	(1) Fringe width is directly proportional to the distance of the slit from the wall/ screen. (2) Fringe width is inversely proportional to the slit width.
Self evaluation and follow-up	Students will be interested to do further experimentation. In the same way they may plan to generate double slit interference pattern Students will be motivated and will slowly get rid of Physics-phobia.
Resources	(1) Diffraction of light through edges of razor blades

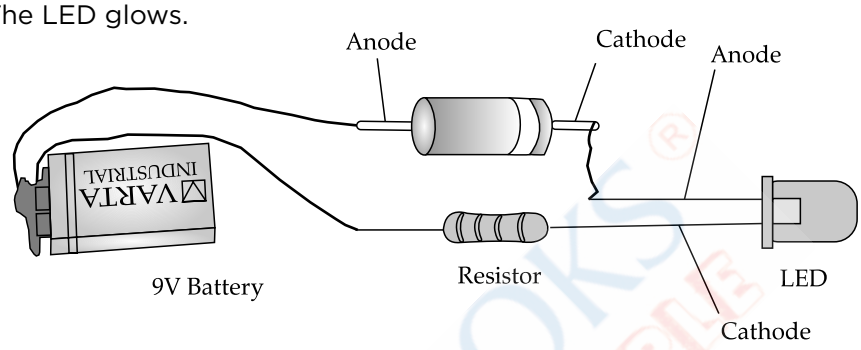
Art Integration

Subject	Physics
Chapter covered	Semiconductor Electronics: Materials, Devices and Simple circuits
Subject art integrated	Rectifier
Objective	To show (i) In half wave rectifier, the diode conducts only for positive half cycle of input ac and output is available only for that half cycle. (ii) In full wave rectifier, one diode conducts for positive half cycle and the other diode conducts for negative half cycle of the input ac and the output is available for both the cycles.
Materials required	See table below
Methodology of activity	Identification of anode and cathode of a silicon diode. There is a silver ring at one end of the diode. That end of the diode is cathode and the other end is anode.  Identification of anode and cathode of a LED. The longer lead of the LED is the anode and the shorter one is the cathode. If the two leads are of same length, then, looking through the transparent material of the LED, the larger terminal is cathode and the shorter terminal is anode. 

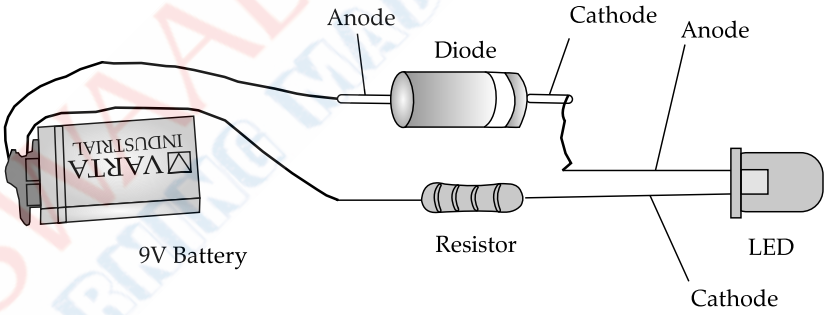
Sr. No.	Description	Quantity
1.	Silicon diode 1N4001	2
2.	Light emitting diode	4
3.	9V Battery	2
4.	Battery clip	2
5.	4.7KΩ resistor	1

Methodology of activity

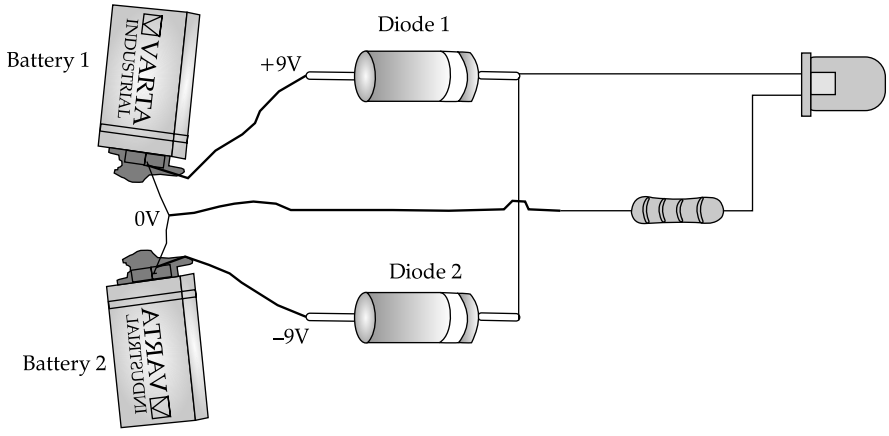
Design of half wave rectifier:
The positive (red) terminal of the battery is connected to the anode of the diode.
Cathode of diode is connected to the anode of the LED. Cathode of LED is connected to the resistor and the other end of the resistor is connected to the negative (black) terminal of the battery.
This represents the appearance of positive half cycle.
The LED glows.

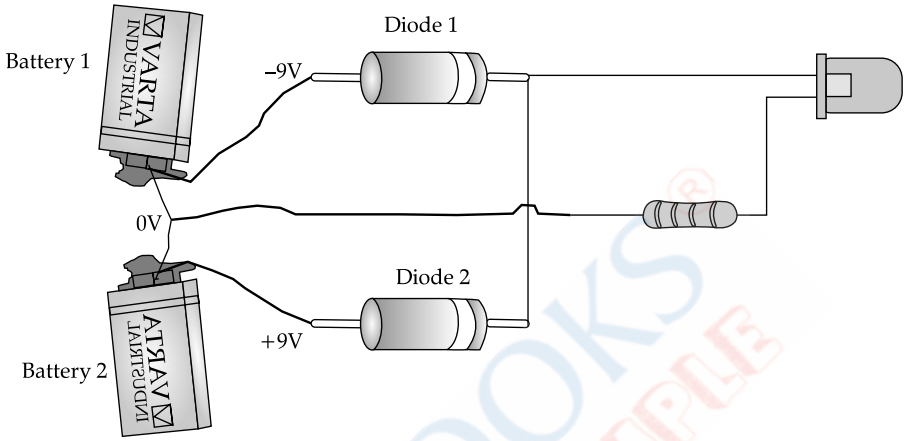


Battery terminals are now reversed.
Positive terminal is connected to the resistor and negative terminal is connected to the anode of the diode.
This represents the appearance of negative half cycle.
The LED does not glow.
So, it is concluded that when positive half cycle appears then only the diode conducts and the output is available.



Design of full wave rectifier:
Negative terminal of battery 1 is connected to the positive terminal of the battery 2. This junction becomes the 0V point. The red wire is +9V. The black wire is -9V.
This battery combination can replace a 9V-0V-9V centre tap transformer. Figure A: +9V is connected to anode of Diode 1, -9V connected to anode of Diode 2. 0V is connected to resistor.



Methodology of activity	The LED glows. Figure A: -9V is connected to anode of Diode 1, +9V connected to anode of Diode 2. 0V is connected to resistor. The LED glows. So, it is concluded that for both the half cycles the output is available. 
Learning outcome	(1) Output of half wave rectifier is available for positive half cycle of ac only. (2) Output of full wave rectifier is available for both the half cycles of ac.
Self evaluation and follow-up	Students will be interested to do further experimentation. They may plan to connect one LED with each diode to show which diode is conducting for which half cycle. Students will be motivated and will slowly get rid of Physics-phobia.
Resources	Bridge Rectifier