Name: _____

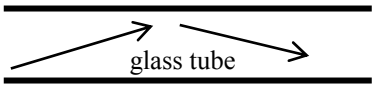
Period: _____

Ch 15:2

Miscellaneous Light Topics

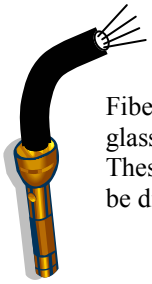
Total Internal Reflection

Light usually passes through clear boundaries, but if it strikes at an angle greater than the ***critical angle*** will stay inside the medium (glass, air, etc.). ***Total internal reflection*** is when all the light is reflected back inside the medium. The critical angle for glass is about 41°.



Total Internal Reflection*: light past the* ***critical angle*** *cannot escape.*

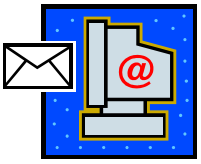
Fiber Optics



Fiber optics work by ***total internal reflection.***

Fiber optics pass light through flexible glass or plastic tubes (called fibers). These tubes can be bent allowing light to be directed where it is wanted.

Fiber optic scopes can see around corners.



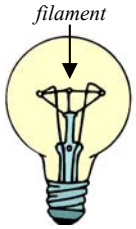
Fiber optic cables carry much of the communications of our world (Internet and phone) because it travels at the speed of light.

Types of Lights

Incandescent Light

Incandescent (normal)light bulbs make light by very high heat. The ***filament*** glows bright when enough electricity flows through it.

Incandescent light is very inefficient because ***most of the energy is lost as heat.***



Incandescent Lightbulb

Fluorescent Light

Fluorescent Lightbulb

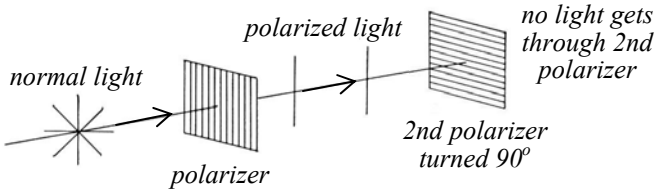
Fluorescent lights are four times more efficient than incandescent bulbs. 3/4 of the energy of an incandescent bulb is lost to heat.

In fluorescent light bulbs electricity excites a gas inside, emitting mostly UV light. The white coating on the outside of the bulb absorbs the UV light and emits white light.

Polarization

Light is a ***transverse*** wave (vibrating 90° to the direction of motion).

Normal light is chaotic, with transverse waves moving in all directions. A ***polarizer*** allows only light going one direction to go through (like a comb).



Only light in one direction can get through a polarizer. Two polarizers turned 90° can cancel out all light.

Polarization is used in some sunglasses to reduce glare.

Polarization also allows small computers and calculators screens to make letters and images.

Glow-in-the-Dark

Glow-in-the-dark (***photoluminescent)*** objects contain the element ***phosphorous***. When phosphorous' electrons are energized, they come down a few at a time, giving off light over time. When all the electrons have fallen the phosphorous goes dark. Visible light recharges them (raising them up) so that they give off light again.

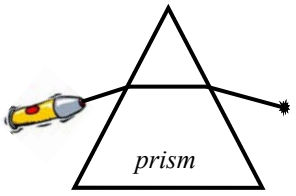
Phosphorous atoms give off light gradually, seeming to glow-in-the-dark.

Lasers

LASER – Light Amplification by Stimulated Emission of Radiation

How Lasers Work

Lasers give off light of one particular wavelength. This comes from forcing a substance (usually a gas) to give off light. This light bounces back and forth between mirrors, causing other atoms to give off more light. When the light is powerful enough it escapes as a laser beam.



Compact laser light refracts, but does not spread out in a prism.

Why We Use Lasers

Laser light is compact: it **doesn't spread out** like regular light. That's why we use them for pointers and why they don't bend in prisms.

Lasers can be powerful. Some lasers are used industry and medicine for precision cutting. Military lasers are just now able to blow up incoming missiles.

Name: _____

Period: _____

1. Total internal reflection	A. Light created from high heat.
2. Critical angle	B. The part of a light bulb that glows when hot and makes incandescent light.
3. Fiber optics	C. When all light cannot escape glass or another medium and stays inside.
4. Incandescent	D. The angle past which light cannot escape.
5. Fluorescent	E. Technology based on bending light in cables.
6. Filament	F. Efficient light from UV radiation.

How can light be redirected by fiber optics?

Can a fiber optic cable be bent any direction? Why or why not?

You have an office building and need to cut cost. What kind of lights will you use and why?

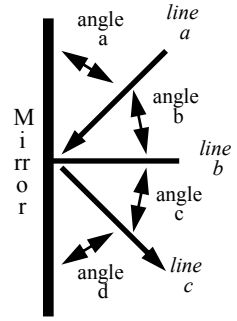
Light is passed through a polarizer. How could you cancel out light with a second polarizer?

What element is photoluminescent and why?

Why don't lasers spread out into a rainbow in a prism?

A convex lens is convergent/divergent and magnifies/reduces.
A concave lens is convergent/divergent and magnifies/reduces.
A convex mirror is convergent/divergent and magnifies/reduces.
A concave mirror is convergent/divergent and magnifies/reduces.

Angle of incidence: _____
Angle of reflection: _____
Normal: _____
Incident ray: _____
Reflected ray: _____



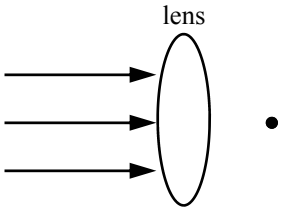
If the angle of incidence is 25°, what is the angle of reflection?

If the angle between the incident and reflected rays is 80°, what is the angle of reflection?

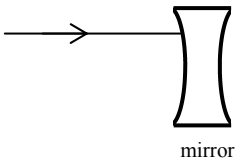
If an image look 20 meters away in a mirror how far away is the object?

An object is 4 meters away from a mirror. How far away does the image look?

1. Polarization	A. An object that screens out all but light in one direction.
2. Polarizer	B. Light amplification by stimulated emissions of radiation.
3. Photoluminescence	C. An element that releases light slowly; used in glow-in-the-dark objects.
4. Phosphorous	D. The act of only allowing one-directional light to pass through a "filter".
5. Laser	E. Objects that give off light slowly.



Show where the 3 light rays will go.
Concave or convex lens?
What do we call the dot?
Magnifying or reducing?
Convergent or divergent?



Show where the light will go.
Concave or convex mirror?
Magnifying or reducing?
Convergent or divergent?

Use RGB to make these colors.		Use CMYK to make these colors.	
Cyan _____	Yellow _____	Blue _____	Red _____
White _____	Black _____	White _____	Black _____
Green _____	Magenta _____	Green _____	Magenta _____

Using CMYK—What color does yellow absorb?

What colors does cyan reflect?

What has more energy: Radio waves or Visible light?
What has a shorter wavelength: Ultraviolet or Gamma rays?
What has a higher frequency: Visible light or Infrared?

A sound wave has a period of 0.5 secs. Find its frequency.

Find the wavelength of the above wave.

If the fourth harmonic of a standing wave is 48 Hz, find the fundamental frequency.

You hear your echo 6 seconds after you yell into a canyon. How wide is the canyon?