Science 8

Optics I

Name: Key
Date:
Block:

1. Optics Observations
2. Waves

Optics Observations

Station #1: Prisms

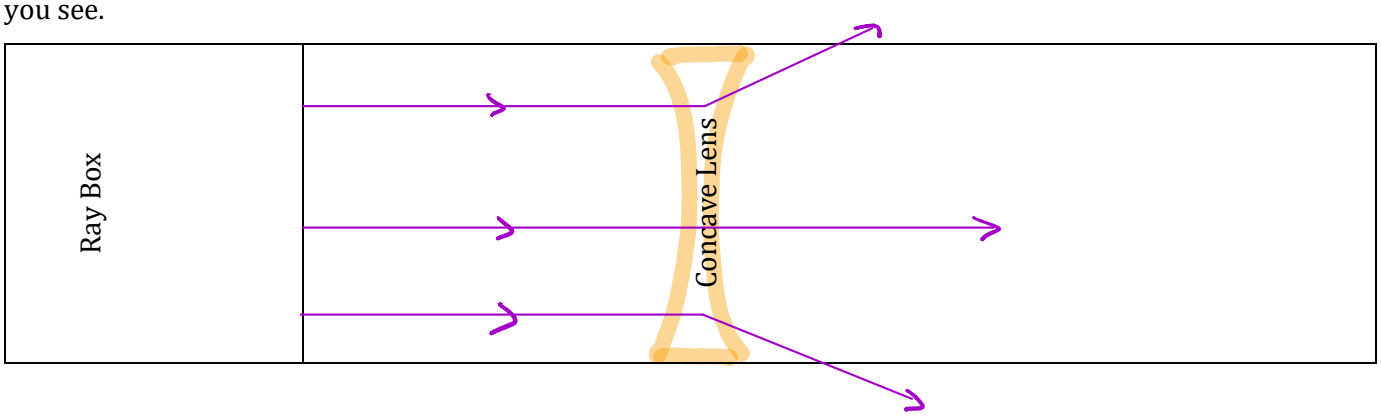
Place one prism in front of a ray box. Can you find the rainbow?

What are the colours of the rainbow?

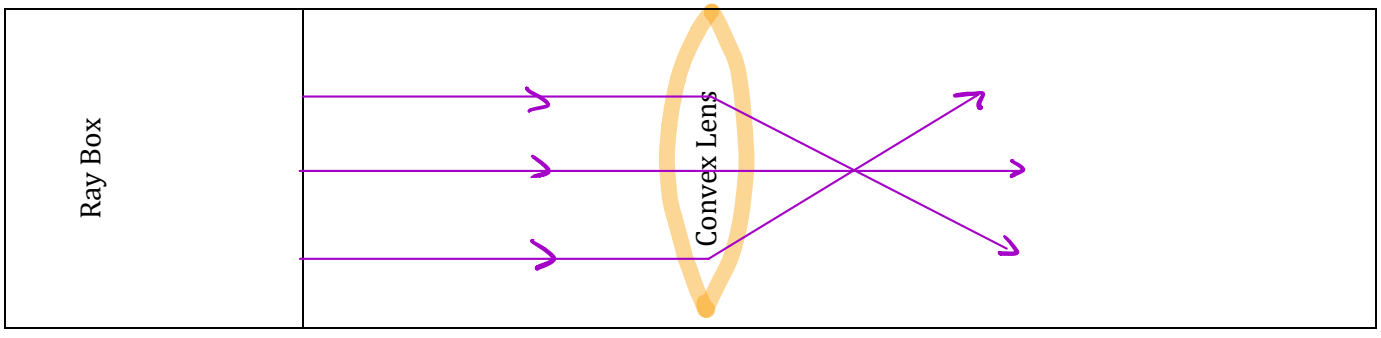
Red Orange Yellow Green Blue Indigo Violet

Station #2: Lenses

Use a ray box and see what happens when you place a **concave (caved in) lens** in front of the light. Draw what you see.

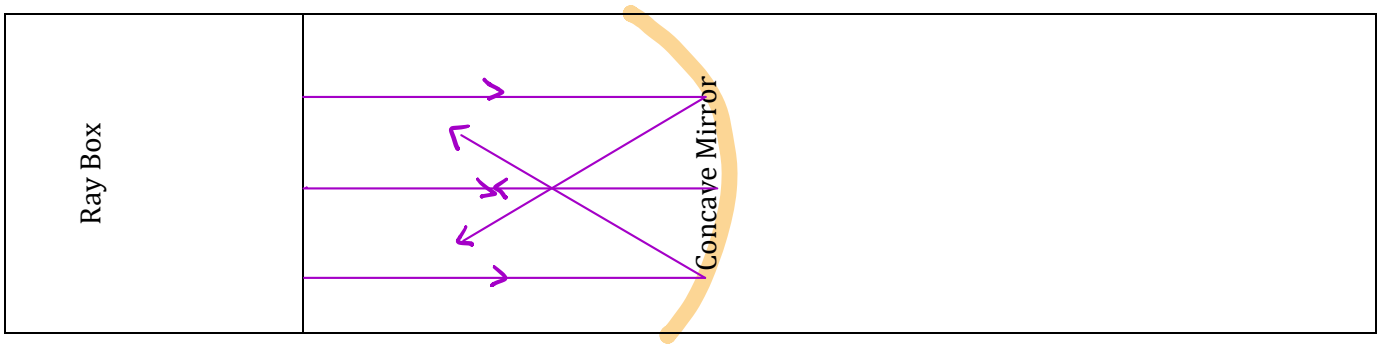


Use a ray box and see what happens when you place a **convex (curved out) lens** in front of the light. Draw what you see.

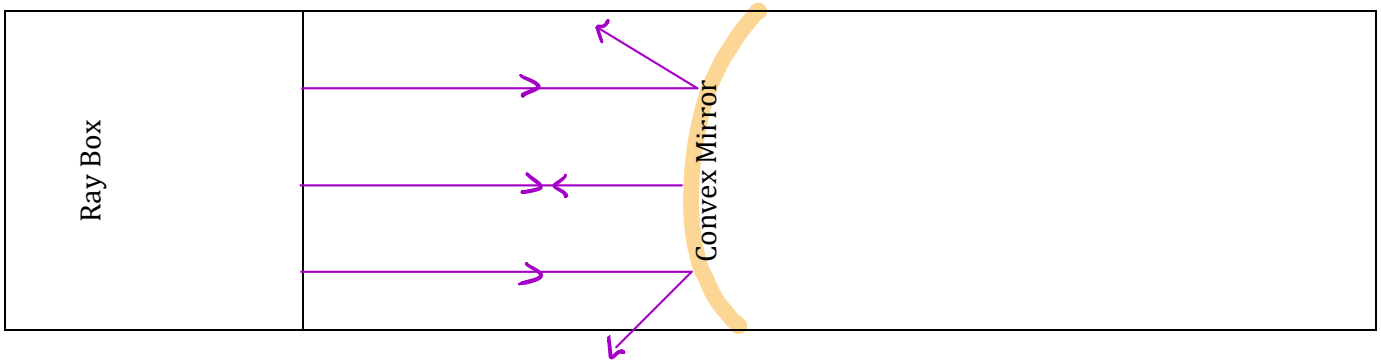


Station #3: Mirrors

Use a ray box and see what happens when you place a **concave (caved in) mirror** in front of the light. Draw what you see.



Use a ray box and see what happens when you place a **convex (curved out) mirror** in front of the light. Draw what you see.



Station #4: Curved Mirrors & Lenses

A **concave mirror** is a mirror that is caved in. Hold it close to your face.

Does the image seem: *larger* *smaller* // *upright* *upside down*

Now hold the concave mirror an arm's length away.

- Does the image seem: *larger* *smaller* // *upright* *upside down*

A **convex mirror** is a mirror that is curved out. Hold it close to your face.

- Does the image seem: *larger* *smaller* // *upright* *upside down*

Now hold the convex mirror an arm's length away.

- Does the image seem: *larger* *smaller* // *upright* *upside down*

A **concave lens** is a lens that is caved in. Use it to look at this text.

Does the image seem: *larger* *smaller* // *upright* *upside down*

Now hold up the concave lens to look at an object on the other side of the room.

- Does the image seem: *larger* *smaller* // *upright* *upside down*

A **convex lens** is a lens that is curved out. Use it to look at this text.

- Does the image seem: *larger* *smaller* // *upright* *upside down*

Now hold the convex lens to look at an object on the other side of the room.

- Does the image seem: *larger* *smaller* // *upright* *upside down*

Waves

Can you name a few waves?

- hand wave
- sound wave
- radio wave
- ocean wave
- heat wave
- microwave

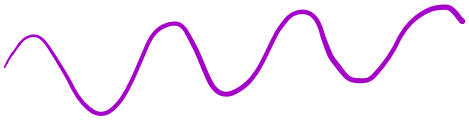
What is a wave?

- Disturbance or movement that transfers energy through matter or space.
- Doesn't cause any position change.
  - Example: wave through a crowd, but each person still stays in their seat

- This energy must move through a medium.
- The medium can be solid, liquid, or gas.
  - Examples of mediums:

ocean wave = medium is water

Typically, there are two types of waves:

Transverse Wave	**Compression Wave**
Definition: • Particles move up and down	Definition: • A wave where the particles move left to right
Example: Water waves	Example: Slinky
Diagram: 	Diagram: 

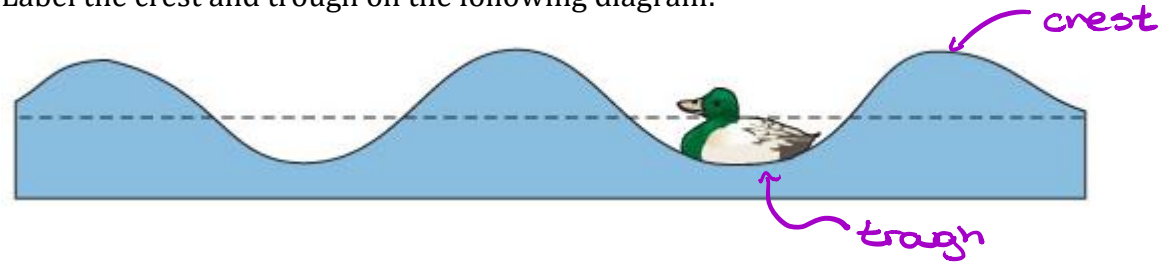
We will be focusing more on TRANSVERSE waves

Characteristics of a wave:

Crest: the highest point in a wave.

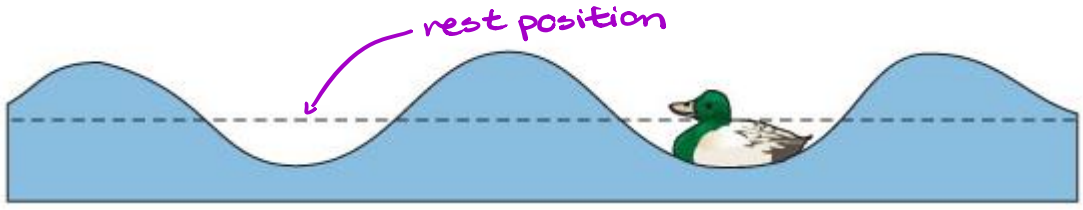
Trough: the lowest point in a wave.

Label the crest and trough on the following diagram:



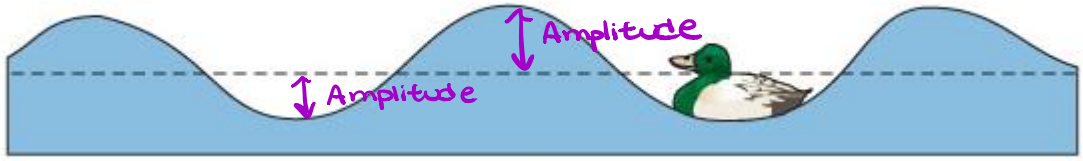
Rest Position: the level of water between the crest and trough.

Label the rest position on the following diagram:



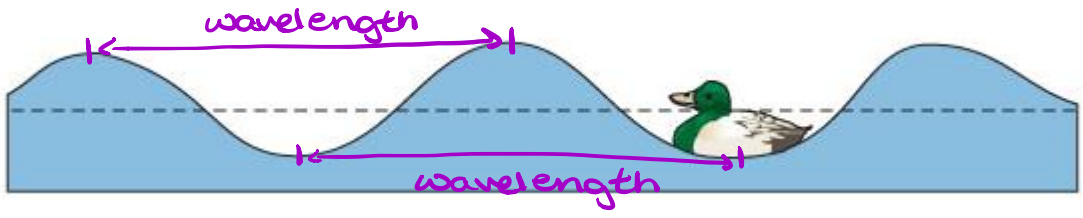
Amplitude: the height of the crest or depth of the trough as measured from its rest position.

Label the amplitude on the following diagram:

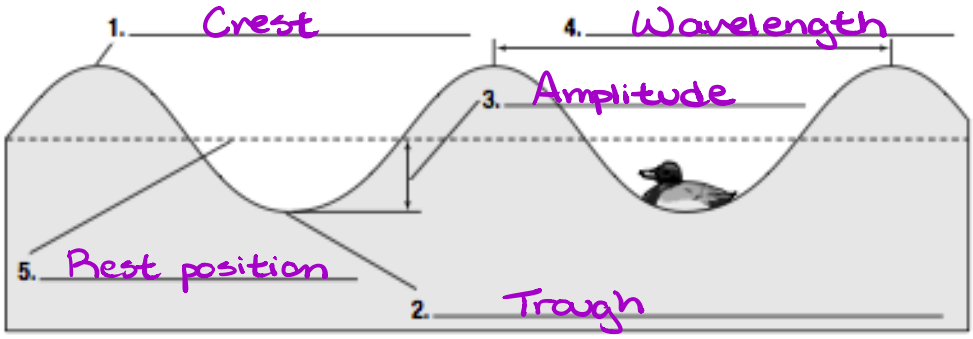


Wavelength: the distance from crest to crest or trough to trough.

Label the wavelength on the following diagram:



Label the following diagram:

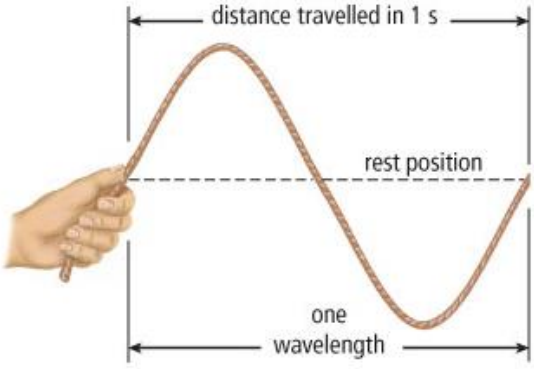


- Crest
- Trough
- Rest position
- Amplitude
- Wavelength

Frequency:

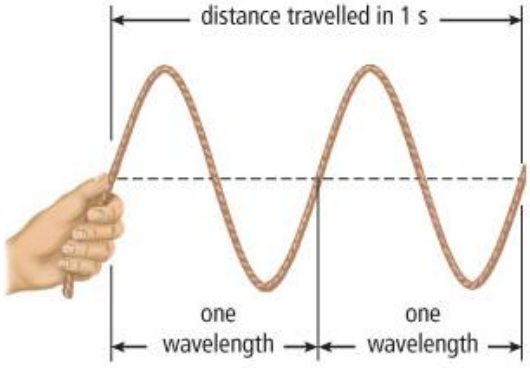
- How often does something occur?
- The number of repetitive motions in a given time.

Frequency is measured in hertz (Hz) or cycles per second.



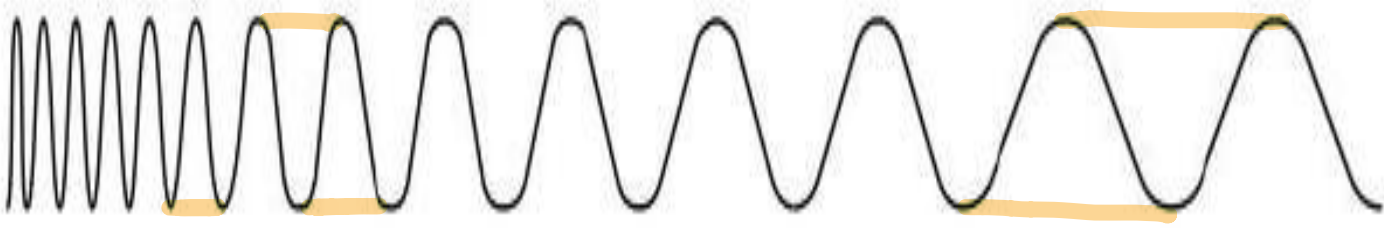
(a)

Frequency: 1 Hz



(b)

Frequency: 2 Hz



WAVELENGTH: long / short

FREQUENCY: high / low

WAVELENGTH: long / short

FREQUENCY: high / low

When one value increases as the other decreases, this is called an inverse relationship.

Frequency = $\frac{\text{cycles}}{\text{sec}} = \frac{\text{\# bounces}}{\text{sec}}$

Bouncer A:	**Bouncer B:**
Number of bounces:	Number of bounces:
Time:	Time:
Frequency (bounces per second):	Frequency (bounces per second):

Who had the higher frequency?

Use the following equation to calculate frequency (in hertz) for each of the examples below:

Frequency = cycles per second 1 min = 60 sec

a) Pendulum: 24 swings in 6 seconds.

$f = \frac{\text{cycles}}{\text{sec}} = \frac{24 \text{ swings}}{6 \text{ sec}} = 4 \text{ Hz}$

b) Merry-go-round: 12 revolutions per 2 min.

2 min = 120 sec $f = \frac{\text{cycles}}{\text{sec}} = \frac{12 \text{ revolutions}}{120 \text{ sec}} = 0.1 \text{ Hz}$

c) Flashing red light at an intersection: 30 flashes in 0.5 min.

0.5 min = 30 sec $f = \frac{\text{cycles}}{\text{sec}} = \frac{30 \text{ flashes}}{30 \text{ sec}} = 1 \text{ Hz}$

d) Heart rate: 18 beats per 20 second.

$f = \frac{\text{cycles}}{\text{sec}} = \frac{18 \text{ beats}}{20 \text{ sec}} = 0.9 \text{ Hz}$

e) Car drive shaft: 2000 rpm (revolutions per minute)

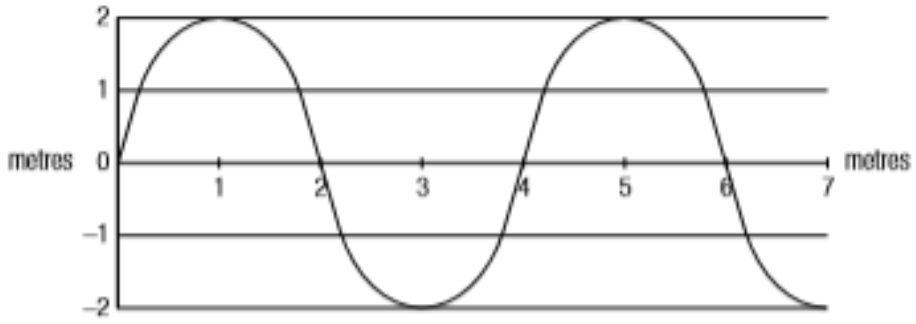
$f = \frac{\text{cycles}}{\text{sec}} = \frac{2000 \text{ rpm}}{60 \text{ sec}} = 33.3 \text{ Hz}$

Characteristics of waves

Use the information in the graphs to answer the questions.

1. How long is the wavelength of the wave below? 4m

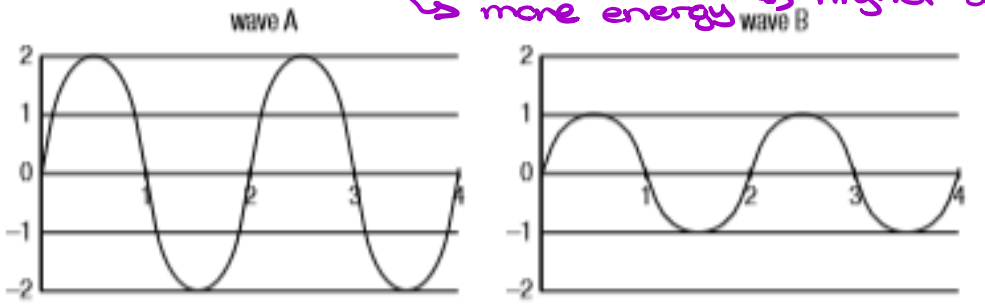
2. How large is the amplitude of the wave below? 2m



3. Which wave below has the smaller amplitude, A or B? B

4. Which wave carries more energy, A or B? A

↳ more energy → higher amplitude.



5. What is the same for waves X and Y below: amplitude, wavelength, or frequency? amplitude

6. Which wave has a greater frequency, X or Y? Y

7. Which wave has a longer wavelength, X or Y? X