

Student To Do:

☐ Complete as homework

☐ Corrections

☐ Others: _____

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Did you know? Greenhouses feature roofs containing trapped air pockets to grow sweet fruits. Because air is a poor conductor of heat, it slows down heat loss from inside the greenhouse to the colder surroundings on chilly days, maintaining an optimal temperature.

🎯 Learning Objectives

- ✓ Differentiate between how light sources and non-luminous objects are seen by the human eye
- ✓ Predict and explain shadow variations using the core properties of light
- ✓ Distinguish clearly between the concepts of heat and temperature using exact scientific terminology
- ✓ Analyse the rate of heat transfer across different materials

Student Info

Name: _____

Date : _____ Day: _____

Tutor : _____

1. Light and Shadow

Light is a form of **energy** that helps us to see things.

1.1. Sources of Light

Objects that give off light are known as **sources of light**.

Sources of light can be natural or man-made.

	Natural	Man-made
Explanation	Natural sources of light give off light naturally.	Man-made sources of light require energy input to give off light. It converts the energy from another form into light energy.
Examples	Sun, stars, lightning Fireflies, glow-worm, jellyfish	Candle light, light bulb, torch, fireworks

1.2. How We See Objects

We can see objects that are **sources of light** because they **give off light** which enters our **eyes**.

We can see objects that are **not sources of light** when light is **reflected** from the object and enters our **eyes**.

1.3. Shadow

Shadows are dark areas formed on a surface when light is completely or partially blocked by an object.

Shadows can be formed because of two properties of light:

- 1) Light **travels** in straight lines
- 2) Light **cannot pass through** an **opaque** object.
Only **some light** can **pass through** a **translucent** object.

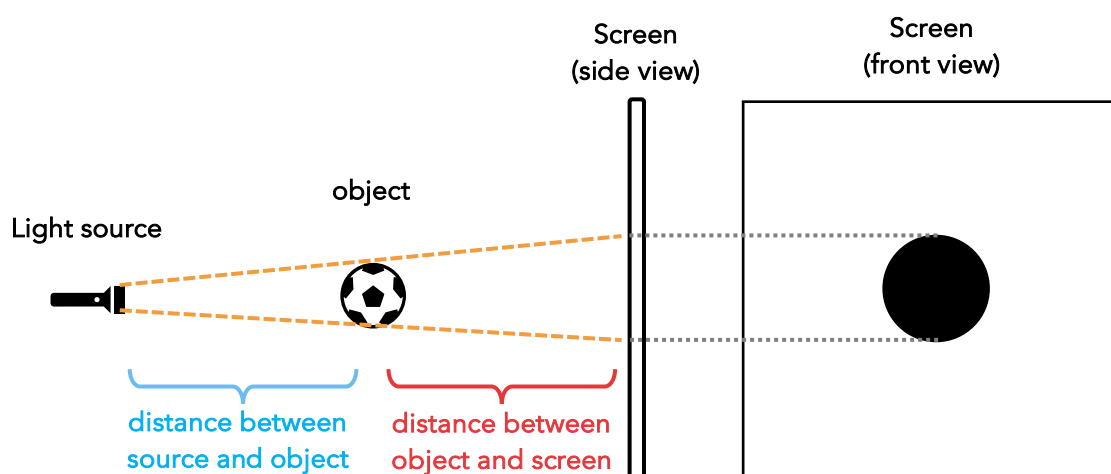
1.4. Factors that Affect the Size of Shadows

Shadows of different sizes can be formed by the same object.

The size of a shadow depends on:

- The distance between the object and the source of light and
- The distance between the object and the surface on which the shadow is formed

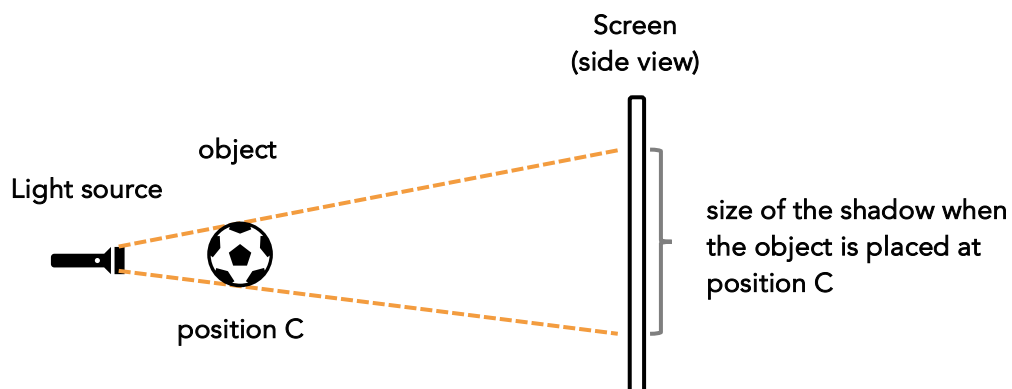
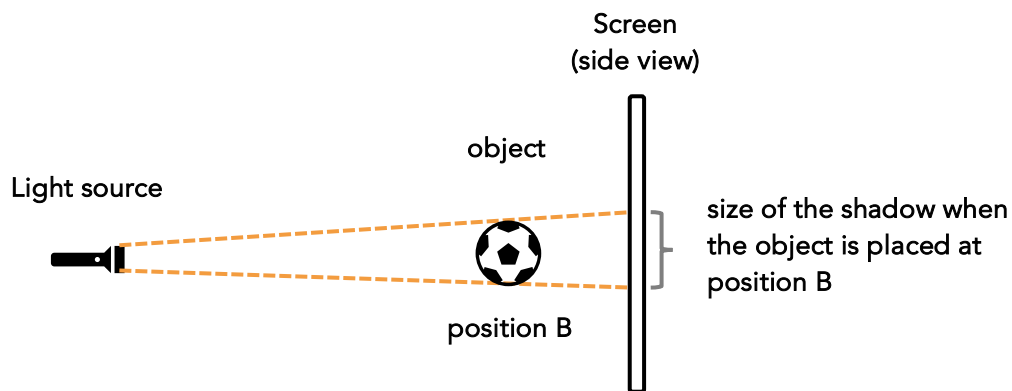
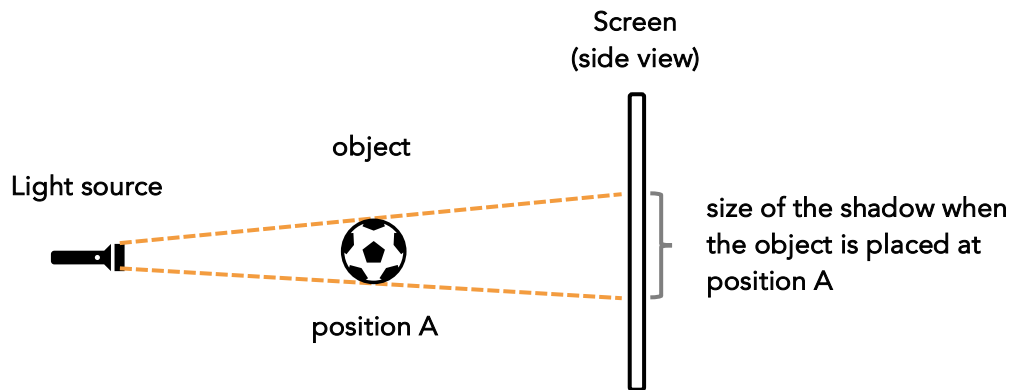
The surface on which a shadow is formed is called the **screen**.



Change	distance between		Size of shadow
	light source and object	object and screen	
Light source is placed further away from the object	increases	no change	decreases
Light source is placed closer to the object	decreases	no change	increases
Screen is placed further away from the object	no change	increases	increases
Screen is placed nearer to the object	no change	decreases	decreases
Object is placed nearer to the screen, further away from the light source	increases	decreases	decreases
Object is placed nearer to the light source further away from the screen	decreases	increases	increases

1.5. Using light ray drawings to predict the size of shadow

To predict the size of the shadow of the object, we can draw light rays from the light source past the top and bottom of the object to show where these light rays will reach the screen.

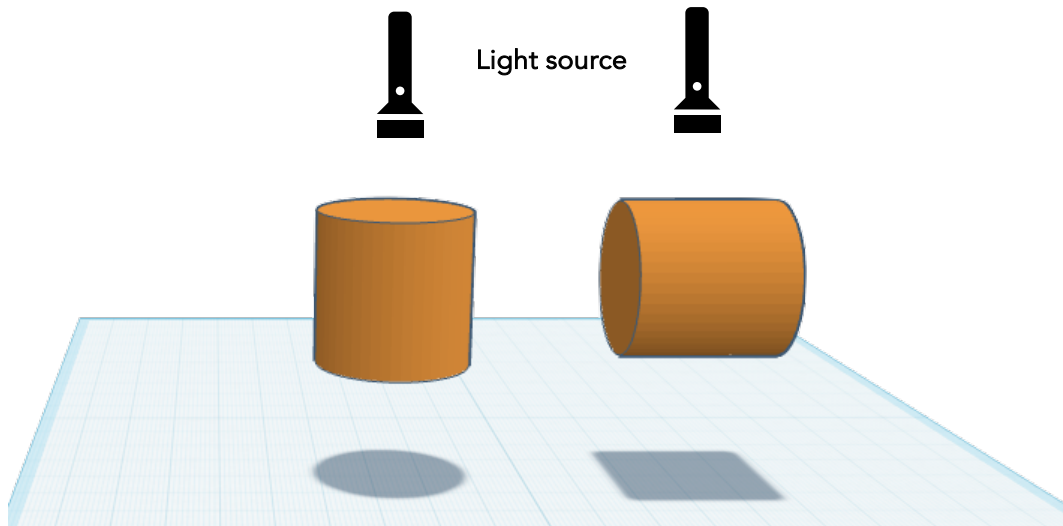


From the above diagrams, we can tell that the size of the shadow is biggest when the object is placed at position C.

1.6. What affects the shape of shadows?

The shape of an object determines the shape of its shadow.

For a 3D object whose shape is non uniform, its shadow will depend on the part of the object that light is shone onto.



2. Heat

2.1. What is temperature?

Temperature is a measure of how hot or cold something is.

Definition: Temperature

Temperature is a measure of how hot or cold something is.

2.2. Temperature can be measured using a thermometer

The thermometer is an instrument that can measure temperature accurately.

Temperature is measured in degree Celsius (°C).

The hotter an object is, the higher its temperature.

2.3. Heat causes temperature to change

Heat is a form of energy which causes temperature to change.

- When an object **gains heat**, its temperature **increases**.
- When an object **loses heat**, its temperature **decreases**.

Important: Temperature is not the same as heat

Temperature is a property of an object, while heat gained or lost is the reason why the temperature of an object changes.

2.4. Heat flows from hotter area to colder area

Heat flows from an object or an area with a higher temperature to an object or an area with a lower temperature until they have the same temperature. .

This concept of heat flow explains many of the changes in temperature happening around us.

Situation	Observation	Explanation
A cold metal spoon placed in a cup of hot milo	The metal spoon felt hot after some time.	The milo had a higher temperature than the metal spoon. Therefore, heat flowed from the hot milo to the cold metal spoon. Since the metal spoon gained heat , its temperature increased .
A cup of iced coffee is left on a table	The iced coffee warmed up to room temperature after some time	The iced coffee had a lower temperature than its surrounding. Therefore, heat flowed from the surrounding to the iced coffee. Since the iced coffee gained heat , its temperature increased .

2.5. Different materials conduct heat at different rates

Ice in a polystyrene cup takes a longer time to melt than ice in a metal cup. The reason is because heat flows more slowly through polystyrene than metal.

	Good conductors of heat	Poor conductors of heat
Description	materials that allow heat to flow through them quickly	materials that do not allow heat to flow through them quickly
Examples	metals	glass, plastic, wood, air
Uses	frying pan	the handle of the frying pan

⚠ Attention: How we "feel" temperature is dependent on the rate of heat flow

Given a metal spoon and a plastic spoon at the same temperature, the metal spoon will feel colder to us because it is a better conductor of heat.

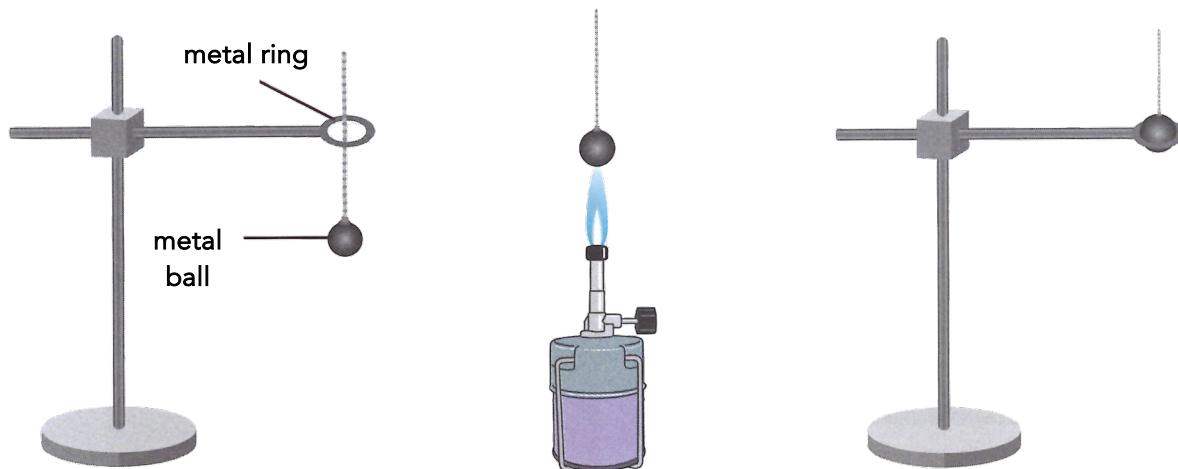
2.6. Effects of heat gain or heat loss

2.6.1. Objects expand when they gain heat, contract when they lose heat

Heat can cause objects to expand or contract.

- When an object **gains heat**, it will **expand**
- When an object **loses heat**, it will **contract**

Below is an experiment that demonstrates the above concept.



Before being heated, the metal ball can pass through the metal ring.

The metal ball is heated by the flame.

After being heated, the metal ball cannot pass through the metal ring.

After some time, the hot metal ball will lose heat to the surrounding and cools down. It will therefore contract, allowing it to pass through the metal ring again.

2.6.2. Heat can cause a change in the state of matter

Water can change from one state to another due to heat.

