

Convection LR

Convection Objective To learn about the process of convection. We know that liquids are bad conductors of heat. But, heat does get transferred in liquids.

Let's find out how. Here's an activity. To learn how heat gets transferred in liquids, take some water in a beaker and place it on a tripod stand.

Gently drop a crystal of potassium permanganate in the water. Soon, the crystal starts dissolving in the water and gradually the water gets colored. Now place a Bunsen burner below the stand and light it to heat the water.

You will observe that the colored water rises up. After moving up to a certain level, the water spreads out and moves down along the sides of the beaker. This happens because the water near the flame gets heated and expands.

As it expands, its density decreases. Therefore, it becomes lighter and rises up. The cold water on top, being heavier, moves down along the sides of the beaker.

This cold water also becomes hot and rises up. And once more, the cold water moves down along the sides. This process continues till all the water gets heated up.

The circulating stream of water, due to heating, is known as a convection current. And this mode of heat transfer is known as convection. In convection, the transfer of heat takes place by the movement of the heated molecules from the hot to the cold region.

So, heat gets transferred in liquids by convection. However, convection cannot take place in solids because the particles in a solid cannot move as they are tightly bound together. As in liquids, in gases too, heat travels by convection.

Let's perform an activity to study convection currents in air. Here's a rectangular glass box fitted with two glass chimneys. Let's light a candle, place it below one of the chimneys and close the box.

Next, we burn an incense stick and hold it at the top of the other chimney. We observe that the smoke enters the box through this chimney and rushes out of the other one. This happens because the air above the candle gets heated, becomes lighter, rises up, and comes out through the chimney above the candle.

The smoke also rises upward along with the hot air. The rising hot air is replaced by the fresh air rushing into the box through the other chimney. Also, the smoke rushes down along with the fresh air.

In this manner, hot air keeps moving out through one chimney and cold air keeps entering the box through the other chimney, setting a cycle of convection current. To summarize, convection is the process of the transfer of heat that takes place by the movement of the heated molecules from the hot to the cold region. Convection takes place in liquids and gases but not in solids.

Summary of Convection

Understanding Convection

✓ **Convection** is the transfer of heat through the movement of heated molecules from a **hot** region to a **cold** region.

✓ **Convection occurs in liquids and gases, but not in solids** because solid particles are tightly bound and cannot move freely.

How Convection Works in Liquids

✓ Activity:

- Take a **beaker with water** and place it on a **tripod stand**.
- Drop a **crystal of potassium permanganate** in the water to color it.
- Heat the water using a **Bunsen burner**.
- **Observation:**
 - The colored **hot water rises** and spreads out.
 - The **cold water moves down** to take its place.
 - This movement forms a **convection current**.

✓ Reason:

- **Hot water expands**, its **density decreases**, and it **rises up**.
 - **Cold water is heavier**, so it moves **downward** and gets heated.
 - This process **continues until all the water is heated evenly**.
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How Convection Works in Gases (Air)

✓ Activity:

- Take a **rectangular glass box** with **two chimneys**.
- Light a **candle** under one chimney.
- Burn an **incense stick** near the other chimney.
- **Observation:**
 - **Hot air rises** from the candle and moves out through the chimney.
 - **Cold air enters** through the other chimney.
 - The **smoke follows this airflow**, showing the convection current in action.

✓ Reason:

- **Hot air becomes lighter and rises**.
 - **Cold air rushes in** to replace it.
 - This cycle continues, creating a **convection current** in air.
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Key Takeaways

- ✓ Convection is the transfer of heat through the movement of heated molecules.
 - ✓ It occurs in liquids and gases but NOT in solids.
 - ✓ Hot fluids (liquids or gases) rise, and cold fluids sink, forming a convection current.
 - ✓ Convection is responsible for heating water, air circulation, and weather patterns.
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Quiz on Convection

1. What is convection?

- ✓ **The transfer of heat through the movement of heated molecules.**
- ✗ The direct transfer of heat through solids.
- ✗ The reflection of heat from a surface.
- ✗ The transfer of heat without movement of molecules.

2. Why does convection not occur in solids?

- ✓ **Because solid particles are tightly bound and cannot move freely.**
- ✗ Because solids do not conduct heat.
- ✗ Because solids have no heat energy.
- ✗ Because heat gets trapped inside solids.

3. What happens when water is heated in a beaker?

- ✓ **Hot water rises, and cold water moves down, forming a convection current.**
- ✗ The water evaporates instantly.
- ✗ Only the top layer of water gets heated.
- ✗ The water remains at the same temperature.

4. What happens in the glass box experiment with two chimneys?

- ✓ **Hot air rises through one chimney, and cold air enters through the other.**
- ✗ The smoke remains in one place.
- ✗ The candle stops burning.
- ✗ Both chimneys release cold air.