

Name _____

Convection Vs. Radiation NOTES

Convection occurs when heat is transferred through a gas or liquid by the hotter moving into a cooler area.

- In meteorology, it is the transfer of heat and other atmospheric properties by the movement of masses of air, particularly in an upward direction.
- In geology, it is the slow movement of material below the Earth's crust.



Everyday Examples of Convection

- **Boiling water** - The heat passes from the burner into the pot, heating the water at the bottom. Then, this hot water rises and cooler water moves down to replace it, causing a circular motion.
- **Radiator** - Puts warm air out at the top and draws in cooler air at the bottom.
- **Steaming cup of hot tea** - The steam is showing heat being transferred into the air.
- **Ice melting** - Heat moves to the ice from the air. This causes the melting from a solid to liquid.
- **Hot air balloon** - A heater inside the balloon heats the air and so the air moves upward. This causes the balloon to rise because the hot air gets trapped inside. When the pilot wants to descend, he releases some of the hot air and cool air takes its place, causing the balloon to lower.
- **Frozen material thawing** - Frozen food thaws more quickly under cold running water than if it is placed in water. The action of the running water transfers heat into the food faster.

Convection in Meteorology and Geology

- **Mantle convection** - The rocky mantle of the Earth moves slowly because of the convection currents that transfer heat from the interior of the Earth up to the surface. This is the reason the tectonic plates move gradually around the Earth. Hot material is added at the growing edges of a plate and then it cools. At the consumption edges, material becomes dense by contracting from the heat and sinks into the Earth at an ocean trench. This triggers the formation of volcanoes.
- **Oceanic circulation** - Warm water around the equator circulates towards the poles and the cooler water at the poles moves towards the equator.
- **Convection of a star** - A star has a convection zone where energy is moved by convection. Outside the core is a radiation zone where plasma moves. A convection current forms when the plasma rises and the cooled plasma descends.
- **Forced convection** - This is where a fan, pump or suction device is used to facilitate convection. Here are examples:

Air conditioning, central heating, steam turbines, car radiator using fluid, blood circulation in warm blooded animals, the shock waves coming from an explosion, a convection oven

Radiation refers to energy that travels through space or matter in the form of energetic waves or particles. When radiation occurs, the waves move out in all directions from the producer of the energy. Radiation can be ionizing, which means it has the capacity to modify the ions of an atom, or non-ionizing, in which it does not possess that ability.



Examples of Everyday Radiation

Non-ionizing Radiation	Ionizing Radiation
Visible light Infrared light Near ultraviolet light Microwaves Radio waves Waves produced by mobile phones A campfire's heat Thermal radiation Power lines Strong magnets MRI LEDs Lasers Light bulbs Light from the sun Remote controls Cordless phones Radio-frequency radiation such as televisions, FM and AM radio Shortwave and CB's Computer screens Infrared lamps use to maintain food temperature in restaurants	Ultraviolet light X-rays Gamma-rays Radioactive decay's particles Cosmic rays Alpha rays Beta rays Medical imaging equipment Ionization of food Sterilization of medical tools Nuclear power production Metal mining can result in exposure to ionizing radiation Coal mining and power production from coal Nuclear weapons Galactic Cosmic Radiation (to which astronauts are exposed) Solar Particle Event radiation (to which astronauts may be exposed) Natural background radiation Radiation therapy for specific forms of cancer Radon CT scans Nuclear medical scans X-Rays Airport security scanners (in extremely high usage)

Types of Radiation

There are three types of ionizing radiation as classified by scientists based on how hard it is to stop the waves or particles"

- **Alpha radiation** is the easiest to stop as it can be stopped by paper.
- **Beta radiation** is a bit more difficult to stop & requires metal to stop it, though the metal can be thin.
- **Gamma radiation** is most powerful and dangerous and can only be stopped by many feet of earth, water of great depth, or metal of intense thickness.

Radiation Effect on Humans

Effects of ionizing radiation on humans can include cancer, sickness of varying types, death, and mutation. These are as a result of the change in DNA that ionizing radiation can cause. Those exposed to lower levels of radiation (such as non-ionizing) are unlikely to develop any adverse effects.

Radiation is an everyday phenomenon as you can see from the above examples and information.