

Topic/Objective: Energy Transfer	Name: Hannah Daley
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Essential Question: What is the difference between Conduction, Convection, and Radiative Heat transfer? What is the greenhouse gas effect?
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Questions: What is Conduction and how does it impact the weather?	Notes: Conduction = the transfer of energy through contact and energy transfer <ul style="list-style-type: none"> • What is energy transfer? Think of how a metal spoon gets hot on the handle when placed in hot tea. The tea transfers its energy to the metal spoon and because metals are good “conductors” energy is transferred throughout the spoon all the way to the handle. This is called conduction • Atmospheric example: When the surface of the Earth is very hot and this heats up the air above it, this is called conduction • Air is not a good conductor; Metals are excellent conductors • Very important at Earth’s surface
What is Convection and how does it relate to Conduction?	Convection = the transfer of energy by vertical motion. <ul style="list-style-type: none"> • Hot/light air rises; Cold/heavy air sinks • Atmospheric example continued: SO, because of conduction, Earth’s surface can heat the air right above the surface. NOW because of convection the hotter air will rise. • According to the ideal gas law ($\text{Pressure} = \text{Density} \times \text{Gas Constant} \times \text{Temp}$), As Temperature rises, density decreases (See 8/29 class notes) <div data-bbox="487 1276 1559 1785" data-label="Diagram"> <p style="text-align: center;">Energy Transfer: Convection</p> <p>The diagram is titled "Energy Transfer: Convection". It is divided into two panels, (a) and (b). Panel (a) shows a yellow sun in the upper left corner. A yellow arrow points from the sun down to a yellow surface at the bottom, labeled "sun heats the surface". From the surface, a red arrow points up to a dashed blue circle labeled "a warm air blob forms". Below panel (a) is the text "The hot surface heats the air by conduction". Panel (b) shows the same sun and surface. A circular flow of air is depicted with red arrows. One red arrow points up from the surface, labeled "warm air rises". Another red arrow points down from the top of the circle, labeled "colder air sinks". A third red arrow points right from the bottom of the circle back to the surface. A large red arrow on the right side of the panel points upwards, labeled "heat flow". Below panel (b) is the text "hot surface".</p></div> <p style="text-align: center;">Note: The pressure in the “blob” is the same as the surrounding air pressure</p>

<p>Potential Exam question</p>	<p>The following picture is a common exam-type question. You need to know that air rises over hot surfaces, it will spread out in the upper air and then will sink back down.</p> <div data-bbox="492 258 1567 865" data-label="Diagram"> <p>© Cengage Learning. All Rights Reserved.</p> </div> <p>Rising, hot air creates convective circulation</p> <p>Thermals will eventually spread out, sink and move back to the starting point creating wind</p> <p><i>Fig 2.7: Essentials of Meteorolo</i></p>
<p>What is radiative Heat? What wavelengths does Earth receive and emit?</p>	<p>Radiative Heat is due to electromagnetic radiation. The wavelengths that represent this radiation is known as solar spectrum</p> <ul style="list-style-type: none"> • Radiation can be absorbed, reflected, or scattered <ul style="list-style-type: none"> ◦ Absorbed: Molecules in the atmosphere absorb radiation (example, ozone absorbs UV radiation which helps protect us) ◦ Reflected: White colors reflect more light, thus white surfaces like snow have a higher %reflectivity or <u>higher albedo</u>. ◦ Scattered: molecules scatter some light. Nitrogen and Oxygen optimally scatter blue light (<u>Rayleigh scattering</u>) which is why the sky looks mostly blue • The sun releases UV and Visible wavelengths • The Earth receives UV and Visible radiation from the sun, absorbs the UV radiation and releases/emits IR radiation. IR radiation is also known as heat, which is why the troposphere heats from the surface of the Earth up
<p>What is the Greenhouse Gas effect?</p>	<ul style="list-style-type: none"> • Greenhouse gases: greenhouse gases have <u>NO EFFECT on incoming radiation</u>; however they <u>absorb IR from Earth's outgoing radiation</u> and <u>re-emit</u> this energy back to Earth • Greenhouse gas effect: The reemission of Earth's emitted IR radiation back to Earth heats up the surface and acts like a blanket. • Water is the worst Greenhouse Gas because it absorbs the most IR/thermal; HOWEVER, we cannot directly control water so we focus on what we can control <ul style="list-style-type: none"> ◦ The only thing that impacts water in the atmosphere is temperature

- If the blanket gets too thick.. It gets hotter

Summary:

This is my notes on the 9/17 Energy slides. We talked about this for a few lectures after. Students should feel very comfortable knowing what convection is and how to draw it, what type of incoming and outgoing radiation that the Earth received, and what the greenhouse gas effect is.