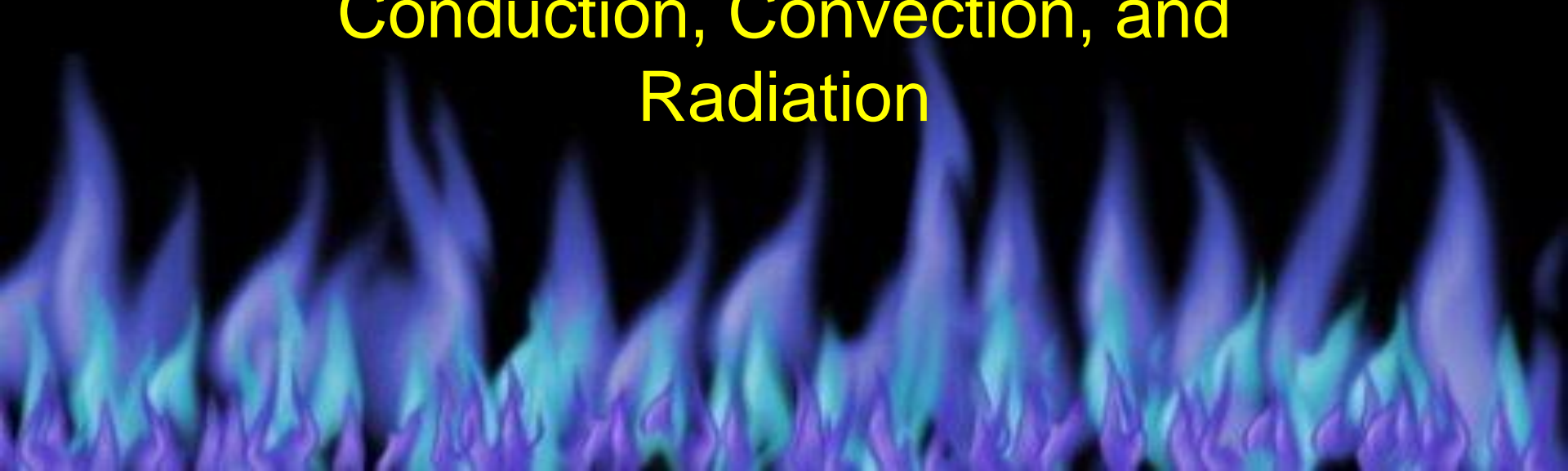


HEAT TRANSFER

Conduction, Convection, and
Radiation



Heat Transfer

- Heat transfer is the movement of thermal energy **from a warmer** item to a cooler item.
- Remember, heat moves in predictable ways, from a **high** to a **low**.



Three Heat Transfer Situations:

- Conduction
- Convection
- Radiation

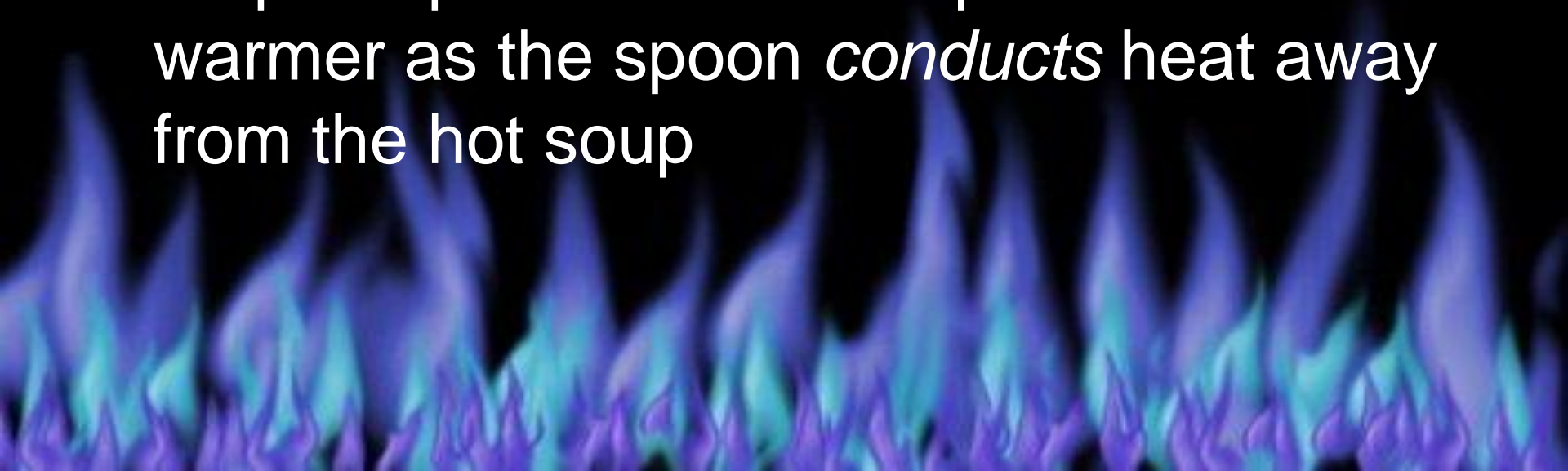


Conduction

- **Conduction** is heat **transfer through contact**.

Examples:

- Your feet transfer (*conduct*) heat to a cold tile floor
- A spoon placed in hot soup becomes warmer as the spoon *conducts* heat away from the hot soup



Conduction examples

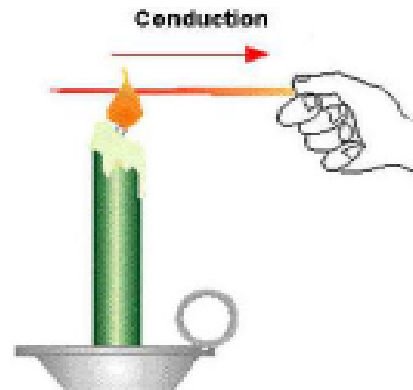
Conduction example
1

Conduction from hot
soup to a spoon



Conduction example
2

Conduction along a
metal rod being held
in a flame



Conduction
example 3

Conduction
from a frying
pan to a
cooking egg



Table 2 – three examples of conduction where heat is transferred from particle to particle.

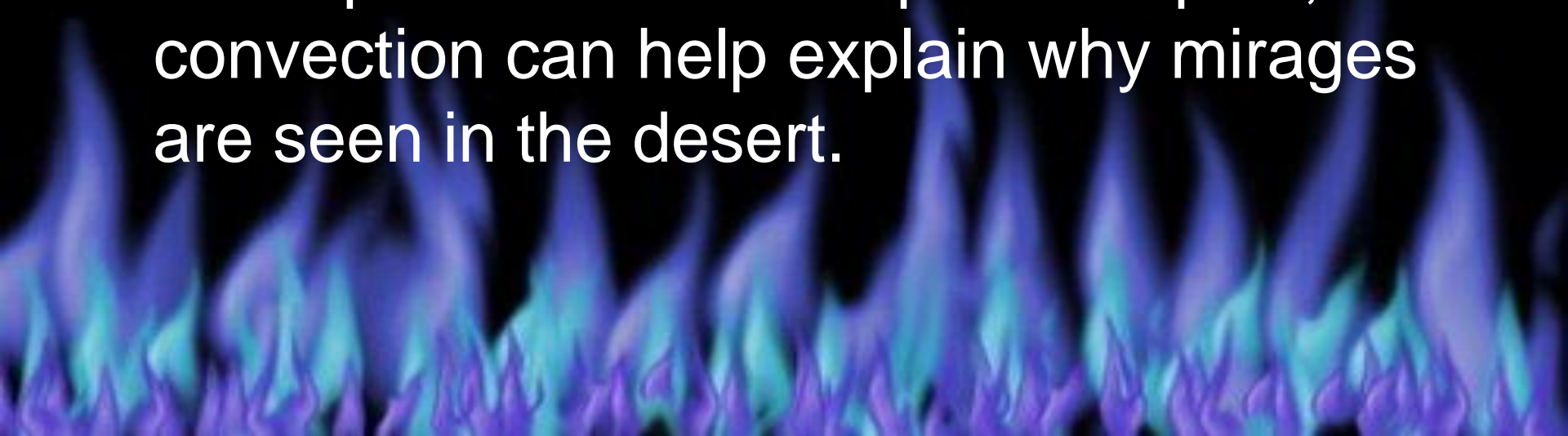
Convection

- Convection occurs in **cycles**
 - During convection, hot air or liquid rises and as it cools it goes back down. This cycle continues over and over.



Convection continued

- Consider this - when you look at the road in the summertime on a hot day, you may notice that the air above the road looks “blurry” – this is convection taking place as the hot air directly over the road *absorbs* the heat from the road and **rises**. Although the explanation can be quite complex, convection can help explain why mirages are seen in the desert.




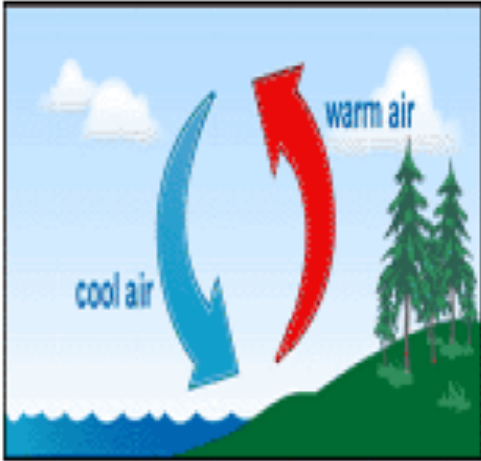
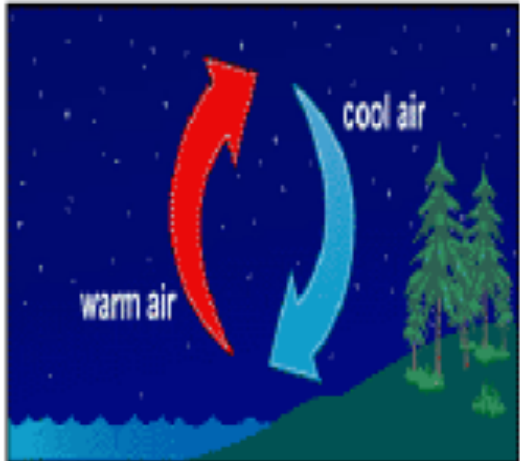
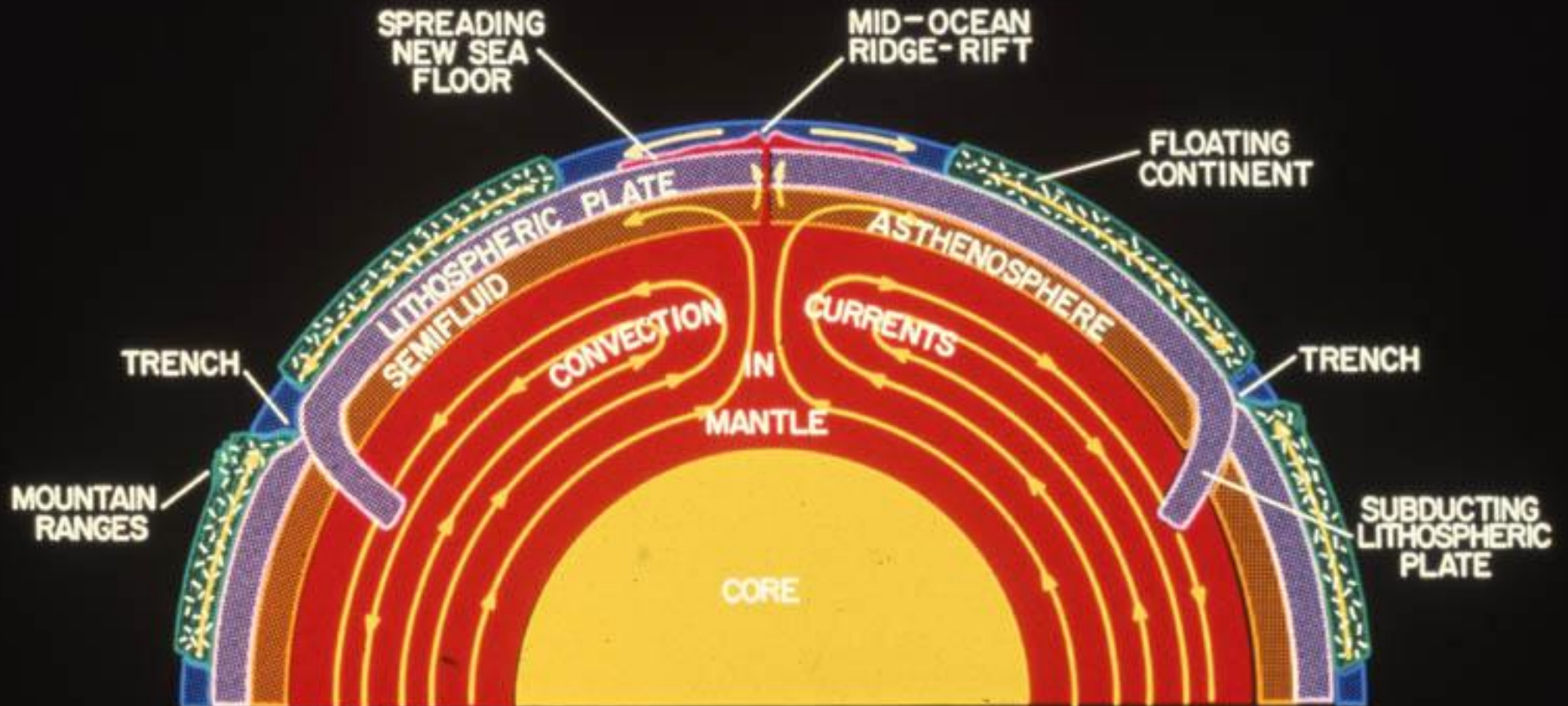
Convection Example 1	Convection Example 2	Convection Example 3
<p>Convection occurring in water inside a pot that is on a stove</p>	<p>Convection in the atmosphere during the day – warmer air rising off the land and cooler air sinking over the water</p>	<p>Convection in the atmosphere during the night – warmer air rising off the water and cooler air sinking over the land</p>
	 <p>DAY TIME</p>	 <p>NIGHT TIME</p>

Table 3 - three examples of convection where heat is transferred in fluids (liquids and gases).

Convection and Earth Science Connection



Radiation

- Question: If conduction deals with solids and convection deals with liquids, how does heat arrive to Earth from the Sun?
- There is very little matter in between the Earth and Sun.



Radiation Diagram

Sun

Space

Earth



Radiation continued

- Heat can travel in waves without a medium (a liquid, solid, or gas).
- Radiation is the term that describes heat movement without a medium of matter.



The Electromagnetic Spectrum

The Electromagnetic Spectrum

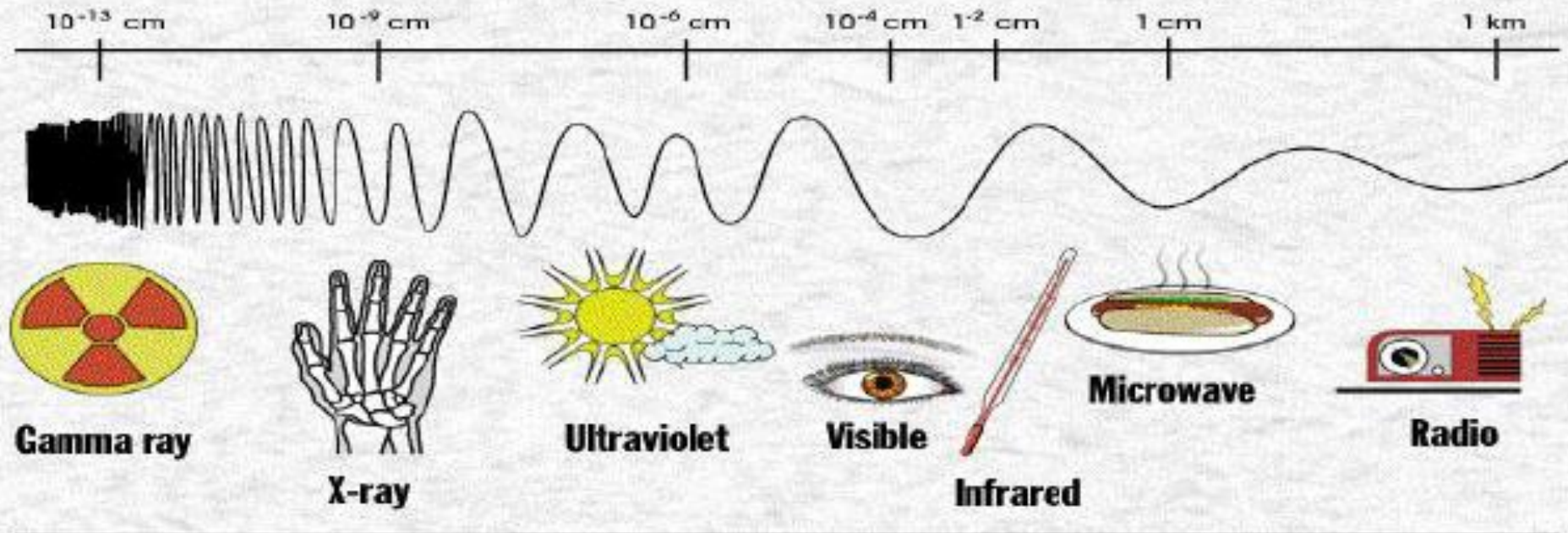


Diagram 3 – The electromagnetic spectrum

Radiation continued

- All of the forms of electromagnetic energy in the spectrum can travel through the universe as waves – we call this radiation.



Real-World Situations

- How are potholes formed?
 - <http://www.youtube.com/watch?v=hNyg0CttU8Y>
- How does a hot air balloon work?
 - http://www.youtube.com/watch?v=77Ej_Ayugxk

