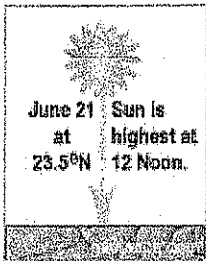


NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

CLASS: \_\_\_\_\_ TEACHER: \_\_\_\_\_

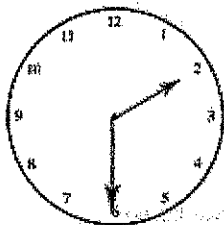
**INSOLATION: EARTH SCIENCE LESSON**

**The Hottest and Coldest Times of the Day ~ Explained Simply**



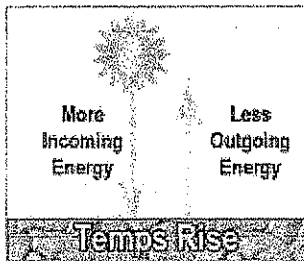
**MAXIMUM INSOLATION** occurs at **12:00 noon** when the sun is highest in the sky each day for a given location.

At specific times of the year, this highest altitude of the sun may be at zenith (overhead) for people living on or between 23.5° S and 23.5° N latitudes, but the sun will NEVER be overhead for anyone living at higher latitudes.



Hottest Time of the Day

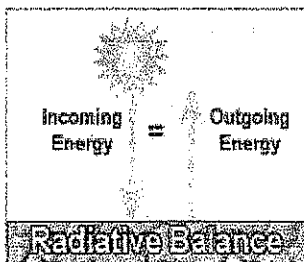
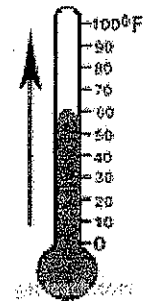
Maximum temperatures occur approximately 2 hours later (2:00-3:00 PM).



When the sun rises, Earth receives more radiant energy that it re-radiates as infrared heat energy.

So, temperatures RISE.

Even at SOLAR NOON, temperatures are STILL RISING.



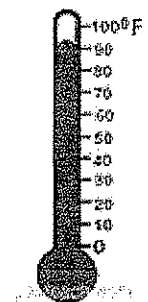
At about 2:00 PM, Earth is receiving sun insolation and giving back its terrestrial radiation in equal amounts.

**Incoming Solar Radiation = Outgoing Terrestrial Radiation**

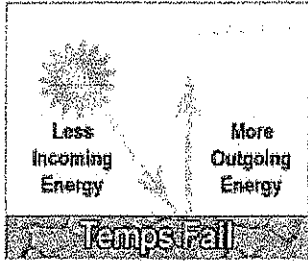
At this point in time, temperatures are at their HIGHEST point for the day.

The earth is said to be in a state of: **RADIATIVE BALANCE**.

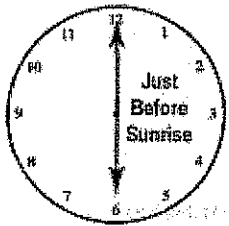
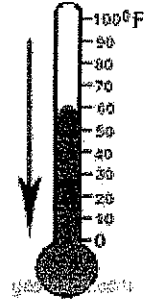
*RADIATIVE BALANCE* occurs when incoming and



outgoing energy between Earth and sun are equal.



From that point on, as the sun's angle of insolation lowers towards sunset, incoming energy from the sun is LESS THAN outgoing energy from the earth, so average daily temperatures begin to FALL.

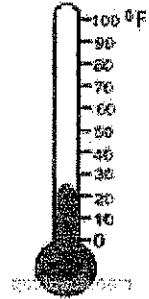


Coldest Time of the Day

The Earth continues to lose heat via terrestrial (ground) radiation all evening until, just before sunrise, average temperatures are at their lowest.

The coldest time of the day usually occurs just before sunrise, on the average, 6 AM.

The earth is once again in a state of **RADIATIVE BALANCE**.



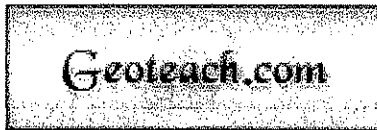
**Go to:**

*The Hottest and Coldest Times of the Year*

*or*

*Go to a Review Worksheet on:*

*The Hottest and Coldest Times of the Day and the Year*



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**Close Window**

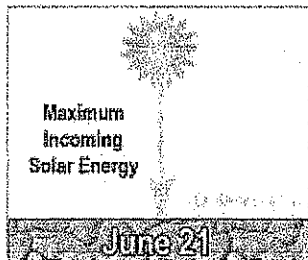


NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

CLASS: \_\_\_\_\_ TEACHER: \_\_\_\_\_

**INSOLATION: EARTH SCIENCE LESSON**

**The Hottest and Coldest Times of the Year ~ Explained Simply**

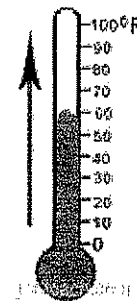


**MAXIMUM INSOLATION** occurs on **June 21** (Summer Solstice) for people living in the Northern Hemisphere.

The illustration to the left represents the sun's altitude at 23.5° N latitude (the Tropic of Cancer).

When the sun reaches its highest altitude in the sky for any location for the entire year, Earth receives maximum insolation from the sun.

So, average daily temperatures are **RISING**.



Maximum Insolation for Year is on **June 21**

June						
Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	<b>21</b>	22	23
24	25	26	27	28	29	30

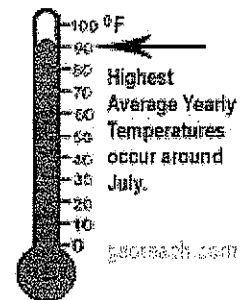
Time of Highest Yearly Temperatures is Approximately 3 Weeks Later

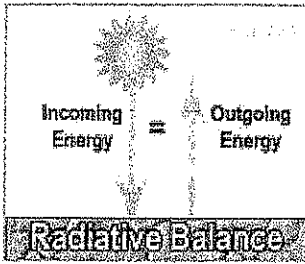
July						
Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	<b>14</b>
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

**Maximum average yearly temperatures occur about 3 weeks later, in JULY.**

This happens because Earth's land and water are still cold from a long winter. So, maximum temperatures are not yet reached by June 21.

It takes the earth several weeks **AFTER** maximum insolation for the land and water to heat up to a point where maximum temperatures for the year can occur.

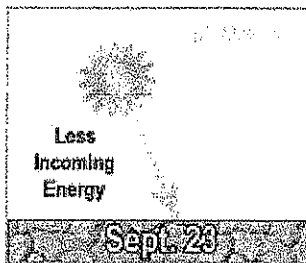




When maximum average yearly temperatures are reached, about 3 weeks after June 21 (in JULY), the earth is said to be in a state of: **RADIATIVE BALANCE.**

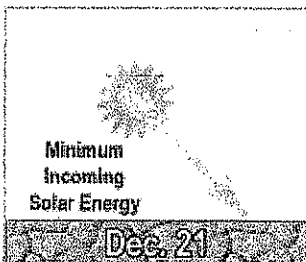
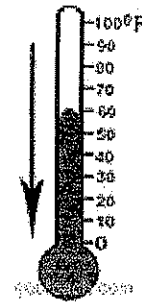
*RADIATIVE BALANCE* occurs when incoming and outgoing energy between Earth and sun are equal.

$$\text{Incoming Solar Radiation} = \text{Outgoing Terrestrial Radiation}$$



From that point on, the sun's angle of insolation continues to lower in the sky.

As the Fall Equinox (Sept. 23) draws nearer, incoming energy from the sun is **LESS THAN** outgoing, infrared heat energy from the earth, so temperatures begin to **FALL.**



The earth receives **MINIMUM INSOLATION** on **December 21** (Winter Solstice) for people living in the Northern Hemisphere.

That is the time that the angle of the sun in the sky is lowest and when the amount of insolation received from the sun is also at its lowest.

However, the temperatures are still falling.

Minimum Insolation for Year is on  
December 21

December						
Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Time of Lowest Yearly Temperatures  
is Approximately 3 Weeks Later

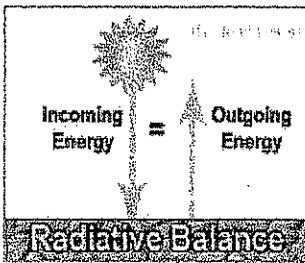
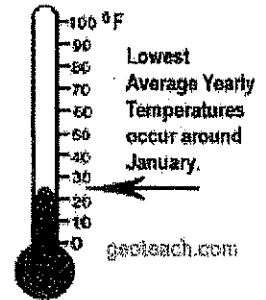
January						
Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

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**Coldest average temperatures occur around 3 weeks later in JANUARY.**

Earth's land and water are still warm from the summer, so it takes about 3 weeks for temperatures to fall to their lowest values.

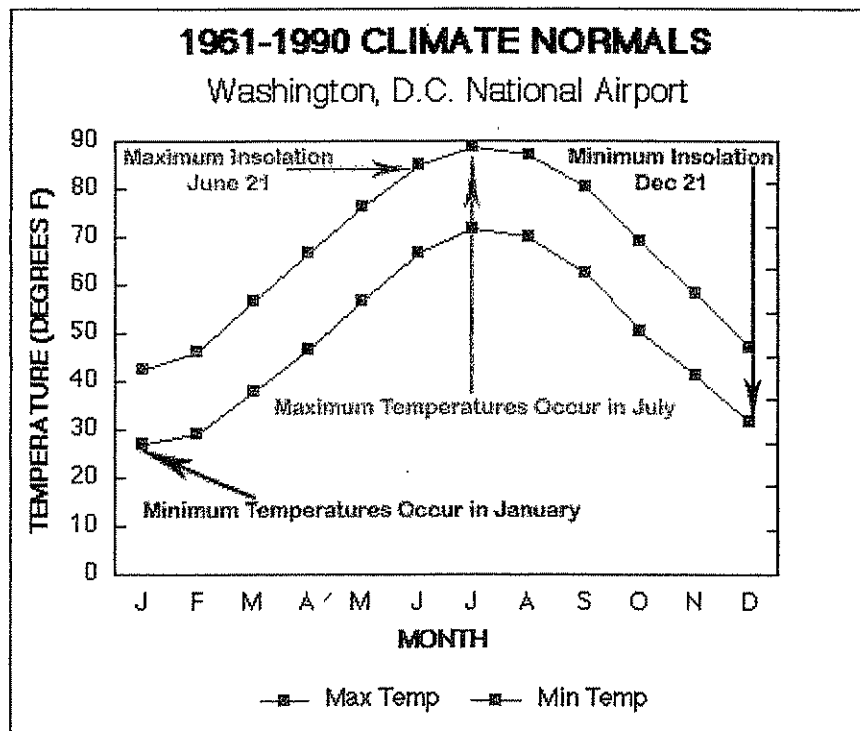
Therefore, the coldest time of the year usually occurs in January.



At this time the earth is said to once again be in a state of **RADIATIVE BALANCE.**

Notice that Maximum Insolation occurs on June 21 but Maximum Temperatures occur in July.

Minimum Insolation occurs on Dec 21 but Minimum Temperatures occur in January.



NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

CLASS: \_\_\_\_\_ TEACHER: \_\_\_\_\_

**INSOLATION: EARTH SCIENCE LESSON****Hottest and Coldest Times of the Day and Year ~ Student Assignment**

This worksheet accompanies and reinforces the concepts presented in the lessons on the following pages:

**Hottest and Coldest Times of the Day and The Hottest and Coldest Times of the Year**

**Directions:**

Place all answers on the following **The Hottest and Coldest Times of the Year Answer Sheet**. It will open in a new window and it is printable.

Answer all questions in this assignment basing your answers on information appearing on the above 2 pages, the illustrations and your knowledge of Earth Science.

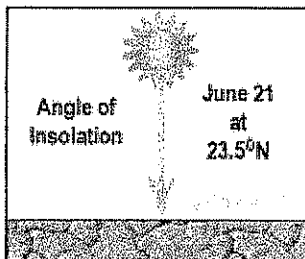
For multiple choice question, place the correct letter on the Answer Sheet.

**Questions:**

The following illustration shows the sun's angle of insolation at Noon on June 21 for a person for a person living at 23.5° N latitude.

1a- In a complete sentence, state whether the sun's angle would be lower, higher or remain the same 3 weeks later, in July, for this location.

1b- Also comment on the average daily temperatures this person would experience on June 21 compared to the temperatures 3 weeks later in July.



2- In New York State, maximum insolation occurs in June. Which statement best explains why the maximum yearly temperature is about a month later in July?

- a- Earth is closer to the sun in June than in July.
- b- Earth is farther from the sun in June than in July.
- c- New York State loses far more energy than it receives from the sun during most of July.
- d- New York State receives more energy from the sun than it loses during most of July.

3- Earth loses heat during the evening hours and temperatures drop because of:

- a- Strong winds
- b- Ground (terrestrial) radiation
- c- Heavy precipitation has occurred resulting in considerable evaporation.
- d- Condensation and cloud formation

4- Why are temperatures in the Northern Hemisphere warmer in July than in February?

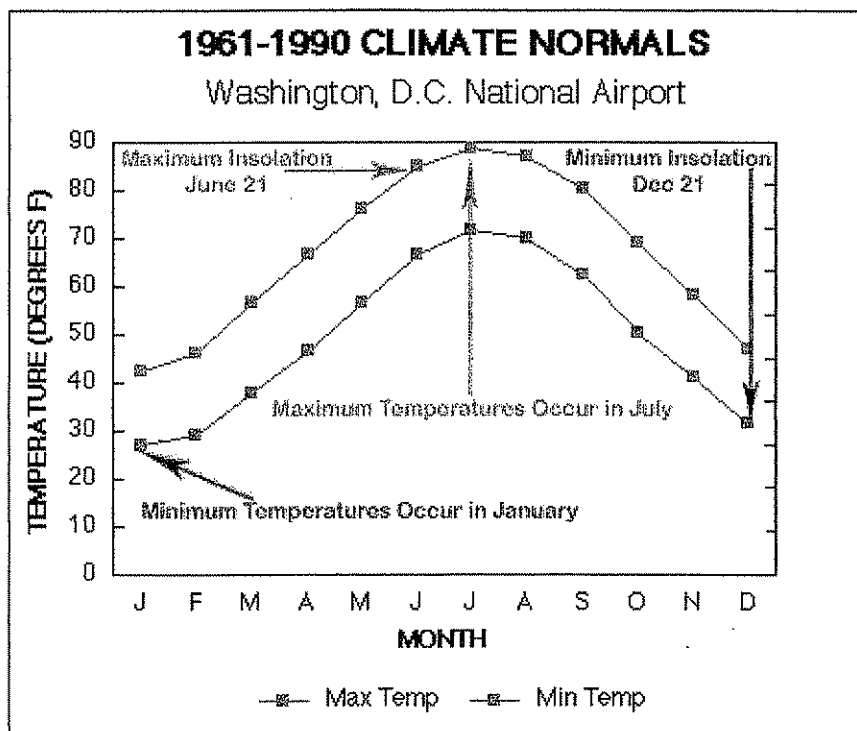
- a- The Southern Hemisphere is in a state of Radiative Balance.
- b- Earth is closer to the sun in July.
- c- Insolation is greater in July.
- d- The angle of insolation at noon is greater in February.

5- On an average, when will daily temperatures be at their lowest?

- a- At sunset
- b- At midnight
- c- At 2:00 AM in the morning
- d- Just before sunrise

6- Fill in the following information based on the graph below. All data in the graph and all answers you provide apply to the Northern hemisphere.

- a- Date of maximum insolation received: \_\_\_\_\_
- b- Approximate time of highest yearly temperatures: \_\_\_\_\_
- c- Date of minimum insolation received: \_\_\_\_\_
- d- \_\_\_\_\_



7- Referring back to the graph and your answers for question number 6, explain why:

- a- It takes about 3 weeks after maximum insolation for maximum temperatures to be reached.
- b- It takes about 3 weeks after minimum insolation for minimum temperatures to occur.

8- Earth is said to be in *RADIATIVE BALANCE* when incoming and outgoing energy between the Earth and the sun are equal.

At approximately what times of the year is the Earth in a state of Radiative Balance?  
 \_\_\_\_\_ and \_\_\_\_\_

9- At what time of day is the angle of insolation the greatest for people living in either the Northern or the Southern Hemisphere?  
 \_\_\_\_\_

10- At approximately what time of day is the highest daily temperature reached?  
 \_\_\_\_\_

11- What accounts for the difference in times between maximum daily intensity of insolation and maximum temperature?

12a- On the average, around what time of the day are temperatures at their lowest for the day?

12b- Why are average daily temperatures lowest at this time?

13- At approximately what times of the day is the Earth in a state of Radiative Balance?

\_\_\_\_\_ and \_\_\_\_\_

14- If incoming solar radiation is greater than outgoing infrared (heat) radiation from Earth, what happens to Earth's temperatures?

15- If incoming solar radiation is less than outgoing infrared (heat) radiation from Earth, what happens to Earth's temperatures?



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