

Name _____

Due Date _____

Partners _____

Earth's Heat Budget

INTRODUCTION: The length of the day and night undergo a cyclic change at most locations over the course of a year. The change in the duration of daylight has a direct effect on the surface temperatures at a given location. There is an analogy, or similarity, between the balance of energy flow at the Earth's surface and a your bank balance. Insolation absorbed can be thought of as money you earn and deposit, and energy re-radiated is similar to money you withdraw and spend. The resulting temperature is analogous to your bank balance. As long as you continue to deposit more than you withdraw, you'll have a budget surplus. If you start to deposit less than you withdraw, you'll have a budget deficit. Similarly, if Anytown, NY receives more insolation than it re-radiates, temperatures will climb, and if less insolation is received than re-radiated, temperatures will decline. By the way, the numbers we'll use in this lab are arbitrary: I made them up, so they don't represent real data.

OBJECTIVE: To compare the insolation absorbed with the energy re-radiated at a given location over the course of a year, and to understand how this balance (between energy in and energy out) affects the surface temperatures.

VOCABULARY:

deficit	surplus	radiative balance

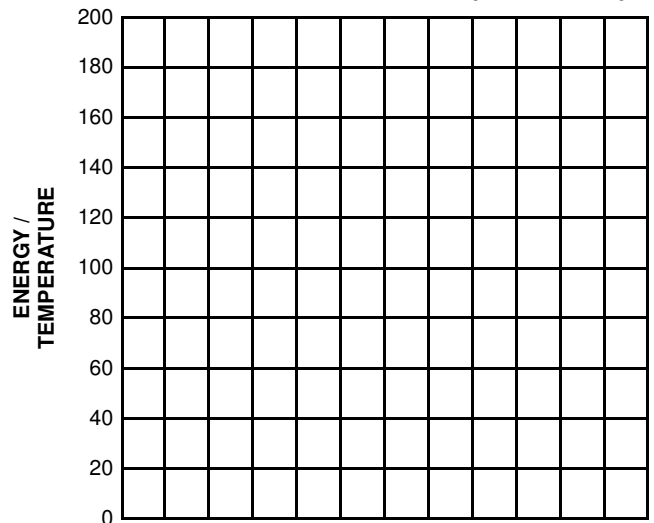
PROCEDURE:

1. On the report sheet you will find a table of ENERGY ABSORBED (DEPOSITED) and ENERGY RERADIATED (WITHDRAWN), for each month over a year's time. As you see in the first two rows, by subtracting the first column from the second column, you get the difference. **Find the difference for January.**
2. Again, as you see in the first two rows, by adding the DIFFERENCE to the previous SURFACE TEMPERATURE (BALANCE) you get the SURFACE TEMPERATURE (BALANCE) for that month. Now apply the difference to the previous SURFACE TEMPERATURE to **find the temperature for January.** Record this under SURFACE TEMPERATURE (BALANCE).
3. **Find the differences and temperatures for the rest of the months.**
4. **Make a graph from your data,** plotting the following 3 variables on one set of axes. *Label the axes with variables and units, use a different color for each line and provide a key.*

REPORT SHEET – Energy Balance for Anytown, NY

MONTH	ENERGY AB-SORBED (DEPOSITED)	ENERGY RE-RADIATED (WITHDRAWN)	DIFFERENCE	SURFACE TEMPERATURE (BALANCE)
NOV	130	140	-10	40
DEC	120	135	-15	25
JAN	130	132		
FEB	140	135		
MAR	150	140		
APR	160	150		
MAY	170	160		
JUN	180	162		
JUL	170	166		
AUG	160	170		
SEP	150	160		
OCT	140	150		
NOV	130	140		

Earth's Heat Balance (One Year)



TIME	
KEY	
	ABSORBED
	RE-RADIATED
	TEMPERATURE

QUESTIONS:

- The duration of insolation is the longest during the month of _____, and the maximum temperatures occur during the month of _____. Do the longest duration and maximum temperature occur in the same month? _____
- The duration of insolation is the shortest during the month of _____, and the minimum temperatures occur during the month of _____. Do the shortest duration and minimum temperature occur in the same month? _____
- According to your report sheet, list the months which show an overall energy surplus:

- According to your report sheet, list the months which show an overall energy deficit:

- When there's an energy surplus, the temperature goes _____. When there's an energy deficit, the temperature goes _____.
- During the warmest or coldest time of year, the energy absorbed (> < =) the energy re-radiated. At these two points during the year the Earth is in _____.

CONCLUSION: Why don't the dates of maximum and minimum insolation coincide with the dates of the maximum and minimum temperatures?