

Name _____

Earth Science

Lab 20: Earth's Heat Budget

Date _____

Introduction: The number of daylight hours undergoes a cyclic change during the year at most places on Earth's surface. This change in duration of daylight has an effect on the Earth's surface temperatures. In this lab, you are to imagine an analogy in which the incoming solar energy is money you receive and put into a bank account. The energy given off (emitted) by the Earth is money you must withdraw from your account in order to meet expenses. The balance is the remaining energy after deposits and withdrawals. The values given are arbitrary and so do not include units.

Objective: You will be able to compare the seasonal changes in the energy absorbed by the Earth with the energy re-radiated and describe the effect this has upon surface temperature.

Vocabulary:

Analogy

Arbitrary

Deficit

Surplus

Radiative balance

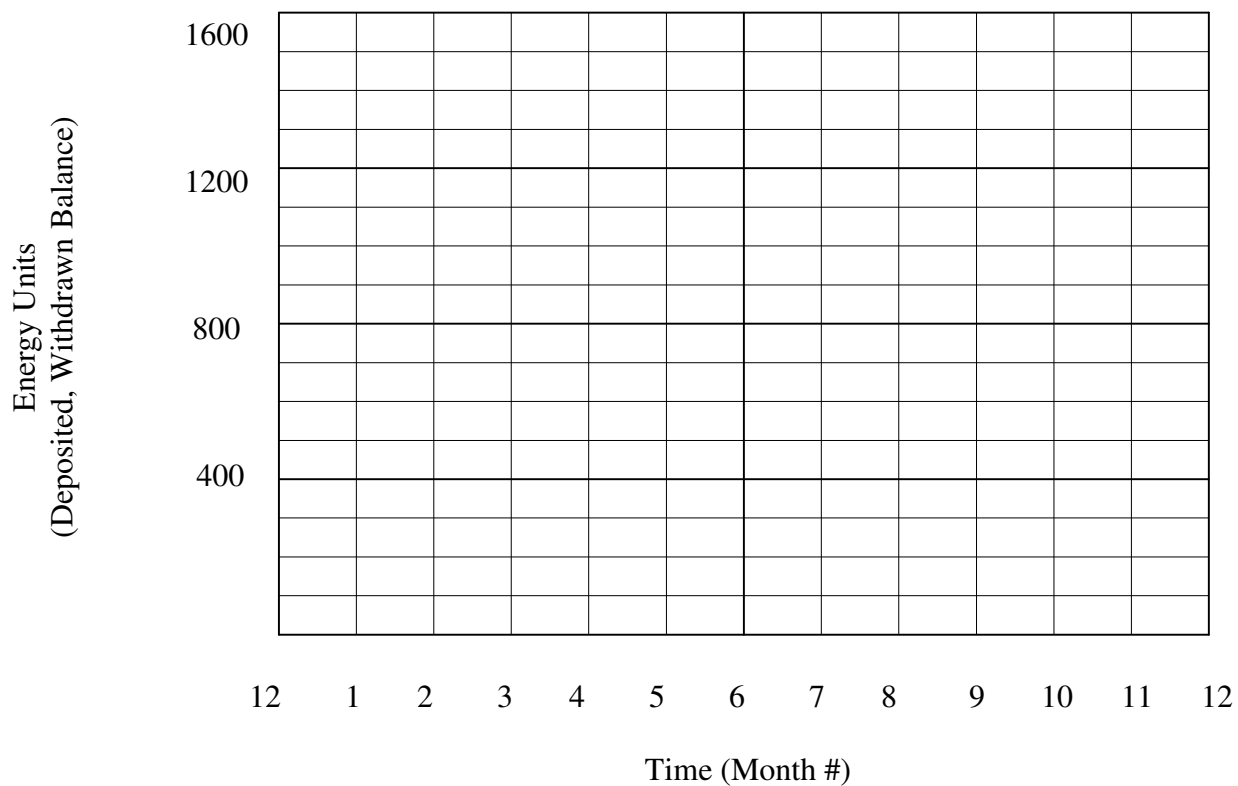
Procedure:

1. On the Report Sheet you will find a statement of your deposits and withdrawals for one year. Assume you had a previous balance of 1300 units. In December, month 12, you deposited 100 units of energy and 400 units of energy were re-radiated to space. This leaves you with a balance of 1000 units for that month.
2. Now calculate the difference between your deposit and withdrawal for January. Record the difference in the appropriate column in the report sheet.
3. Determine the new balance for Earth's energy after the change for that month.
4. Continue in this manner for each month of the year, recording the difference between incoming and outgoing radiation and the balance on a monthly basis.
5. The monthly balances are not *cumulative*.
6. Construct a graph from your data plotting the following 3 quantities on one set of axes. Use a different color for each line and provide a key.
 - a. Amount deposited
 - b. Amount withdrawn
 - c. Balance
7. Locate areas where the "withdrawn" line is above the "deposited" line and shade that area blue. Label it as "deficit".
8. Locate areas where the "deposited" line is above the "withdrawn" line and shade that area red. Label it as "surplus".

Report Sheet

Month	Energy Absorbed (Deposited)	Energy Re-radiated (Withdrawn)	Difference in Deposit and Withdrawal	Balance \approx Temperature
12	100	400	-300	1000
1	200	400		
2	300	400		
3	400	400		
4	500	400		
5	600	400		
6	700	400		
7	600	400		
8	500	400		
9	400	400		
10	300	400		
11	200	400		
12	100	400		

Analogy Graph



Discussion Questions

1. In which month is the duration of insolation the longest?
2. Which month has the maximum temperature?
3. Do the longest duration of insolation and the maximum temperature occur in the same month?
4. In which month is the duration of insolation the shortest?
5. Which month has the minimum temperature?
6. Do the shortest duration of insolation and the minimum temperature occur in the same month?
7. By looking at the lines for deposit and withdrawal on your graph, list the months in which the radiation absorbed by Earth was greater than the energy re-radiated by Earth.
8. What change in surface temperature occurs when there is a surplus of energy?
9. By looking at the lines for deposit and withdrawal on your graph, list the months in which radiation absorbed by Earth was less than the energy emitted by Earth.
10. What change in surface temperature occurs when there is a deficit of energy?
11. Why don't the dates of maximum and minimum temperatures coincide with the dates of maximum and minimum insolation?