Interpreting and Making Pie Graphs

In this activity you will interpret and make a series of pie graphs to represent the radioactive decay of two isotopes.

These isotopes are identified by the name of the element followed by the mass number of the isotope. For example, $^{14}_{6}C$ is written carbon–14. Similarly, $^{40}_{19}K$ is potassium–40; $^{14}_{7}N$ is nitrogen–14; and $^{40}_{18}Ar$ is argon–40.

PART A

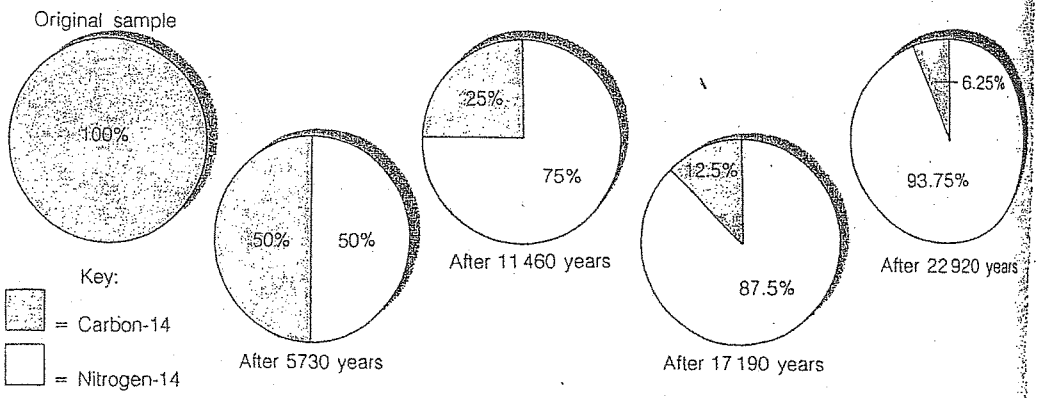
The series of pie graphs below represent the radioactive decay of carbon-14. Nitrogen–14 results when carbon–14 decays. Look at the pie graphs and answer the questions.

1. What percentage of carbon–14 atoms are found in the first sample?
2. In how many years is the percentage of carbon–14 reduced by half?
3. According to the pie graph, what percentage of carbon–14 remains after 11 460 years?
4. Use the pie graphs to determine the half-life of carbon–14.
5. What percentage of carbon–14 would you expect to find in a piece of wood that is 28 650 years old?

PART B

Potassium–40 has a half-life of 1.3 billion years. Argon–40 is produced when potassium–40 decays. Follow the steps below to make a series of pie graphs for the radioactive decay of potassium–40.

1. On a separate piece of paper, trace the five circles shown in Part A.
2. Choose two colors. One color represents potassium–40, the other argon–40.
3. The first circle represents the sample of potassium–40. Fill in the circle with the potassium–40 color. Label your graph.
4. To show one half-life of potassium–40, shade half the second circle with the color for potassium–40 and the other half with the color for argon–40. Indicate the number of years the pie graph represents and label the parts of the graph.
5. Fill in the next three pie graphs, showing the percentages of potassium–40 and argon–40 for the next three half-lives. Use a protractor to mark the sections, if necessary. Label each graph and indicate the number of years represented.



Graphing and Interpreting Data

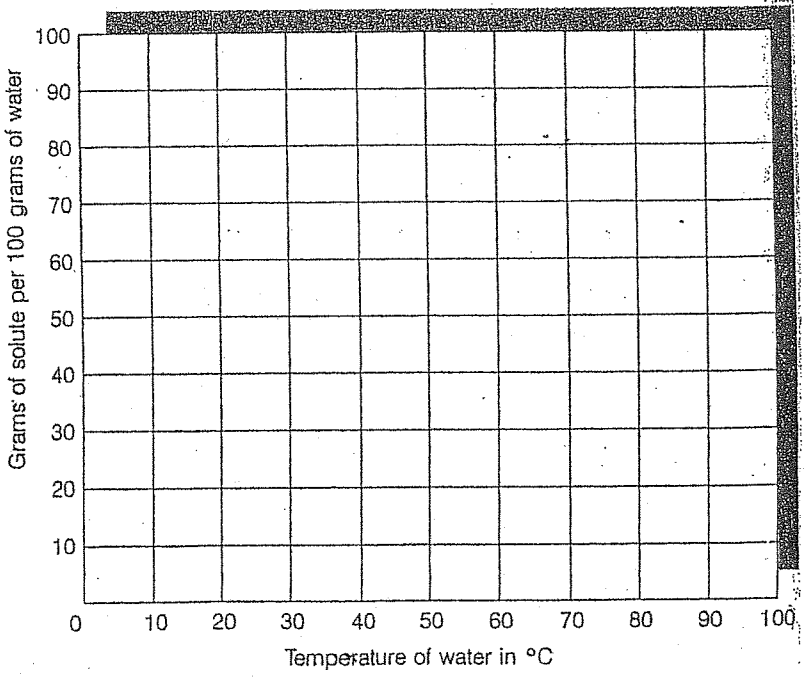
You have learned that line graphs show relationships between two quantities or factors. For example, a line graph can show how the solubility of a substance changes as the temperature changes. In this activity you will graph the solubility of two different salts, table salt (NaCl) and potassium chloride (KCl). Then, use your graph to answer the questions.

Copy the grid shown below. Note the range of data in the table and determine appropriate scales for both the horizontal and vertical axes. Plot the data for KCl and connect the points with a line. Using a different color, plot the data for NaCl and connect the points with a line. Title your graph.

Next, study the graph and answer the following questions.

1. What quantity is plotted on the vertical axis of the graph?
2. What quantity is plotted on the horizontal axis of the graph?
3. What temperature is required to dissolve 36 grams of sodium chloride in 100 grams of water?
4. How many grams of potassium chloride dissolve in 100 grams of water at 60°C?
5. How many grams of potassium chloride dissolve in 100 grams of water at 90°C?
6. At what temperature could you dissolve equal amounts of both compounds?
7. What does the graph tell you about the relationship of solubility to temperature for these two substances?

Temp. in °C	NaCl in grams	KCl in grams
0	34	29
20	35	34
40	36	39
60	37	44
80	38	49
100	39	54



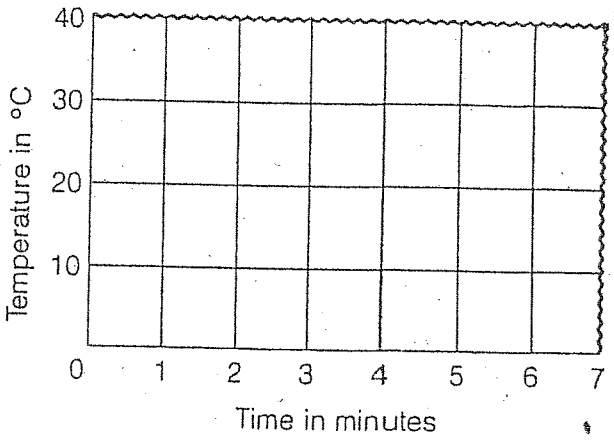
Interpreting a Graph that Shows Temperature-Time Relationships

Interpreting time-temperature changes can help you understand how heat energy affects different substances. In this activity, you will use a graph to show how the temperature of each of two liquids changes over time when the liquids are heated.

In a certain experiment, two beakers, one half full of water and one half full of wood alcohol, were placed in a large container of hot oil. After one minute, an experimenter began to collect the data given in the table. Use this data to draw a graph line for each liquid. Use the grid below the table as a model for your graph. Answer the questions below, referring to your completed graph.

1. Which liquid, according to your graphs, shows a greater rate of increase in temperature during any interval of time between 0 and 6 minutes?
2. What are the temperatures of the water and alcohol after 3 minutes?
3. At what specific time is the temperature of the water the same as the temperature of the alcohol?
4. Describe what happens to the water between 20° C and 100° C.
5. Describe what happens to the alcohol between 20° C and 65° C.
6. Describe what is happening to the water in the time interval during which its temperature is 100° C.
7. Describe what is happening to the alcohol in the time interval during which its temperature is 65° C.
8. Explain how the graph illustrates latent heat.

Time in minutes	Temperature °C Water	Wood Alcohol
0	20	20
1	25	27
2	30	34
3	35	41
4	40	48
5	45	55
6	50	62
7	55	65
8	60	65
9	65	65
10	70	65
11	75	65
12	80	
13	85	
14	90	
15	95	
16	100	
17	100	
18	100	
19	100	
20	100	



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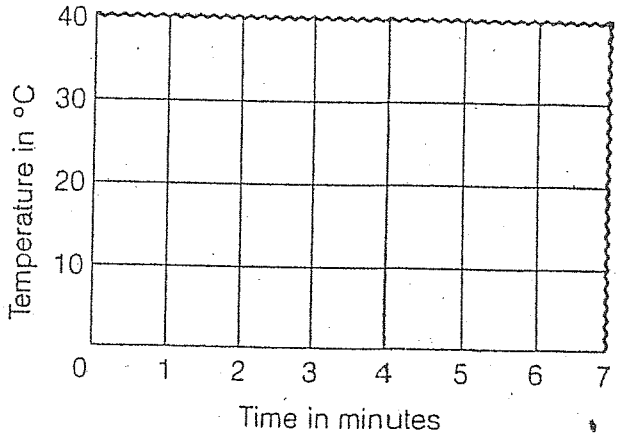
8	60	65
9	65	65
10	70	65
11	75	65
12	80	
13	85	
14	90	
15	95	
16	100	
17	100	
18	100	
19	100	
20	100	



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INTERPRETATION OF DATA

Use the data below to answer the following questions:

TIME	NUMBER OF ANTS LEAVING COLONY IN 5 MINUTES		
	DAY 1	DAY 2	DAY 3
5 am	3	4	3
8 am	28	30	7
11am	105	100	20
12 noon	110	115	25
1 pm	98	95	30
3 pm	115	110	27
5 pm	95	80	15
7 pm	5	8	4

1. Which interpretation do the data best support?
   a) Ants are more active in the morning than in the afternoon.
   b) Ant activity is greatest during the hours of 11am to 3 pm.
   c) The bright sunlight stimulates ant activity.
   d) Ants are inactive prior to 10 am.

2. The data support the inference that
   a) cool weather produces greatest activity.
   b) ant activity is not affected by sunlight.
   c) midday conditions favor ant activity.
   d) the hotter the day, the greater the ant activity.

3. Which additional observation would most likely produce data helpful in determining what specific environmental conditions affect ant activity?
   a) To observe the colony over a longer period of time.
   b) To record the temperature each hour.
   c) To count the numbers of ants leaving the nest every 30 minutes.
   d) To artificially light the colony between 11am and 3 pm.

A second study was made of the same colony.

TIME	NUMBER OF ANTS LEAVING COLONY IN 5 MINUTES			TEMPERATURE (°C)		
	DAY 1	DAY 2	DAY 3	DAY 1	DAY 2	DAY 3
5 am	3	4	3	13	14	7
8 am	28	30	7	16	16	8
11am	105	100	20	21	21	13
12 noon	110	115	25	28	28	15
1 pm	98	95	30	33	33	16
3 pm	115	110	27	29	29	16
5 pm	95	80	15	22	22	13
7 pm	5	8	4	16	15	8

4. The hypothesis best supported by the data from the second study is
   a) unknown forces control ant behavior.
   b) ant activity is greater at morning temperature of 21°C than at an afternoon temperature of 21°C.
   c) ant activity is the same at any given temperature.
   d) ant activity seems to be related to temperature.

5. The data from the second study indicates that
   a) ant activity is greatest at temperatures higher than 32°C.
   b) maximum activity occurs at temperature between 27°C and 31°C.
   c) ants are more active in the morning than afternoon.
   d) ant activity is related to light intensity.

6. A logical interpretation of the data from these two investigations is that
   a) the first investigation does not support the second.
   b) all ants respond the same to a given stimulus.
   c) ant activity is proportional to temperature increase.
   d) the general pattern of ant activity is the same in each investigation.

HOMEWORK: *Experiencing Minor Difficulties*

A scientist could waste time, money, and specimens if he conducted an experiment that did not test his hypothesis. Read the following three experiments and *ON YOUR OWN PAPER*:

1) state the problem;
2) the hypothesis;
3) the data;
4) the interpretation;
5) any error in the experimental design (think variables and controlled experiment).

Experiment #1: Diaz was studying the effect of a new hybrid corn on his cattle. Over a two year period, Diaz fed half his cattle the hybrid corn and fed the other half the standard corn diet. After two years, he found that the cows fed the hybrid corn were heavier, produced better steaks, and yielded better supplies of milk than the standard fed cows. He reported that hybrid corn is better food for his cattle.

Experiment #2: Miller was testing the abilities of a new type of plant. He placed all 12 of the plants in exactly the same dirt and placed all of them in the same room at the same temperature. He then watered them all with salt water for a week. He observed and reported that they all died.

Experiment #3: Bettison is trying to determine the effect of light on the growth of chickens. He placed six newly born chicks in a very brightly lit room and carefully recorded their growth for a week. He controlled the temperature and humidity in the room and recorded these readings every two hours. The chicks had all the food and water they wanted. He reported the conditions and that the average weight gained by the chicks at the end of the week was 12.1 ounces.