

Activity - Graphing Atmospheric Data

Purpose: To determine the changes in temperature and pressure throughout the atmosphere.

Procedure: The table below summarizes atmospheric data gathered at various altitudes. Use this information to create the graphs and answer the questions.

1) Without looking at the data, predict the shape of the graph line for a plot of

- temperature versus altitude
- pressure versus altitude

Altitude (km)	Temperature (°C)	Pressure (mmHg)	Mass (g) of 1 L Sample	Total Molecules in 1 L Sample
0	20	760	1.20	250×10^{20}
5	-12	407	0.73	150×10^{20}
10	-45	218	0.41	90×10^{20}
12	-60	170	0.37	77×10^{20}
20	-53	62	0.13	27×10^{20}
30	-38	18	0.035	7×10^{20}
40	-18	5.1	0.009	2×10^{20}
50	2	1.5	0.003	0.5×10^{20}
60	-26	0.42	0.0007	0.2×10^{20}
80	-87	0.031	0.00007	0.02×10^{20}
100	-60	0.0075	0.000009	0.004×10^{20}
120	60	0.00043	0.0000002	0.0008×10^{20}

2) Prepare graphs according to the instructions below:

a) For the first graph, plot a line graph of temperature (y-axis) versus altitude (x-axis) data. Insert the graph in your lab book.

b) For the second graph, plot pressure versus altitude data. Insert the graph in your lab book.

c) Does the shape of either graph differ from what you predicted in Question 1? If so, how?

3) Compare the ways in which air temperature and air pressure change with increasing altitude.

a) Which follows a more regular pattern?

b) Try to explain this behavior.

4) Based on the graphed data, would you expect air pressure to rise or fall if you traveled from sea level (0 km) to

a) Pike's Peak (4301 m above sea level)?

b) Death Valley (86 m below sea level)?

5a) Suppose you took one-liter samples of air at several different altitudes. How would the following change?

i) mass of the air sample

ii) number of molecules in the air sample

b) If you were to plot those two values (mass versus number of molecules) on a new graph, what would the plotted line look like?

c) Why?

6) Scientists often characterize the atmosphere as having four layers: troposphere (nearest Earth), stratosphere, mesosphere and thermosphere (outermost layer). Make predictions telling the range of altitude for all four layers.

7) Temperature is the only property from above that doesn't seem to be affected by the height above the Earth's surface. What other factors would you hypothesize to have some effect on the temperature at altitude?

Conclusion:

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