Carbon Dioxide and Temperature – Teachers Notes



In classic scientific experiments we follow the rules that we:

Change one thing (independent variable), measure one thing (dependent variable) and everything else stays the same".

We call this type of experiment "**closed**" because only one variable is permitted to effect a change. For example, scientists tested to see the effect of increasing carbon dioxide levels on the internal temperature of a closed container in a controlled temperature area of the laboratory. The experiment produced the following result.

CO ₂ in container (%)	Temperature (°C)	
0.02%	20°C	
0.03%	22°C	
0.04%	24°C	
0.05%	26°C	
0.06%	28°C	

(fabricated results for purposes of exercise)



Graph these results below.

Which measurements should be placed on the vertical (y) axis? Temperature in °C or more generally the dependent variable.

Which measurements should be placed along the horizontal (x) axis? Days or more generally the independent variable

Which type of graph would you chose and why? A line graph would be best because the graph will display the change of one thing (temperature) against one other (time).



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1 mark 2 marks

2 marks

Title

Axes labelled

Graphing points accurately positioned and graph drawn by pencil

In Science we try to collect data that is both *precise and accurate*.

How could we make this data more accurate? Take more readings.

How could we make this data more precise? Use a thermometer, thermo-probe or other piece of heat measuring equipment that will read temperature in smaller (more precise) units. We usually try to be accurate to two decimals places. E.g. 25.23°C

Run a quick five-minute survey of twelve of your classmates to find out the answer to a simple question such as "Girls make better scientists than boys". Your teacher may suggest another survey question for you to use.



Enter your data in the table provided below

Student	Yes	No	Student	Yes	No
#			#		
1			7		
2			8		
3			9		
4			10		
5			11		
6			12		

If we only used data from the first two students, what percentage of students said yes? Total number of yes replies divided by 2 and multiplied by 100.

If we only used data from the first 5 students, what percentage of students said yes? Total number of yes replies divided by 5 and multiplied by 100.

If we used data from all twelve students, what percentage of students said yes? Total number of yes replies divided by 12 and multiplied by 100.

The larger the group surveyed, the more accurate the response will be.

In this example, does the level of carbon dioxide affect the temperature inside the container? YES

How would you describe the relationship between carbon dioxide levels and temperature? Direct or linear relationship.





From these results, can we now directly relate world rises in average temperature to increased levels of carbon dioxide? Explain your answer. No we cannot as these results are from a single small controlled experiment over a narrow range of increased carbon dioxide levels and only performed once. In nature, many variables combine to affect changes in temperature.

If we repeated the experiment using only water vapour and found the same results, could we then say that a mix of carbon dioxide and water vapour will produce the same degree of heating as either gas? No because we do not know if their joint effect would multiply the increase or keep it the same. Usually the increase is a multiple of both factors.

Which other atmospheric gasses would we have to consider if we wanted to explain recent atmospheric warming? Other greenhouse gases such as methane, CFCs, and nitrous oxide.

What did Milankovic suggest also affected the average temperature at Earth's surface over time? Earth's position and orientation in space (eccentricity, axial tilt and precession)

Is it possible to have a single controlled experiment that could include all these variables? No. We would be unable to discriminate which variable created which change.

Climate scientists work to produce models of change over time, taking into account many factors and their possible interactions.



Model of predicted increase in average surface temperatures over time

How will we know if we are using a good model? Our predictions will be correct (within tolerance values)

Where in Australia can we find good scientific data and predictions on climate change? CSIRO and Bureau of Meteorology websites.

Why do scientific models and predictions change over time? As new information or better recording technology becomes available the predictions may change