

# Graphing the Relationship between Atomic Mass and Atomic Number

## PROBLEM

How did Mendeleev discover periodicity even though he arranged the elements by mass?

## INTRODUCTION

Mendeleev believed that periodicity was related to mass. When elements such as tellurium and iodine were arranged in mass order, however, they ended up in the wrong families. Moseley showed that periodicity was related to atomic number rather than to atomic mass. This being the case, how did Mendeleev succeed in observing periodicity at all?

## MATERIALS (per group)

Graph paper; *Periodic Table of the Elements*

## PROCEDURE

- On a separate sheet of graph paper, prepare a graph with the atomic number of elements 1-103 on the X-axis and the atomic masses on the Y-axis. Label and select appropriate intervals for each axis.
- Obtain the data for each of the elements from the *Periodic Table*. Round off the atomic masses to the nearest integer. Plot the points and draw the best straight line or curve lightly. Make sure the points are still showing.
- Circle each pair of points that are not in mass order. Note which elements they are. Tellurium and iodine, as shown to the right, are examples. These are the ones that gave Mendeleev trouble. There are others, however.

		Group					
		13	14	15	16	17	18
10.81	14.0067	14.003094	15.9994	18.998403	20.179		
5 B	6 C	7 N	8 O	9 F	10 Ne		
26.98154	28.0855	28.0855	32.06	35.453	39.948		
13 Al	14 Si	15 P	16 S	17 Cl	18 Ar		
63.546	65.39	68.72	72.59	78.972	83.80		
29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	36 Kr	
107.868	112.41	114.82	118.71	127.60	126.90		
47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	
196.967	200.59	204.383	207.2	238.02891			
79 Au	80 Hg	81 Tl	82 Pb	83 Bi			
(112)	(112)		(209)				
* Uuu 111	Uub 112		Uuq 114				

## OBSERVATIONS

Attach graphs to laboratory report.

- Which pairs of elements are not arranged in mass order? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## CONCLUSIONS

1. Based on your graph, is there a relationship between atomic mass and atomic number? If so, is the relationship linear or curved, and direct or indirect? \_\_\_\_\_  
\_\_\_\_\_
2. Explain why Mendeleev was able to observe periodicity even though the basis for the order in which he arranged the elements was incorrect? \_\_\_\_\_  
\_\_\_\_\_
3. Why does it make more sense for chemical properties to be related to atomic number than to atomic mass? \_\_\_\_\_  
\_\_\_\_\_
4. Which subatomic particle is related to atomic mass but not to chemical properties? \_\_\_\_\_  
\_\_\_\_\_
5. Why does tellurium have a larger atomic mass than iodine even though it has a smaller atomic number? \_\_\_\_\_  
\_\_\_\_\_
6. Is there a relationship between the number of neutrons and protons in the atom? If so, what type? \_\_\_\_\_  
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