

**The Predictive Power of the Periodic Table***Use with textbook pages 104-105.**Use the following diagram representing Mendeleev's periodic table to answer questions 1 to 9.*

|              |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |             |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
|--------------|--|--|--|--------------|--|--|--|--------------|--|--|--|--------------|--|--|--|--------------|--|--|--|--------------|--|--|--|-------------|--|--|--|--------------|--|--|--|--------------|--|--|--|--------------|--|--|--|--|--|--|--|--|--|--|--|
| I            |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |             |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
| H<br>1.01    |  |  |  | II           |  |  |  | III          |  |  |  | IV           |  |  |  | V            |  |  |  | VI           |  |  |  | VII         |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
| Li<br>6.94   |  |  |  | Be<br>9.01   |  |  |  | B<br>10.81   |  |  |  | C<br>12.01   |  |  |  | N<br>14.01   |  |  |  | O<br>16.00   |  |  |  | F<br>19.00  |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
| Na<br>22.99  |  |  |  | Mg<br>24.31  |  |  |  | Al<br>26.98  |  |  |  | Si<br>28.09  |  |  |  | P<br>30.97   |  |  |  | S<br>32.07   |  |  |  | Cl<br>35.45 |  |  |  | VIII         |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
| K<br>39.10   |  |  |  | Ca<br>40.08  |  |  |  |              |  |  |  | Ti<br>47.87  |  |  |  | V<br>50.94   |  |  |  | Cr<br>52.00  |  |  |  | Mn<br>54.94 |  |  |  | Fe<br>55.85  |  |  |  | Co<br>58.93  |  |  |  | Ni<br>58.69  |  |  |  |  |  |  |  |  |  |  |  |
| Cu<br>63.55  |  |  |  | Zn<br>65.41  |  |  |  |              |  |  |  |              |  |  |  | As<br>74.92  |  |  |  | Se<br>78.96  |  |  |  | Br<br>79.90 |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
| Rb<br>86.47  |  |  |  | Sr<br>87.62  |  |  |  | Y<br>88.91   |  |  |  | Zr<br>91.22  |  |  |  | Nb<br>92.91  |  |  |  | Mo<br>95.94  |  |  |  |             |  |  |  | Ru<br>101.07 |  |  |  | Rh<br>102.91 |  |  |  | Pd<br>106.42 |  |  |  |  |  |  |  |  |  |  |  |
| Ag<br>107.87 |  |  |  | Cd<br>112.41 |  |  |  | In<br>114.32 |  |  |  | Sn<br>118.71 |  |  |  | Sb<br>121.76 |  |  |  | Te<br>127.60 |  |  |  | I<br>126.90 |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
| Ce<br>140.12 |  |  |  | Ba<br>137.33 |  |  |  | La<br>138.91 |  |  |  |              |  |  |  | Ta<br>180.95 |  |  |  | W<br>183.84  |  |  |  |             |  |  |  | Os<br>190.23 |  |  |  | Ir<br>192.22 |  |  |  | Pt<br>195.08 |  |  |  |  |  |  |  |  |  |  |  |
| Au<br>196.97 |  |  |  | Hg<br>200.59 |  |  |  | Tl<br>204.38 |  |  |  | Pb<br>207.2  |  |  |  | Bi<br>208.98 |  |  |  |              |  |  |  |             |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |
|              |  |  |  |              |  |  |  |              |  |  |  | Th<br>232.04 |  |  |  |              |  |  |  | U<br>238.03  |  |  |  |             |  |  |  |              |  |  |  |              |  |  |  |              |  |  |  |  |  |  |  |  |  |  |  |

1. Why do think it is fitting for this tabular arrangement to be called a “periodic” table?  
\_\_\_\_\_
2. Mendeleev noticed trends and used columns and rows to organize the known elements. From the table above, what can you infer about how Mendeleev arranged the elements?  
\_\_\_\_\_
3. What do you think the white gaps in Mendeleev’s periodic table represent?  
\_\_\_\_\_
4. Mendeleev’s decision to leave these gaps made his periodic table successful. What made Mendeleev certain that he should leave gaps in his table?  
\_\_\_\_\_
5. Analyze Mendeleev’s periodic table. Describe the predictive power of his tabular arrangement.  
\_\_\_\_\_

6. Can you predict the atomic mass of the unknown element that is located between Mo and Ru? Explain your answer.
- \_\_\_\_\_
7. Would you expect to see the unknown element that is between La and Ta to have the same properties as Ti and Zr? Explain.
- \_\_\_\_\_
8. Mendeleev placed “I” and “Te” out of order, even though “I” had a lower relative atomic mass than “Te.” Explain why you think he switched these adjacent elements.
- \_\_\_\_\_
9. Mendeleev accurately predicted the existence of unknown elements that have the same properties as the other elements in the same column. He was able to figure out their atomic mass and predict their properties using his periodic table. The diagram below shows Mendeleev’s prediction of an element which he called eka-boron.

| Property of eka-boron        |                        |                   |
|------------------------------|------------------------|-------------------|
| Property                     | Mendeleev’s Prediction | Actual Data       |
| Atomic mass                  | 44                     | 43.79             |
| Density (g/cm <sup>3</sup> ) | 3.5                    | 3.86              |
| Solubility of oxide          | dissolves in acid      | dissolves in acid |

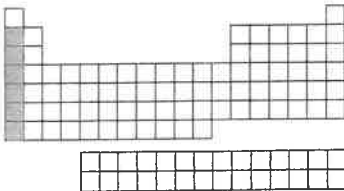
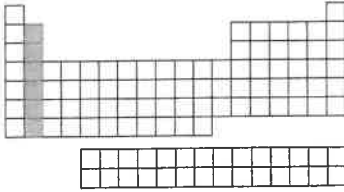
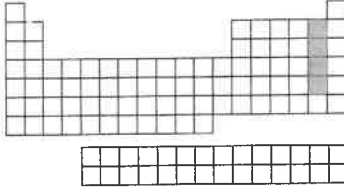
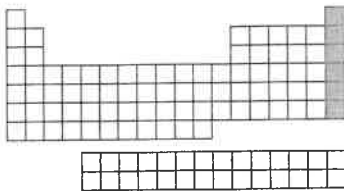
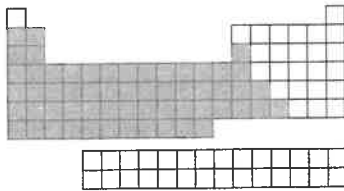
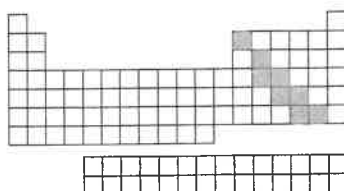
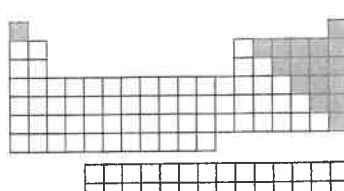
Mendeleev’s Table

|   |   |
|---|---|
| B |   |
| ? | ? |
| Y |   |

- a) Based on Mendeleev’s periodic table, eka-boron is located between which two elements?
- \_\_\_\_\_
- b) How was Mendeleev able to predict that eka-boron has a density of 3.5 g/cm<sup>3</sup> and that it dissolves in acid?
- \_\_\_\_\_
- c) Which elements would you expect eka-boron to have the same properties as?
- \_\_\_\_\_
- d) What is the current accepted element name for eka-boron?
- \_\_\_\_\_

**2.2 Assessment**

Match each term on the left with the best diagram of the periodic table on the right. Each section of the periodic table may be used only once.

| Term                          | Diagram of the Periodic Table                                                           |
|-------------------------------|-----------------------------------------------------------------------------------------|
| 1. ____ metals                | A.    |
| 2. ____ halogens              | B.    |
| 3. ____ non-metals            | C.   |
| 4. ____ semi-metals           | D.  |
| 5. ____ alkali metals         | E.  |
| 6. ____ noble gases           | F.  |
| 7. ____ alkaline-earth metals | G.  |