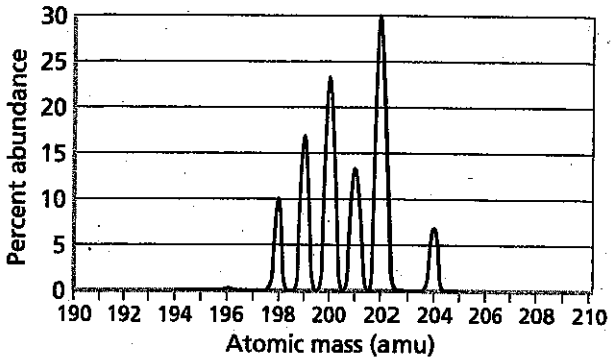
Name _____ Date _____ Class _____

CHAPTER 4 CHALLENGE PROBLEMS

Isotopes of an Element

Use with Chapter 4, Section 4.3

A mass spectrometer is a device for separating atoms and molecules according to their mass. A substance is first heated in a vacuum and then ionized. The ions produced are accelerated through a magnetic field that separates ions of different masses. The graph below was produced when a certain element (element X) was analyzed in a mass spectrometer. Use the graph to answer the questions below.



1. How many isotopes of element X exist? _____

2. What is the mass of the most abundant isotope? _____

3. What is the mass of the least abundant isotope? _____

4. What is the mass of the heaviest isotope? _____

5. What is the mass of the lightest isotope? _____

6. Estimate the percent abundance of each isotope shown on the graph.

_____

_____

7. Without performing any calculations, predict the approximate atomic mass for element X. Explain the basis for your prediction.

_____

_____

8. Using the data given by the graph, calculate the weighted average atomic mass of element X. Identify the unknown element.

_____

_____

_____

_____

_____

_____

_____

_____

3. Cloud Cover 3

Composite

DOK: II - Skill / Concept

Cloud cover is the percent of Earth's surface covered by clouds. Cloud cover may increase because of an increase in the *cosmic ray flux* (number of high-energy particles from space reaching Earth per m^2 per hour). Table 1 shows how Earth's cover of *low clouds* (0 km to 3.2 km altitude) varies with the cosmic ray flux. Figures 1–3 show the *relative cosmic ray flux*, RCRF (the percent below the flux measured on October 1, 1965), and the monthly average cover of *high clouds* (6.0 km to 16.0 km altitude), *middle clouds* (3.2 km to 6.0 km altitude), and low clouds, respectively, from January 1980 to January 1995.

Table 1

Cosmic ray flux (particles/m^2/hr)	Cover of low clouds (%)
340,000	27.8
360,000	28.1
380,000	28.4
400,000	28.7
420,000	29.0

Table 1 adapted from E. Palle Bagó and C. J. Butler, "The Influence of Cosmic Rays on Terrestrial Clouds and Global Warming." ©2000 by Institute of Physics Publications, Ltd.

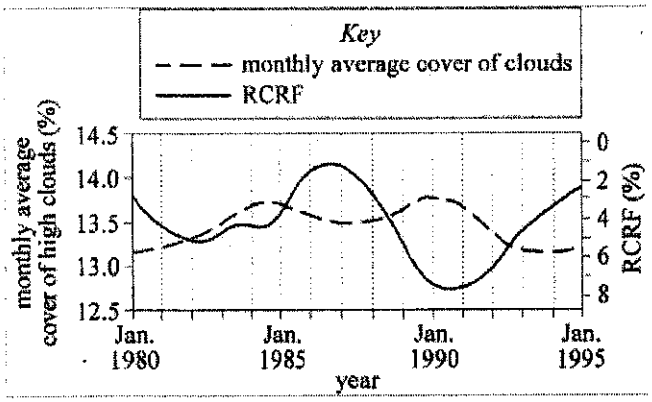


Figure 1

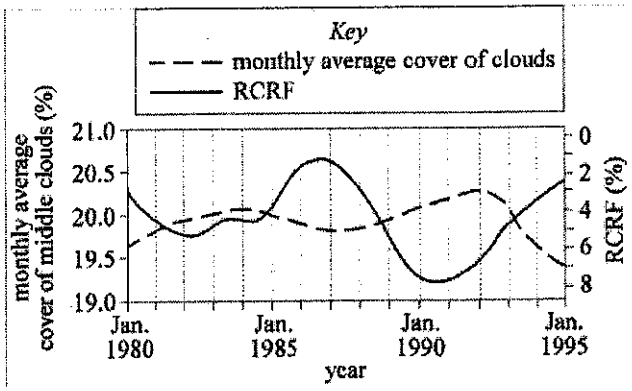


Figure 2

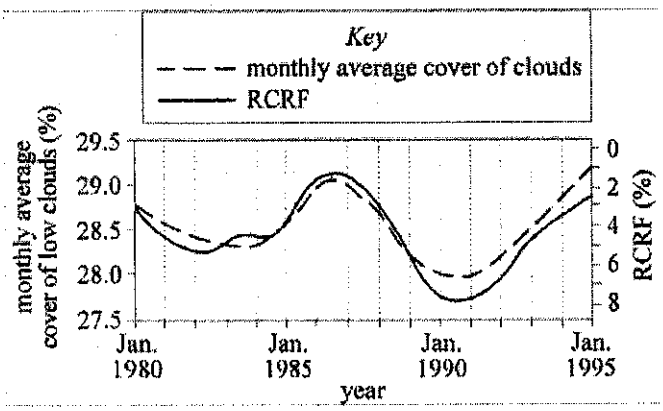


Figure 3

Figures adapted from Nigel Marsh and Henrik Svensmark, "Low Cloud Properties Influenced by Cosmic Rays." ©2000 by The American Physical Society.

Day 2

The percent of Earth's surface covered by high clouds in January 1987 was closest to which of the following?

13%

13.5%

14%

14.5%

Based on Table 1, a cosmic ray flux of 440,000 particles/m2/hr would correspond to a cover of low clouds that is closest to which of the following?

28.7%

29.0%

29.3%

29.6%

Is the statement "The monthly average cover of low clouds is more directly correlated with cosmic ray flux than is the monthly average cover of high clouds" consistent with Figures 1 and 3 ?

Yes, because the plot for the monthly average cover of low clouds more closely parallels the plot for RCRF.

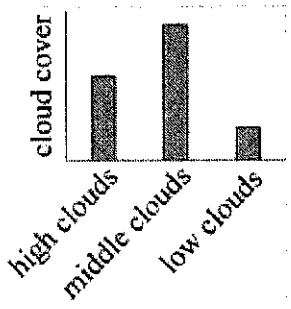
Yes, because the plot for the monthly average cover of high clouds more closely parallels the plot for RCRF.

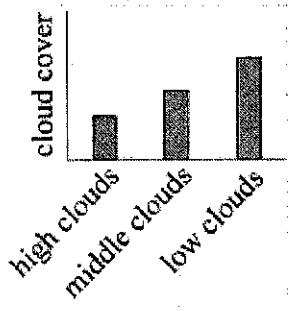
No, because the plot for the monthly average cover of low clouds more closely parallels the plot for RCRF.

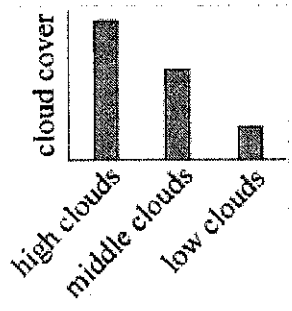
No, because the plot for the monthly average cover of high clouds more closely parallels the plot for RCRF.

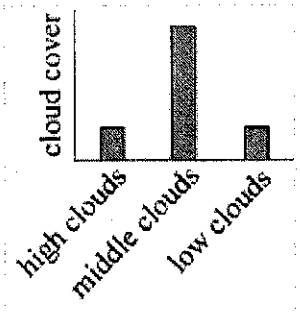
Day 2

Which of the following figures best represents the monthly average cover of high, middle, and low clouds in January 1992 ?









Day 2

High clouds are composed primarily of ice crystals, whereas low clouds are composed primarily of water droplets. This difference is most likely because the average air temperature at altitudes from:

0 km to 3.2 km is at or below 0°C, whereas the average air temperature at altitudes from 3.2 km to 6.0 km is above 0°C.

0 km to 3.2 km is at or below 0°C, whereas the average air temperature at altitudes from 6.0 km to 16.0 km is above 0°C.

0 km to 3.2 km is above 0°C, whereas the average air temperature at altitudes from 3.2 km to 6.0 km is at or below 0°C.

0 km to 3.2 km is above 0°C, whereas the average air temperature at altitudes from 6.0 km to 16.0 km is at or below 0°C.

Day 2

Name _____ Date _____ Class _____

CHAPTER 8 CHALLENGE PROBLEMS

Comparing the Structures of Atoms and Ions

Use with Chapter 8, Section 8.1

The chemical properties of an element depend primarily on its number of valence electrons in its atoms. The noble gas elements, for example, all have similar chemical properties because the outermost energy levels of their atoms are completely filled. The chemical properties of ions also depend on the number of valence electrons. Any ion with a complete outermost energy level will have chemical properties similar to those of the noble gas elements. The fluoride ion (F^-), for example, has a total of ten electrons, eight of which fill its outermost energy level. F^- has chemical properties, therefore, similar to those of the noble gas neon.

Shown below are the Lewis electron dot structures for five elements: sulfur (S), chlorine (Cl), argon (Ar), potassium (K), and calcium (Ca). Answer the questions below about these structures.

1. Write the atomic number for each of the five elements shown above.

_____

2. Write the electron configuration for each of the five elements.

_____

_____

3. Which of the above Lewis electron dot structures is the same as the Lewis electron dot structure for the ion S^{2-}? Explain your answer.

_____

_____

4. Which of the above Lewis electron dot structures is the same as that for the ion Cl^-? Explain your answer.

_____

_____

5. Which of the above Lewis electron dot structures is like that for the ion K^+? Explain your answer.

_____

_____

6. Name an ion of calcium that has chemical properties similar to those of argon. Explain your answer.

_____

Day 3

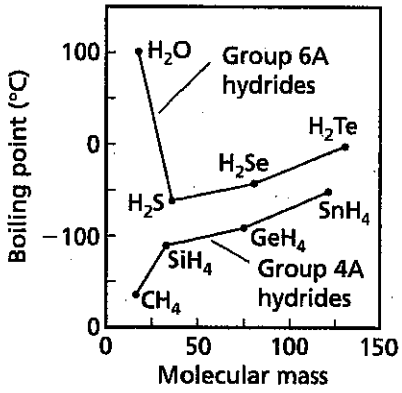
Name _____ Date _____ Class _____

CHAPTER 13 CHALLENGE PROBLEMS

Intermolecular Forces and Boiling Points

Use with Chapter 13, Section 13.3

The boiling points of liquids depend partly on the mass of the particles of which they are made. The greater the mass of the particles, the more energy is needed to convert a liquid to a gas, and, thus, the higher the boiling point of the liquid. This pattern may not hold true, however, when there are significant forces between the particles of a liquid. The graph plots boiling point versus molecular mass for group 4A and group 6A hydrides. A hydride is a binary compound containing hydrogen and one other element. Use the graph to answer the following questions.



1. How do the boiling points of the group 4A hydrides change as the molecular masses of the hydrides change?

2. What are the molecular structure and polarity of the four group 4A hydrides?

3. Predict the strength of the forces between group 4A hydride molecules. Explain how those forces affect the boiling points of group 4A hydrides.

4. How do the boiling points of the group 6A hydrides change as the molecular masses of the hydrides change?

5. What are the molecular structure and polarity of the four group 6A hydrides?

6. Use Table 9-4 in your textbook to determine the difference in electronegativities of the bonds in the four group 6A hydrides.

Day 4

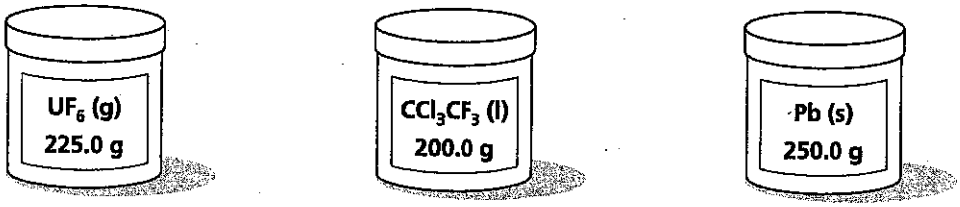
Name _____ Date _____ Class _____

CHAPTER 11 CHALLENGE PROBLEMS

Using Mole-Based Conversions

Use with Chapter 11, Section 11.3

The diagram shows three containers, each of which holds a certain mass of the substance indicated. Complete the table below for each of the three substances.



Substance	Mass (g)	Molar Mass (g/mol)	Number of Moles (mol)	Number of Representative Particles
UF_6(g)				
CCl_3CF_3(l)				
Pb(s)				

1. Compare and contrast the number of representative particles and the mass of UF_6 with the number of representative particles and mass of CCl_3CF_3. Explain any differences you observe.

2. UF_6 is a gas used in the production of fuel for nuclear power plants. How many moles of the gas are in 100.0 g of UF_6?

3. CCl_3CF_3 is a chlorofluorocarbon responsible for the destruction of the ozone layer in Earth's atmosphere. How many molecules of the liquid are in 1.0 g of CCl_3CF_3?

4. Lead (Pb) is used to make a number of different alloys. What is the mass of lead present in an alloy containing 0.15 mol of lead?

Day 5