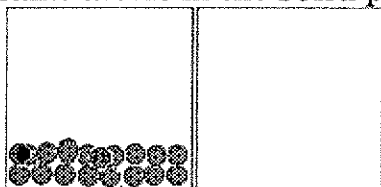


UNIT 1 MATTER

1. What is the difference between **mass** of an object and its **volume**? Draw a picture that shows this.

2. If the box at left contains atoms of aluminum in the **liquid** phase, represent the same atoms in the **solid** phase in the box at right.



3. How would you represent the atoms of aluminum in the gaseous phase? Draw another box with the particles showing this.

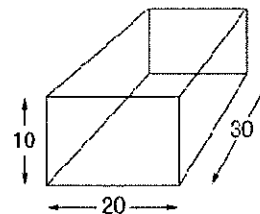
**Density Problems  $d=m/v$**

4. Mercury has a density of 13.6 g/mL. What is the volume occupied by 112.0 grams of mercury?

5. A cube of gold-colored metal with a volume of  $54 \text{ cm}^3$  has a mass of 980 g. The density of gold is  $19.3 \text{ g/cm}^3$ . Is this sample of metal pure gold? Why or why not?

6. If the metal from the previous problem was cut in half, would one of the pieces have the same density? Why or why not?

The box at the right has been measured in centimeters. What would the volume be in centimeters cubed? \_\_\_\_\_



7. What would this volume be in milliliters? \_\_\_\_\_ In cc's? \_\_\_\_\_

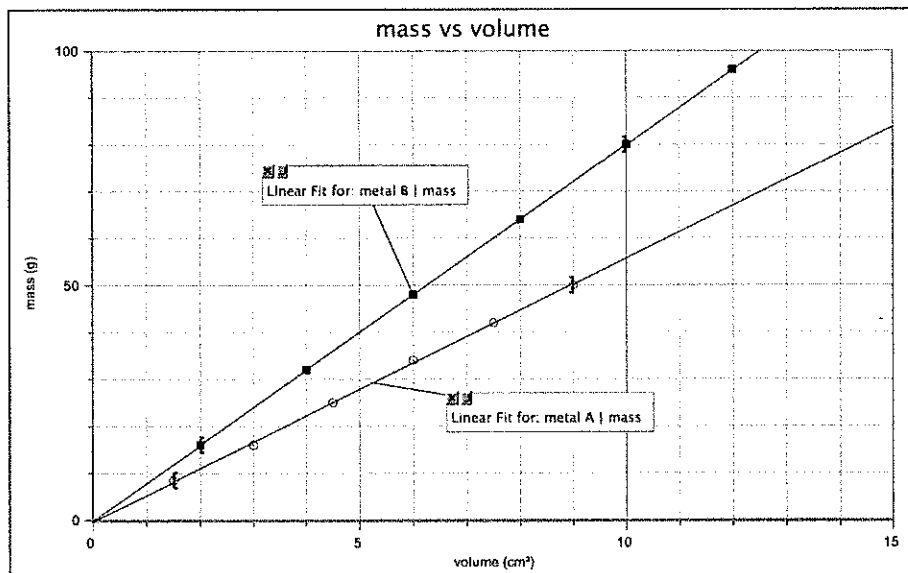
8. Describe the relationship between milliliters and centimeters.

9. Solid, liquids, and gases \_\_\_\_\_ when they are heated. This is why a liquid thermometer works to measure temperature. When this happens, the (volume or mass?) increases but the (volume or mass?) does not change.

10. State the Law of Conservation of Mass in your own words.

11. You dissolve 40 grams of sugar in 200 grams of water. What's the mass of the solution you made.

12. A student graphed the following data:



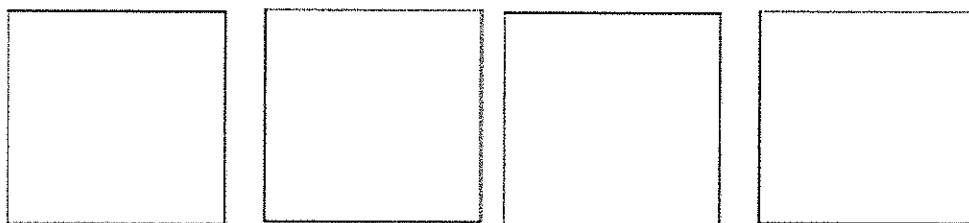
a) Find the slope of each line.

b) What does the slope tell you about each metal?

**UNIT 2 Energy – Particles in Motion**

13. Show with a particle drawing what would happen if a certain smelly gas like perfume or popcorn smell were released in the middle of a room. Assume it stays in the room.

- A. After 10 seconds
- B. After 1 minute
- C. After 10 minutes
- D. After 2 hours



A

B

C

D

14. What is the name for this process? \_\_\_\_\_

15. What causes it (at the particle level)?

16. How would this change if the room was A. hotter? B. colder?

17. Explain your answer to the previous question at the particle level.

18. Gases are in constant \_\_\_\_\_ and \_\_\_\_\_ with each other and the walls of their container. The result of this behavior is that gases exert \_\_\_\_\_.

19. Pressure is defined as the \_\_\_\_\_ per unit \_\_\_\_\_.

20. List four different units of pressure

21. An instrument that's used to measure gas pressure is a \_\_\_\_\_.

These are the scientific laws that describe gas behavior

Boyle's Law:  $P_1V_1 = P_2V_2$

Charles' Law:

Gay-Lussac's Law:  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

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22. What happens to gas volume when

- a) Pressure on the gas is increased?
- b) Temperature is increased?

23. How is pressure on a gas, and its volume related?

24. How is temperature on a gas, and its volume related?

25. How is pressure on a gas, and its temperature related?

26. Someone took a bag of Doritos on a hot air balloon ride. They didn't open the bag before they left on the ride, but about halfway through the trip the bag exploded. Why?

27. Why might you have to put more air in your tires as winter approaches and it gets colder?

**IMPORTANT:** whenever you use temperature with gas laws, it must be in Kelvin (K), so remember the equation:  $K = ^\circ C + 273$

28. What makes Kelvin temperatures special? How are they different from Celsius temperature readings?

29. What happens to gases at zero Kelvin?

30. Convert 27 °C to K.

31. Convert 300 K to degrees Celsius.

Boyle's Law:  $P_1V_1 = P_2V_2$

Charles' Law:  $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

Gay-Lussac's Law:  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

32. A gas has an initial volume of 3.0 L at a temperature of 285 K. If the temperature changes to 380 K, what is the new volume of the gas if the pressure is unchanged?

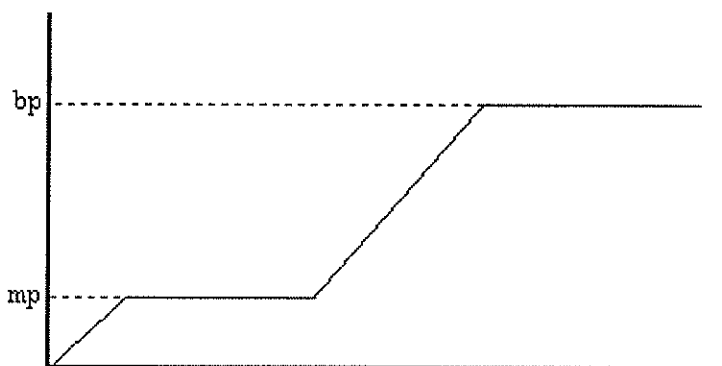
33. The volume of a gas is 2.5 L when the pressure is at standard pressure (101 kPa). What is the volume of the gas if the pressure decreases to 85 kPa and the temperature remains unchanged?
34. The pressure of a sample of gas was 29.9 inHg and the volume of the gas was 3.75 L. If the gas was put in a container with a volume of 8.00 L, what would the pressure in the container be?
35. A sample of argon gas occupies a volume of 950 mL at 25.0°C. What volume will the gas occupy at 50.0°C if the pressure remains constant?
36. A 2 L glass bottle containing only air is sealed at a temperature of 22°C and a pressure of 0.982 atm. The bottle is placed in a freezer and allowed to cool to -3°C. What is the pressure in the bottle?

### UNIT 3 Energy – States of Matter

#### **Kinetic Molecular Theory**

This theory describes all matter as being composed of tiny particles in endless random motion. In a solid, the particles vibrate, but are locked into an orderly array. In a liquid, the particles are still touching but are free to move around past one another. In a gas, the particles are moving very rapidly and are widely separated.

When energy is transferred to a sample of matter, *either* the particles speed up (**thermal energy** and temperature increases) *or* they get pulled apart (**phase energy** cause phase change), but *not* both at the same time. This helps account for the shape of the warming curve you got in the Icy Hot lab.



37. Label the axes of the graph based on the lab where we heated ice to boiling. Temperature on the y and time on the x axis.
38. Label which phases are present in each portion of the graphed line above.

39. Label the sections in which the **thermal energy** ( $E_{th}$ ) of the sample is changing.  
Label the sections where the **phase energy** ( $E_{ph}$ ) is changing.

40. When a sample of liquid is cooled, its thermal energy

- increases
- decreases
- remains the same
- varies depending on the pressure
- varies depending on the volume

41. While a sample of liquid is freezing, its thermal energy

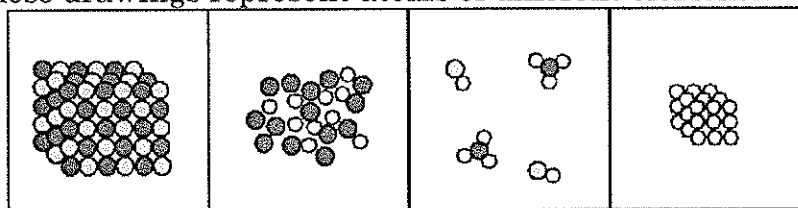
- increases.
- decreases.
- remains the same.
- is transferred into phase energy.

42. Say you were melting a piece of solid metal like iron. Show the shape of the temperature-time graph.

43. Say you heated some ice to melt it and then heat the water to 50 degrees C. Show the shape of the temperature-time graph.

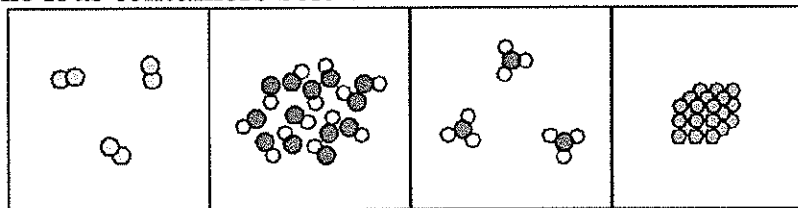
44. Make a sketch of boiling water. Show a bubble in this boiling water and describe what's inside.

The spheres in these drawings represent atoms of different elements:



- Which of these are mixtures? \_\_\_\_\_ pure substances? \_\_\_\_\_
- Which contain only compounds? \_\_\_\_\_ only elements \_\_\_\_\_

45. Consider the four containers below.



- Label these as molecules or elements.
- Which contain only compounds? \_\_\_\_\_ only elements \_\_\_\_\_

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46. Know the number of valence electrons for the elements in the 8 main groups of the periodic table (write this number below the group number below):

1 2 13 14 15 16 17 18

Except helium in group 18, which has \_\_\_\_

47. Which group has full valence shells (number and name of group)?

When you draw a Bohr Diagram, you put \_\_\_\_\_ electrons on the first shell, and \_\_\_\_\_ electrons in the second shell.

48. Draw Bohr diagrams (draw the atom showing the number of protons and neutrons in the nucleus, and the electrons in the main shells or rings) for the following atoms.

a) magnesium-25

49. You should be able to tell how many valence electrons an atom has by which column of the periodic table the element is in. How many valence electrons are in each of the following atoms?

a) bromine v.e. \_\_\_\_\_ b) tin v.e. \_\_\_\_\_ c) krypton v.e. \_\_\_\_\_ d) rubidium v.e. \_\_\_\_\_

Periodic Table

1																	18																												
H 1													He 2																																
Li 3	Be 4											B 5	C 6	N 7	O 8	F 9	Ne 10																												
Na 11	Mg 12	3	4	5	6	7	8	9	10	11	12	Al 13	Si 14	P 15	S 16	Cl 17	Ar 18																												
K 19	Ca 20	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36																												
Rb 37	Sr 38	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54																												
Cs 55	Ba 56	La 57	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86																												
Fr 87	Ra 88	Ac 89	Unq 104	Unp 105	Unh 106	Uns 107	Uno 108	Uue 109																																					
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>Ce 58</td><td>Pr 59</td><td>Nd 60</td><td>Pm 61</td><td>Sm 62</td><td>Eu 63</td><td>Gd 64</td><td>Tb 65</td><td>Dy 66</td><td>Ho 67</td><td>Er 68</td><td>Tm 69</td><td>Yb 70</td><td>Lu 71</td> </tr> <tr> <td>Th 90</td><td>Pa 91</td><td>U 92</td><td>Np 93</td><td>Pu 94</td><td>Am 95</td><td>Cm 96</td><td>Bk 97</td><td>Cf 98</td><td>Es 99</td><td>Fm 100</td><td>Md 101</td><td>No 102</td><td>Lr 103</td> </tr> </table>																		Ce 58	Pr 59	Nd 60	Pm 61	Sm 62	Eu 63	Gd 64	Tb 65	Dy 66	Ho 67	Er 68	Tm 69	Yb 70	Lu 71	Th 90	Pa 91	U 92	Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	Es 99	Fm 100	Md 101	No 102	Lr 103
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50. On the periodic table, explain where you would find similar elements to a specific element.

### Periodic Table

51. Know that the smaller value number on the element's square (periodic table) is the \_\_\_\_\_. The larger value number is the \_\_\_\_\_.
52. Mendeleev first numbered his table (in the year 1869) by \_\_\_\_\_.
53. From the discoveries of Henry Moseley in 1913, the elements are now organized by \_\_\_\_\_, which is equal to the number of \_\_\_\_\_ an atom has.
54. Know where the **metals** and **nonmetals** are on the periodic table. I'll only ask you about the obvious ones, not any that are close to the metalloids (except **aluminum**, which we know is a metal). \_\_\_\_\_ are left and middle, \_\_\_\_\_ are in the right corner area.
55. Know where the **metalloids** are generally (along the stair step line) and that they have properties of both metals and nonmetals.



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56. Know that \_\_\_\_\_ or \_\_\_\_\_ are the 18 vertical columns on the periodic table and that they have \_\_\_\_\_ properties.

57. Know where these **groups** are located on the periodic table: **Noble gases** (right side), **Halogens** (right next to noble gases), **transition metals** (groups 3-12 in the middle) **Alkali metals** (left side). Draw a picture below that shows this.

58. Know that the **most reactive metals** are in the group called the \_\_\_\_\_ and the **most reactive nonmetals** are in the group called the \_\_\_\_\_.

59. Know that a \_\_\_\_\_ is the name for one of the 7 horizontal rows on the periodic table.

60. The atomic number tells us number of \_\_\_\_\_ in an atom.

61. In a neutral atom (not an ion), the atomic number will also equal the number of \_\_\_\_\_.

62. How many electrons would  $\text{Na}^+$  have? \_\_\_\_\_

63. How many electrons would  $\text{P}^{3-}$  have? \_\_\_\_\_

**Periodic Table**

1																	18																												
H 1																	He 2																												
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64. On the periodic table, explain where you would find similar elements to a specific element.
65. Show the oxidation numbers (charges) at the top of the 8 main groups on this periodic table.
66. What would the charge of indium be? What would the charge of selenium be?  
Write the ion symbols below and make the formula for the ionic compound these two elements would form.

\_\_\_\_\_ => \_\_\_\_\_

67. What is the formula for Copper II Nitrate? \_\_\_\_\_
68. What is the formula for Strontium Phosphide? \_\_\_\_\_
69. What is the formula for Lead IV Selenide? \_\_\_\_\_
70. What would the name of FeBr<sub>3</sub> be? \_\_\_\_\_

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71. Write the formula or the name to go with the other:

- a.  $\text{Na}_3\text{PO}_4$  \_\_\_\_\_ e.  $\text{Sn}(\text{NO}_2)_2$  \_\_\_\_\_  
b. Aluminum Chlorate \_\_\_\_\_ f.  $\text{CuCl}$  \_\_\_\_\_

**UNIT 5 Counting Particles**

72. Definitions

- a. mole  
b. molar mass  
c. Avogadro's number

73. There are 7 elements that are diatomic gases at room temperature. The way to remember them is Mr. Brinclhof. Write the element symbols and names of the gases below.

74. The unit for the mass of an atom or molecule (atomic mass) is the \_\_\_\_\_.

75. The unit for the mass of a mole of molecules or atoms is \_\_\_\_\_.

76. A baker's dozen = \_\_\_\_\_ things, a mole equals \_\_\_\_\_ things.

77. A mole of gold would weigh \_\_\_\_\_ and would contain \_\_\_\_\_ atoms of gold.

78. If you have one half of a mole of hydrogen gas you will have \_\_\_\_\_ grams.

79. One mole of  $\text{CO}_2$  always contains \_\_\_\_\_ molecules.

80. True or False - One mole of  $\text{H}_2$  and one mole of  $\text{O}_2$  weigh the same amount.

81. To find the mass of a mole simply add up the \_\_\_\_\_.

82. 100 moles of water weighs \_\_\_\_\_ grams

83. One half of a mole of any molecular substance will contain \_\_\_\_\_ molecules.

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84. Two moles of an element will contain \_\_\_\_\_ atoms.

85. Find the molar mass of the following:

a.  $\text{KNO}_3$  \_\_\_\_\_

d. Oxygen gas \_\_\_\_\_

b.  $(\text{NH}_4)_2\text{CO}_3$  \_\_\_\_\_

e.  $\text{Ca}(\text{NO}_3)_2$  \_\_\_\_\_

c.  $\text{Ag}_2\text{CrO}_4$  \_\_\_\_\_

f.  $\text{PbSO}_4$  \_\_\_\_\_