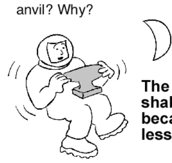
Name ____________________ Date ____________

Conceptual Chemistry

PRACTICE PAGE

Chapter 2: Particles of Matter
Physical Quantities

An astronaut floating in outer space tries to shake an iron anvil that is twice as massive as she is. Which shakes more: the astronaut or the anvil? Why?

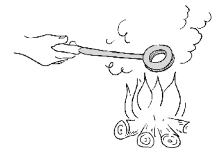


The astronaut shakes more because she has less inertia.

A friend hammers a small nail into a piece of wood placed on the top of a pile of books on your head. Why doesn't this hurt you?

The books have a lot of mass, hence inertia, which means they tend NOT to move downward into your head.

Why can't you establish whether you are running a high temperature by touching your own forehead?
Both your hand and your forehead are at an elevated temperature. The heat flow between the two, therefore, is not so significant.



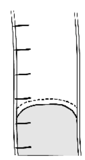
When the temperature of a metal ring increases, does the hole become larger? smaller? or stay the same?


(hint)

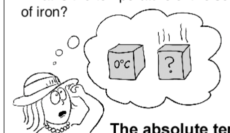
Everything expands, including the hole in the middle.

When a mercury thermometer is warmed, the mercury level momentarily goes down before it rises. Why?

The glass is expanding.



A piece of iron has a temperature of 0°C. A second identical piece of iron is twice as hot. What is the temperature of the second piece of iron?



The absolute temperature scale must be used. 0°C is 273K. So twice 273 equals 546 K. Convert this back to Celsius and that's 273°C.

Name ____________________ Date ____________

Conceptual Chemistry

PRACTICE PAGE

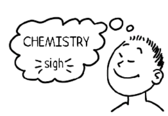
Chapter 2: Particles of Matter
Gas Laws

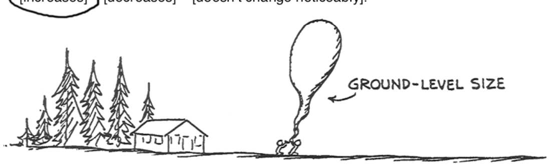
1. A principle difference between a liquid and a gas is that when a liquid is under pressure, its volume
[increases] [decreases] [doesn't change noticeably]

and its density
[increases] [decrease] [doesn't change noticeably].

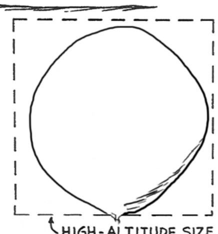
When a gas is under pressure, its volume
[increases] [decreases] [doesn't change noticeably]

and its density
[increases] [decreases] [doesn't change noticeably].





2. The sketch above shows the launching of a weather balloon at sea level. Make a sketch of the same weather balloon when it is high in the atmosphere. In words, what is different about its size and why?
The balloon is much larger because the atmospheric pressure at higher elevations is less. The gas inside the balloon is thus able to expand.



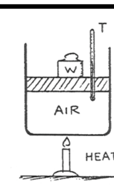
3. Using Boyle's Law, shown below, it is possible to calculate the new volume of the weather balloon at the higher altitude. Assume its volume is 10 m^3 at ground level where the atmospheric pressure is 1 atm. What will be its new volume at an altitude of 10 km where the atmospheric pressure is 0.3 atm?

(1 atm)(10 m^3) = (0.3 atm)(x m^3)

$$P_1V_1 = P_2V_2 \qquad \frac{(1\text{ atm})(10\text{ M}^3)}{(0.3\text{ atm})} = x = 33\text{ m}^3$$

Name ____________________ Date ____________

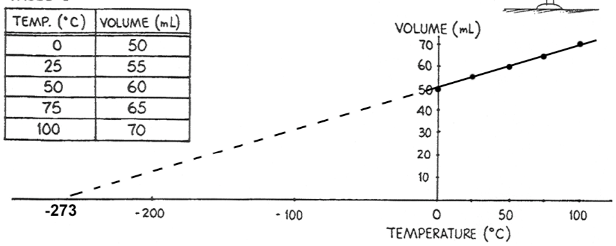
A mass of air is contained so that the volume can change but the pressure remains constant. Table I shows air volumes at various temperatures when the air is warmed slowly.



4. Plot the data in Table I on the graph and connect the points.

TABLE I

TEMP. (°C)	VOLUME (mL)
0	50
25	55
50	60
75	65
100	70



5. The graph shows how the volume of air varies with temperature at constant pressure. The straightness of the line means that the air expands uniformly with temperature. From your graph, you can predict what will happen to the volume of air when it is cooled.

Extrapolate (extend) the straight line of your graph to find the temperature at which the volume of the air would become zero. Mark this point on your graph. Estimate this temperature.
-273 °C. **(your best guess suffices)**

6. Although air would liquefy before cooling to this temperature, the procedure suggests that there is a lower limit to how cold something can be. This is the absolute zero of temperature.

Careful experiments show that absolute zero is **-273** °C.

7. Scientists measure temperature in *kelvins* instead of degrees Celsius, where the absolute zero of temperature is 0 kelvins. If you relabeled the temperature axis on the graph in Question 4 so that it shows temperature in kelvins, would your graph look like the one below? **YES**

See Figure 17.6 of your textbook.