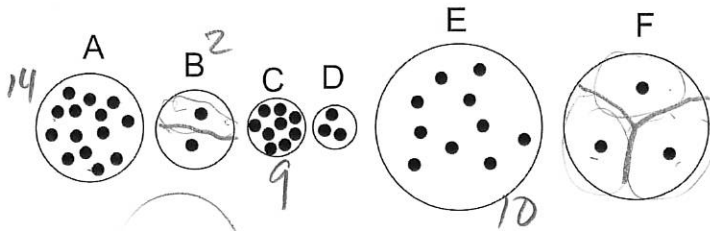


Part 1: Mass, Volume, Density, Weight



1. Most mass: A 2. Most volume: E 3. Most density: C 4. Most weight: A
 5. Least mass: B 6. Least volume: D 7. Least density: F 8. Least weight: B

In each of the following situations, what happens to mass, volume, density and weight? You may use =, +, and – symbols.

9. Something gets smaller and floats better than it did before, what has happened to its...
 Mass: – Volume: – Density: – Weight: –
10. If stuff is added to an object, and the object's size does not change, what has happened to its...
 Mass: + Volume: = Density: + Weight: +
11. When a piece of steel is taken to the moon, what happens to its...
 Mass: = Volume: = Density: = Weight: –
12. If someone's weight stays the same, but that person's volume increases, what happens to his/her...
 Mass: = Volume: + Density: –

Part 2: Pressure, Buoyancy, Temperature

** Note the strange numbering for this section. I intentionally numbered this way to emphasize the fact that these questions were taken randomly (almost) from the quiz review. You should still study the other numbers that I did not include here. Trying these without looking back at your notes will help you gauge how much you remember, but you still need to study the other information from that quiz review.

2. Describe how air pressure changes as you rise higher above the ground. Also explain why air pressure changes in this way.

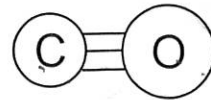
Pressure decreases because there is less air above you when you rise higher.

6. What is buoyancy, and what causes it?

The force of pressure pushing objects upward.

Cause: There is always stronger pressure pushing up on the bottoms of things and weaker pressure pushing down from the top. Movement is from high p. to low p.

Assume that the picture on the right shows substances in a gas.



8. How many atoms are in the picture on the right? *5*
9. How many elements are in the picture? *3*
10. How many particles are in the picture? *4*

14. What usually happens to a substance's volume when the substance is heated? Explain how this is caused by particle motion on a microscopic level.

Volume increases because hotter particles move faster and push away from one another, thus spreading out.

17. What happens to a substance's temperature when it is compressed?

Temp increases. →  ←

18. Why does compression of a substance cause the temperature of the substance to change in that way?

Compression gives particles a "push", causing them to move faster

22. When our sun first began to shine, it got a lot bigger. Why?

↳ This heated the sun up. Heating causes expansion.

23. Why is the Universe getting colder?

*The universe is expanding.
Expansion causes cooling.*

Part 3: Understanding Hot Air Balloons With Physical Properties

1. What three primary factors control the density of air? [Hint: these relate to the data you enter into the online density calculator.] For each of these factors, describe its effect on air density. In other words, if the factor increases, what happens to air density? What happens if it decreases?

Factor #1: Temperature

What happens to air density when factor 1 increases?

Air becomes less dense when temp. increases

Explain why:

Hotter particles spread out, becoming less crowded.

Factor #2: Pressure

What happens to air density when factor 1 increases?

Increasing pressure causes increased density.

Explain why:

Increased pressure compresses air, making the particles more crowded.

Factor #3: Humidity (H₂O Vapor Content)

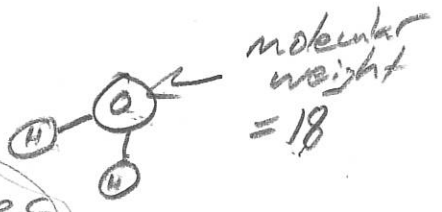
What happens to air density when factor 1 increases?

Higher humidity causes lower air density.

Explain why:

↑ more H₂O vapor in air

Air is mostly Nitrogen molecules. Nitrogen molecules (N₂) are heavier than water molecules. When there is more water in the air, there is less nitrogen, so there are more light particles and fewer heavy ones. Mass decreases



2-5. For these problems, consider a hot air balloon that is hovering in the classroom air (neither rising nor sinking). The density of the air in the classroom is 0.00119 g/cm^3 . The balloon's volume = $250,000 \text{ cm}^3$. When all of the air is removed from the balloon, its mass is ~~45g~~ ^{45g}. Nothing extra is attached to the balloon.

2. What is the balloon's overall density while it is hovering in the air? Explain how you know.

$$\rho = \text{density} = 0.00119 \text{ g/cm}^3$$

The balloon is not rising or sinking, so it has the same density as the surrounding air.

3. What is the total mass of the hovering balloon and all of the air inside?

$$\rho = \frac{m}{V} \quad 0.00119 \text{ g/cm}^3 = \frac{m}{250,000 \text{ cm}^3} = 297.5 \text{ g}$$

4. What is the mass of the hot air inside the hovering balloon?

Total mass = empty mass + hot air mass
 (Total mass) - (empty mass) = hot air mass
 $297.5 \text{ g} - 45 \text{ g} = 252.5 \text{ g}$

5. What is the density of that hot air?

$$\rho = \frac{m}{V} = \frac{252.5 \text{ g}}{250,000 \text{ cm}^3} = 0.00101 \text{ g/cm}^3$$

Assume for these questions that a hot air balloon includes all of the parts of the balloon, plus the hot air inside.

6. In class, we used a hot air blower (like a hairdryer) to pre-fill the balloons with warm air. As we were doing this, what happened to the balloon's...

- a. Mass? $+$ b. Volume? $+$ c. Density? $-$ d. Weight? $+$



7. After the balloon was filled with warm air, a flame was lit inside the balloon. The balloon got hotter and hotter, but it was no longer getting bigger. During this process, what was happening to the balloon's...

- a. Mass? $-$ b. Volume? $=$ c. Density? $-$ d. Weight? $-$

