SCIENCE 8 – DENSITY CALCULATIONS WORKSHEET

Show all Work!

NAME: _____

1) A student measures the mass of an 8 cm^3 block of brown sugar to be 12.9 g. What is the density of the brown sugar?

with units

Given: Find: Equ: Work: Answer:

2) A chef fills a 50 mL container with 43.5 g of cooking oil. What is the density of the oil?

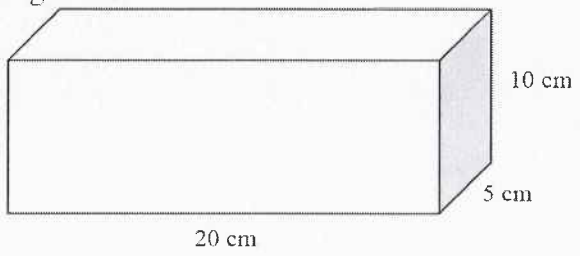
3) Calculate the mass of a liquid with a density of 2.5 g/mL and a volume of 15 mL.

4) Calculate the volume of a liquid with a density of 5.45 g/mL and a mass of 65 g.

5) A machine shop worker records the mass of an aluminum cube as 176 g. If one side of the cube measures 4 cm, what is the density of the aluminum?

6) A teacher performing a demonstration finds that a piece of cork displaces 23.5 mL of water. The piece of cork has a mass of 5.7 g. What is the density of the cork?

7) A carver begins work on the following block of granite that weighs 2700 g. What is the density of the granite?



8) A piece of PVC plumbing pipe displaces 60 mL when placed into a container of water. If the pipe has a mass of 78 g, what is the density of PVC?

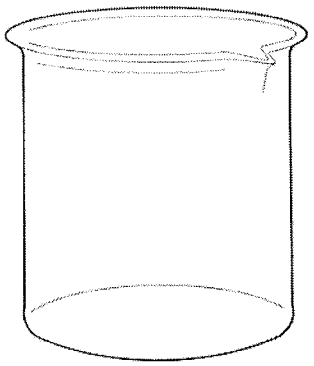
9) A solid magnesium flare has a mass of 1300 g and a volume of 743 cm^3. What is the density of the magnesium?

10) A graduated cylinder has a mass of 50 g when empty. When 30 mL of water is added, the graduated cylinder has a mass of 120 g. If a rock is added to the graduated cylinder, the water level rises to 75 mL and the total mass is now 250 g. What is the density of the rock?

11) A student performs an experiment with three unknown fluids and obtains the following measurements:

Fluid A: m = 2060 g, V = 2000 mL
Fluid B: m = 672 g, V = 850 mL
Fluid C: m = 990 g, V = 1100 mL

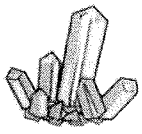
Draw how the fluids would be layered if they were combined in a beaker.



12) Use your density skills to find the identity of the following mystery objects.

Table of Densities			
Solids	**Density g/cm^3**	**Solids**	**Density g/cm^3**
Marble	2.56	Copper	8.92
Quartz	2.64	Gold	19.32
Diamond	3.52	Platinum	21.4

While digging in the backyard, you find an old coin. Its mass is 26.76 g and its volume is 3 cm.

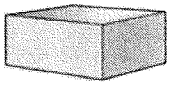


You think you have found a diamond. Its mass is 5.28 g and its volume is 2 cm^3.

What is the coin made of? _____

What did you find? _____

You find a ring with a mass of 107 g. You fill a graduated cylinder up with 10 mL of water and put the ring into the cylinder. The water rises up to the 15 mL mark.



There is a block on your desk that acts as a paperweight. Its measurements are 3 cm by 4 cm by 6 cm. The block has a mass of 184.32 g.

What is the ring made of? _____

What is the block made of? _____

*highlight text for full credit *ONLY important info! *answer questions

Name _____ Date _____ Class _____

CHAPTER 3
LESSON 1

Enrichment Is popcorn dense or not?

Besides being a tasty snack, popcorn is a substance with a remarkable ability to change. In one explosive instant, the density of a kernel of popcorn can decrease by ten times.

Under Pressure

Popcorn kernels have three main parts: the pericarp (the hull or outer covering), the germ (the part that sprouts), and the endosperm (the starch that expands). Popcorn pops because it has a strong pericarp. This tough, outer layer acts like a soda can, holding in pressure until it gets so high that the kernel explodes.

Popcorn's endosperm is made mostly of starch, but it contains some moisture. When the water inside the popcorn kernel is heated, it expands, increasing the pressure on the pericarp. As the kernel continues to heat, the water continues to expand, and the pressure continues to build. Eventually, the pericarp cannot withstand the pressure, and it explodes.

Meanwhile, the starch from the endosperm becomes a gel-like substance as it is heated under pressure. When the pressure inside the kernel is suddenly released, the gelatinized starch of the endosperm expands quickly into the shapes we recognize as popcorn. The total volume of the popcorn increases quickly and its density quickly decreases.

Shake It Down

You may have seen someone cook popcorn in a pot, with oil, on a stove. It is important that unpopped kernels come into contact with the oil at the bottom of the pan. This is where shaking comes in. As with any system, the popcorn in the pot will move toward the lowest possible energy state. Each kernel in the pot has some potential energy due to gravity.

The higher a kernel is away from the bottom of the pot, the greater its potential energy. The total potential energy of all the kernels is lowest when the denser kernels are packed together at the bottom of the pot. This means that if you shake the pot, the denser, unpopped kernels will shift to the bottom of the pot, where they come into contact with the hot oil and pop.

Directions: *Respond to each statement or question below in the space provided.*

1. **Infer** Does a kernel of popcorn have more or less mass after it is popped? How does this affect its density?

_____

_____

2. **Predict** whether a popcorn kernel will pop if its pericarp has a small hole. Explain your answer.

_____

_____

3. **Devise** a method to quickly separate a mixture of plastic and glass marbles.

_____

_____

*highlight text
*Answer questions

Name _____ Date _____ Class _____

Enrichment Buoyant Forces

CHAPTER 3
LESSON 2

Have you ever floated on a raft in a swimming pool? It's certainly fun to do, but did you ever wonder why you didn't sink? It is because there is a buoyant force on you and the raft. As long as the density of you and the raft together is less than the density of the water in the pool, you will float.

Archimedes' Discovery

Buoyant force results when pressure pushes up on the bottom of an object and pressure pushes down on the same object. The buoyant force, according to Archimedes' principle, is equal to the weight of the fluid displaced by the object. Archimedes was an ancient Greek scientist who discovered this almost by accident. Archimedes had been asked to determine if a king's statue was 100 percent gold. While pondering how to measure that, Archimedes began to lower himself into a hot bath. He realized that his own body displaced the water in the tub.

Archimedes put this principle to the test by measuring both the statue and the amount of water displaced when the statue was lowered into a container full of water. He compared the density of the statue with the known density of pure gold and found that the statue was denser. Therefore, he reasoned, it probably contained lead or some other metal and was not pure gold.

Changing Submarine Density

Knowing this should tell us how a submarine is able to both sink and float. As long as the density of the submarine is less than that of the water around it, it accelerates upward, or surfaces. But when the density of the submarine is greater than the water surrounding it, it submerges. Submarine density can be controlled by ballast tanks, which can be filled with air or water. When compressed air is pumped into the ballast tanks and the ballast water is forced out, the submarine becomes less dense than the water around it, so it surfaces. When the air is let out of the ballast tanks and they refill with water, the submarine becomes denser than the water around it, so it submerges.

Directions: *Respond to each question or statement below in the space provided.*

1. **Apply** the idea of changing buoyancy to yourself. How could you change the density of your body to make it easier to sink or float?

2. **Infer** What do you think neutral buoyancy in a submarine is? Theorize about how you think it works and when it would be used.

3. **Contrast** the buoyant force and gravity.

*highlight text

Name _____ Date _____ Class _____

CHAPTER 3
LESSON 3

Enrichment Controlling a Hot-Air Balloon

Imagine floating serenely through the air in the basket of a hot-air balloon. You watch the landscape beneath you. The people below wave to you as the wind carries you over your school and a nearby park.

Climbing

Lost in a daydream, you hardly notice the office building poking up out of a few blocks ahead. Whoa! You realize you're looking straight into the fifth-floor window of a building with seven floors.

Thankfully, you know how to make the balloon rise in time. You simply fire up the burner under the envelope of the balloon. The envelope is the large, often colorful part of a hot-air balloon that holds the hot air. Thermal energy from the flames heats the air in the envelope. Air molecules in the envelope speed up and spread out. The density of the balloon decreases, and you accelerate upward. But you are too close—it looks like you will still scrape against the building!

You have one chance left. Like a ship on the ocean or a submarine, hot-air balloons carry ballast. Ballast in a hot-air balloon is dense material that can be detached from the balloon. It increases the density of the whole balloon. Hot-air balloons carry ballast for just this kind of emergency situation. By throwing ballast out of the balloon, you can quickly decrease the density of the balloon. This means that the balloon will quickly accelerate upward. You must just be careful not to go too high, or to hit anyone below when you drop your ballast.

Going Down

Safely over the building, you see your landing site up ahead. It's time to start descending. You could just wait for the air around your balloon to cool the air in the envelope of the balloon and slowly sink to the ground. Unfortunately, without your ballast, you might be in Nevada before the air in your balloon has cooled enough to bring you back to the ground.

Once again, your balloon is designed for just this type of situation. With a tug on the valve cord, you open the valve on the top of the envelope of the balloon. Hot air rises out of the top of the envelope. This also decreases the pressure inside the envelope, and cooler, denser air from outside the envelope is pulled in from the bottom of the envelope. As this happens, the density of the balloon decreases, and you sink toward your landing site and crew.

Directions: *Respond to each statement below in the space provided.*

1. **Deduce** why a hot-air balloon will always have less mass at the end of its flight than at the beginning. _____

_____

_____

2. **Consider** a few of the challenges of flying a hot-air balloon at high altitudes.

_____

_____

_____

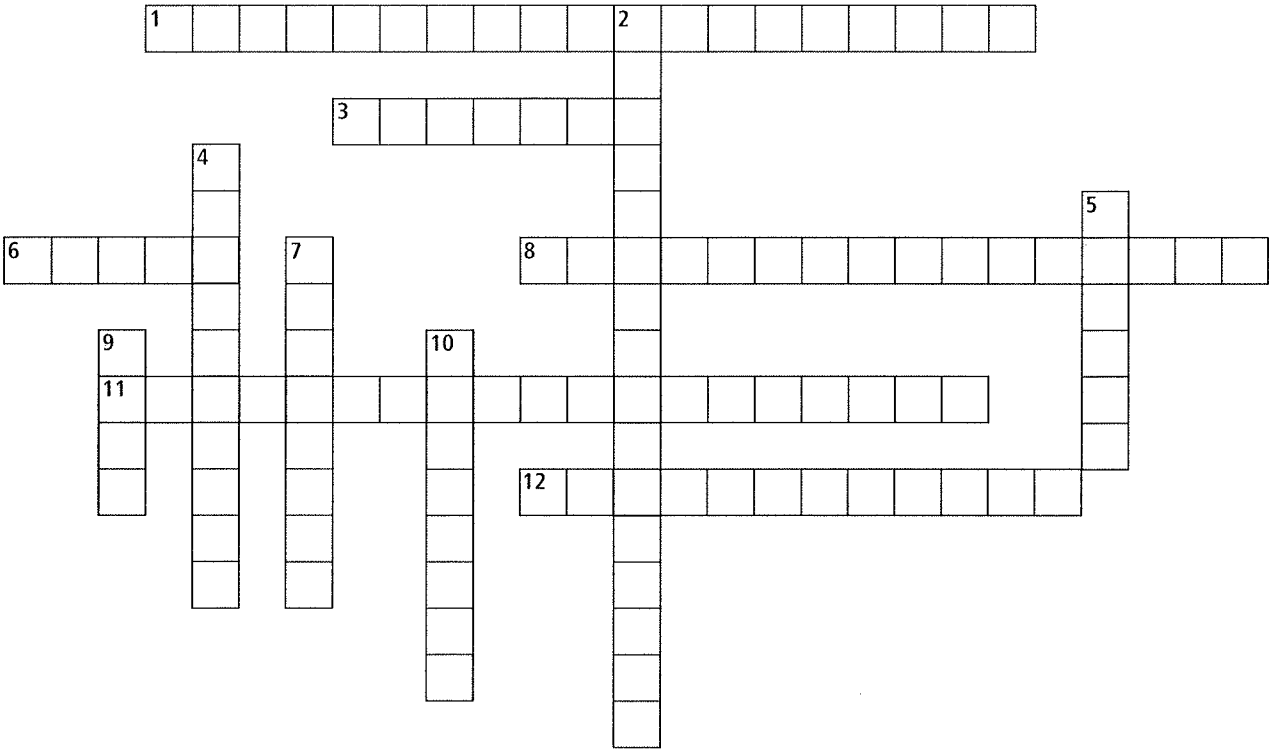
Name _____ Date _____ Class _____

Chapter Review — Density and Buoyancy

CHAPTER 3

Part A. Vocabulary Review

Directions: *Complete the crossword puzzle using the clues below.*



Across

1. scientific law that says the buoyant force on an object is equal to the weight of the fluid the object displaces
3. amount of mass per unit volume
6. material that can flow and has no definite shape
8. six-faced block in which all faces are rectangular
11. force exerted per unit area by air
12. net upward force exerted on an object by the surrounding fluid

Down

2. property of a material that can be measured without changing the identity of the material
4. instrument that measures the density of a fluid
5. amount of space taken up by an object
7. amount of force exerted per unit of area
9. amount of matter that makes up an object
10. combination of all the forces acting on an object