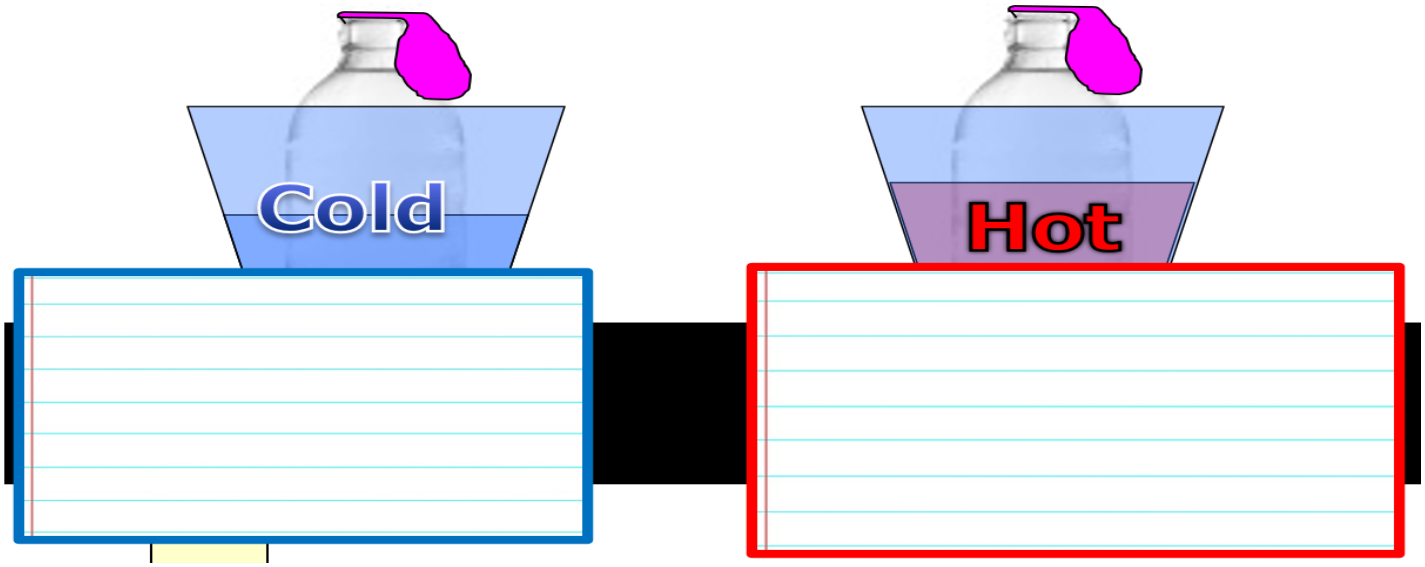
Part 2 Gas Laws

Name:

Part 2 Lesson 1 Charles Law, Boyles Law, Avogadro's Laws

Make some observations of the demonstration in the spaces below. What happened to the two balloons? Why?

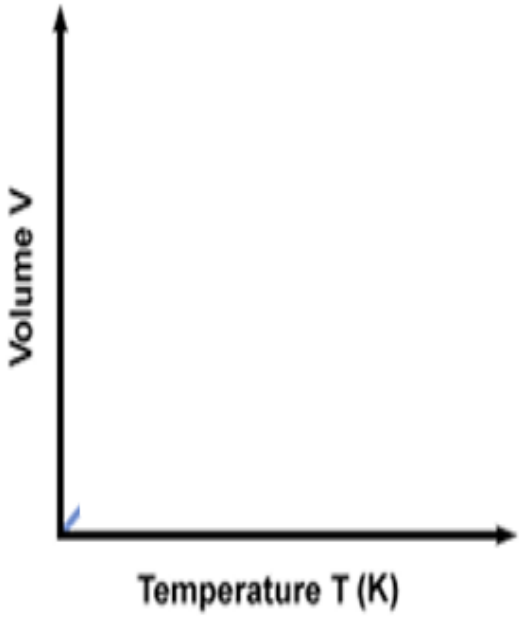


Charles Law: Volume of a gas increases with _____. (Gases expand with heat).

The formula for the law is:

$$\frac{\text{Volume}}{\text{Temp}} = K$$

Draw a graph below showing V over T = K and then fill-in the blanks



V is the _____ of the g____.

T is the _____ of the gas (measured in K____)

K is a constant.

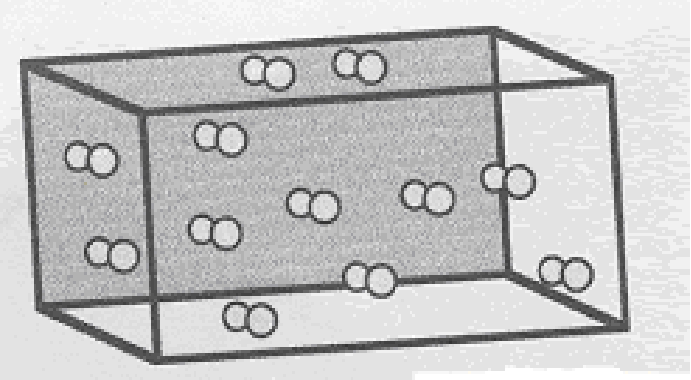
K= The universal constant in the gas equation:

p_____ times v_____ = R times temperature; equal to 8.3143 joules per Kelvin per mole.

Avogadro's Law: Equal _____ of gases, at the same temperature and pressure, contain the _____ number of particles, or molecules.

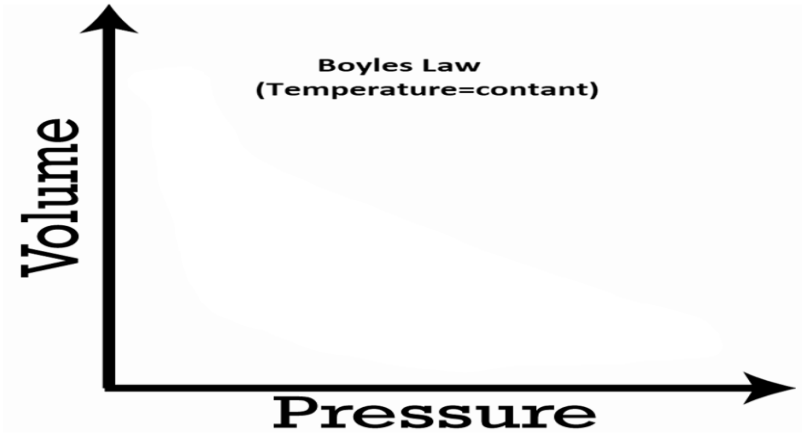
-Gases are made up of molecules which are in constant state of random m_____.
-P_____ is due to collisions between the molecules and the walls of the container.
-All c_____, both between the molecules themselves, and between the molecules and the walls of the container, are perfectly elastic.
  – (That means that there is no loss of k_____ energy during the collision.)
-The t_____ of the gas is proportional to the average kinetic energy of the m_____.
-There are no inter_____ f_____ between the gas molecules.
-The v_____ occupied by the molecules themselves is entirely negligible relative to the volume of the container.
When pressure is increased on a gas its volume is _____

Which pictures best represent Charles Law and Avogadro's Law? Explain your reasoning next to each. A strong answer will incorporate V over T = K



Boyle's Law: Pressure and Volume are _____ proportional.
  As pressure _____, volume decreases.
  As volume decreases, pressure _____.

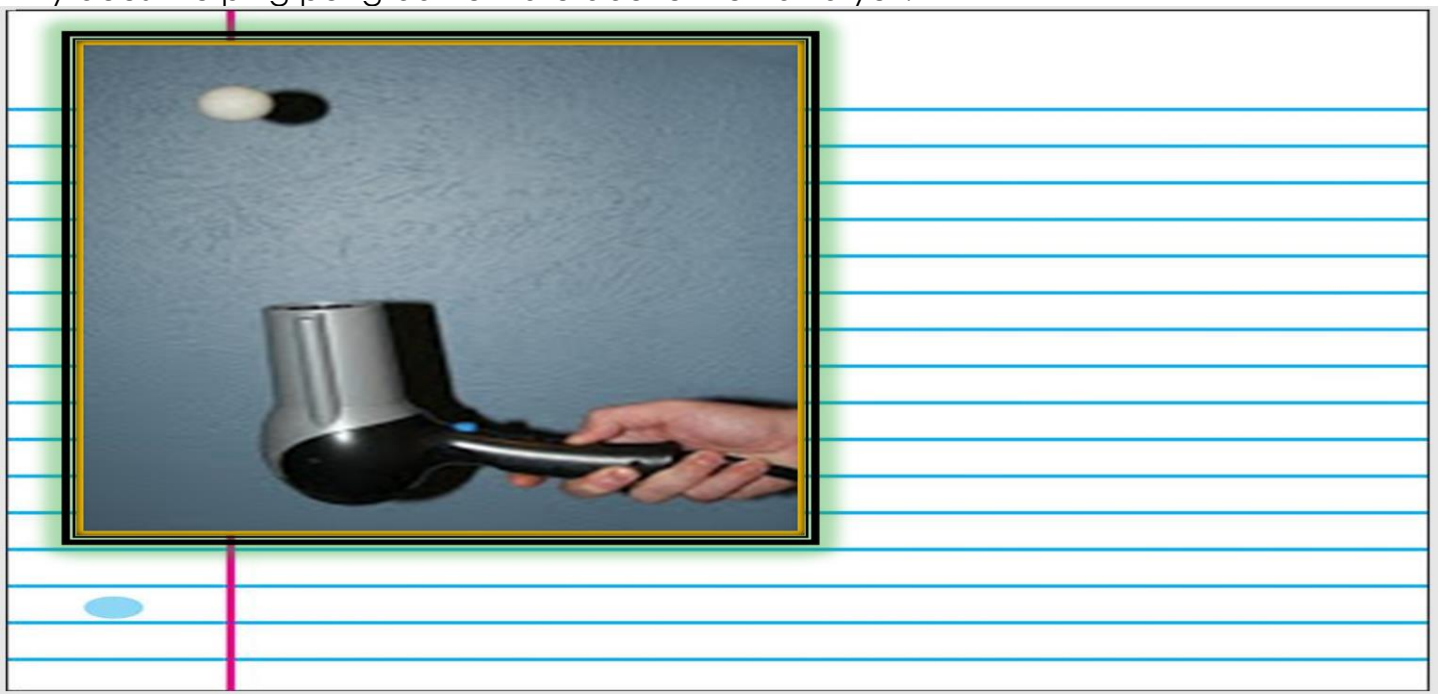
Complete the chart below showing the relationship between volume and pressure.



Describe depressing the Marshmallow? What was happening and why?

Part 2 Lesson 2 Temperature and Pressure

Why does the ping pong ball levitate above the hair dryer?

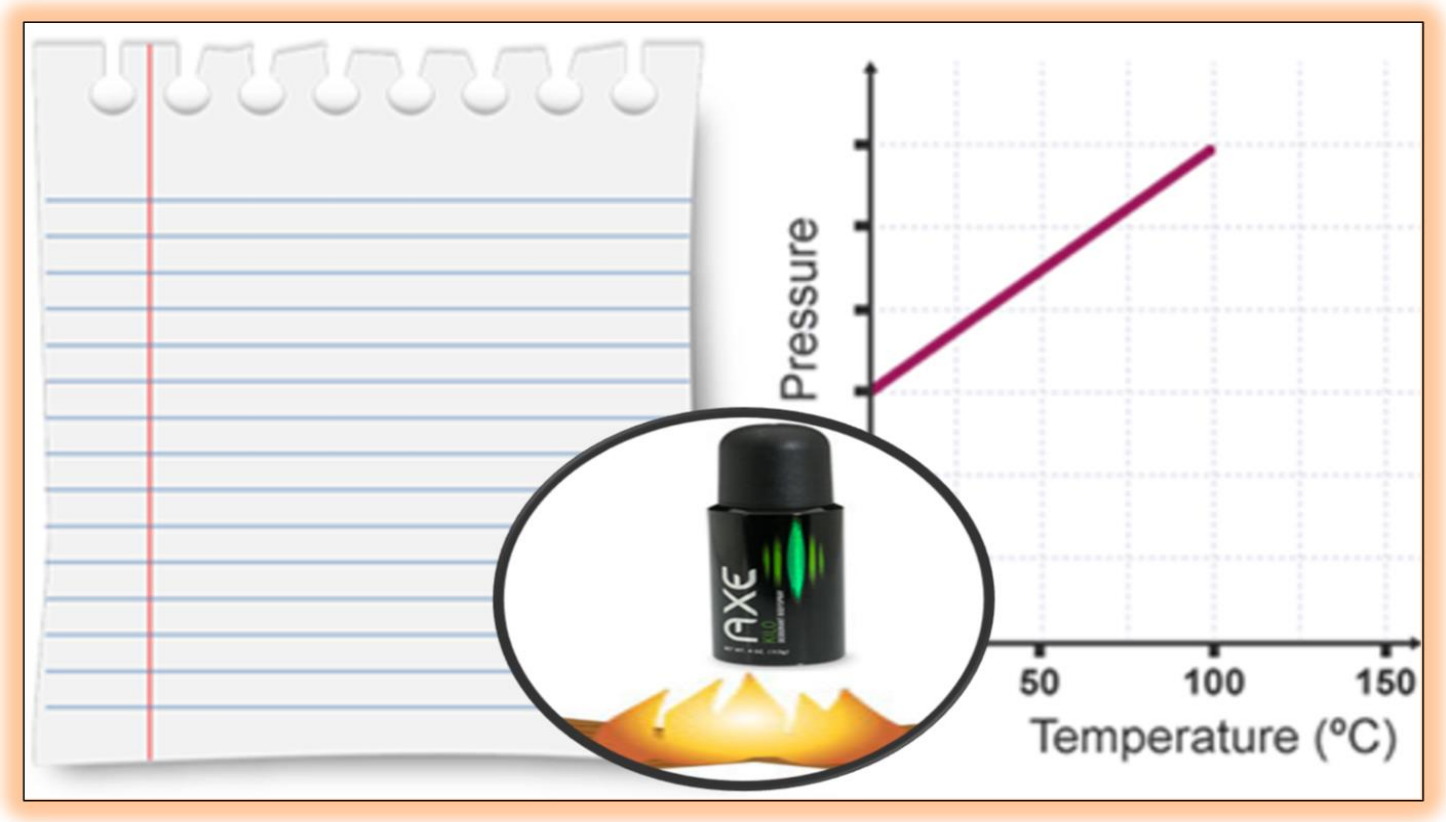


Temperature and Pressure

As temperature rises, pressure _____

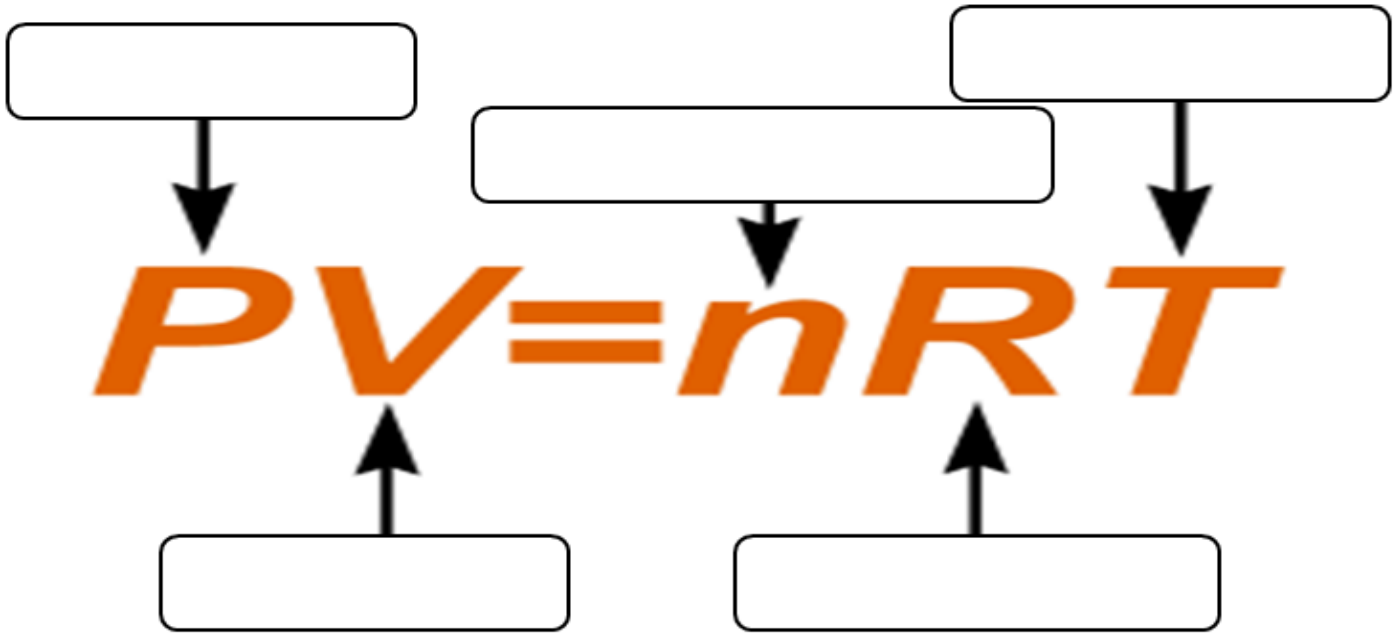
As _____ rises, temperature rises.

Why is it a bad idea to toss this AXE body spray into a fire? Describe below



Part 2 Lesson 3 Ideal Gas Law, Pascals Law

The ideal gas law: PV = nRT (_____ times _____ equals the number of molecules times the _____ times _____)



Sketch out a hydraulic syringe drive? How did it work?

Describe what happens when you squeeze a tube of toothpaste. Make sure to draw a huge mess as well.

Part 2 Lesson 4 Viscosity

Viscosity: Resistance of liquid to _____.

High Viscosity = Travels slow because of _____ resistance.
Low Viscosity = Travels fast because _____ resistance.

Which has a high viscosity? And which has a low viscosity. It is peanut butter vs. Ketchup

Newtonian and non-Newtonian fluids.

Newtonian fluid will flow the _____ when a great deal of _____ is applied as when it is left alone.

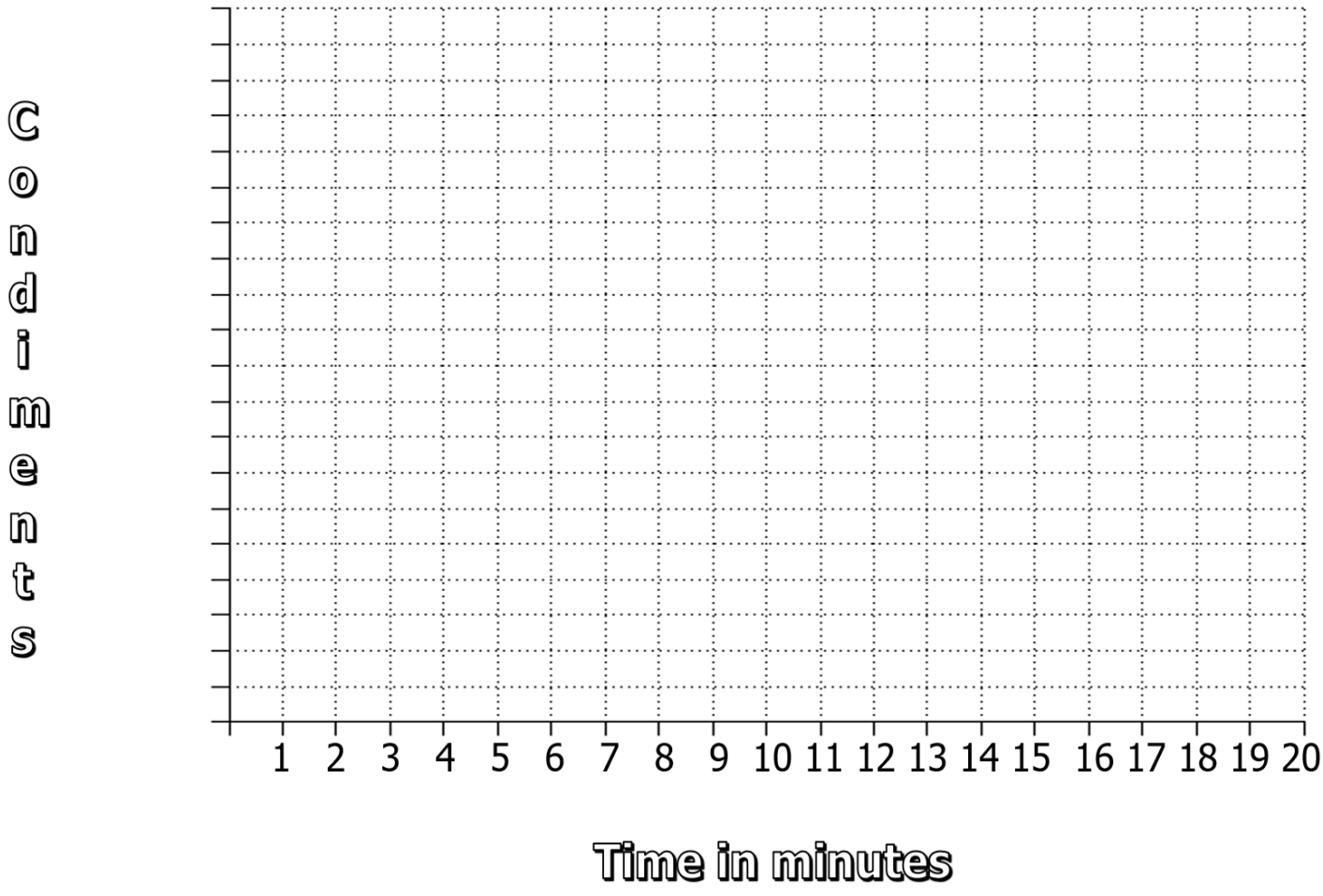
Non-Newtonian fluids change their _____ or _____ under stress.

Describe a Newtonian and a non-Newtonian fluid below.

Newtonian Fluid	Non-Newtonian Fluid

Viscosity Olympics
Lay tray on table.
Place condiments at one side along a starting line.
Use textbooks or manually raise tray just off the vertical at start of race.
Record the times each condiment takes to cross the finish line. (DNF = Did Not Finish)

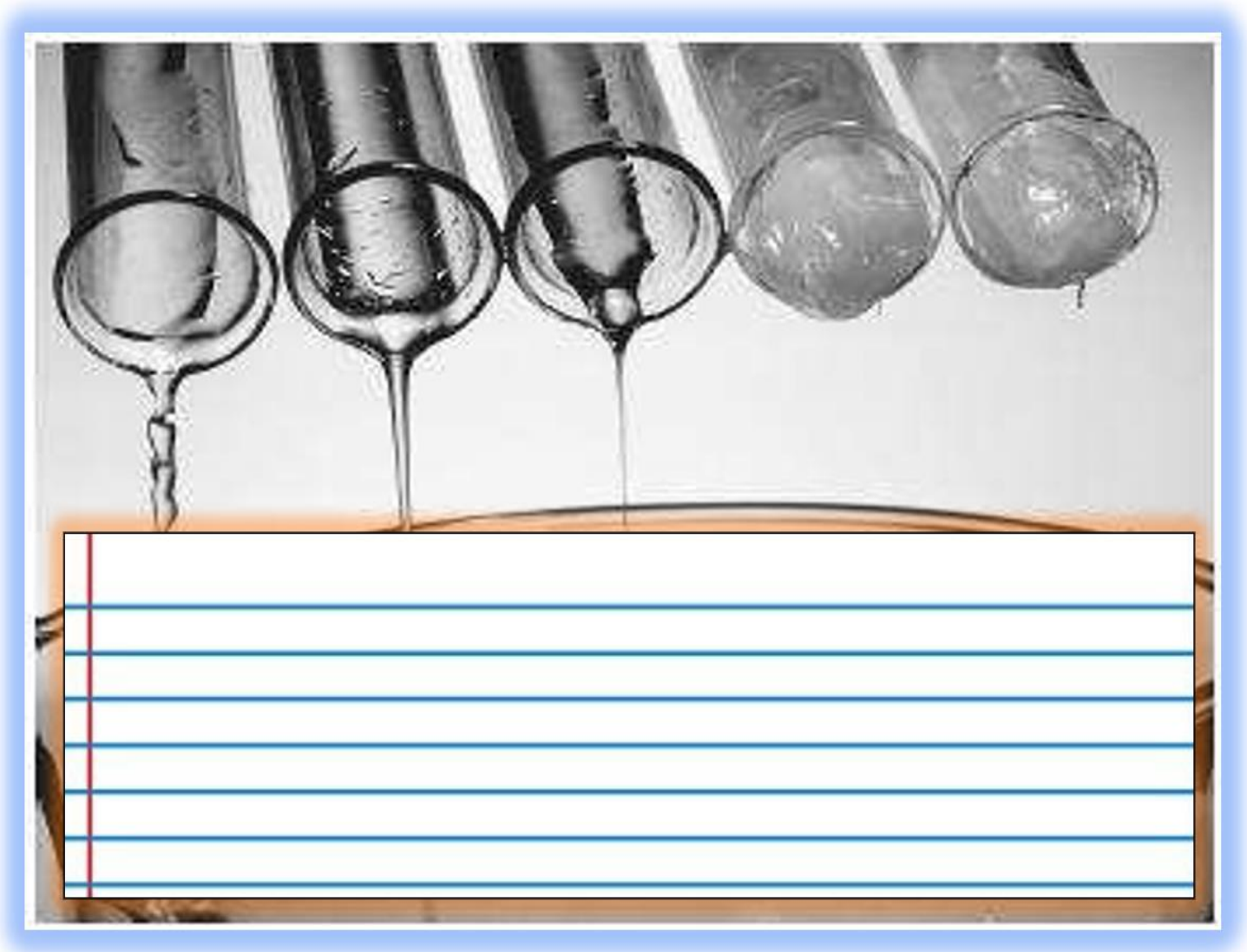
Name of Condiment	Time in seconds from start to finish



Which fluid won the gold medal, and which finished in last place? Why?

Name five other fluids and describe their probable viscosity?

Describe which has a high and low viscosity below.



Part 2 Lesson 5 Archimedes Principle

Archimedes Principle: A body that is submerged in a fluid is buoyed up by a force _____ in magnitude to the weight of the fluid that is _____.

Buoyancy: Buoyancy force is equal to the weight of fluid displaced by the body.

Density: How much mass is contained in a given _____. We use grams/cm³
(grams per cubic centimeter)
Density = Mass _____ by volume

Please determine the densities of the following characters. Who is most and least dense?

Sketch Your boat / hull design for the Aluminum Foil Penny Challenge.

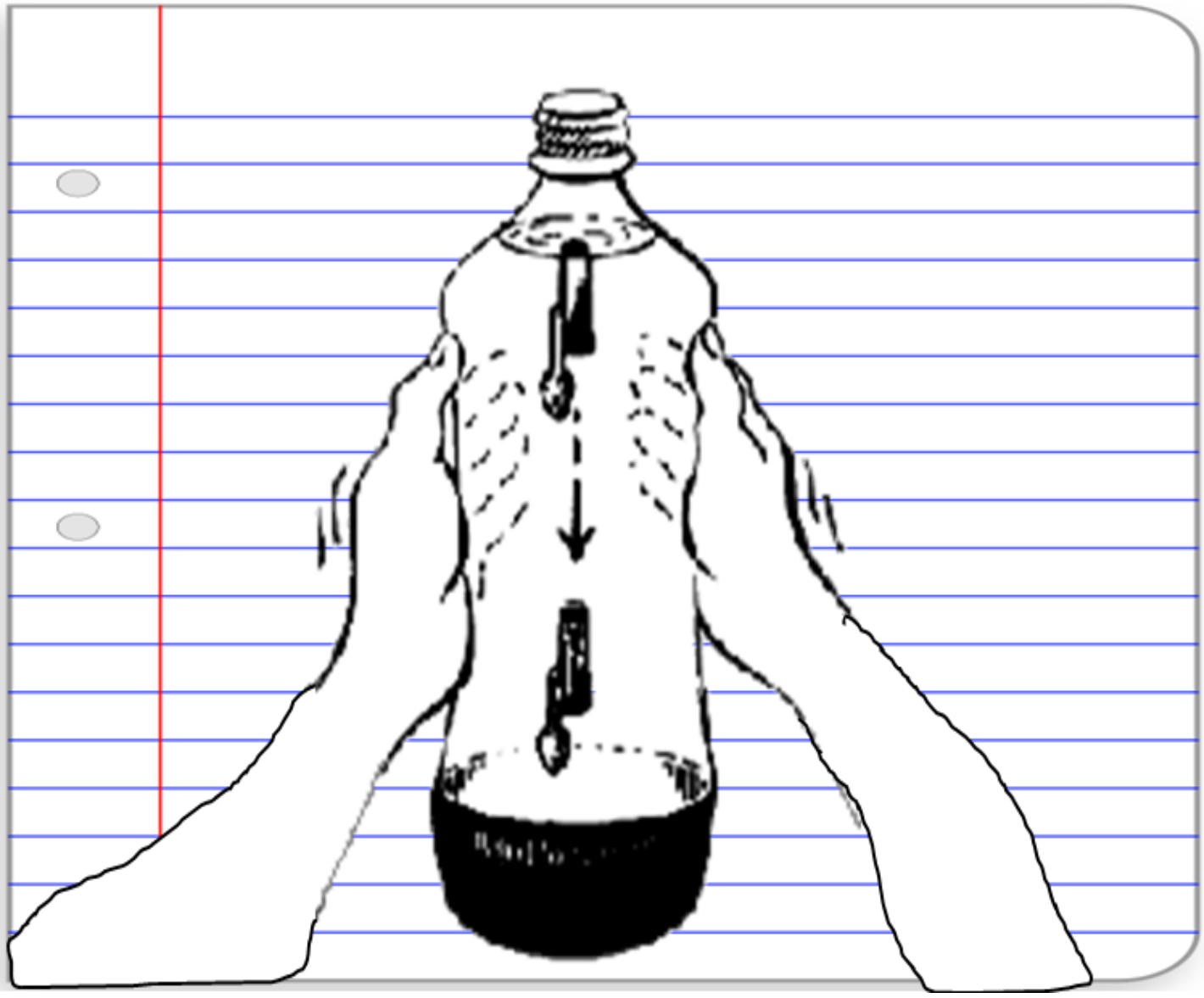
Part 2 Lesson 6 Cartesian Diver

Building your Diver – Spend a minute to decorate your diver with tape and other materials (It can't be weighed down to much and needs to fit into the top of a soda bottle.)

Fill the water glass with water and place the medicine dropper in the glass. Get some water inside the dropper by squeezing the rubber bulb while the end is in the water. You want to get the dropper to just barely float upright in the water. Once you've done this, place the dropper in the full soda bottle and screw on the cap tightly. Don't allow much air to be between the top of the bottle and the cap.

Procedure – Perform two of the following activities.
#1) Gently squeeze the bottle. As you squeeze, the diver will dive (sink) to the bottom of the bottle. If you stop squeezing, the diver floats back to the top.
#2) Try and see how controlled a diver you are and mark a line on the bottle. See if you can diver and hold near the line for one minute
#3) Quietly challenge a friend by timing how long it takes you to do 8 laps from the top to the bottom.
#4) Try and partner with someone and see if you can get one diver to go up and one to go down in the same bottle.
#5) Make a paperclip into a hook and tape it to your diver. Try and dive down and hook another paperclip that is twisted up.
#6) Perform the regular diver demonstration and then add 100 ml of salt. How does salt change your diver?

Please describe how a Cartesian Diver works using the picture below as a resource. Include Boyles Law, Pascals Law, and Archimedes Principle.



Across

1. The ideal gas law: PV = _____ (pressure times volume equals the number of molecules times the gas constant times temperature)
2. The _____ of the gas is proportional to the average kinetic energy of the molecules.
5. _____ Law: Volume of a gas increases with temperature. (Gases expand with heat).
8. a substance or matter in a state in which it will expand freely to fill the whole of a container, having no fixed shape (unlike a solid) and no fixed volume (unlike a liquid).
9. The _____ (Decompression Sickness) – Bubbles form in blood if you rise too quickly because of the rapid decrease in pressure.
10. Gases are made up of molecules which are in constant random _____
12. How much mass is contained in a given volume.
14. _____ is due to collisions between the molecules and the walls of the container.
17. When pressure is increased on a gas its volume _____.
19. As temperature rises, pressure _____

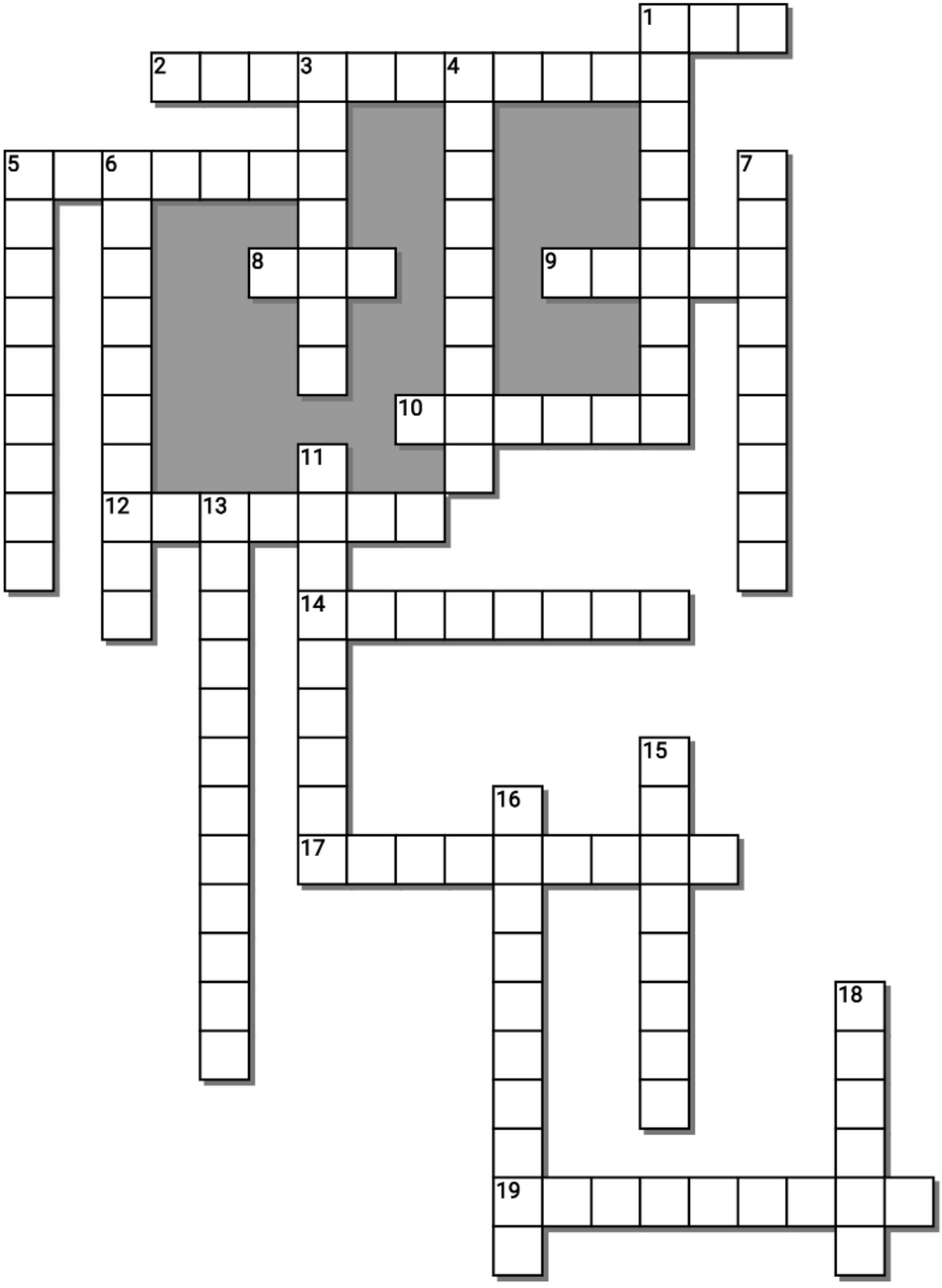
Down

1. This type of fluid will flow the same when a great deal of force is applied as when it is left alone.
3. _____ Law: If you apply pressure to fluids that are confined (or can't flow anywhere), the fluids will then transmit (or send out) that same pressure in all directions at the same rate.
4. _____ Law: Equal volumes of gases, at the same temperature and pressure, contain the same number of particles, or molecules.
5. A _____ diver is a classic science experiment which demonstrates the principle of buoyancy and the ideal gas law.
6. _____ Principle: A body that is submerged in a fluid is buoyed up by a force equal in magnitude to the weight of the fluid that is displaced.
7. Resistance of liquid to flow.
11. Buoyancy force is equal to the weight of fluid _____ by the body.
13. ___-_____These type of fluids fluids change their viscosity or flow under stress.
15. As _____ increases, volume decreases.
16. _____ principle states that for an inviscid flow, an increase in the speed of the fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy.
18. _____ Law: Pressure and Volume are inversely proportional.

----------Teacher can remove this word bank to make more challenging----------

Possible Answers

ARCHIMEDES, AVOGADROS, BENDS, BERNOULLIS , BOYLES , CARTESIAN, CHARLES, DECREASES, DENSITY, DISPLACED, GAS, MOTION, NEWTONIAN, NON-NEWTONIAN, PASCALS, PRESSURE , VISCOSITY, INCREASES, NRT, PRESSURE , TEMPERATURE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Part 2 Gas Laws

Name:

Due: Today

1-20 = 5 pts Part 1 Lesson 5

*20-*25 * = Bonus + 1 pt,

(Secretly write owl in correct space +1 pt)

Final Question = 5 pt wager

Score ____ / 100

UNDER PRESSURE	BOTTLED UP	GOO GOO	BOY E	SLIMED Bonus round 1pt each
1)	6)	11)	16)	*21)
2)	7)	12)	17)	*22)
3)	8)	13)	18)	*23)
4)	9)	14)	19)	*24)
5)	10)	15)	20)	*25)

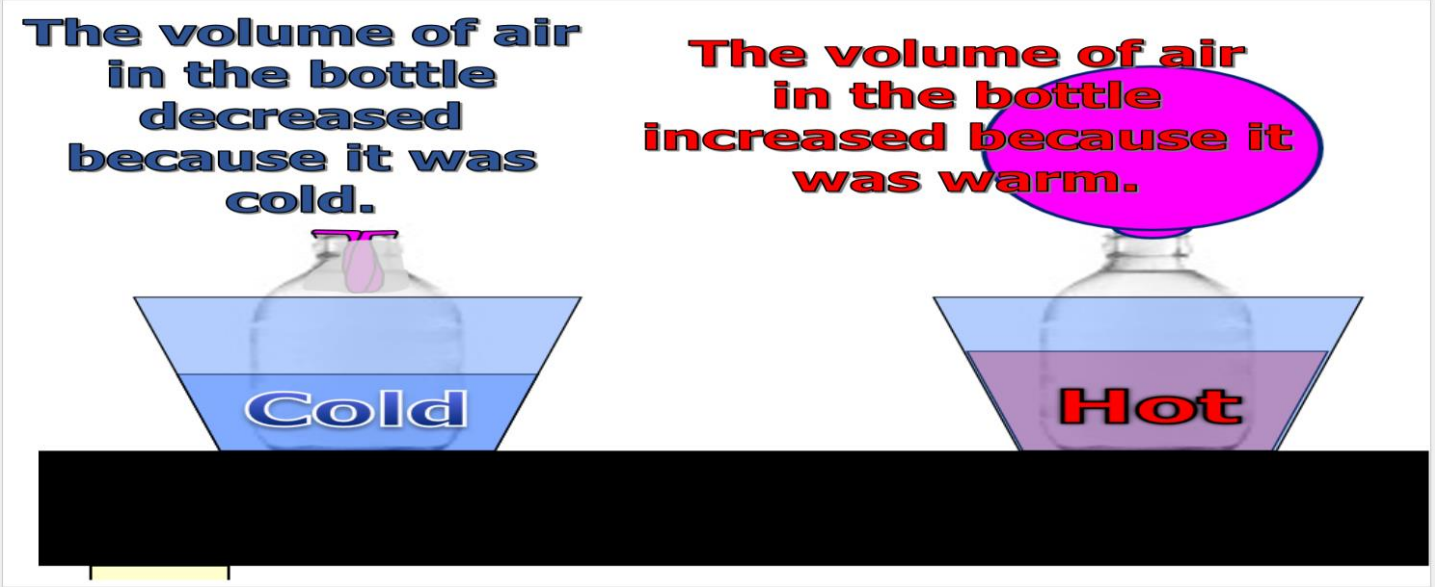
Final Question Wager ___ /5 Answer: _____

Part 2 Gas Laws

Name:

Part 2 Lesson 1 Charles Law, Boyles Law, Avogadro's Laws

Make some observations of the demonstration in the spaces below. What happened to the two balloons? Why?

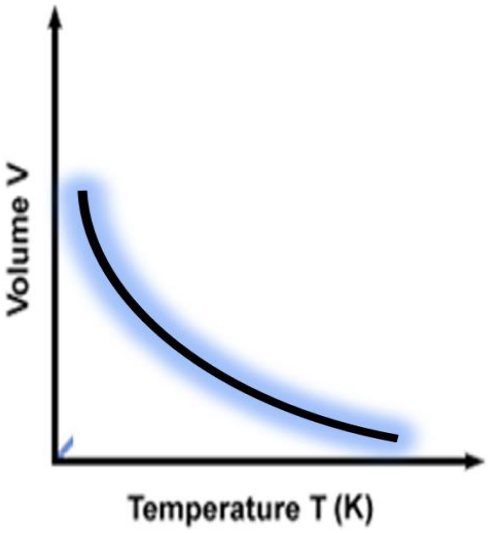


Charles Law: Volume of a gas increases with temperature. (Gases expand with heat).

The formula for the law is:

$$\frac{\text{Volume}}{\text{Temp}} = K$$

Draw a graph below showing V over T = K and then fill-in the blanks



V is the Volume of the g GAS

T is the Temperature of the gas (measured in K Kelvin)

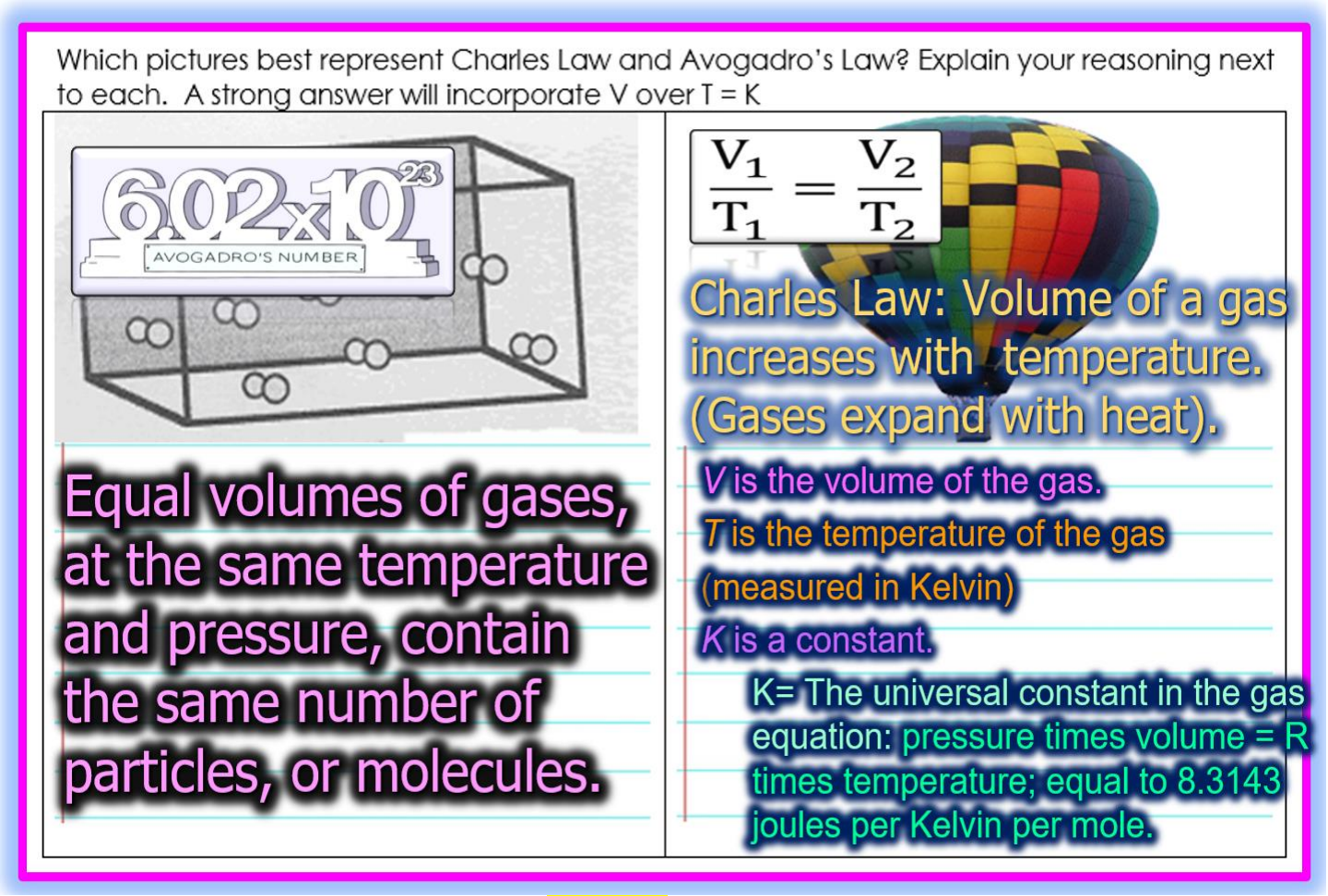
K is a constant.

K= The universal constant in the gas equation:

p Pressure times v Volume = R times temperature; equal to 8.3143 joules per Kelvin per mole.

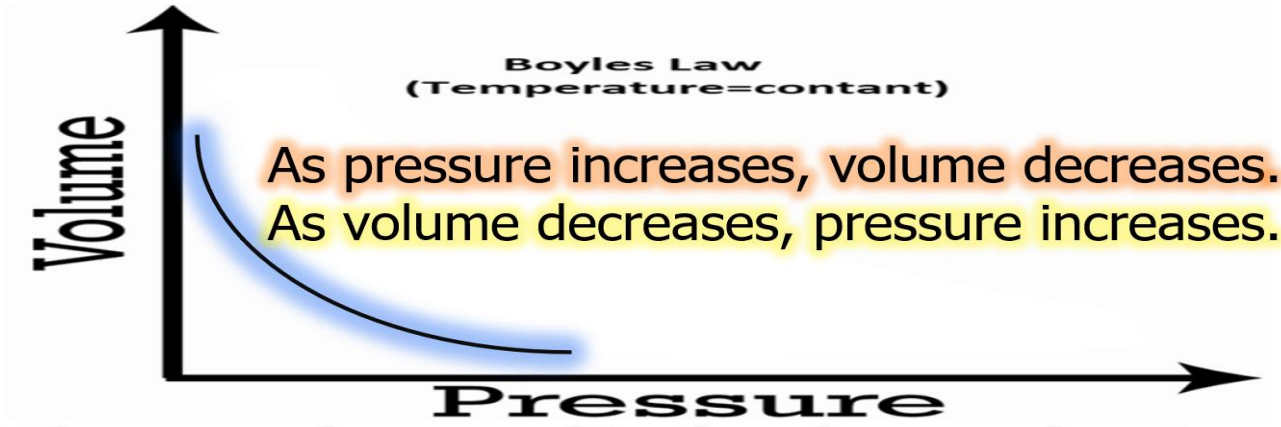
Avogadro's Law: Equal volumes of gases, at the same temperature and pressure, contain the same number of particles, or molecules.

-Gases are made up of molecules which are in constant state of random motion.
-Pressure is due to collisions between the molecules and the walls of the container.
-All collisions, both between the molecules themselves, and between the molecules and the walls of the container, are perfectly elastic.
  – (That means that there is no loss of kinetic energy during the collision.)
-The temperature of the gas is proportional to the average kinetic energy of the molecules.
-There are no intermolecular forces between the gas molecules.
-The volume occupied by the molecules themselves is entirely negligible relative to the volume of the container.
When pressure is increased on a gas its volume is decreased



Boyle's Law: Pressure and Volume are inversely proportional.
  As pressure increases, volume decreases.
  As volume decreases, pressure increases.

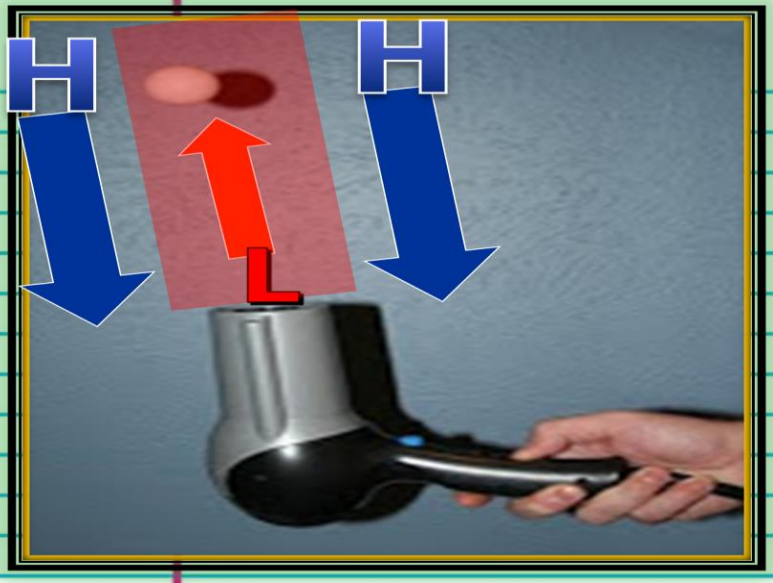
Complete the chart below showing the relationship between volume and pressure.



When you depressed in the plunger, the air pressure increased.
This pushes air bubbles out of the marshmallow and causes it to decrease in size.
When the plunger was pulled out, the pressure decreased so the marshmallow expanded in size.

Part 2 Lesson 2 Temperature and Pressure

Why does the ping pong ball levitate above the hair dryer?

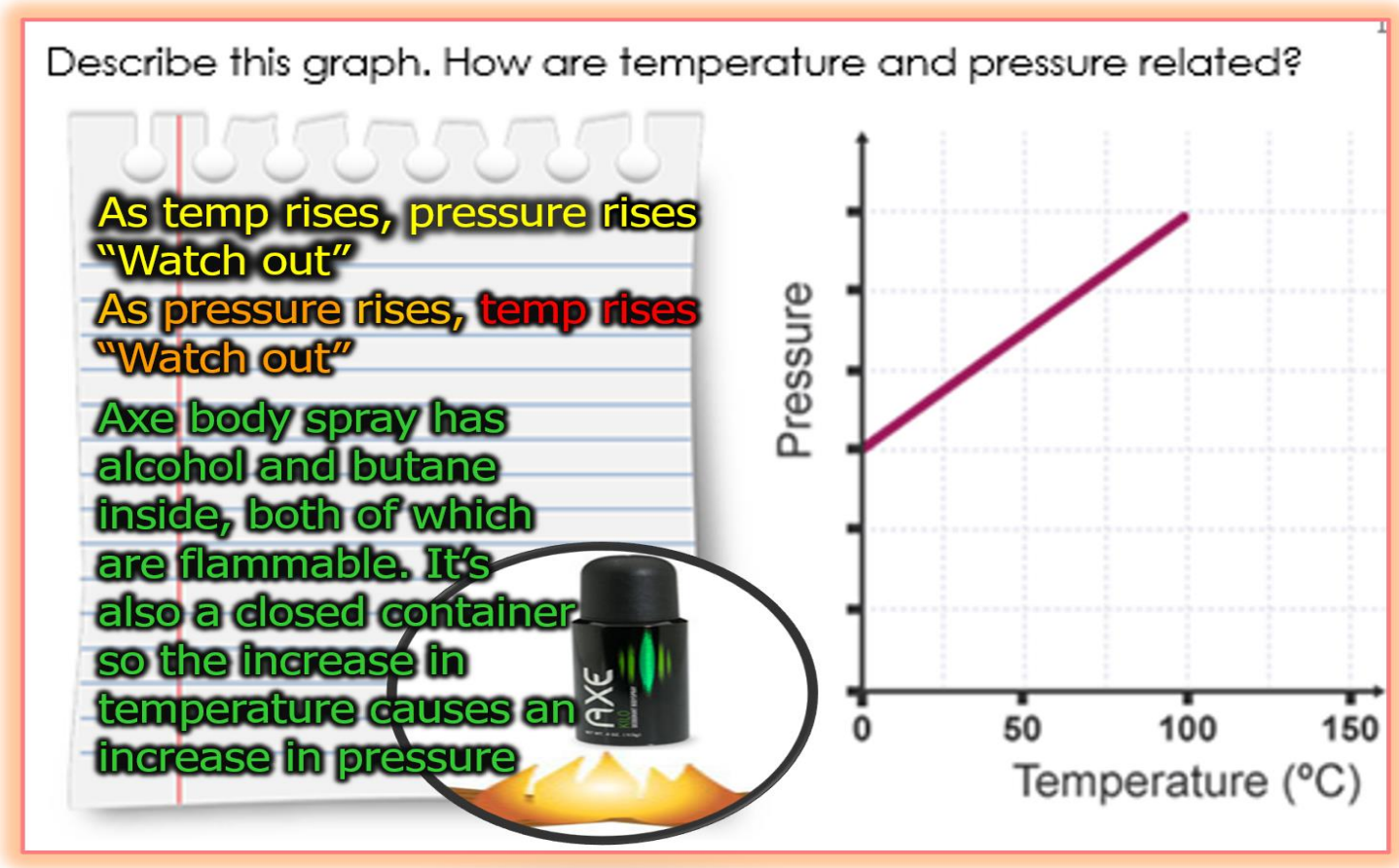


The stream of air moves at high speed. As should be expected from Bernoulli's equation, this stream of air has a lower pressure than the stationary surrounding air. If the ball starts to move to one side of the stream, the high-pressure of the stationary air pushes it back into the stream.

Temperature and Pressure

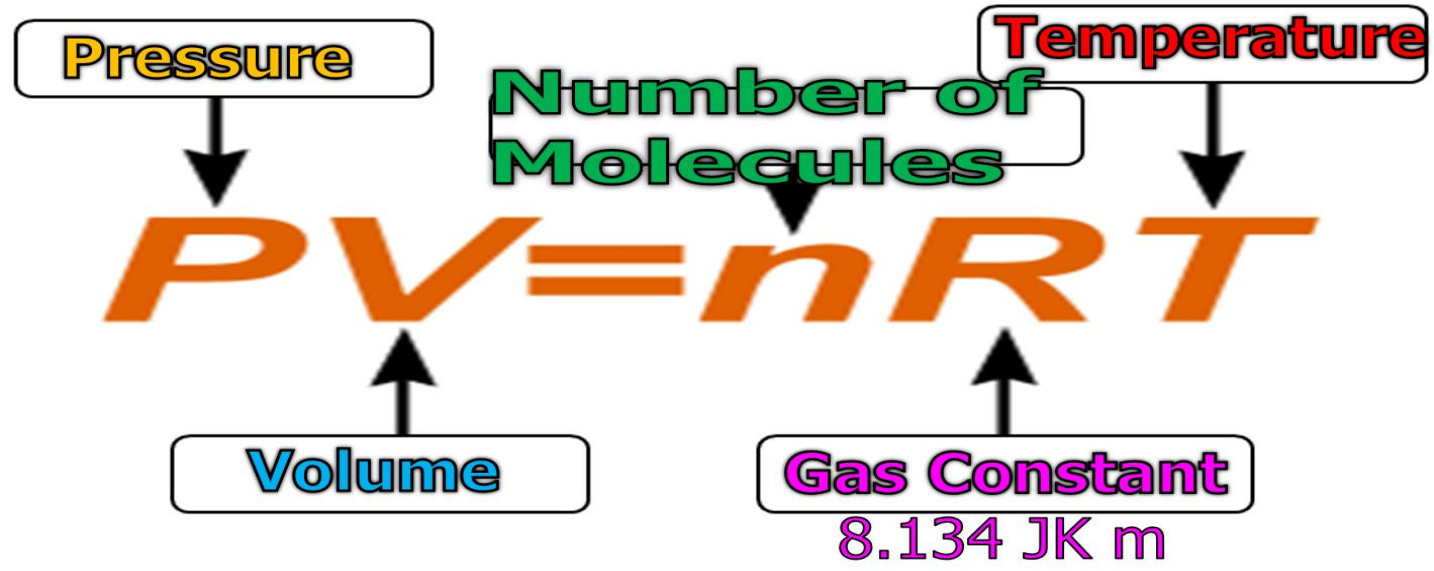
As temperature rises, pressure rises
As pressure rises, temperature rises.

Why is it a bad idea to toss this AXE body spray into a fire? Describe below



Part 2 Lesson 3 Ideal Gas Law, Pascals Law

The ideal gas law: PV = nRT (Pressure times volume equals the number of molecules times the gas constant times temperature)



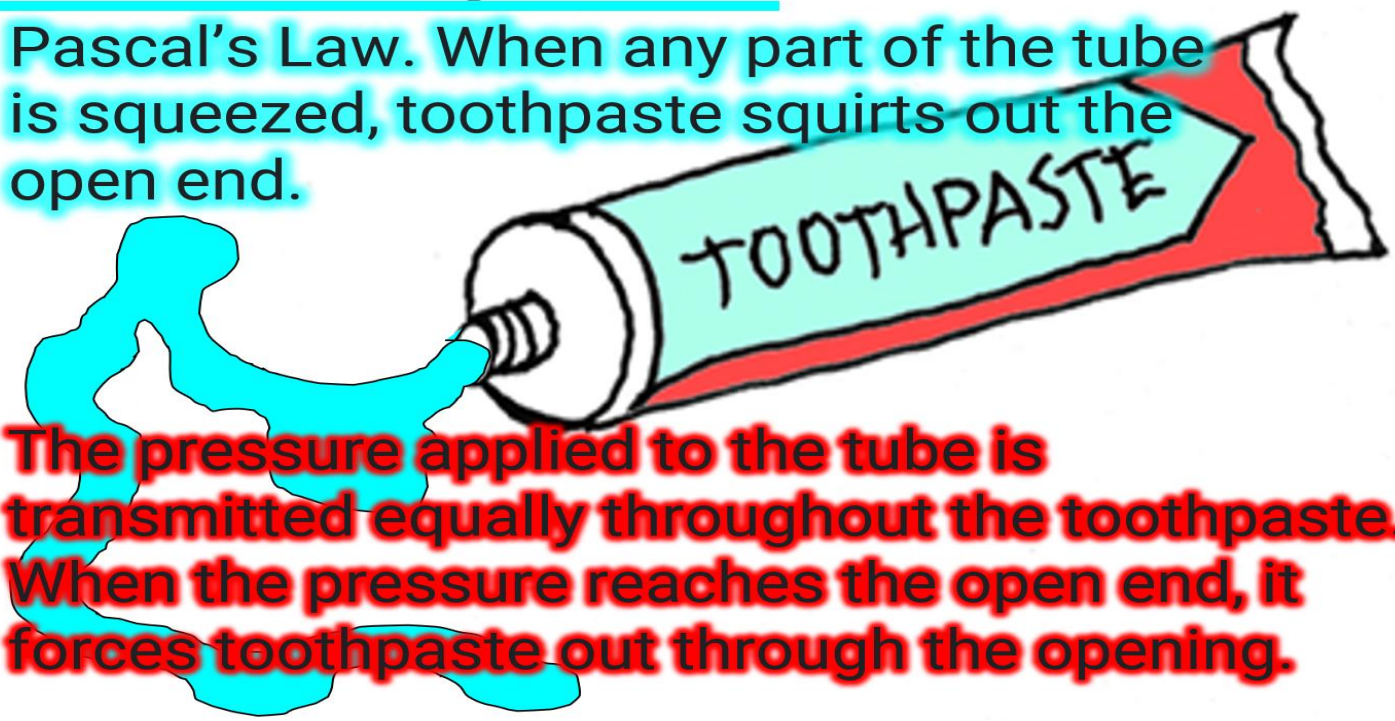
Sketch out a hydraulic syringe drive? How did it work?

Syringe pumps, or syringe drivers, are devices that accurately control the movement of a fluid from a syringe by mechanically inserting or retracting the plunger.

The working of a syringe can also be explained using Boyle's Law. When the plunger of a syringe is pulled out, the volume inside the barrel increases, resulting in a decrease in the pressure inside the barrel. Fluids (such as water) flow from a high pressure area to a low pressure area.

Describe what happens when you squeeze a tube of toothpaste. Make sure to draw a huge mess as well.

Pascal's Law. When any part of the tube is squeezed, toothpaste squirts out the open end.



The pressure applied to the tube is transmitted equally throughout the toothpaste. When the pressure reaches the open end, it forces toothpaste out through the opening.

Part 2 Lesson 4 Viscosity

Viscosity: Resistance of liquid to fluid flow.

High Viscosity = Travels slow because of high resistance.
Low Viscosity = Travels fast because low resistance.

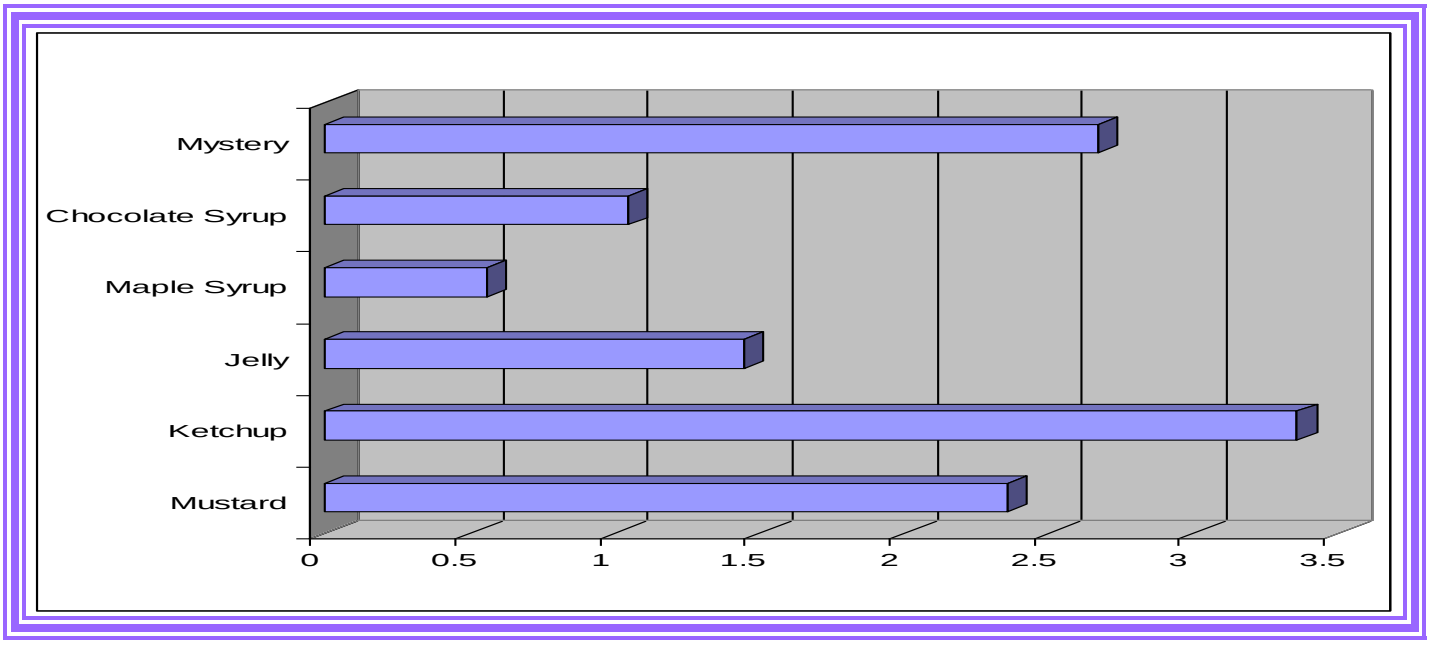
Which has a high viscosity? And which has a low viscosity. It is peanut butter vs. Ketchup

Newtonian and non-Newtonian fluids.

Newtonian fluid will flow the same when a great deal of pressure is applied as when it is left alone.

Non-Newtonian fluids change their viscosity or flow under stress.

Newtonian Fluid	Non-Newtonian Fluid
Water	CREAM
Alcohol	HONEY
Gasoline	TOMATO SAUCE
Mineral Oil	OOBLECK

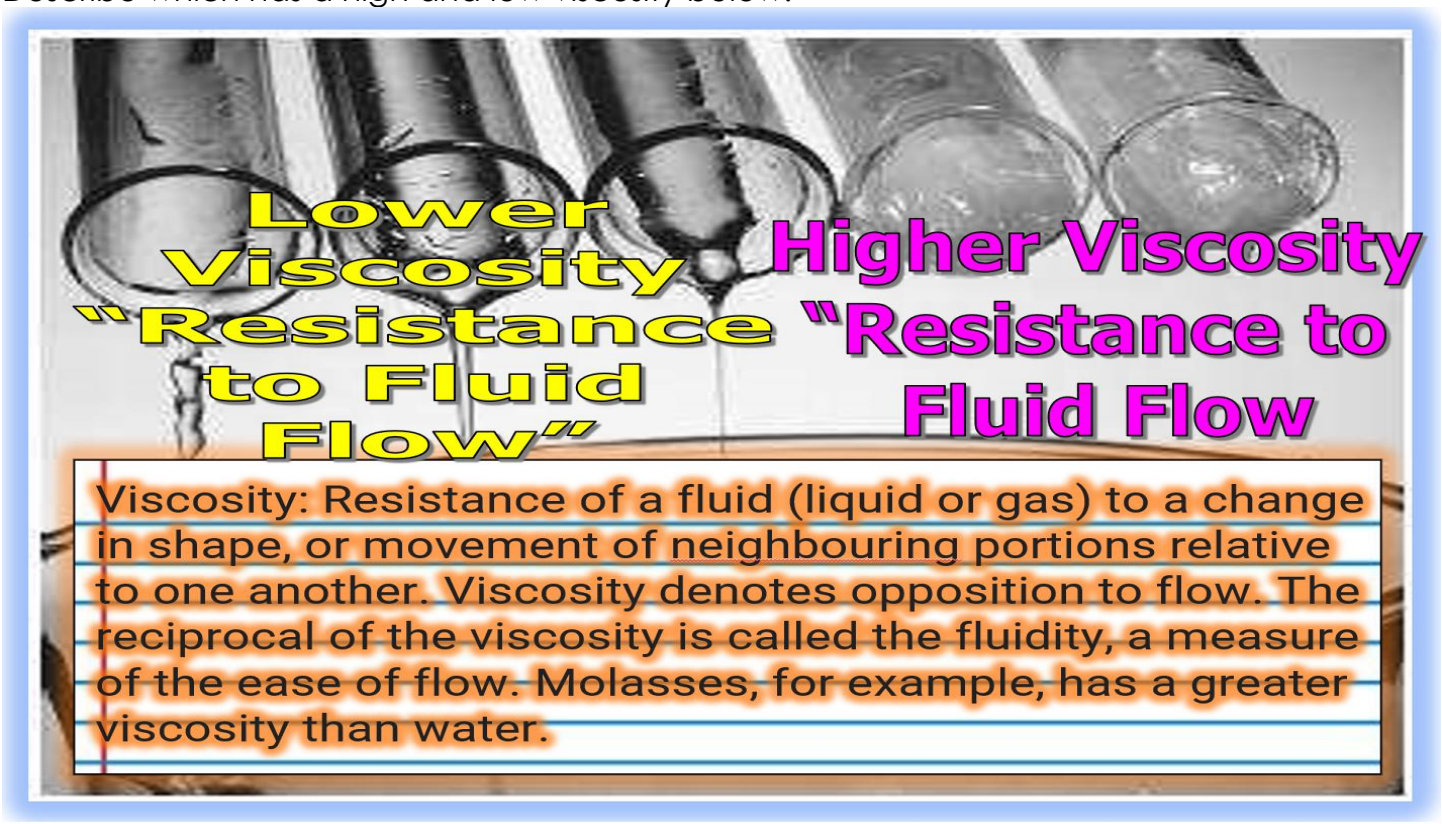


Which fluid won the gold medal, and which finished in last place? Why?
Answers will vary based on the condiments used. Answer: The real maple syrup had the lowest viscosity and traveled quickly down the ramp on to the floor almost immediately after putting it on the ramp.

Name five other fluids and describe their probable viscosity?
Answers will vary

Toothpaste	*Honey*	*Water*	*Dish Soap*	*Mineral Oil*	*Soda*	*Sunscreen*
HIGH Viscosity	*HIGH Viscosity*	*Low Viscosity*	*Medium Viscosity*	*Low Viscosity*	*Low Viscosity*	*Medium Viscosity*

Describe which has a high and low viscosity below.



Part 2 Lesson 5 Archimedes Principle

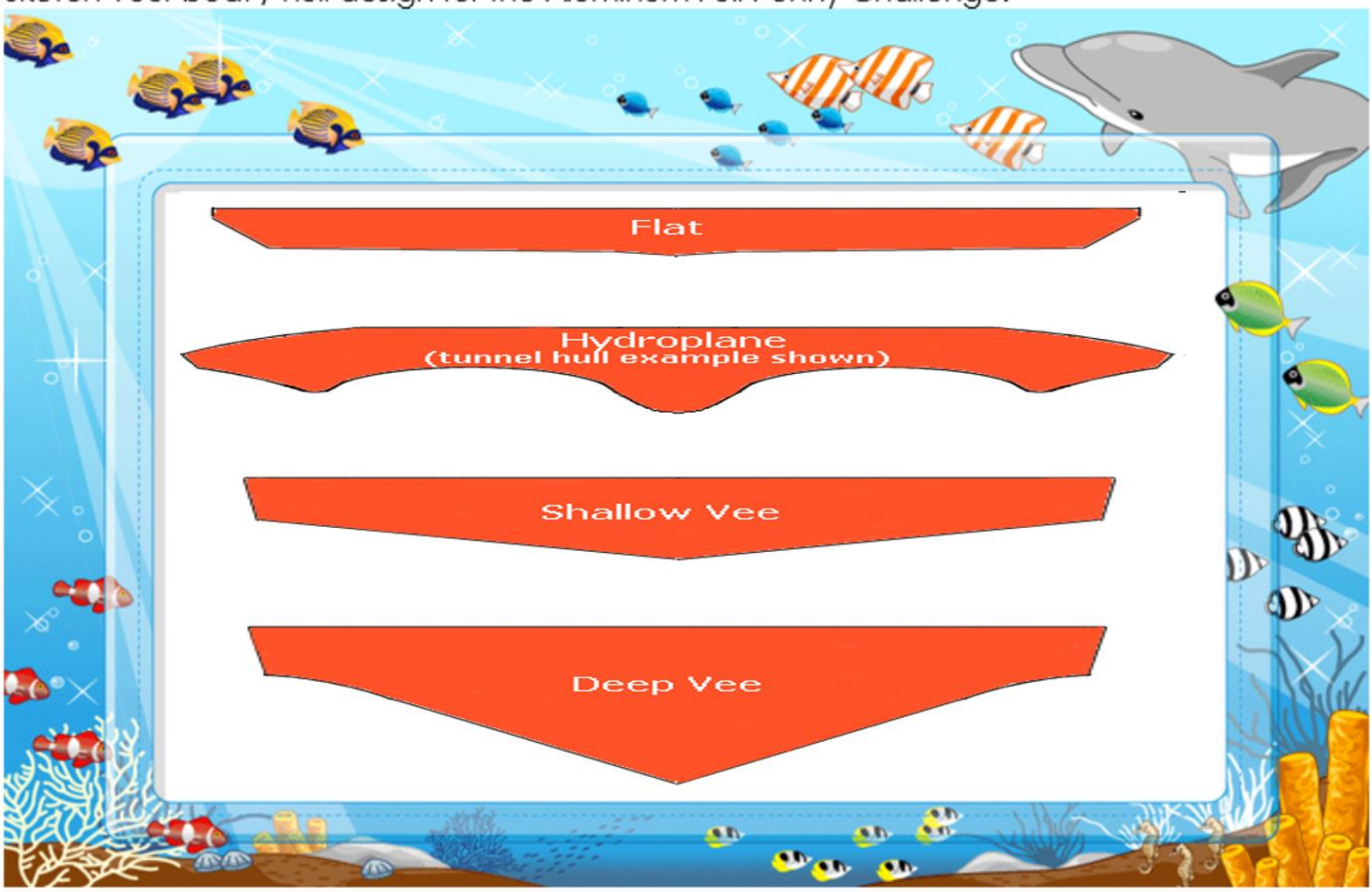
Archimedes Principle: A body that is submerged in a fluid is buoyed up by a force equal in magnitude to the weight of the fluid that is displaced.

Density: How much mass is contained in a given volume. We use grams/cm³
(grams per cubic centimeter)
Density = Mass divided by volume

Please determine the densities of the following characters. Who is most and least dense?

Least Dense Donkey Kong, Least, Most Dense Goomba

Sketch Your boat / hull design for the Aluminum Foil Penny Challenge.



Part 2 Lesson 6 Cartesian Diver

Building your Diver – Spend a minute to decorate your diver with tape and other materials (It can't be weighed down to much and needs to fit into the top of a soda bottle.)

Fill the water glass with water and place the medicine dropper in the glass. Get some water inside the dropper by squeezing the rubber bulb while the end is in the water. You want to get the dropper to just barely float upright in the water. Once you've done this, place the dropper in the full soda bottle and screw on the cap tightly. Don't allow much air to be between the top of the bottle and the cap.

Procedure – Perform two of the following activities.
#1) Gently squeeze the bottle. As you squeeze, the diver will dive (sink) to the bottom of the bottle. If you stop squeezing, the diver floats back to the top.
#2) Try and see how controlled a diver you are and mark a line on the bottle. See if you can diver and hold near the line for one minute
#3) Quietly challenge a friend by timing how long it takes you to do 8 laps from the top to the bottom.
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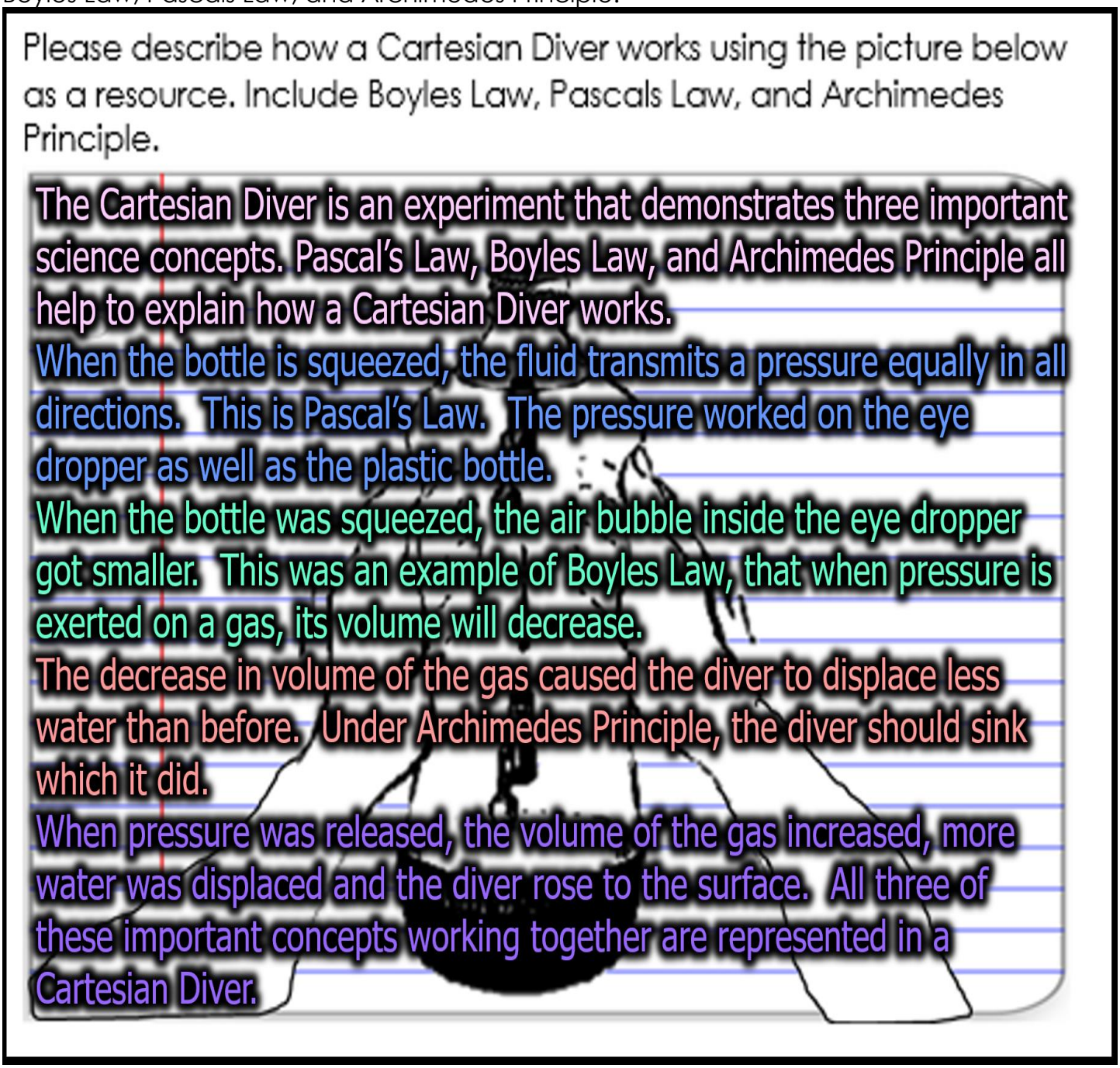
Please describe how a Cartesian Diver works using the picture below as a resource. Include Boyles Law, Pascals Law, and Archimedes Principle.



Across

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2. The _____ of the gas is proportional to the average kinetic energy of the molecules.
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8. a substance or matter in a state in which it will expand freely to fill the whole of a container, having no fixed shape (unlike a solid) and no fixed volume (unlike a liquid).
9. The _____ (Decompression Sickness) – Bubbles form in blood if you rise too quickly because of the rapid decrease in pressure.
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Down

1. This type of fluid will flow the same when a great deal of force is applied as when it is left alone.
3. _____ Law: If you apply pressure to fluids that are confined (or can't flow anywhere), the fluids will then transmit (or send out) that same pressure in all directions at the same rate.
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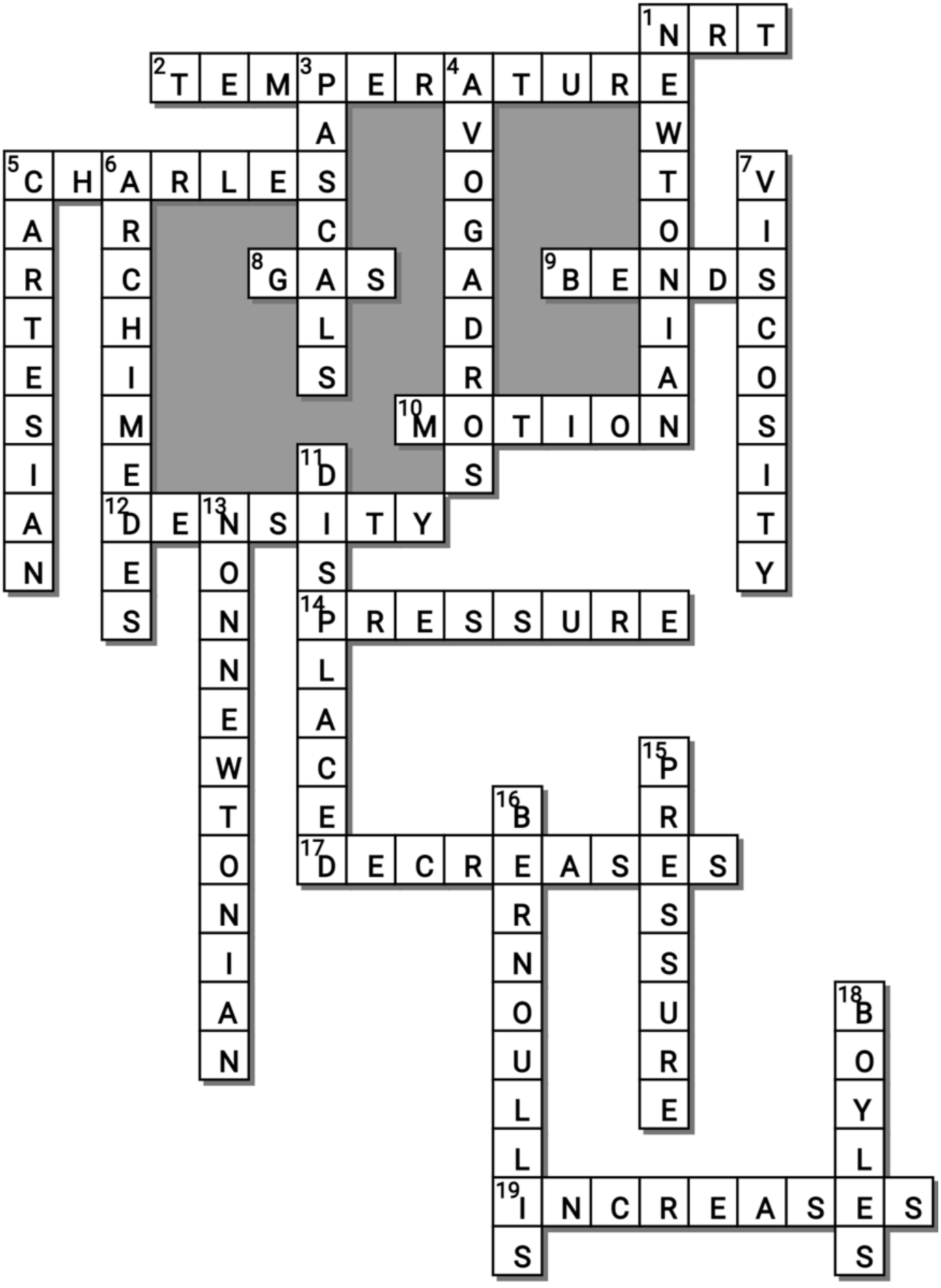
18. _____ Law: Pressure and Volume are inversely proportional.

----------Teacher can remove this word bank to make more challenging----------

Possible Answers

ARCHIMEDES, AVOGADROS, BENDS, BERNOULLIS , BOYLES , CARTESIAN, CHARLES, DECREASES, DENSITY, DISPLACED, GAS, MOTION, NEWTONIAN, NON-NEWTONIAN, PASCALS, PRESSURE , VISCOSITY, INCREASES, NRT, PRESSURE , TEMPERATURE


1 NRT
2 TEMP 3 PERATURE 4
AVOGADRO
WTO
5 CHARTESIAN
6 ARLES
ARCHIMEDES
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7 VISCOSITY
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10 MOTION
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12 DENSITY
13 NONNEWTONIAN
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14 PRESSURE
LACE
15 PRESSURE
16 BERNOULLI
17 DECREASES
18 BOYLES
19 INCREASES

Part 2 Gas Laws

Name:

1-20 = 5 pts Part 1 Lesson 5

Due: Today

*20-*25 * = Bonus + 1 pt,

(Secretly write owl in correct space +1 pt)

Score ____ / 100

Final Question = 5 pt wager

UNDER PRESSURE	BOTTLED UP	GOO GOO	BOY E	SLIMED Bonus round 1pt each
1) P = Pressure T = Temperature K = Constant	6) kPa = Kilopascals PSI = Pounds per square inch	11) A=Pressure B=Temperature C=# of Moles D=K gas Constant E=Volume	16) Letter B and Letter C	*21) Ghostbusters
2) Charles Law	7) The Bends. If you rise too quickly	12) Pascal's Law	17) **Archimedes Principle**	*22) Nickelodeon
3) Boyles Law	8) Bernoulli's Principle	13) Hydraulics	18) Coke has the higher Density b/c it sank	*23) The Day After Tomorrow
4) volume decreases. pressure increases	9) As pressure increases, temperature increases. As pressure decreases, temperature decreases.	14) Viscosity	19) Yoshi was the most dense	*24) Garbage Patch Kids
5) Avogadro's Law	10) They Explode!	15) Viscosity is resistance to flow. Letter A has the lowest resistance to flow or lowest viscosity.	20) Pascals Laws Boyles Law Archimedes Principle	*25) Jabba the Hutt

Final Question Wager ___ /5 Answer: Temperature High, Pressure Low, Temperature Low, Pressure High