

# INVESTIGATING MATTER:

**How**  
**COOL**  
**Are You?**



# HOW COOL ARE YOU KITS

- Bell
- Thermometer
- Digital scale
- Hand warmers & cloths
- Mystery letter cards
- Paper cups
- Instruction sheets
- Molecule set

\*Investigator Journal



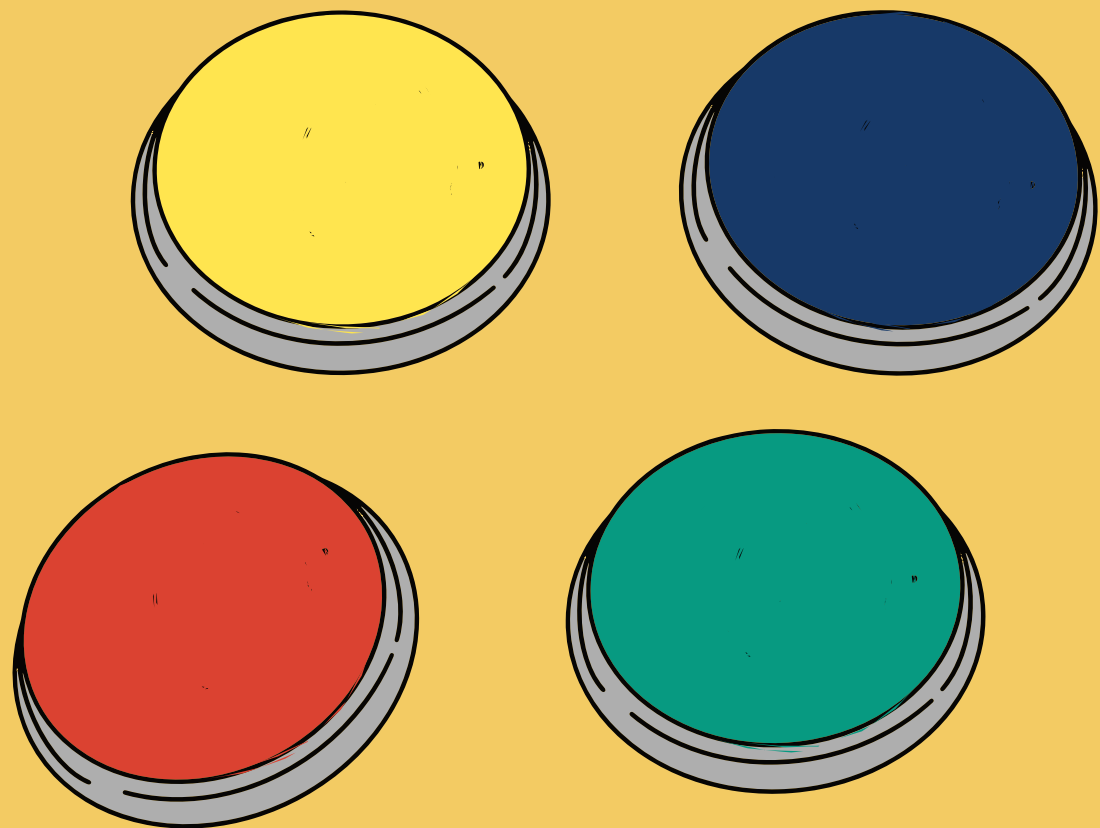
# MYSTERY LETTERS



# CASE #1



THE PARTICLE MODEL QUIZ...SHOW WHAT YOU KNOW



Be the **FIRST** group to *buzz in*  
to answer each question!

# QUESTION

#1



# WHEN A SUBSTANCE HEATS UP, WHAT HAPPENS TO THEIR PARTICLES?

**A**



**B**



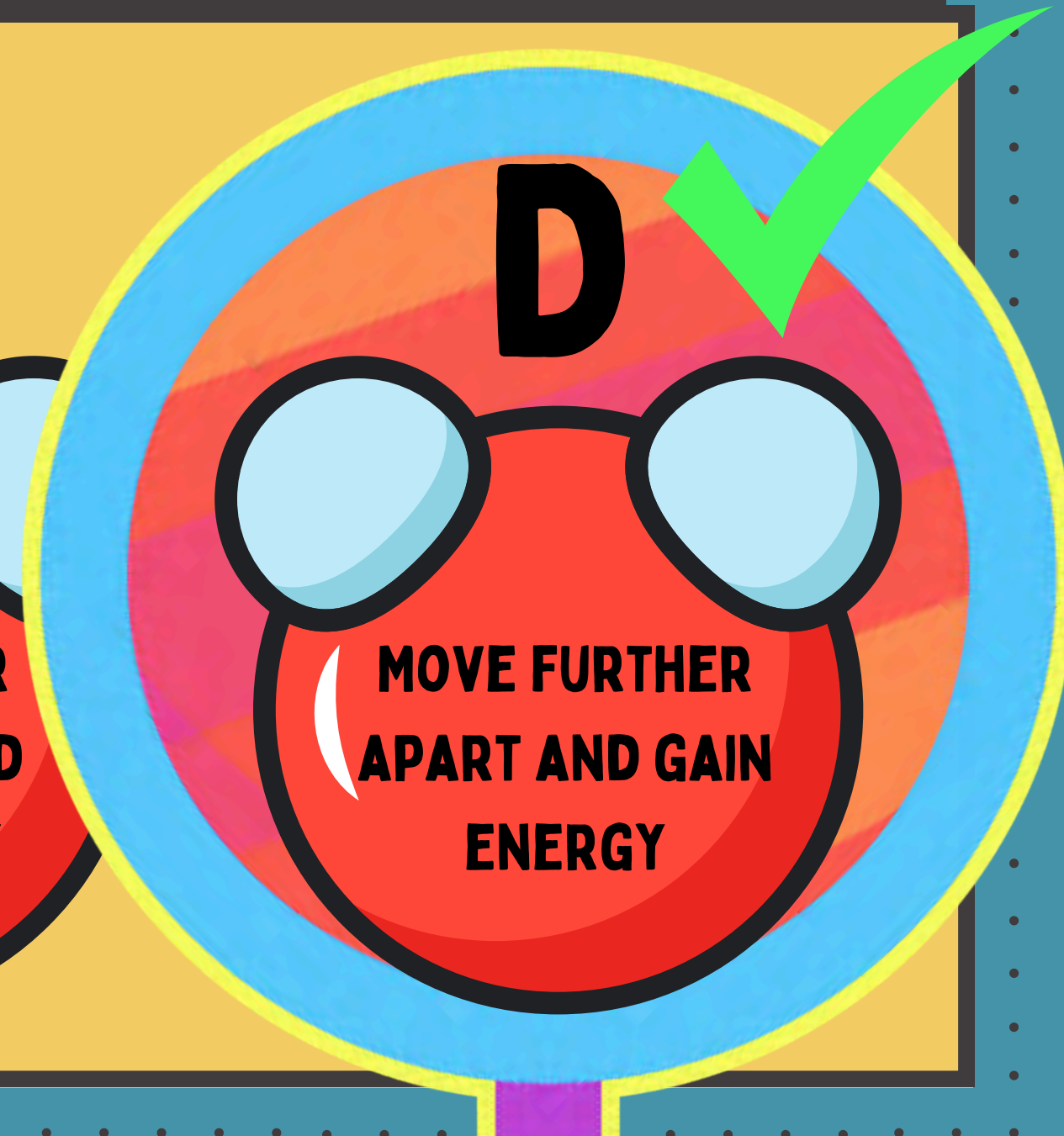
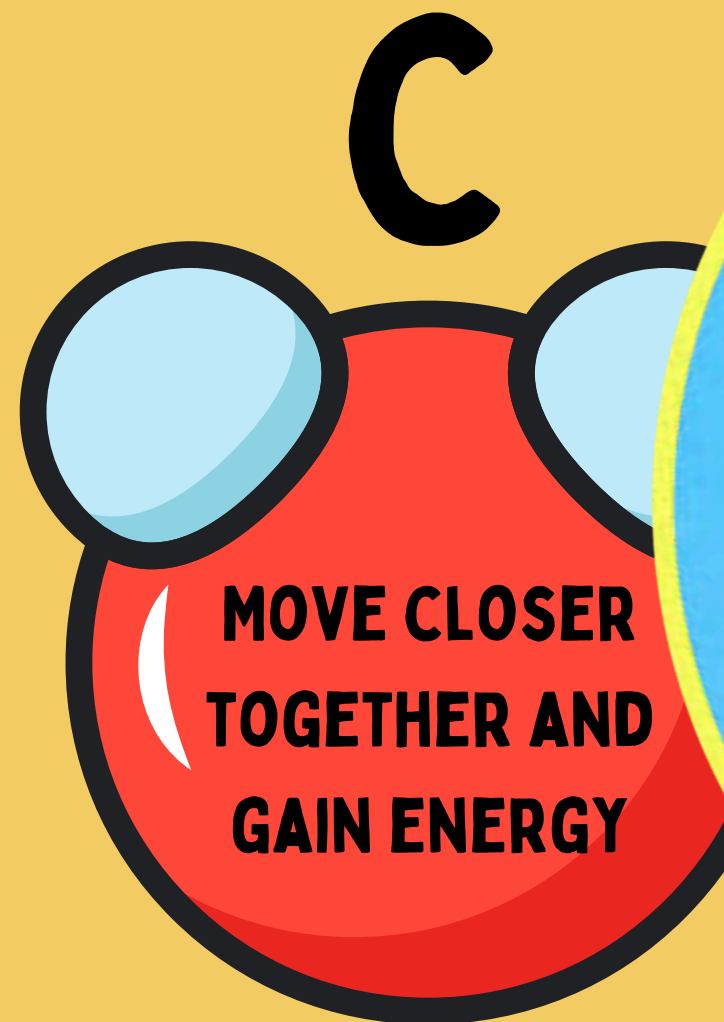
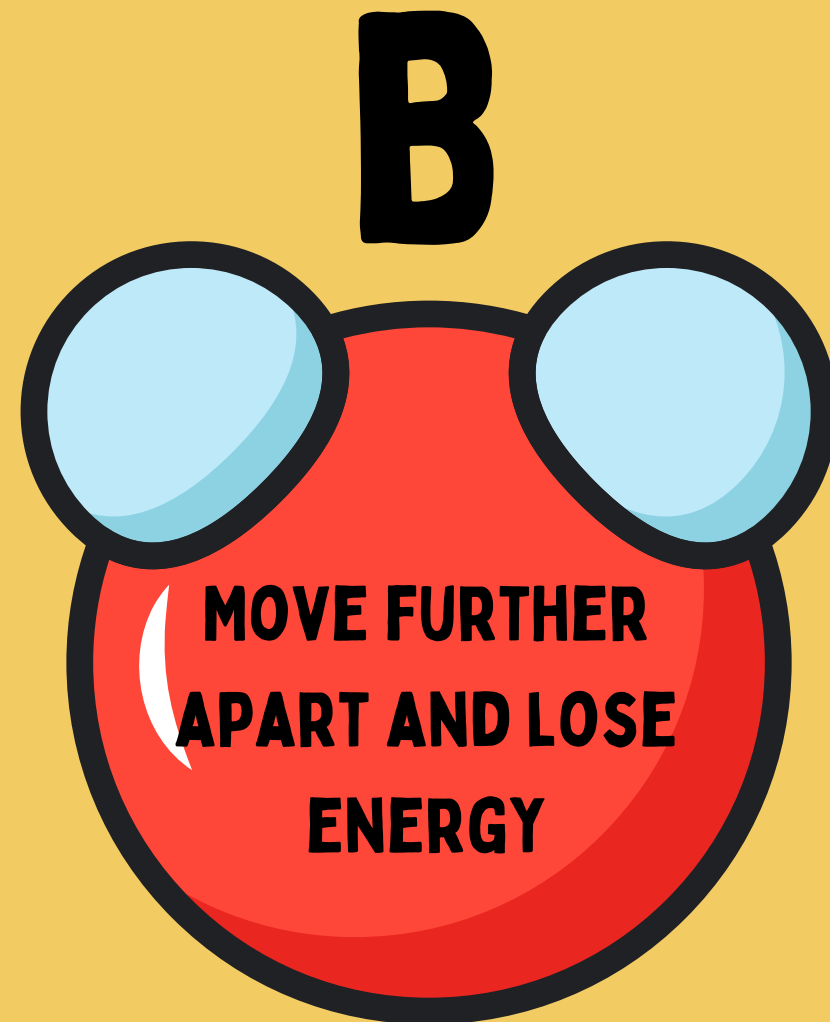
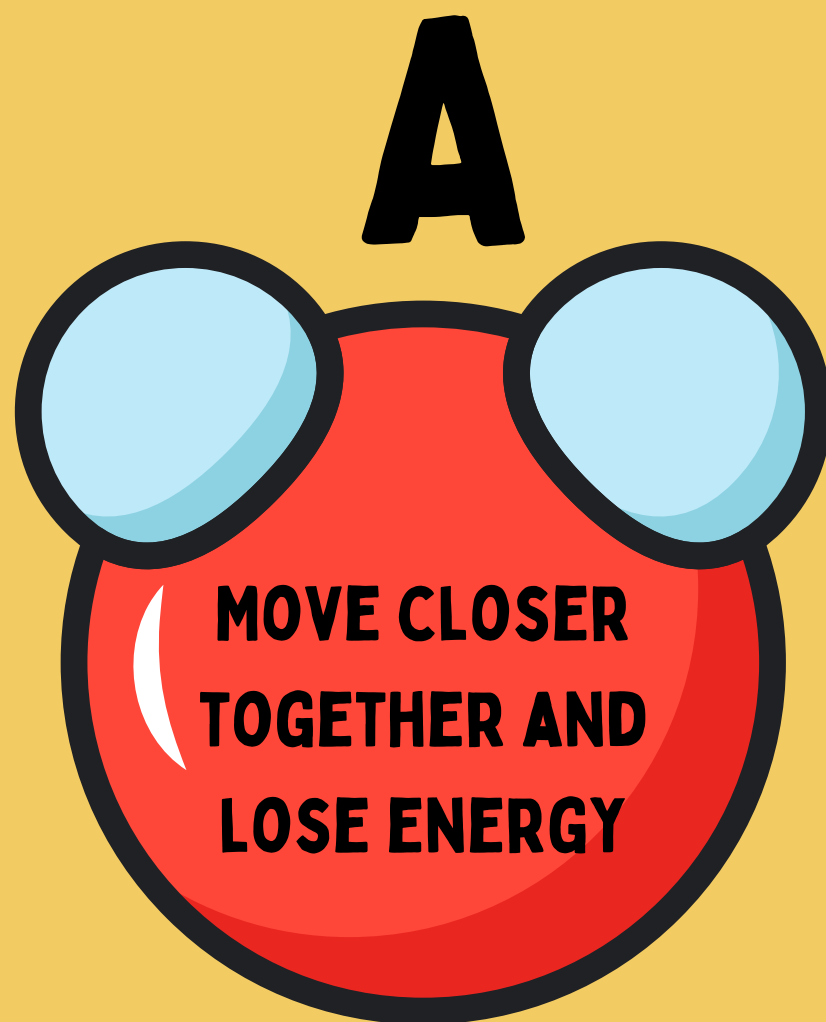
**C**



**D**



# WHEN A SUBSTANCE HEATS UP, WHAT HAPPENS TO THEIR PARTICLES?

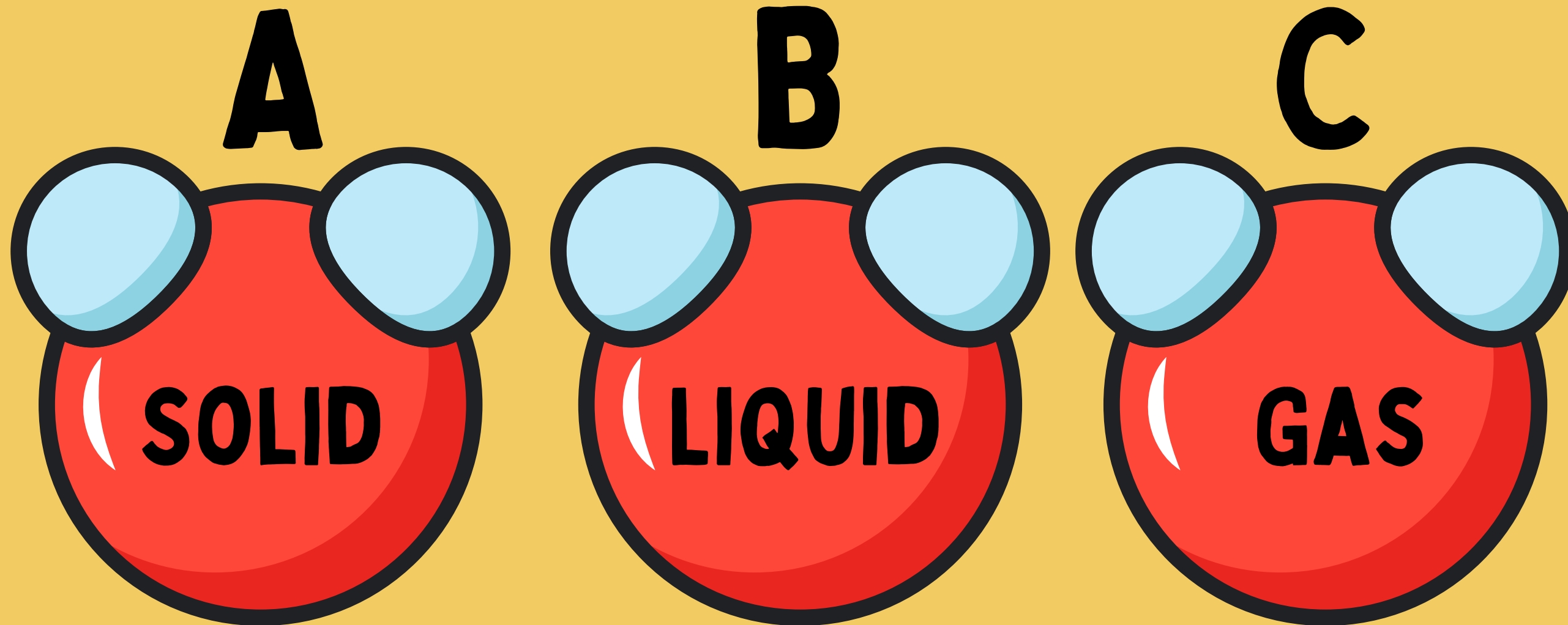


# QUESTION

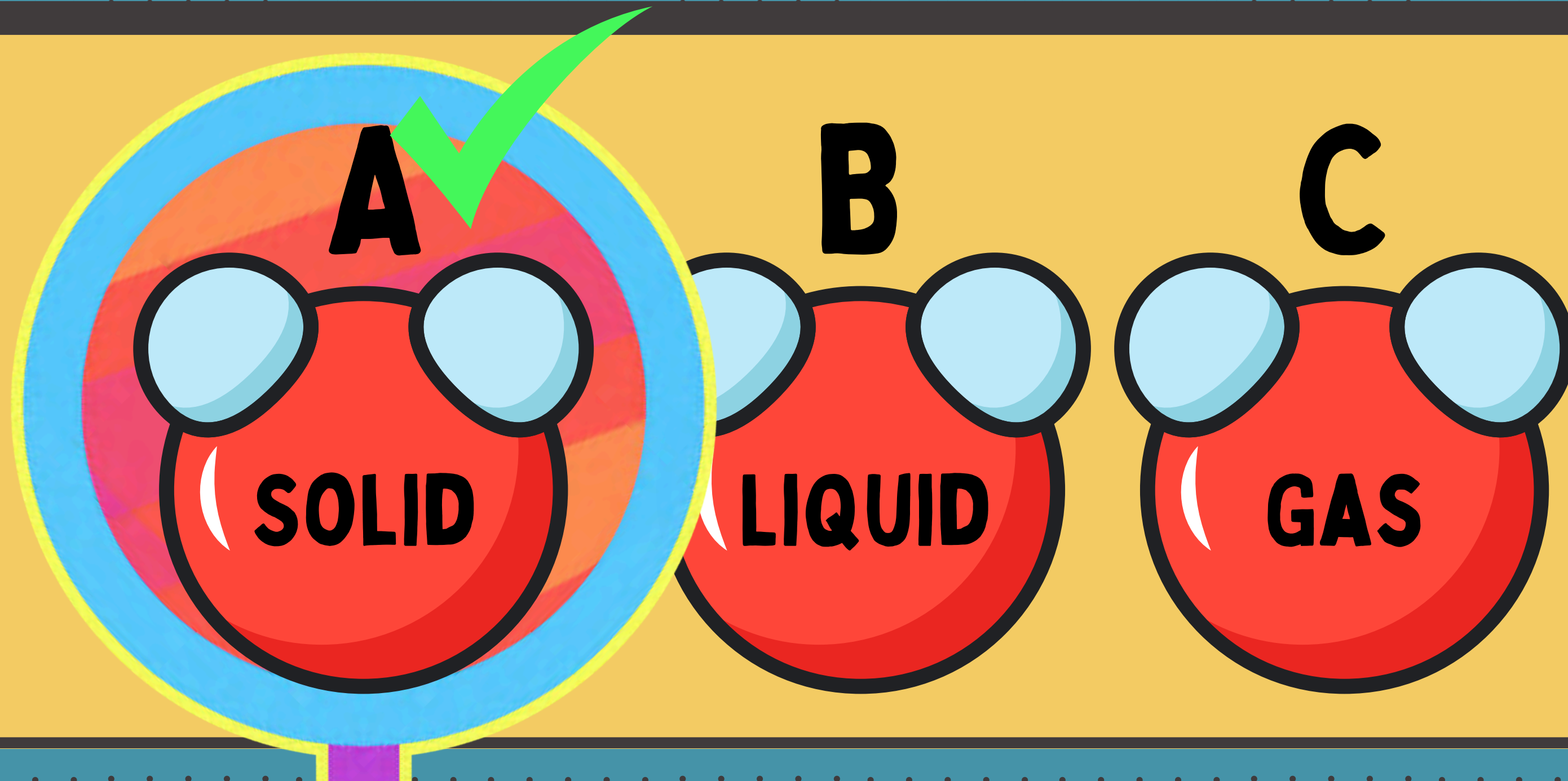
#2



**WHICH STATE OF MATTER DOES NOT  
SPREAD OUT AND KEEP ITS SHAPE?**



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SPREAD OUT AND KEEP ITS SHAPE?**



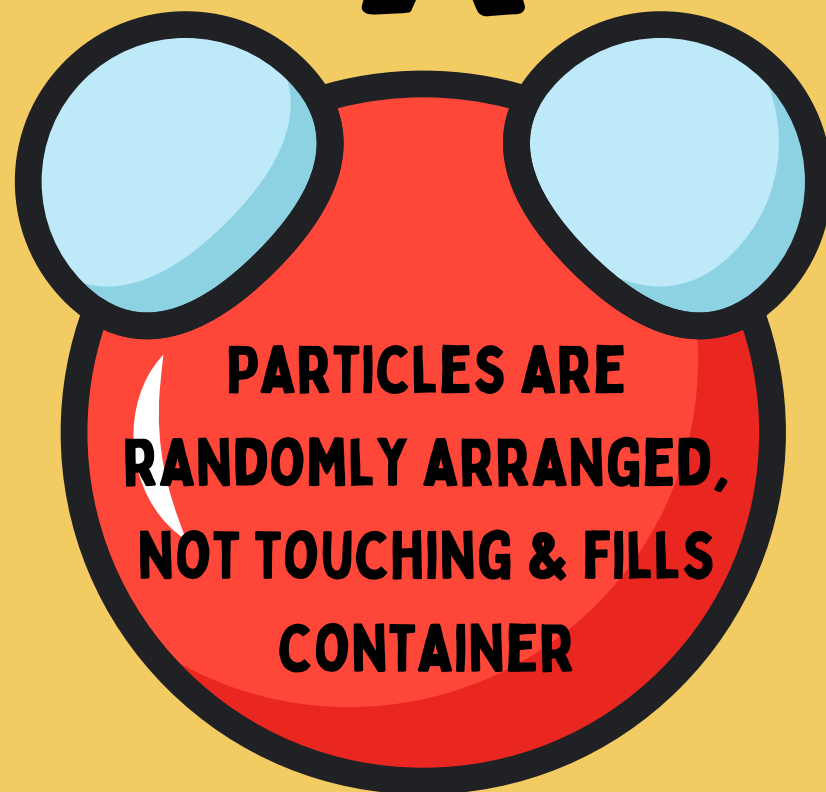
# QUESTION

#3

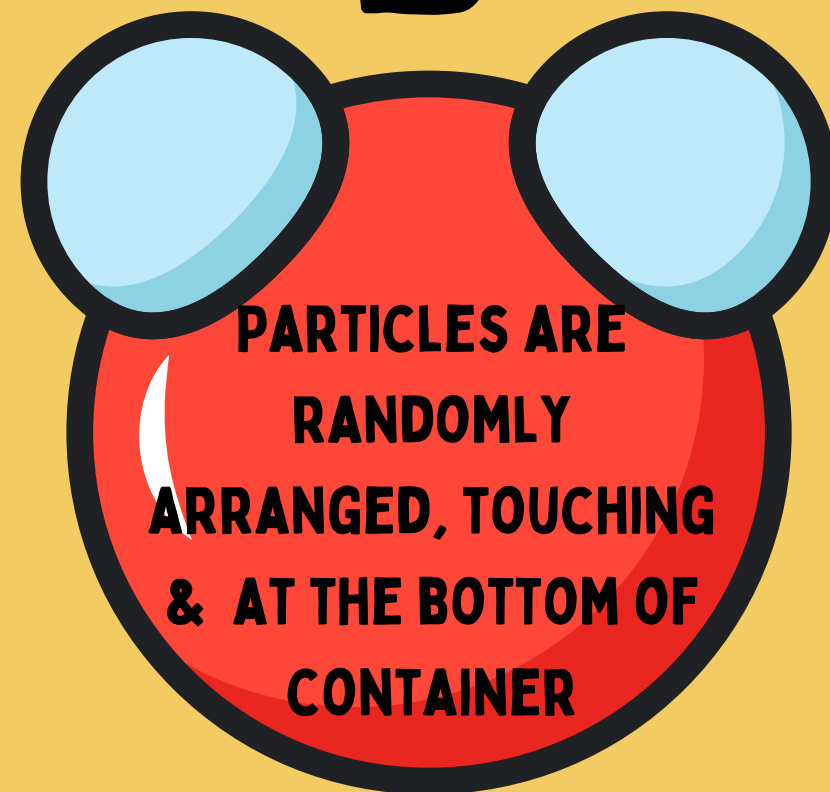


# WHICH OF THESE DESCRIBES A SOLID?

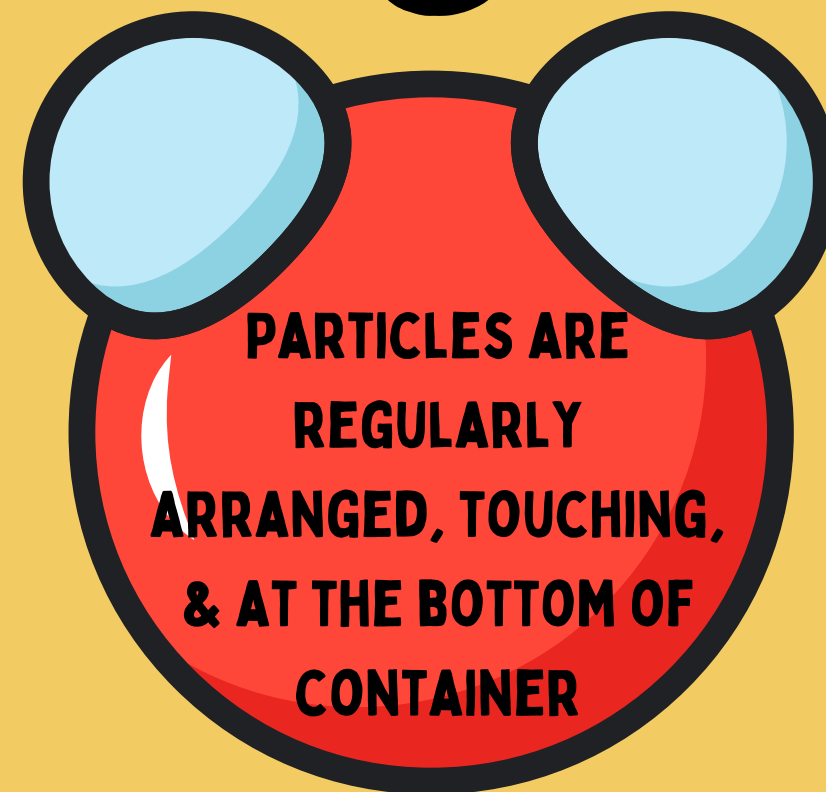
**A**



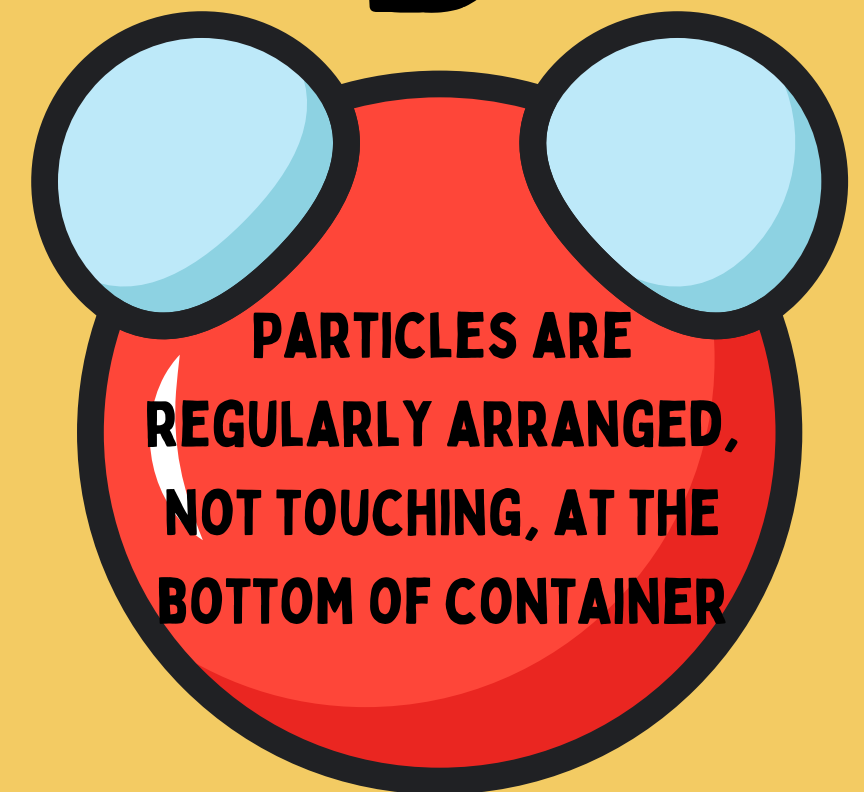
**B**



**C**

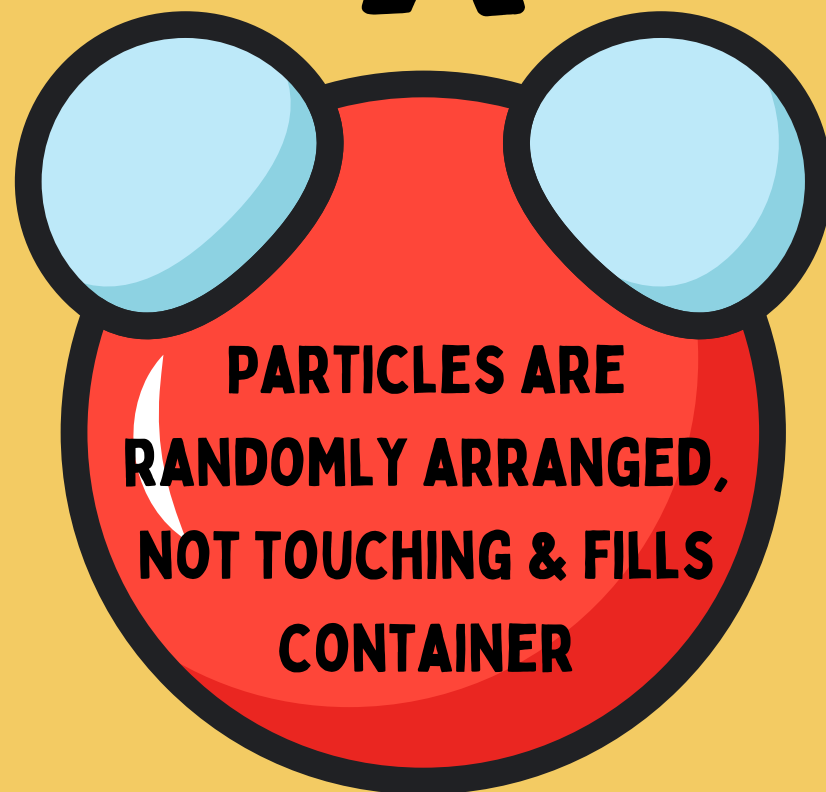


**D**

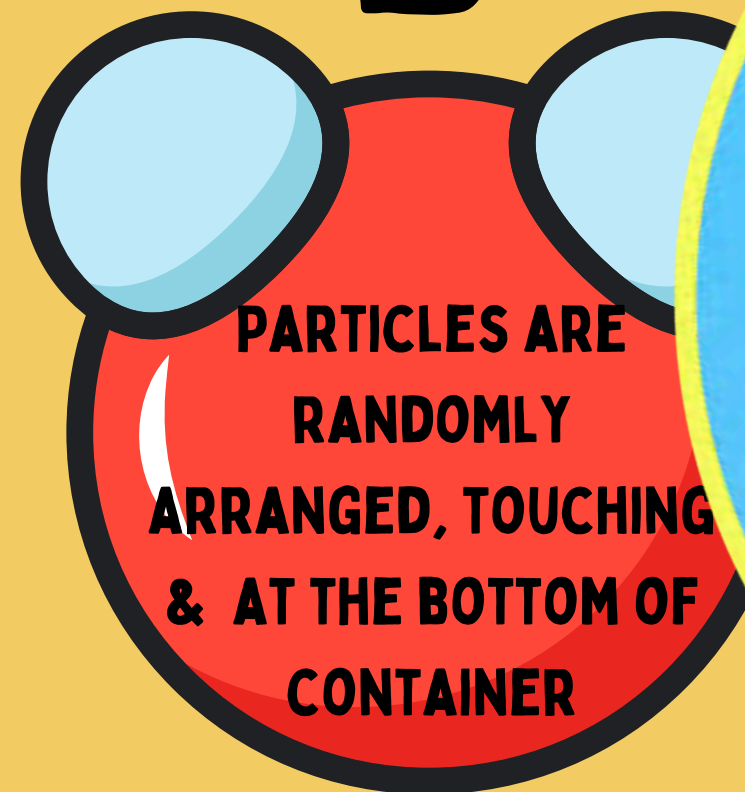


# WHICH OF THESE DESCRIBES A SOLID?

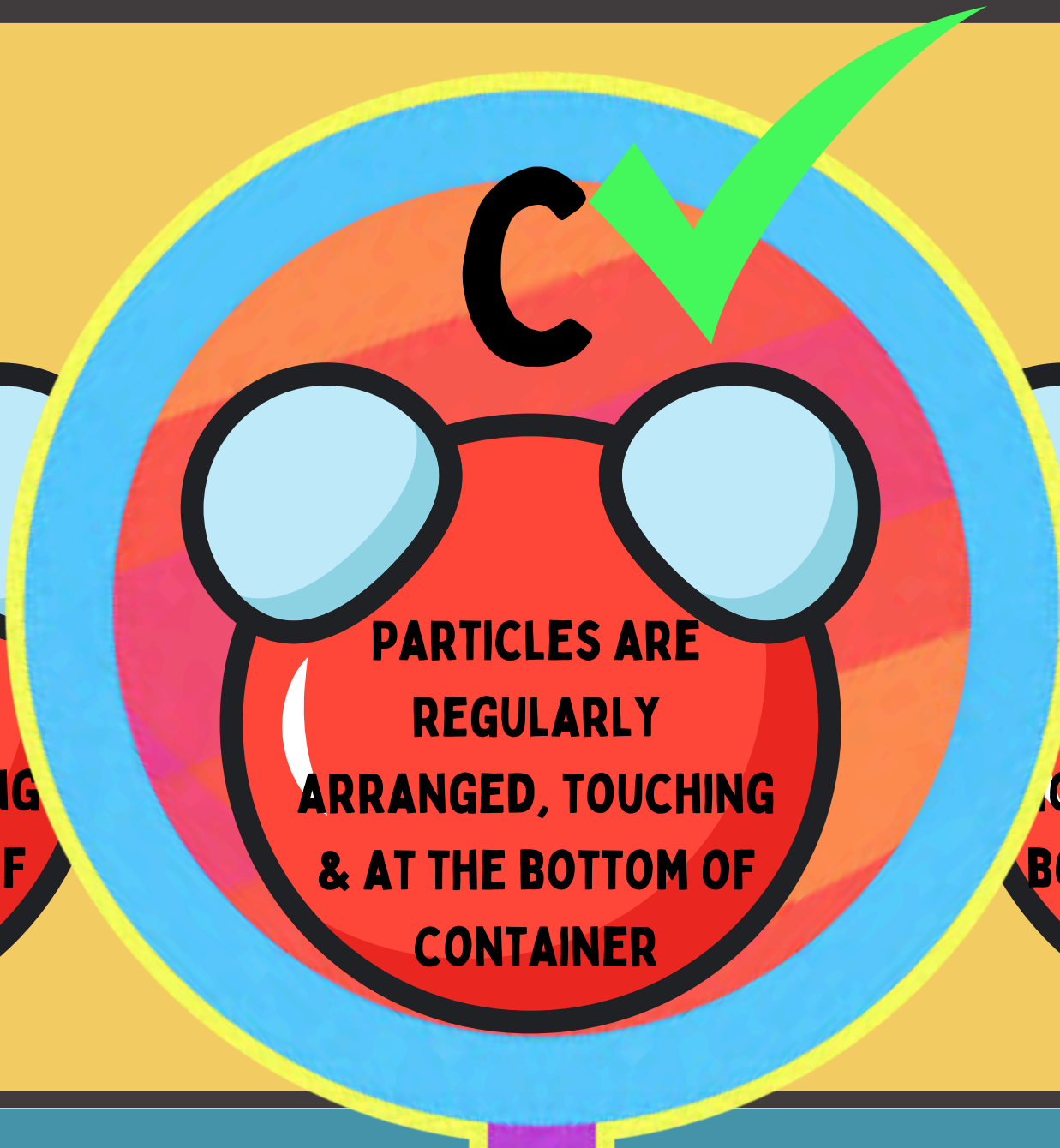
**A**



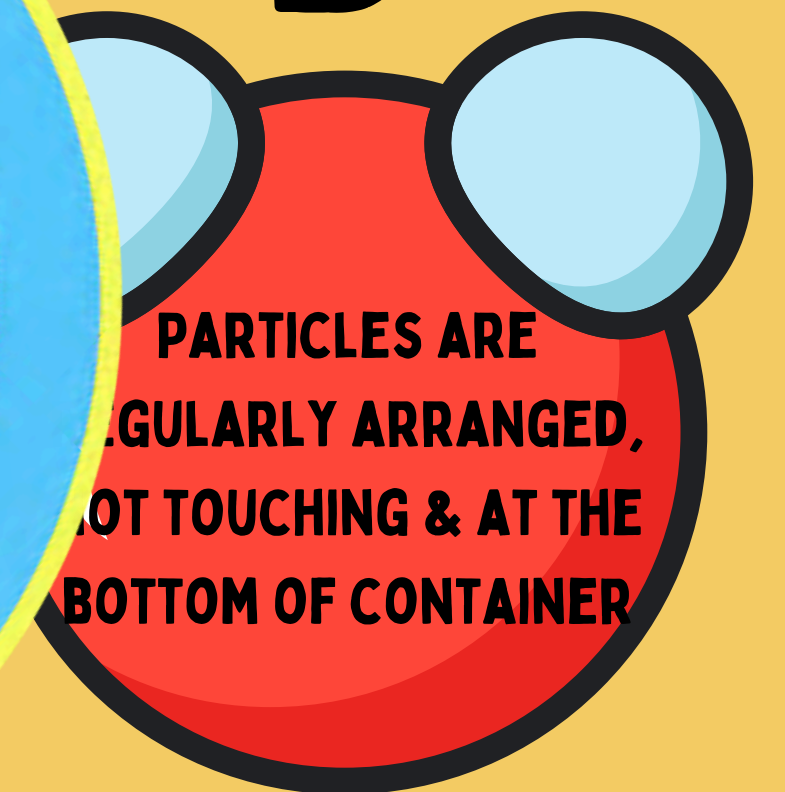
**B**



**C**



**D**

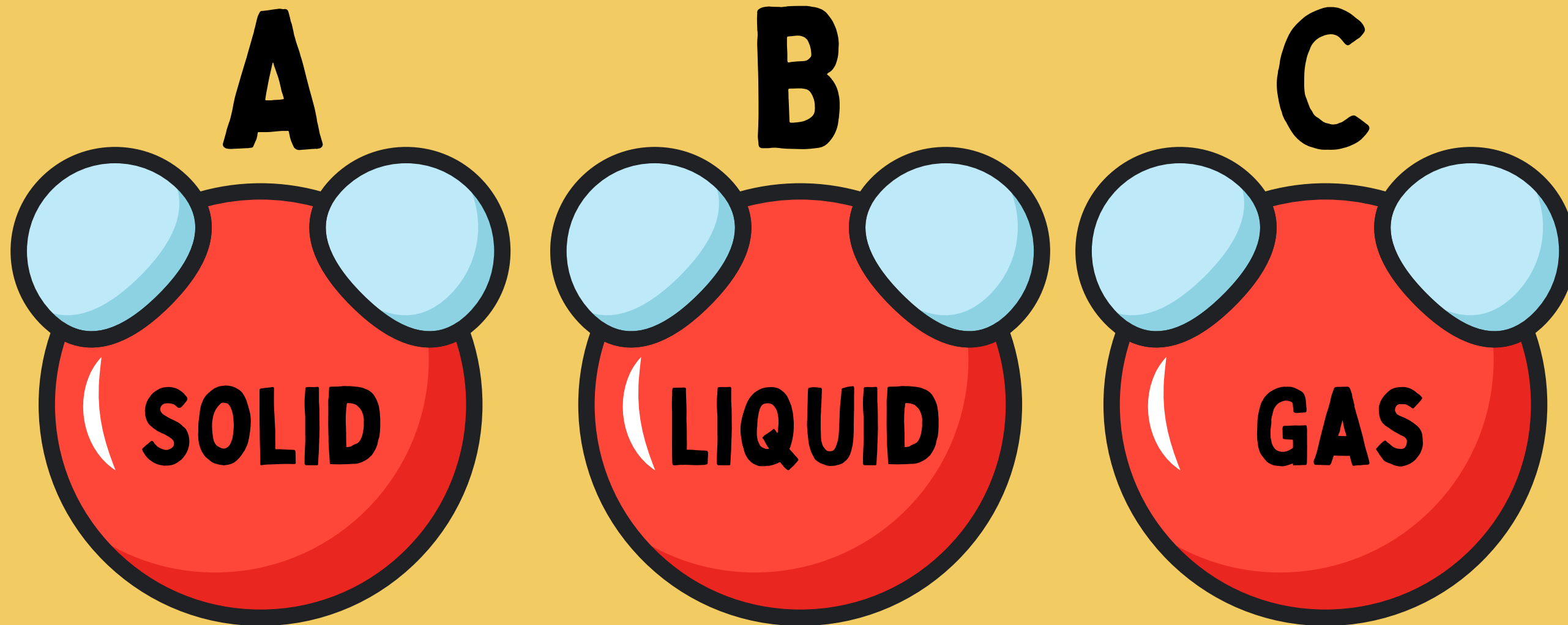


# QUESTION

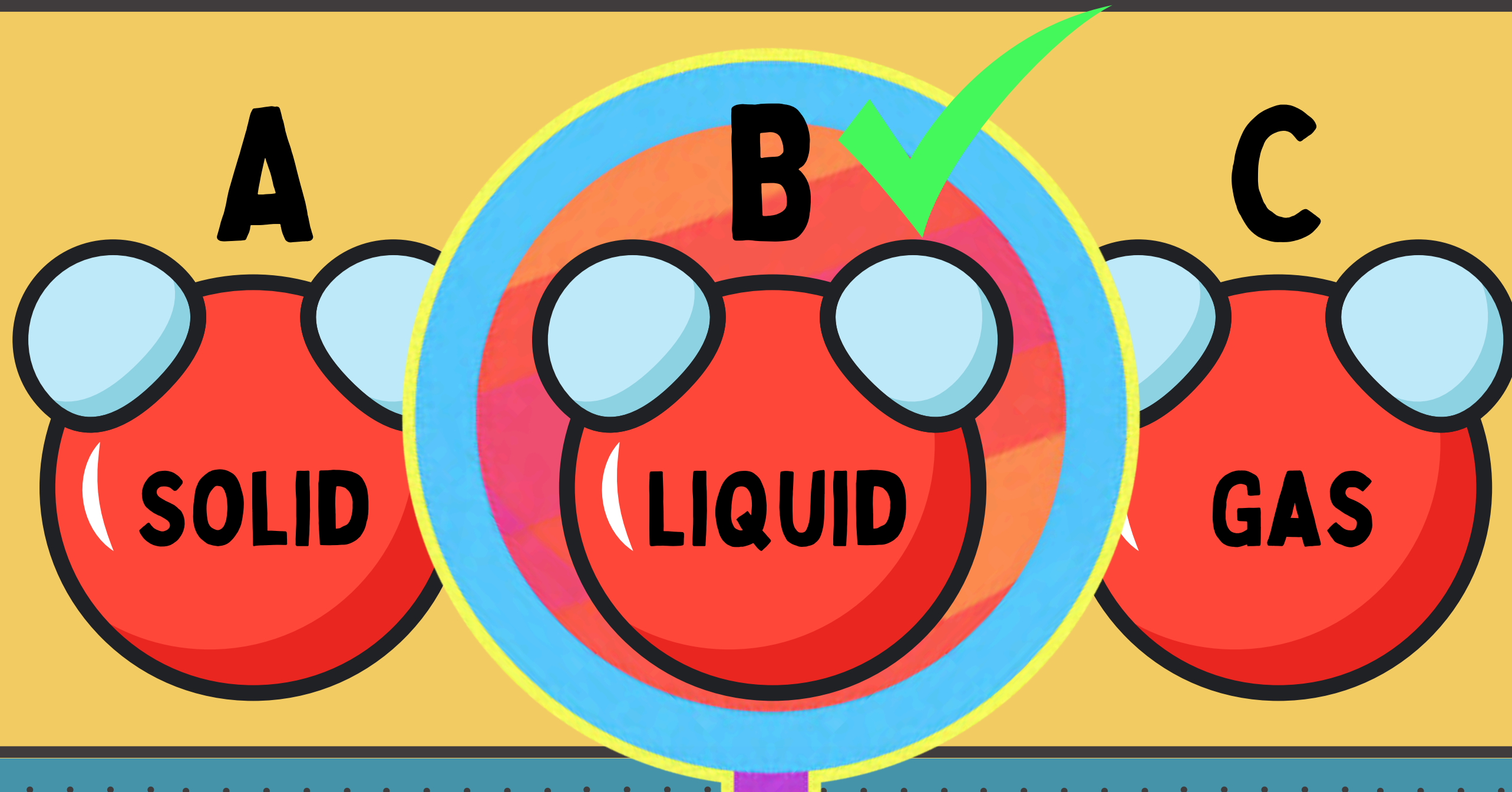
#4



**WHICH STATE OF MATTER SPREADS OUT TO  
FILL THE BOTTOM OF ITS CONTAINER?**



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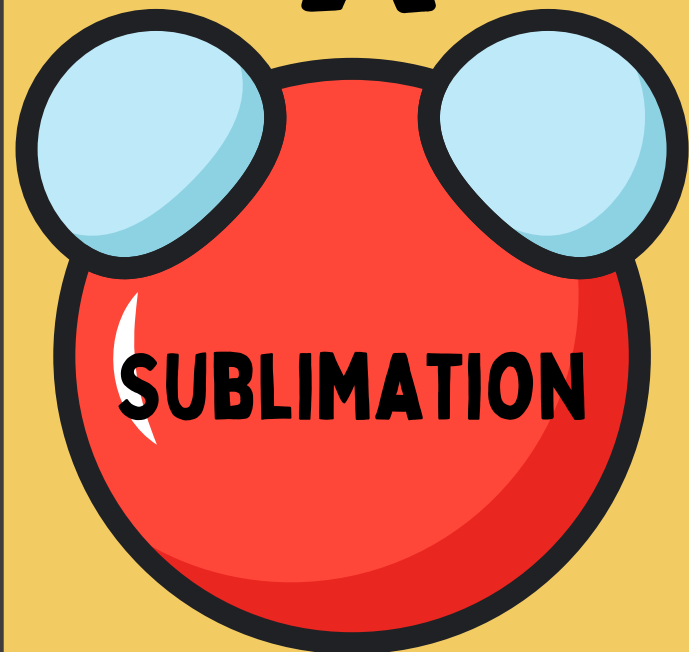
# QUESTION

#5



**WHAT IS THE PROCESS OF GOING FROM A LIQUID TO A GAS CALLED?**

**A**



**SUBLIMATION**

**B**



**BOILING**

**C**



**FREEZING**

**D**



**EVAPORATION**

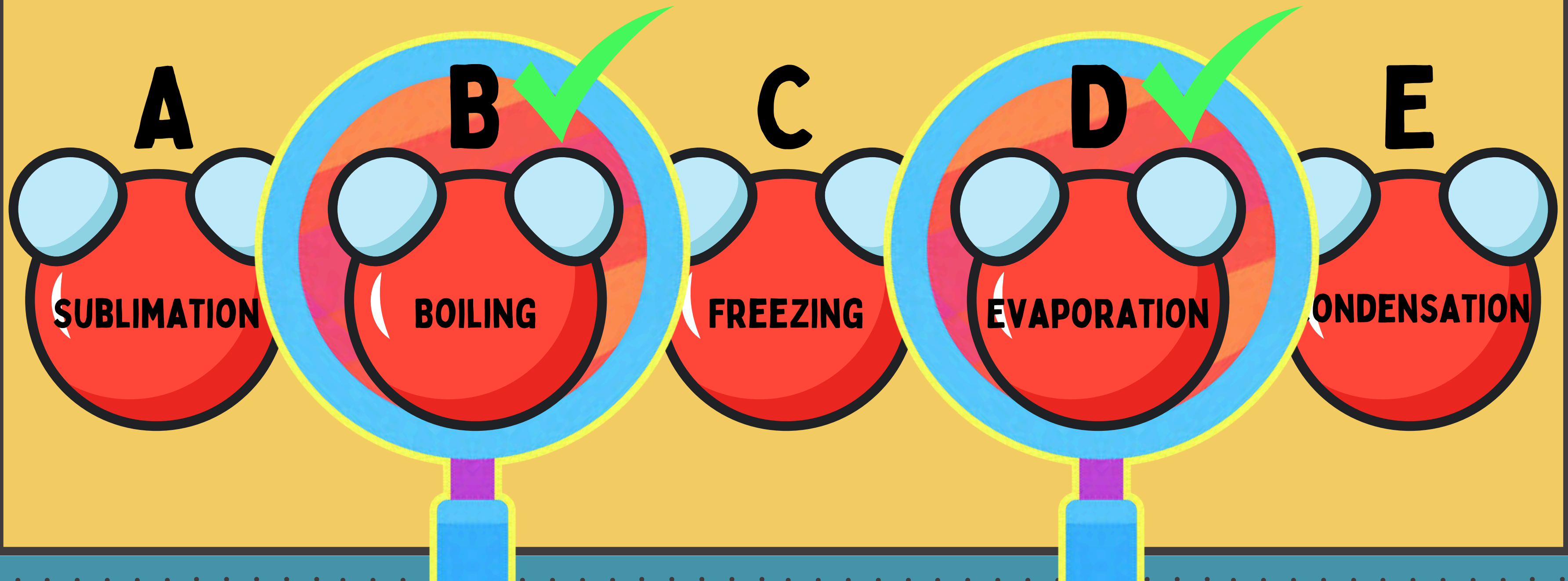
**E**



**CONDENSATION**

**HINT: THERE ARE TWO ANSWERS**

**WHAT IS THE PROCESS OF GOING FROM A LIQUID TO A GAS CALLED?**

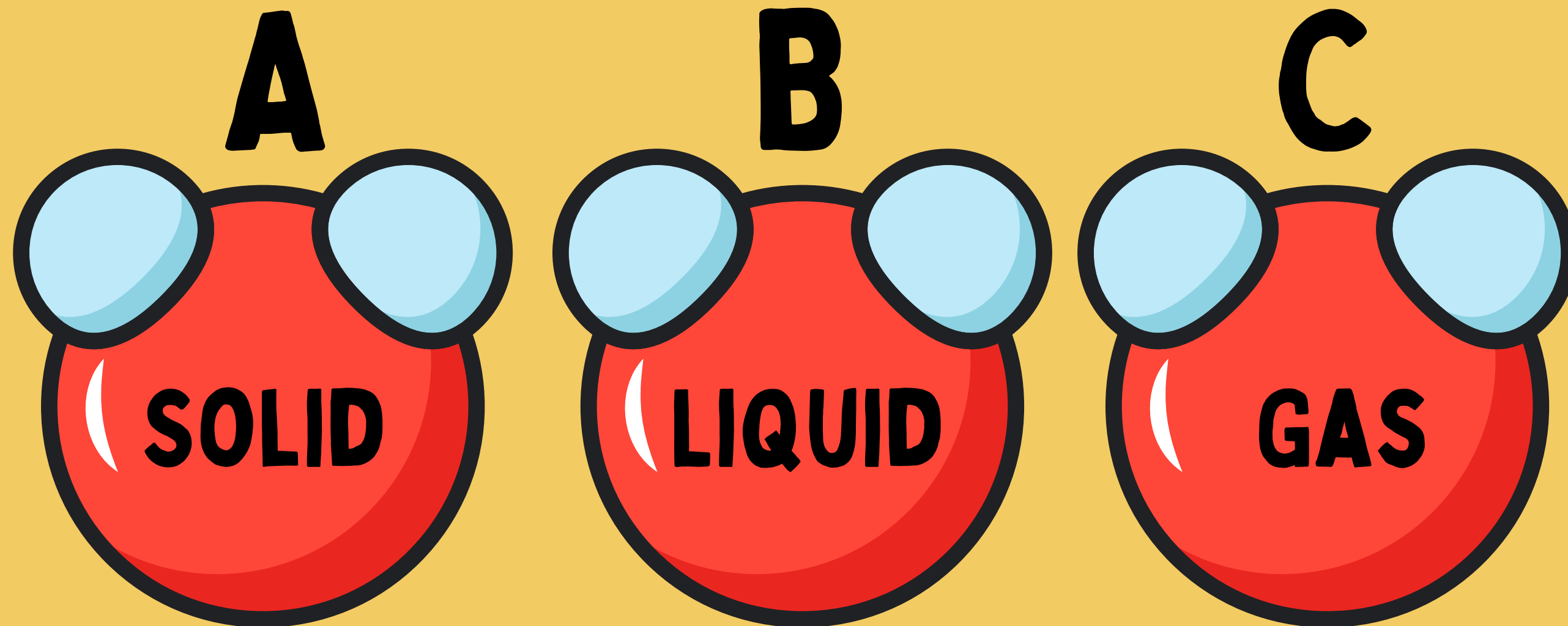


# QUESTION

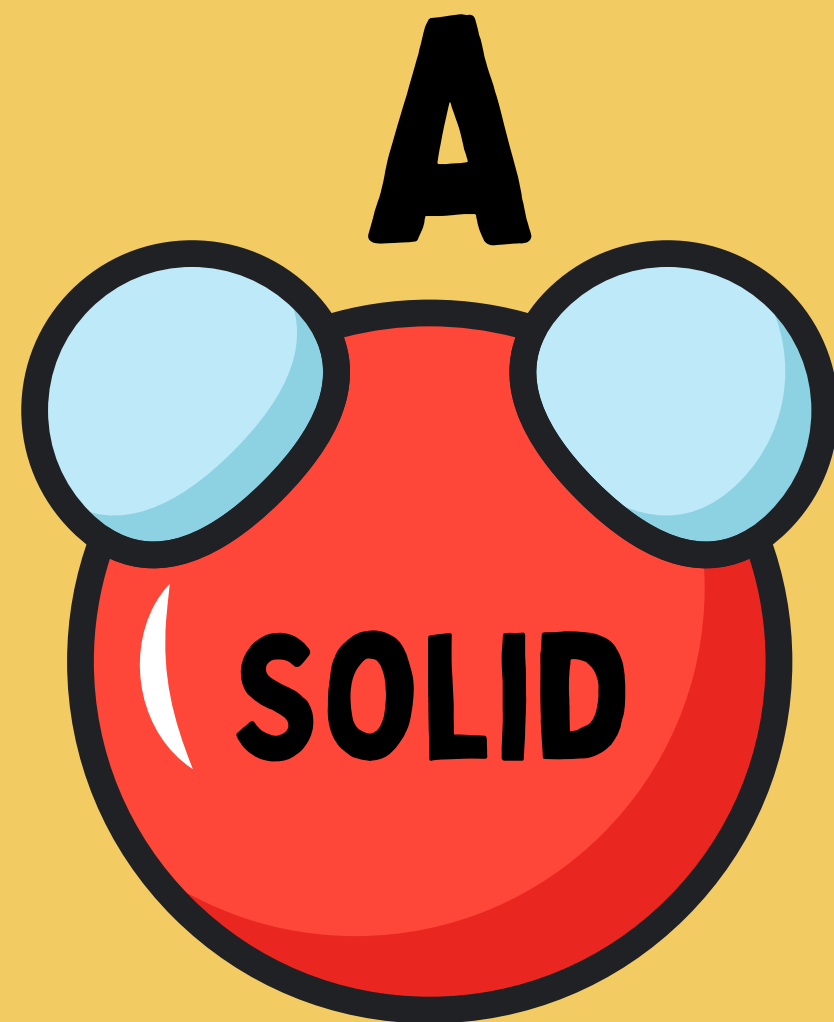
#6



**WHICH STATE OF MATTER SPREADS OUT TO  
FILL ITS WHOLE CONTAINER?**



**WHICH STATE OF MATTER SPREADS OUT TO  
FILL ITS WHOLE CONTAINER?**

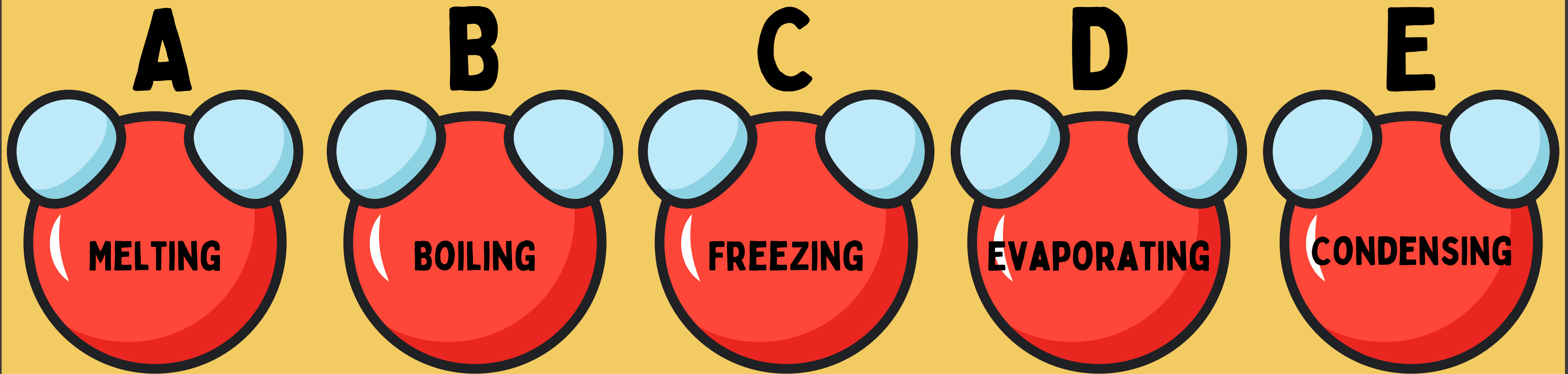


# QUESTION

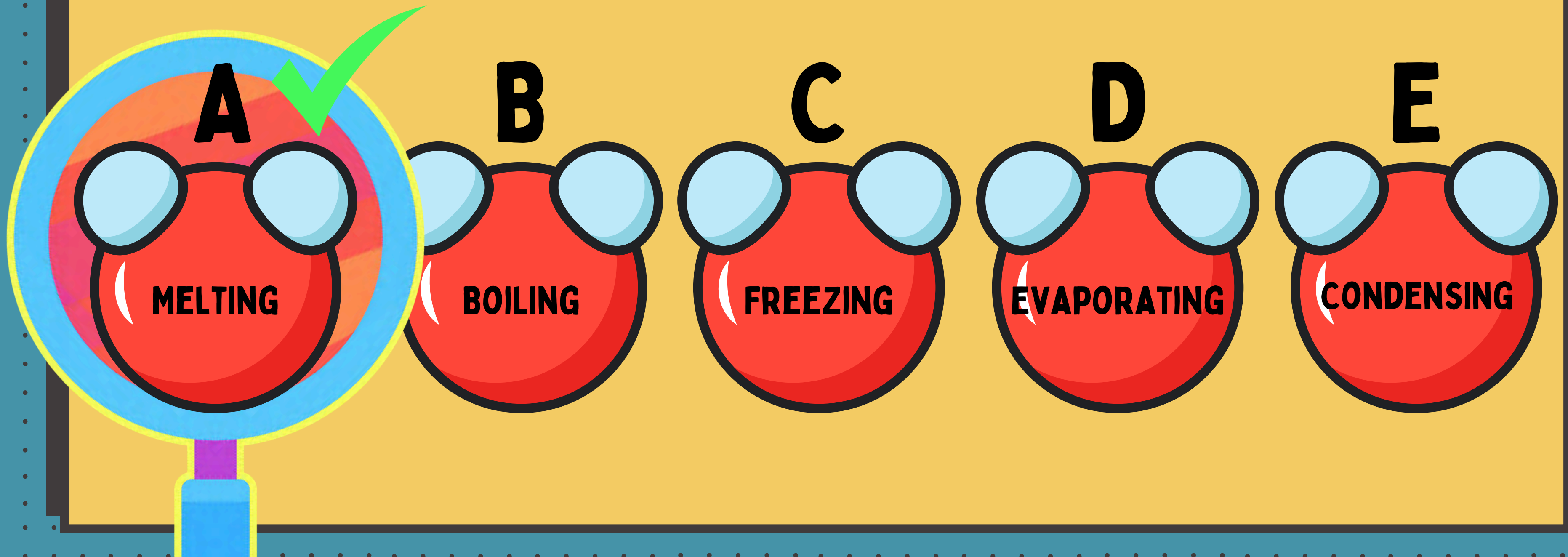
#7



**WHAT IS THE PROCESS WHEN A SUBSTANCE  
GOES FROM A SOLID TO A LIQUID?**

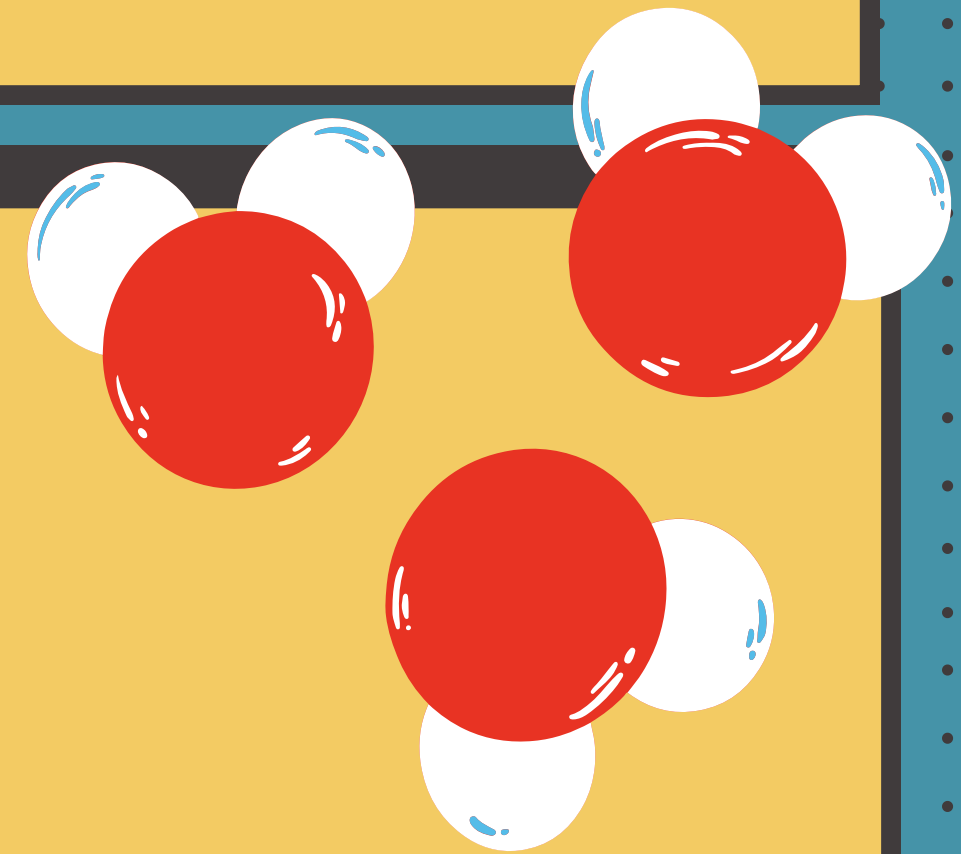


**WHAT IS THE PROCESS WHEN A SUBSTANCE  
GOES FROM A SOLID TO A LIQUID?**



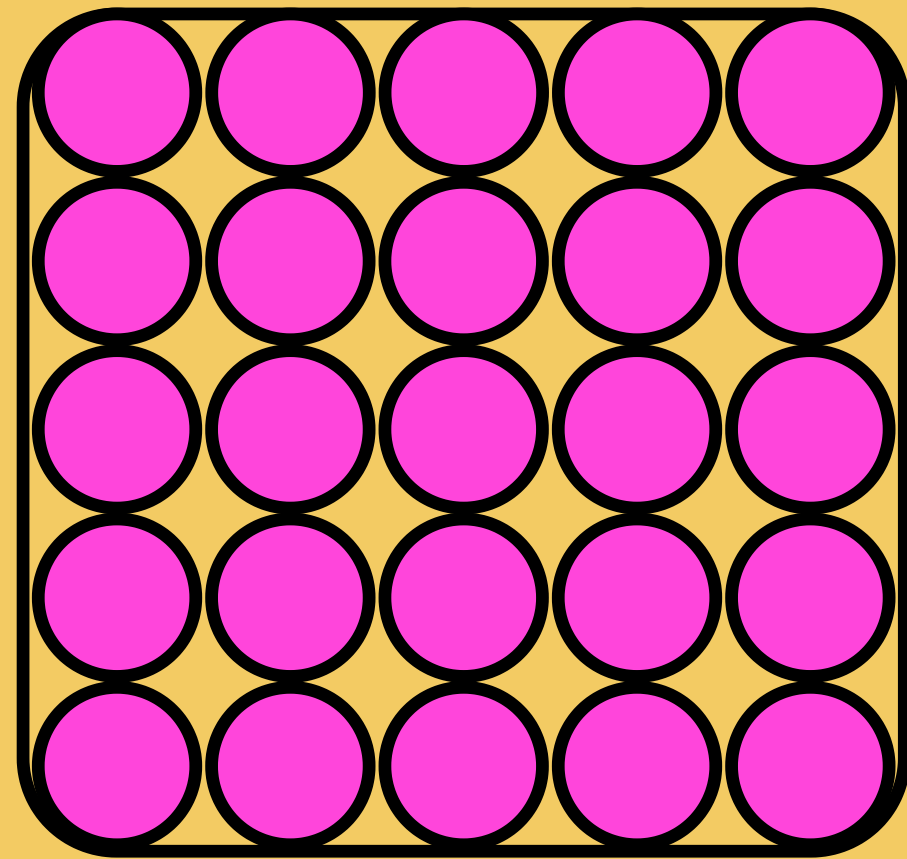
# THE PARTICLE THEORY

- everything is made of particles
- there are spaces between the particles
- particles are attracted to each other
- temperature affects the speed at which particles move
- particles are always moving because they have kinetic energy
- there are different kinds of particles, but all particles of one substance are identical



# DRAW THE PARTICLES

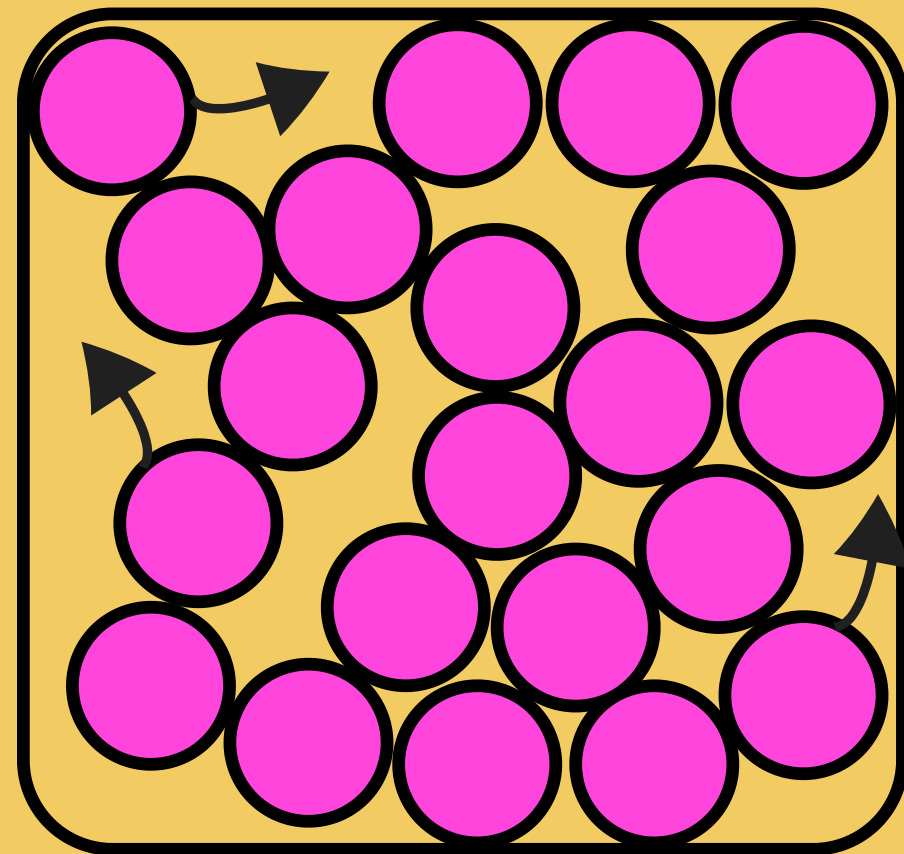
## SOLID



- particles close together
- strongly attracted
- locked in a pattern
- vibrate in place
- fixed shape and volume
- spaces between particles are small

# DRAW THE PARTICLES

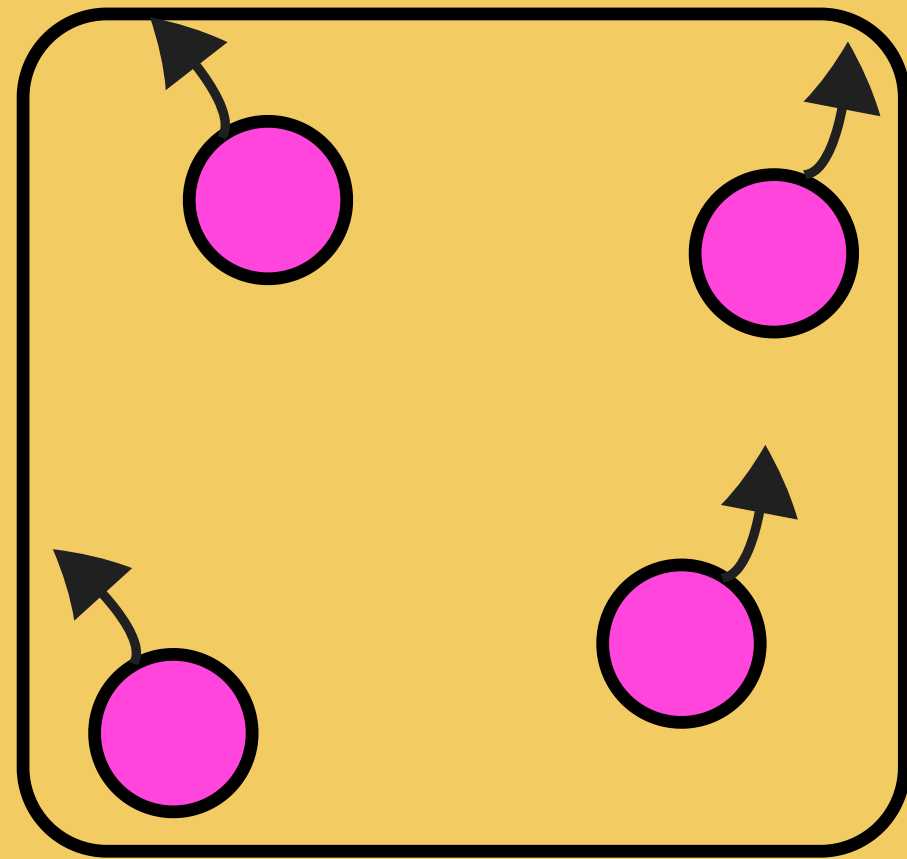
## LIQUID



- particles slightly farther apart
- less attracted
- able to slide past each other
- take the shape of their container
- spaces between particles are larger than in a solid

# DRAW THE PARTICLES

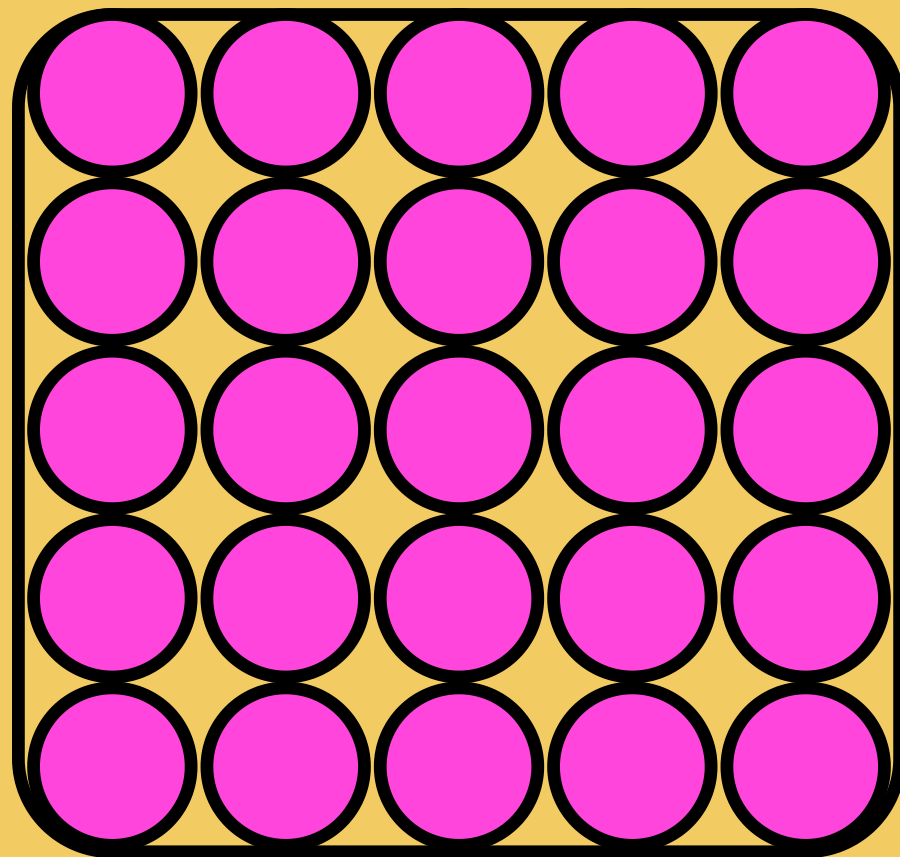
**GAS**



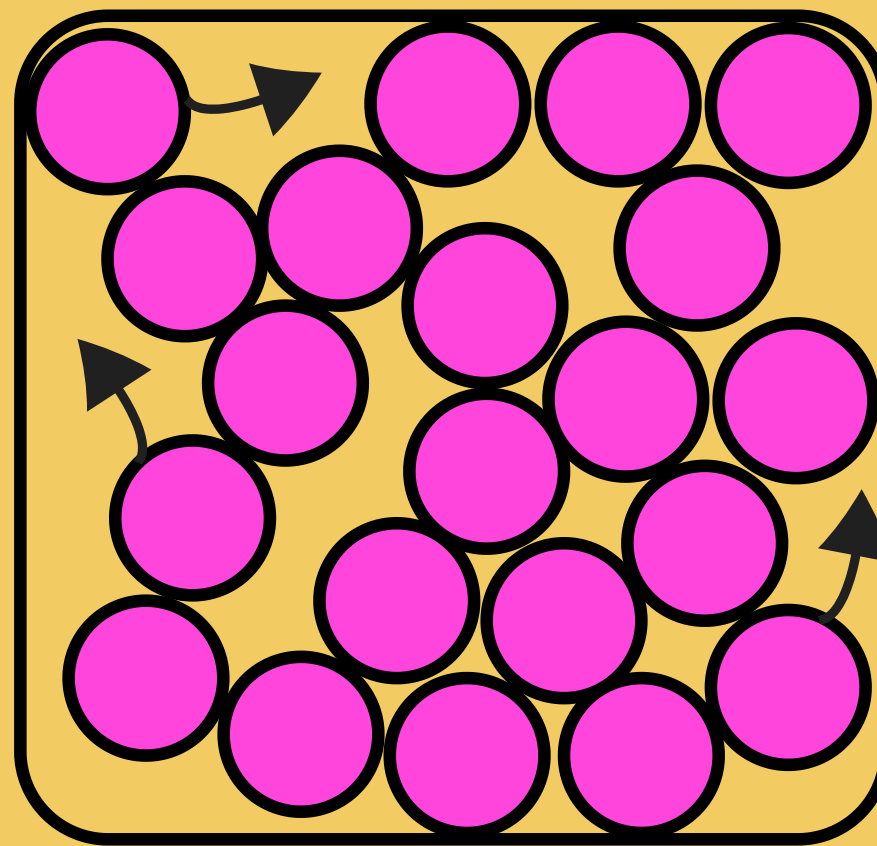
- particles are far apart
- attraction forces are weak
- particles move in any direction
- no fixed shape or volume
- particles expand to fill their container

# DRAW THE PARTICLES!

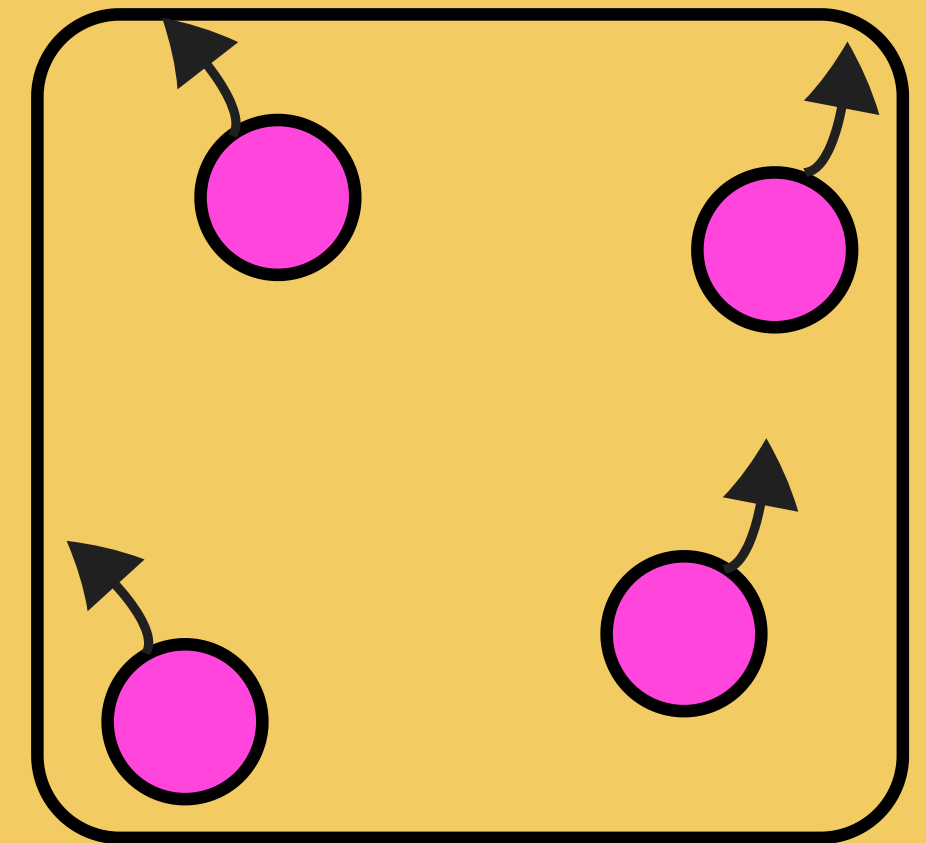
**SOLID**



**LIQUID**



**GAS**



# CASE #1

THE PARTICLE MODEL QUIZ...  
SHOW WHAT YOU KNOW

**COMPLETED**



PICK 1  
MYSTERY  
LETTER



# CASE #2



MYOT (MAKE YOUR OWN THERMOMETER)

What is a thermometer?

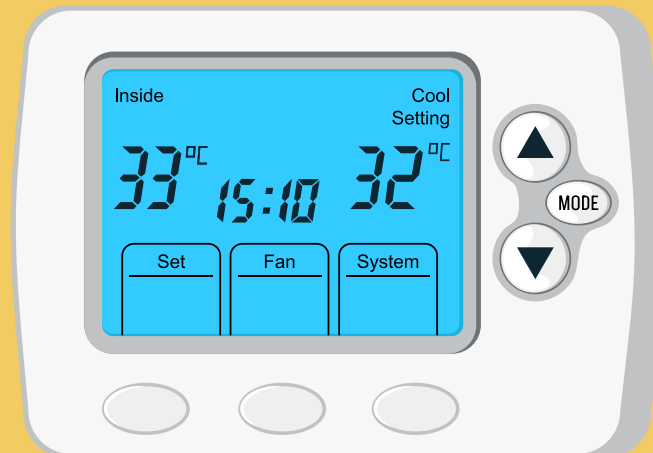
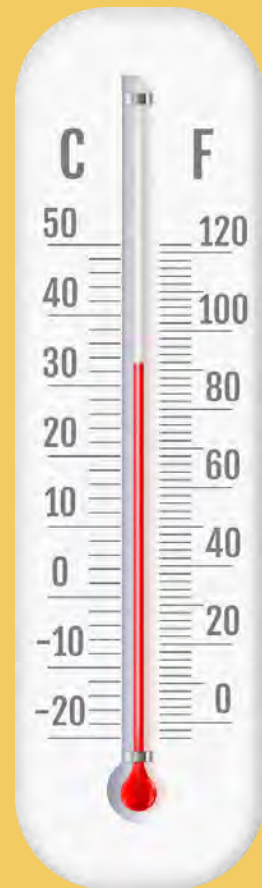
# What is a thermometer?

Any instrument used to measure temperature.



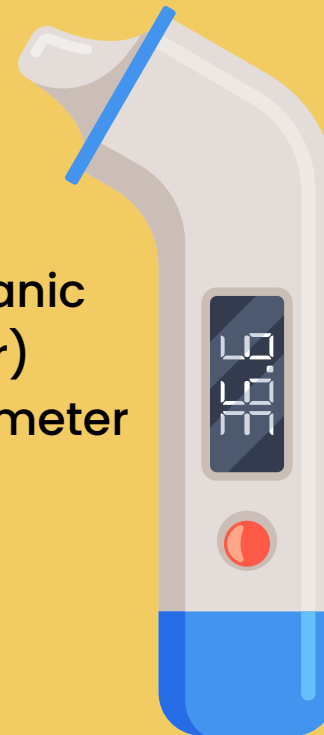
# TYPES OF THERMOMETERS

Mercury Thermometer

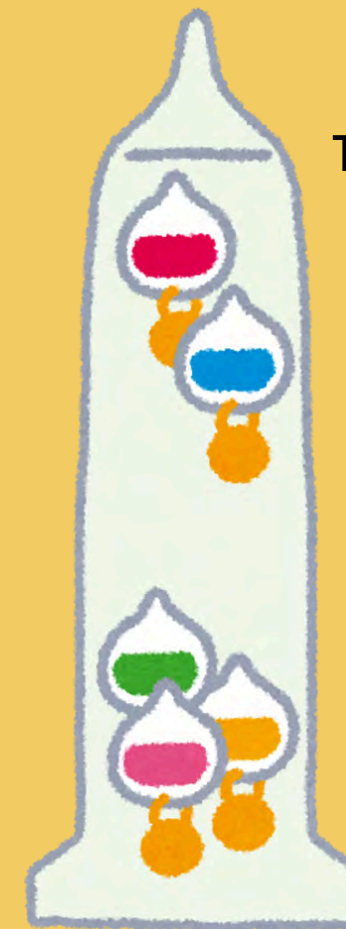


Thermostat or Thermocouple

Tympanic (ear) Thermometer



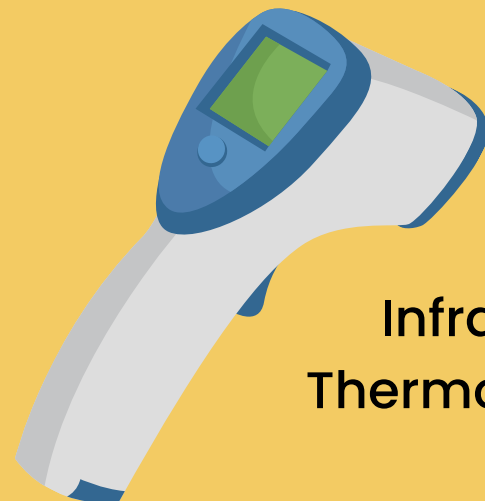
Galileo Thermometer



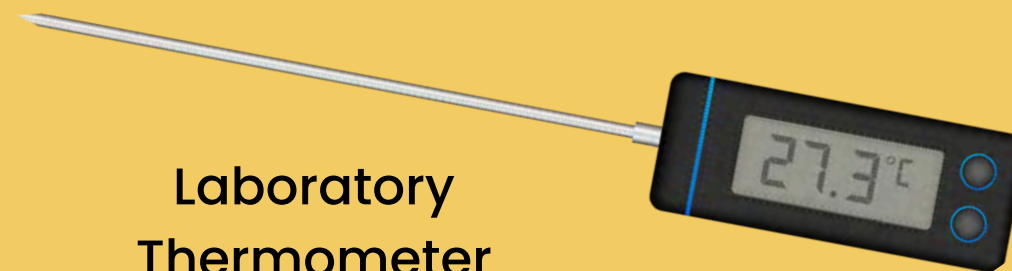
Digital Thermometer



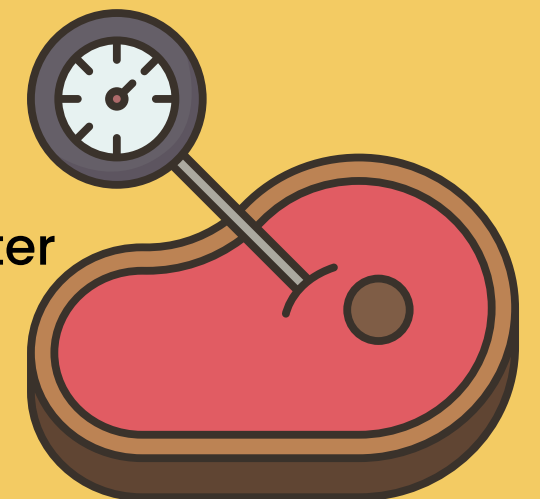
Infrared Thermometer



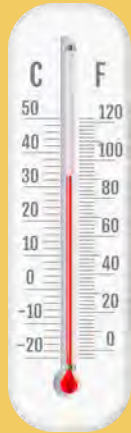
Laboratory Thermometer



Meat Thermometer



# TYPES OF THERMOMETERS



## MERCURY THERMOMETER

- sealed tube with markings to indicate temperatures in Celsius or Fahrenheit
- filled with mercury that changes from solid to liquid when heated and rises in the tube to indicate the temperature



## DIGITAL THERMOMETER

- computer chip registers the temperature on the heat sensitive tip of the thermometer
- faster reading than analog thermometers



## INFRARED THERMOMETER

- non-contact thermometer
- uses infrared technology to register temperature from a distance

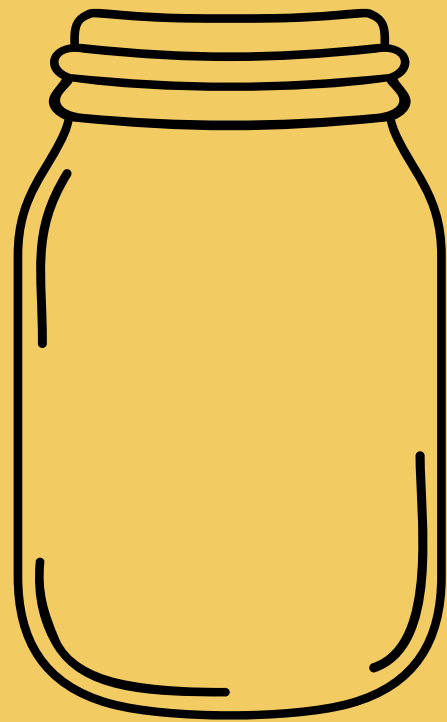


## GALILEO THERMOMETER

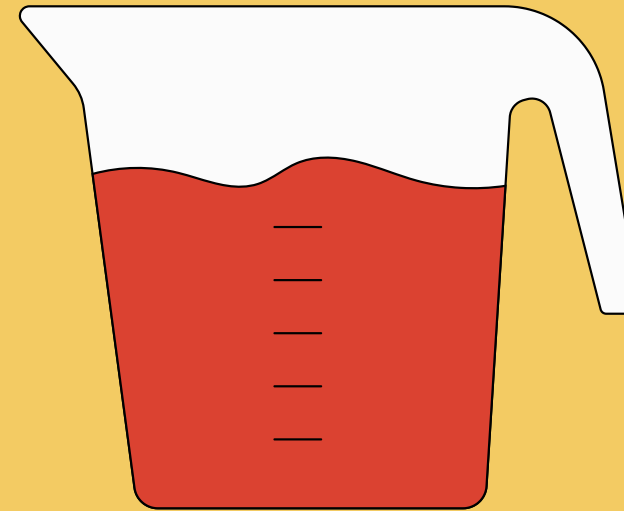
- glass bubble each with a counterweight for a temperature and a different density
- when the liquid in the sealed glass tube is heated, it becomes less dense allowing more bubbles to drop to the bottom of the thermometer
- the temperature on the bubble floating in the middle of the tube is the air temperature

# MAKE YOUR OWN THERMOMETER

Glass Jar



Straw



Water solution



Clay

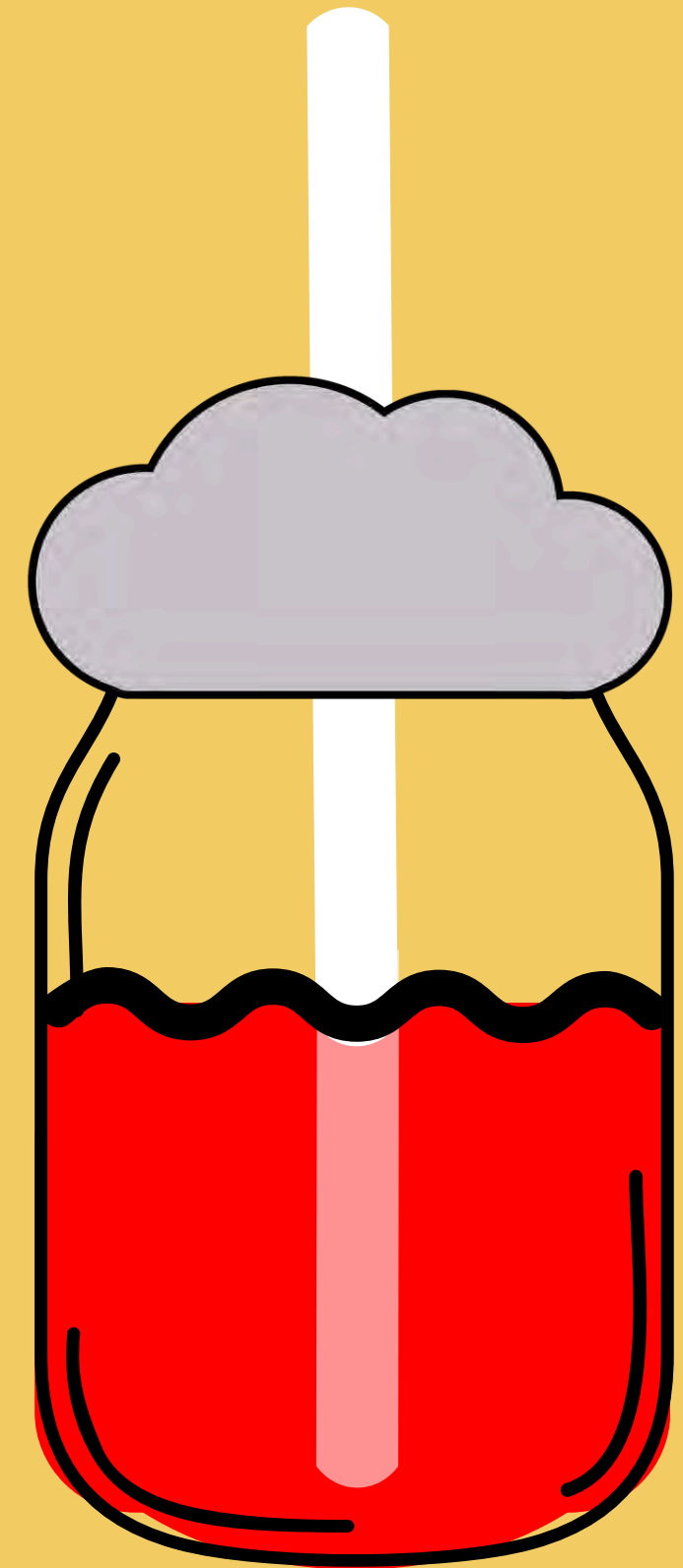
Cloth



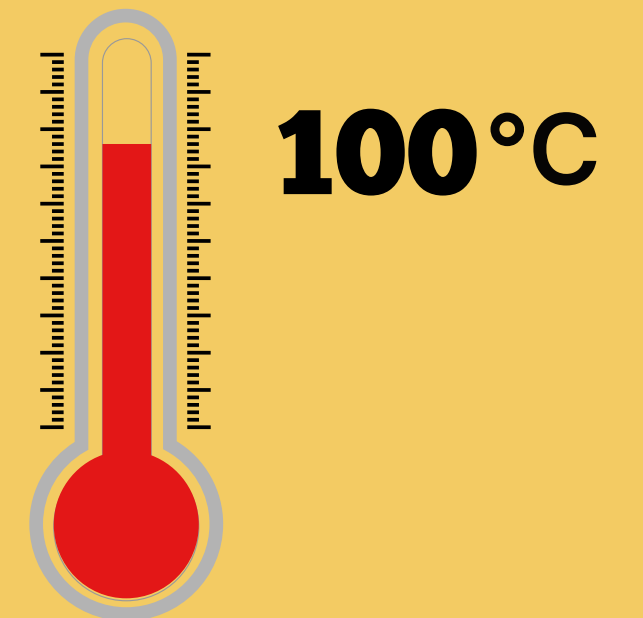
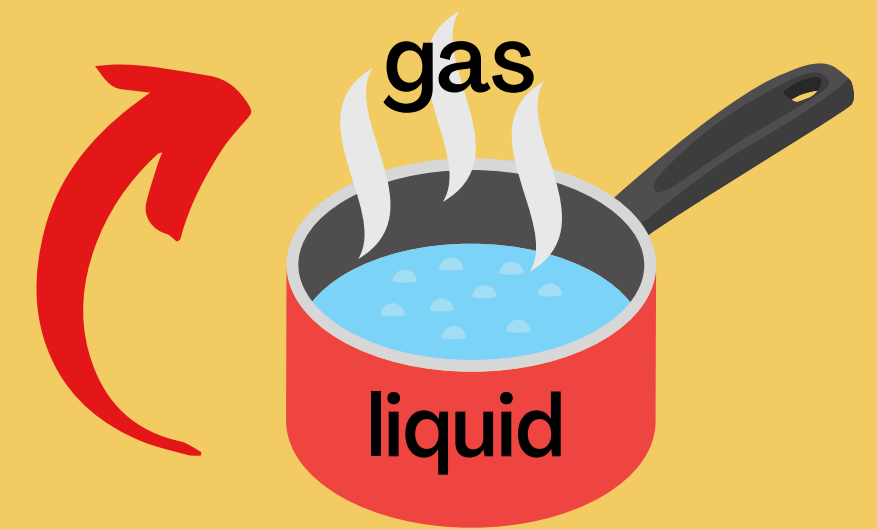
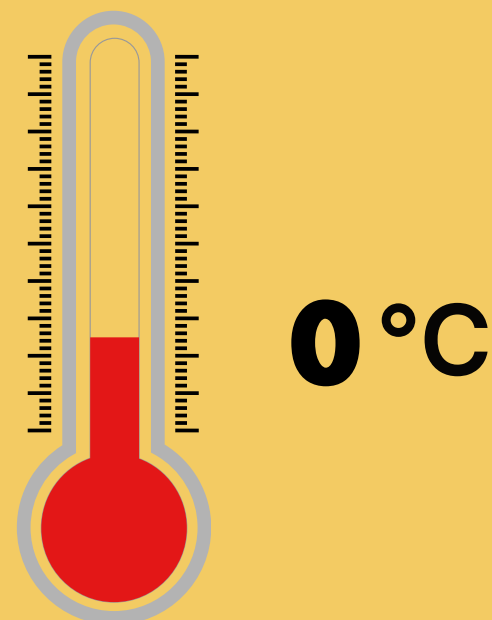
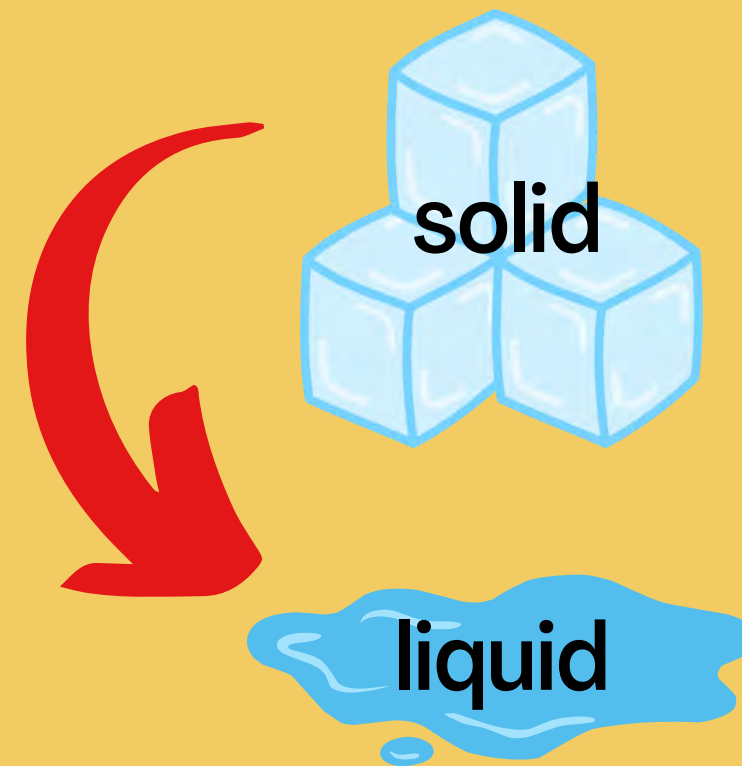
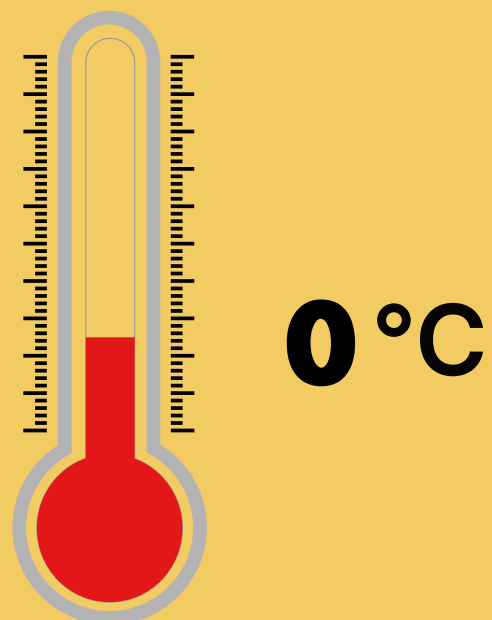
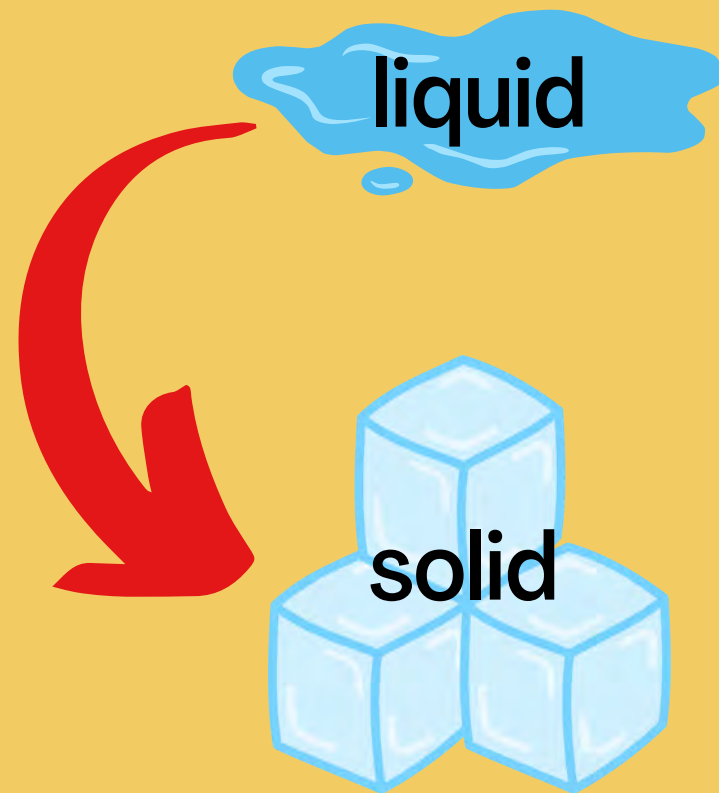
Warmers

# MAKE YOUR OWN THERMOMETER

1. Presenter will fill your jar with water solution.
2. Insert straw into jar.
3. Make sure the straw isn't touching the bottom of the jar.
4. Add clay around the straw at the top of the jar, sealing it.
5. Use warmers to heat up the solution and watch the liquid rise in the straw. Use the cloth to protect your hand.



# FREEZING POINT, MELTING POINT & BOILING POINT



# CASE #2

MYOT

(MAKE YOUR OWN THERMOMETER)

**COMPLETED**



Letter 1:

**PICK 2**

Letter 2:

**MYSTERY  
LETTERS**



# CASE #3

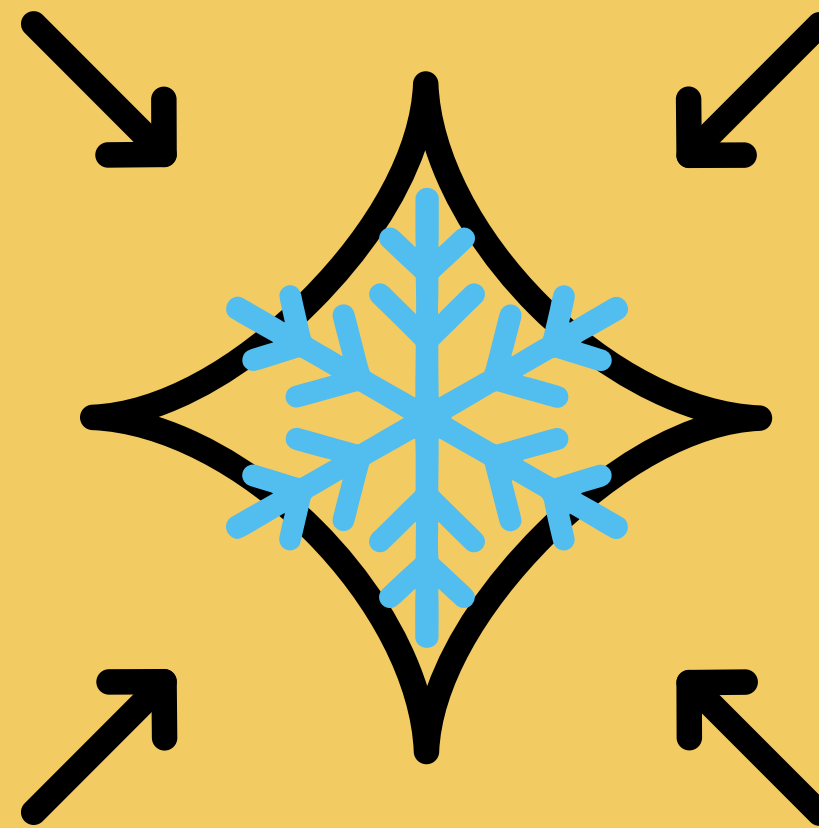


DO MATERIALS MATTER?

**EXPANSION**

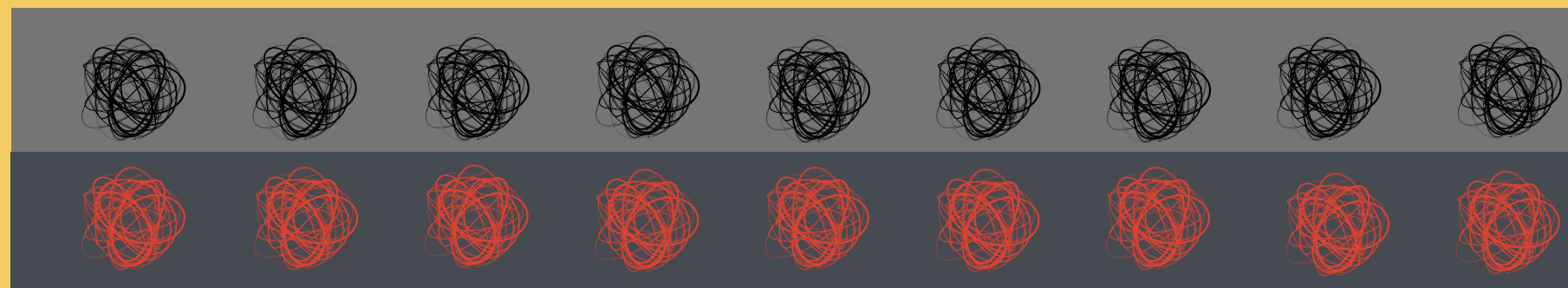


**CONTRACTION**



# THE CASE OF THE BENDING METAL

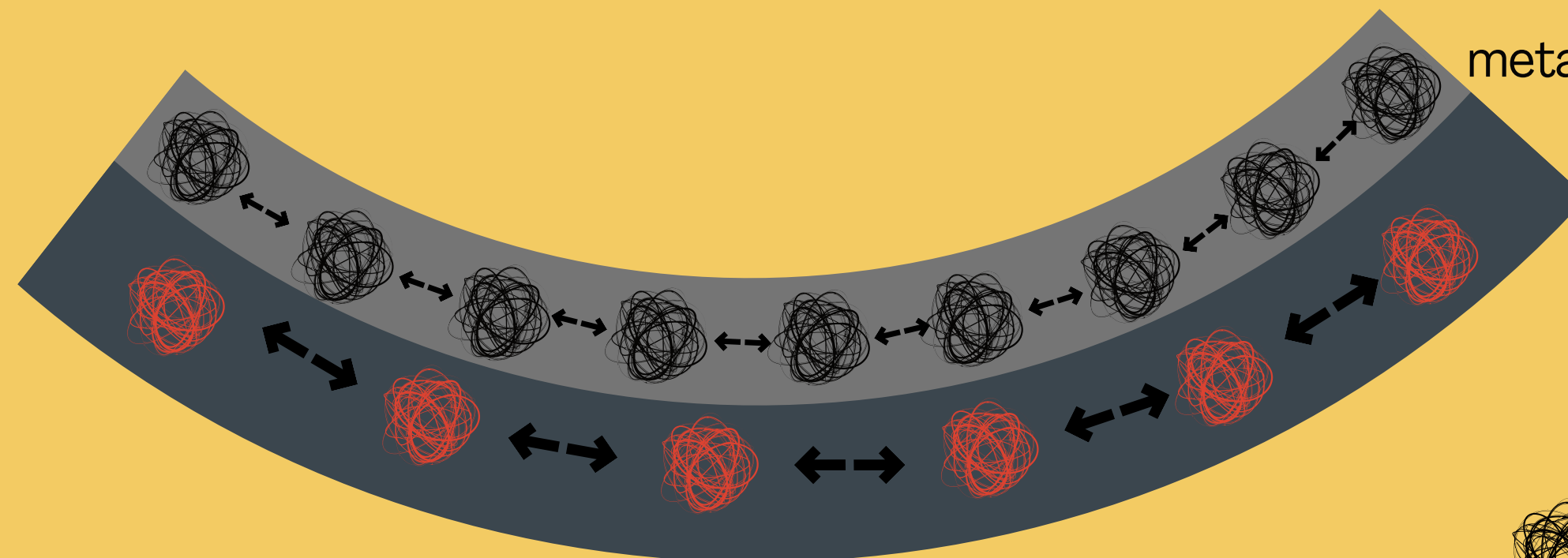
molecules at  
room temperature



metal #1



metal #2

molecules  
warmed up



metal #1

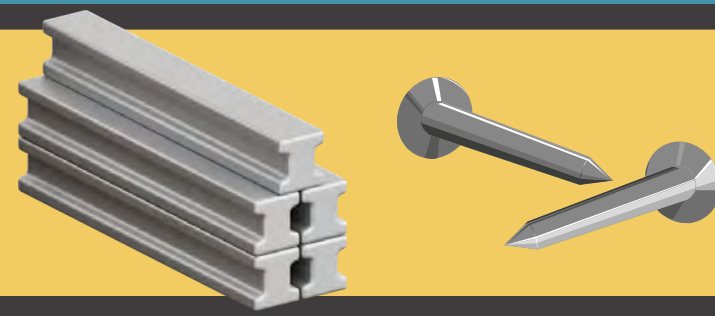
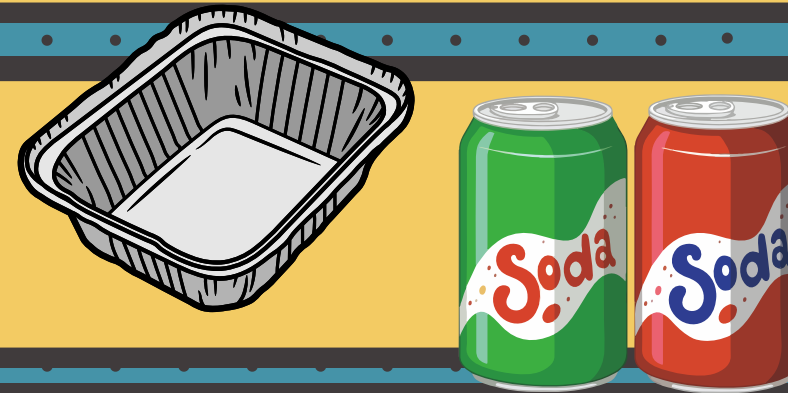
metal #2

  = molecules

# THERMAL EXPANSION WHEN BUILDING THINGS

## Aluminum

- starts expanding at 15 degrees Celsius

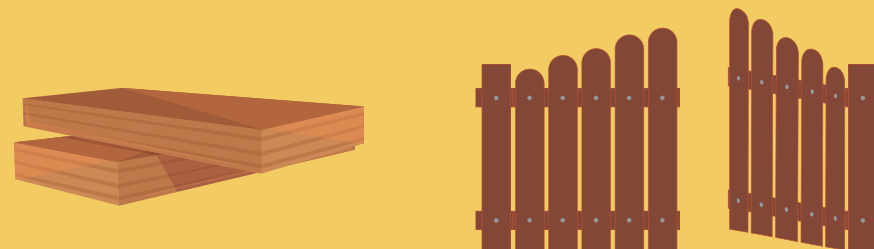
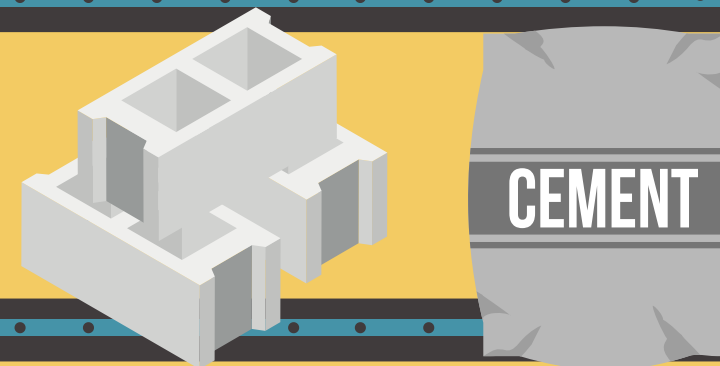


## Steel

- starts expanding at 20 degrees Celsius

## Concrete

- starts expanding at 35 degrees Celsius

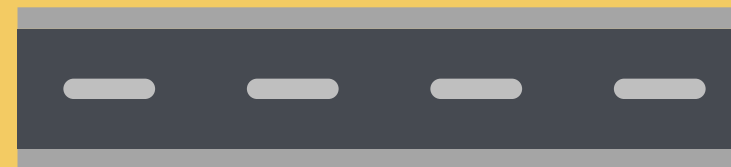


## Wood

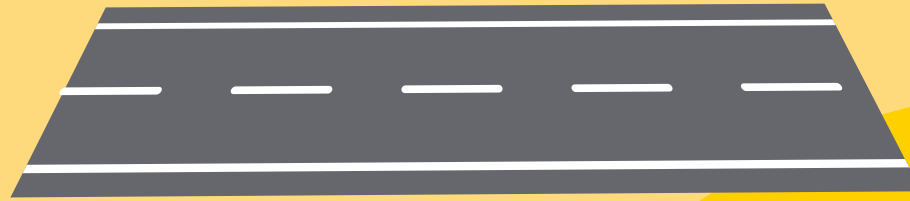
- starts expanding at 30 degrees Celsius

## Asphalt

- starts expanding at 50 degrees Celsius



# LIFE CYCLE OF A POTHOLE



new road cracks

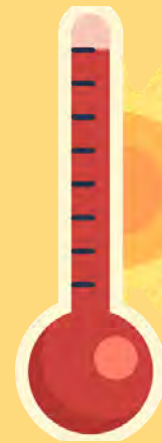
rain falls or snow melts



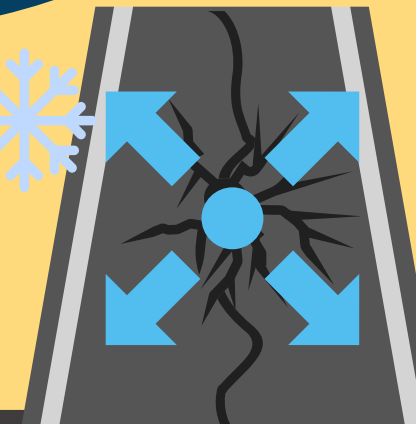
water fills the cracks



water evaporates leaving behind a pot hole



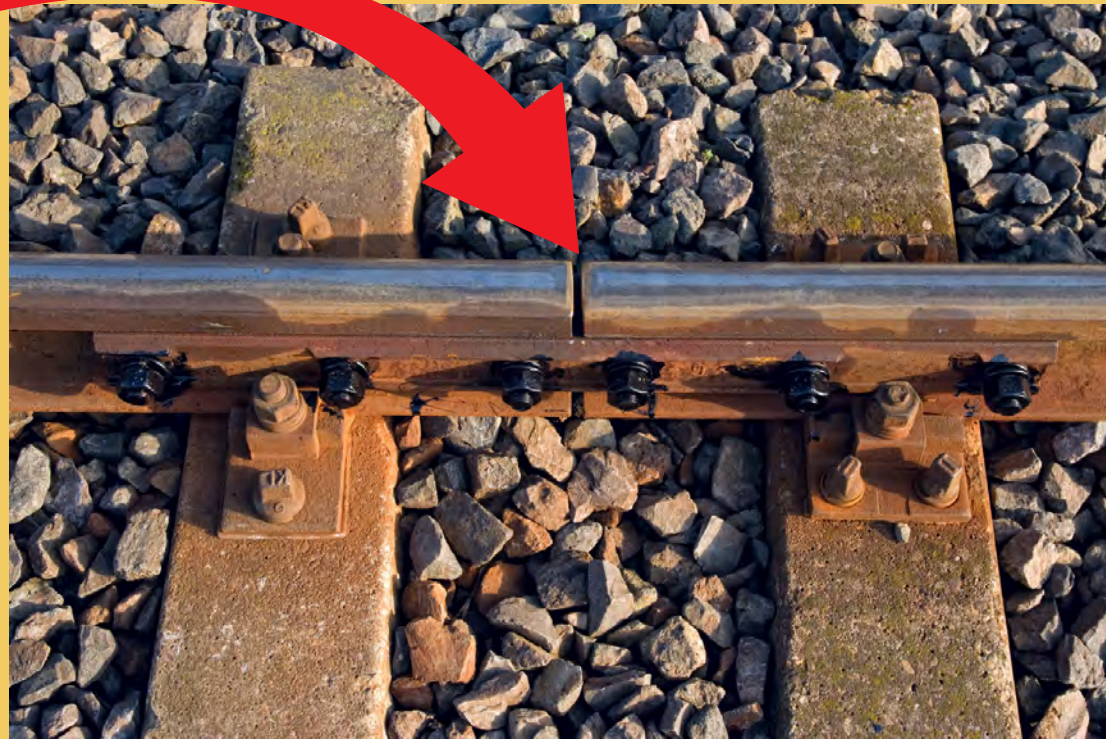
water freezes and expands in the cracks on the road



# EXPANSION AND CONTRACTION IN DAILY LIFE

## Train tracks

- slight gap to allow for expansion & contraction as temperature of rails change



## Doors

- harder to open/close during the summer
- expansion in warm weather makes the wood expand and the door sticks



## Bridges

- concrete and asphalt expand in warmer weather
- joints allow for the expansion & contraction of concrete & asphalt so bridges don't crack and break



# CASE #3

DO MATERIALS MATTER?

COMPLETED



PICK 1  
MYSTERY  
LETTER



# CASE #4

## MASS-TERIOUS CRYSTALS

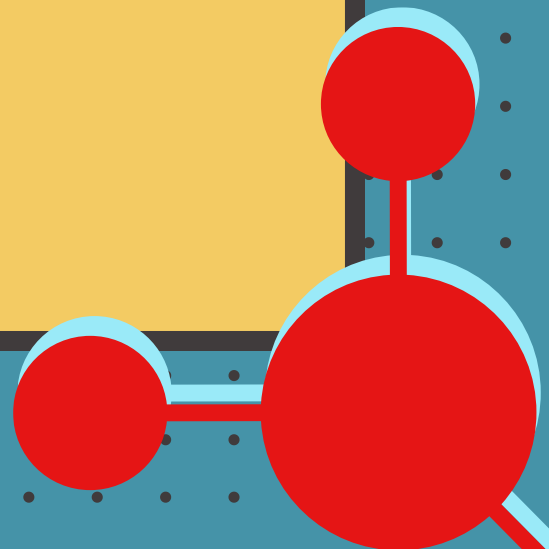


What is Matter?


# MATTER



- has weight
- takes up space
- main forms: solid, liquid, gas



# PHASE CHANGES OF MATTER



**PHASE CHANGE**  
is the change  
from one state  
of matter to  
another

## 6 DIFFERENT PHASE CHANGES

**Melting** → **Solid to Liquid**

**Freezing** → **Liquid to Solid**

**Evaporation** → **Liquid to Gas**

**Condensation** → **Gas to Liquid**

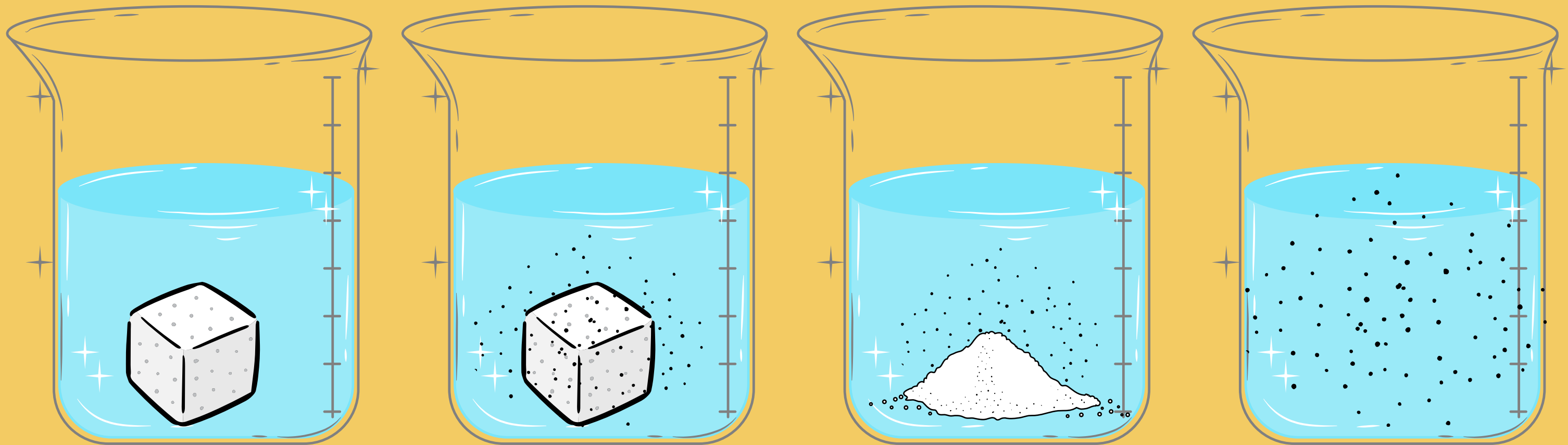
**Deposition** → **Gas to Solid**

**Sublimation** → **Solid to Gas**

# MATTER CHANGING FORM

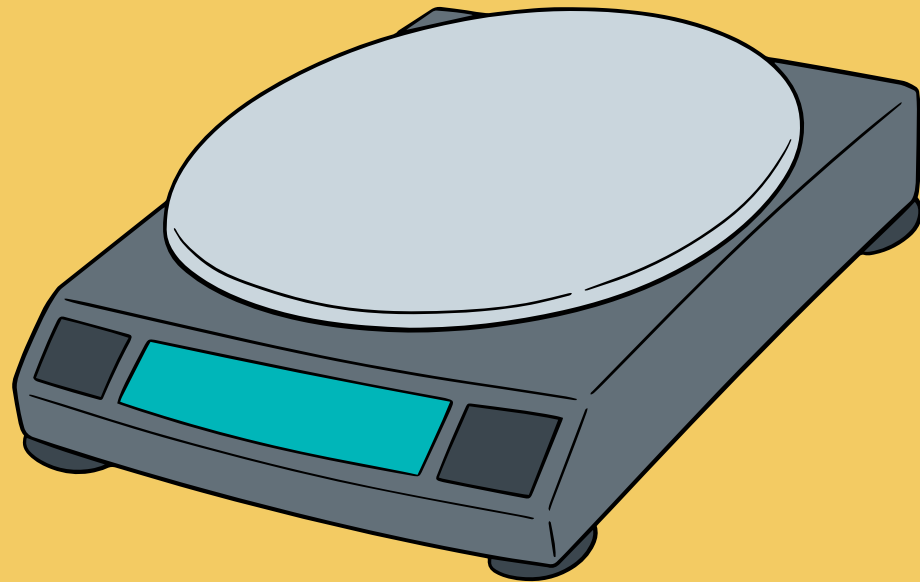
## DISSOLVING

- occurs when a solid mixes into a liquid to create a solution



# MASS-TERIOUS CRYSTALS

Digital Scale



Large container



Juice mix



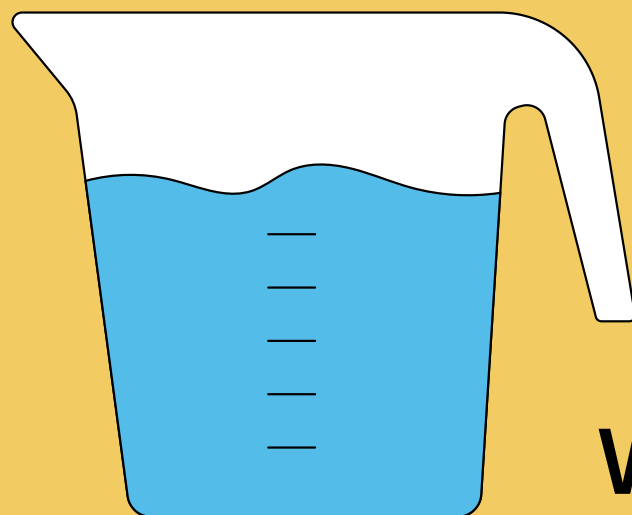
Small container



Stir stick



Small cups



Water

# MASS-TERIOUS CRYSTALS



1. Record your Prediction: Will the mass of juice and water be the same before and after the crystals are dissolved?
2. Place the small container on the digital scale. Zero out scale.
3. Fill the small container with 2 scoops of juice crystals.
4. Record mass of juice crystals.
5. Place the large container on the digital scale. Zero out scale.
6. Fill the large container with 1 cup of water (presenter).
7. Record mass of water.
8. Add the two masses. Record the *expected mass*.
9. Mix juice crystals with water in the large container and stir.
10. Record the actual mass of the juice mix (crystals + water).
11. Record your conclusion.

# THE LAW OF CONSERVATION OF MASS

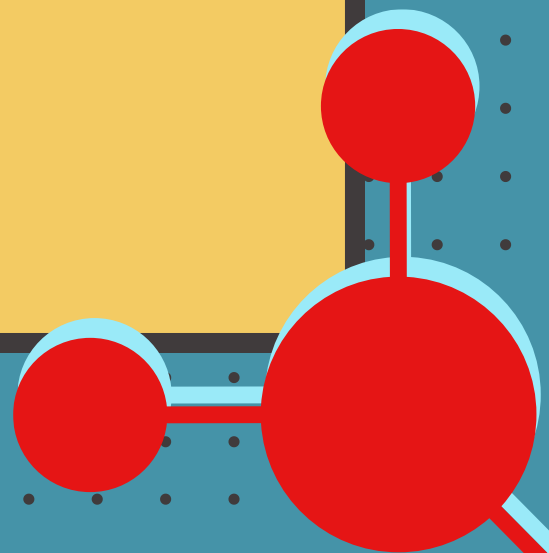
What is the  
Law of Conservation of Mass?



# THE LAW OF CONSERVATION OF MASS



Mass cannot be created or destroyed, but is **TRANSFORMED** from one form to another.



# COOL MASS-ERIOUS CRYSTALS

Let's COOL off!  
**CHEERS!**



# CASE #4

## MASS-TERIOUS CRYSTALS



Letter 1:

PICK 2

Letter 2:

MYSTERY  
LETTERS



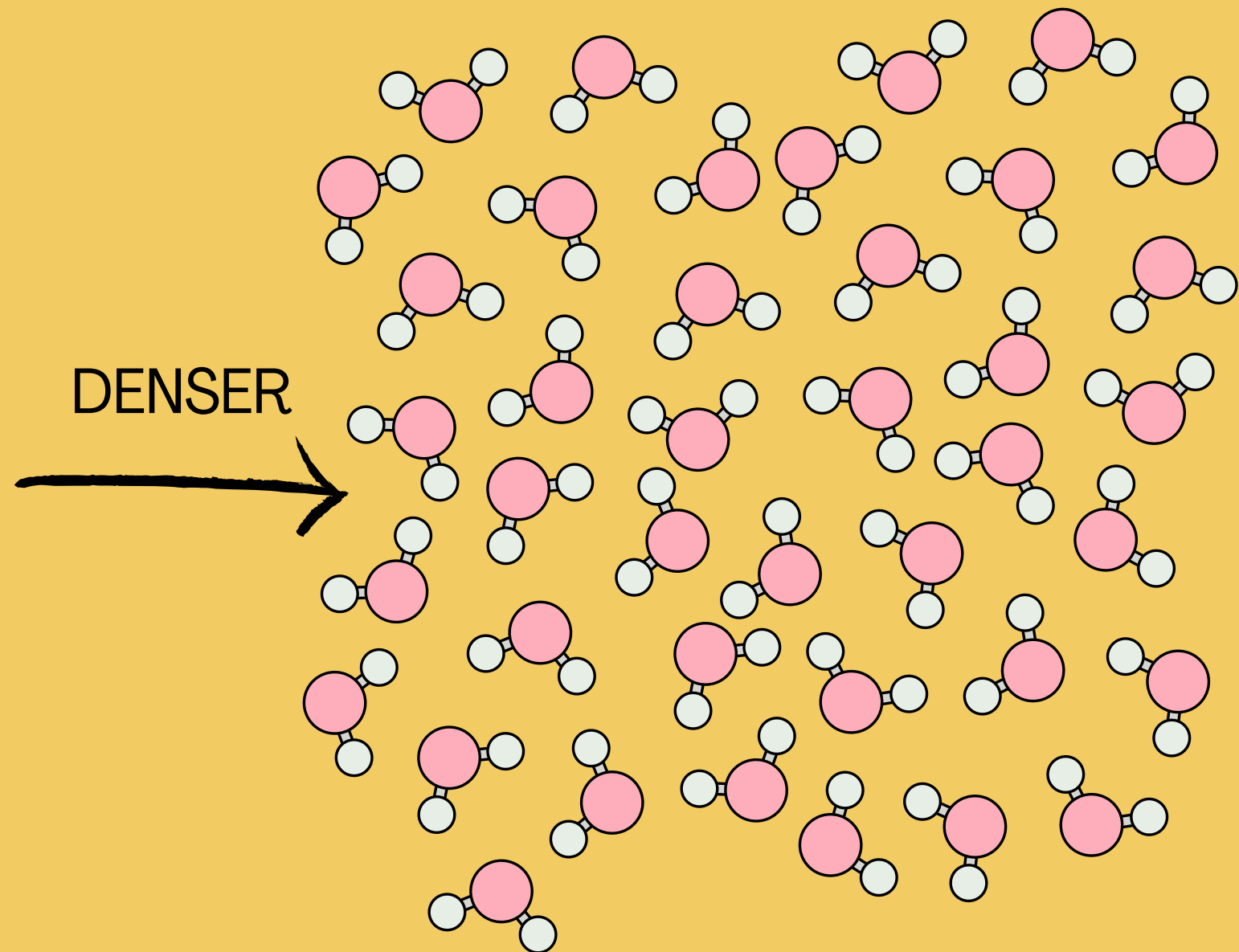
# CASE #5

SINK OR SWIM...HOW COOL IS WATER?

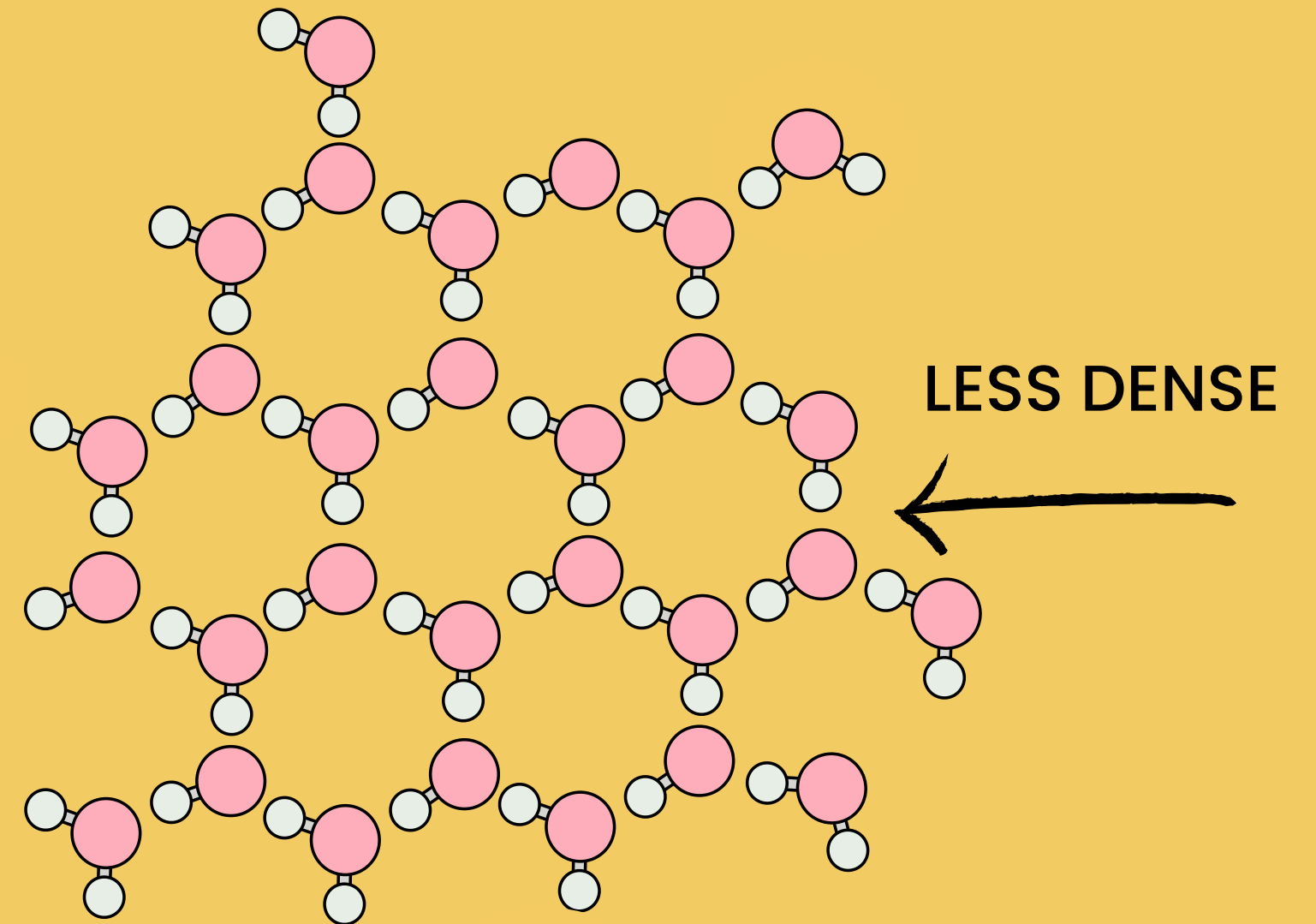


# WATER AS A LIQUID AND A SOLID

**LIQUID**



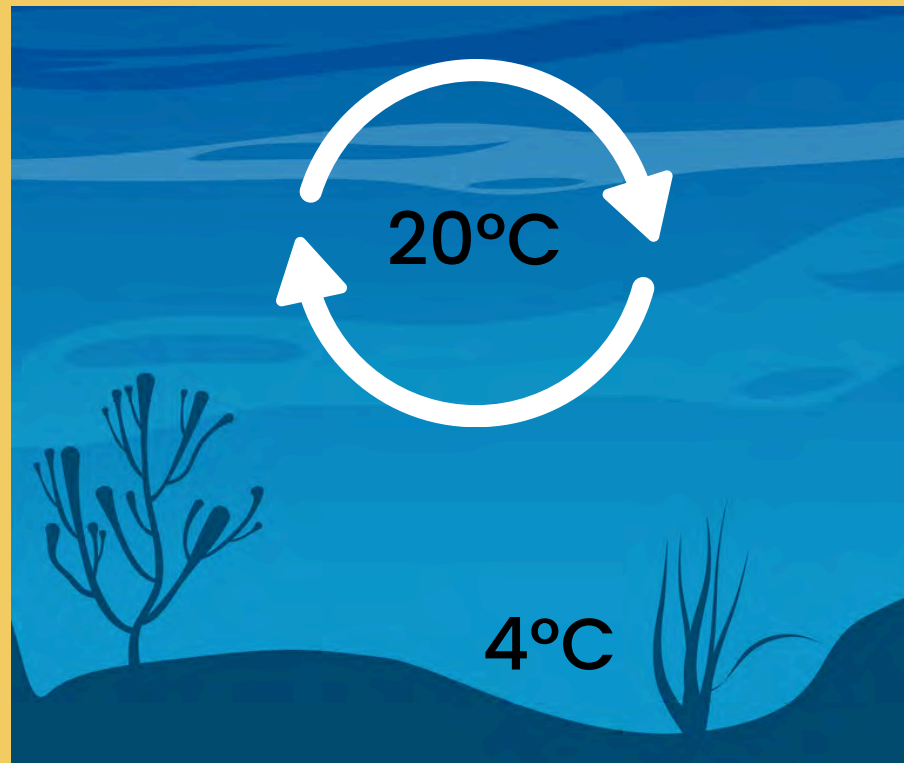
**SOLID**



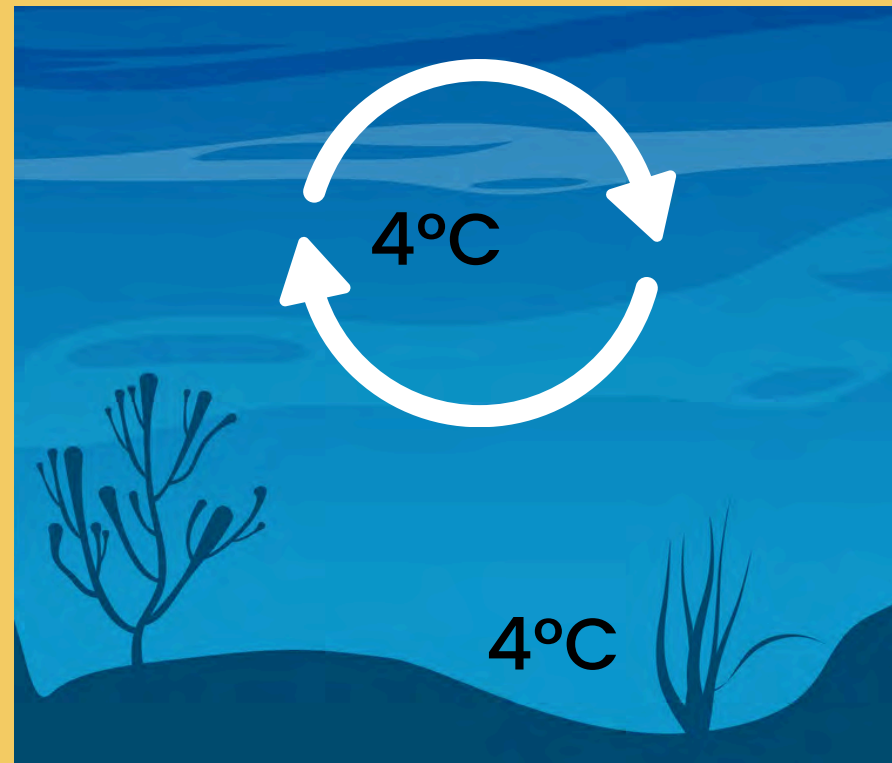
# LAKES IN THE WINTER



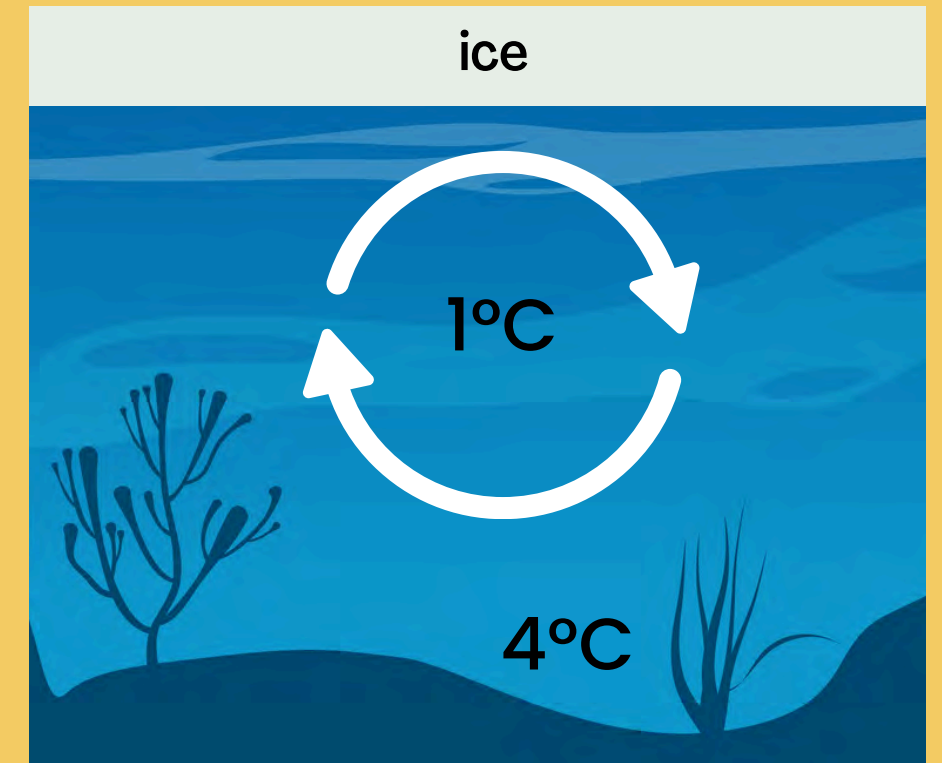
## SUMMER



## SPRING/FALL



## WINTER



# ICE CUBE DEMONSTRATION



# CASE #5

SINK OR SWIM...HOW COOL IS WATER?

**COMPLETED**



Letter 1:

**PICK 2**

Letter 2:

**MYSTERY  
LETTERS**



# MYSTERY WORD UNSCRAMBLE

\_\_\_\_\_



MYSTERY WORD

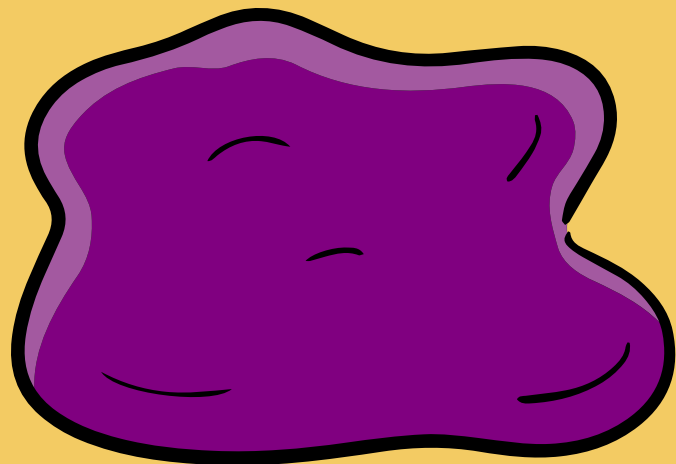
COMPLETED

P A R T I C L E

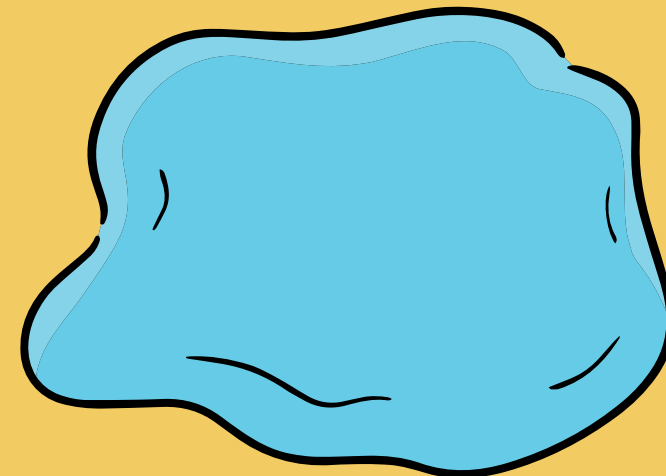


# HEAT CHANGING PUTTY

**HOT**



**COOL**



**GREAT WORK  
TODAY,  
INVESTIGATORS!  
STAY COOL!**

