Name _____ Date _____ Hour____ Table #____

Lab Equipment

Name each piece of equipment that would be useful for each of the following tasks:

1. Holding 100mL of water (ebkare) beaker
2. Measuring 27 mL of liquid (daudgtear ldnreiyc) graduated cylindr
3. Measuring exactly 43mL of an acid (rtube) buret
4. Massing out 120 g of sodium chloride (acbnela) balance
5. Suspending glassware over the Bunsen burner (rwei zeagu) wire gauze
6. Used to pour liquids into containers with small openings or to hold filter paper (unfenl) funnel
7. Mixing a small amount of chemicals together (lewl letpa) well plate
8. Heating contents in a test tube (estt ubet smalcp) test tube clamps
9. Holding many test tubes filled with chemicals (estt ubet karc) test tube rack
10. Used to clean the inside of test tubes or graduated cylinders (iwer srbuh) wire brush
11. Keeping liquid contents in a beaker from splattering (tahcw sgasl) watch glass
12. A narrow-mouthed container used to transport, heat or store substances, often used when a stopper is required (ymerereel kslaf) erlenmuyer flash
13. Heating contents in the lab (nuesnb bneurr) bunsen burner
14. Transport a hot beaker (gntos) tongs
15. Protects the eyes from flying objects or chemical splashes (ggloges) goggles
16. Used to grind chemicals to powder (tmraor nda stlepe) mortar + pestle

5 6

F19

Notes: Matter

Matter - anything that takes up space

elements - made up of one type of atom

compound - made up of two or more types of atoms

mixture - more than one type of particle

↳ heterogenous mixtures
(see the difference in the types of particles)

→ homogenous mixture
(can't see the difference in the types of particles)

Changes

→ physical change - can go back to original state
* type of matter stays the same

→ chemical change - can't go back to original state
* type of matter is changing

Physical property

→ that you can see, can cause a physical change

* density
* melting point / freezing point / boiling point
* color

Chemical property

→ tells us how a compound / element would react

* reacts with acids
* conducts electricity

Evidences of Chemical Reactions

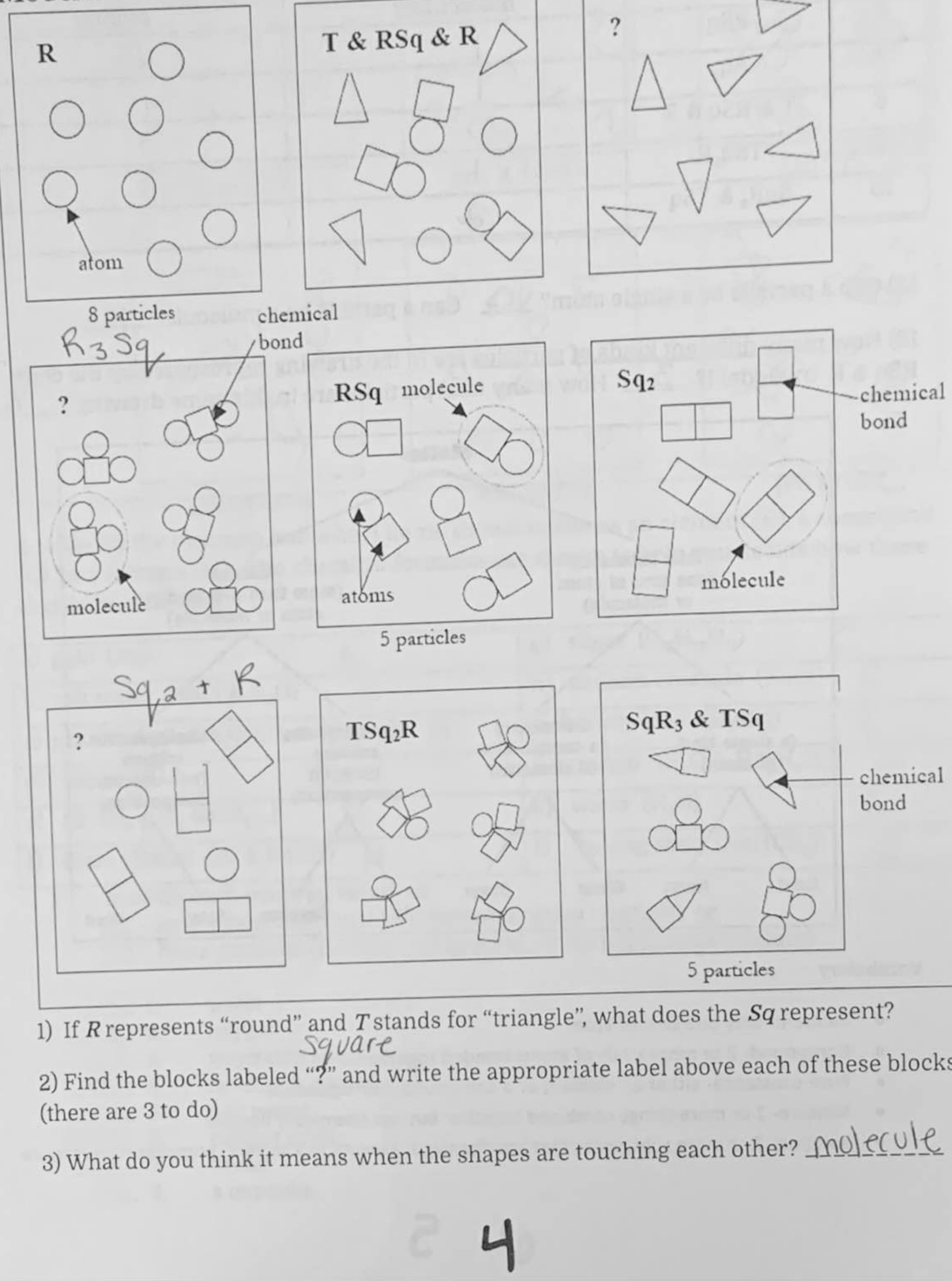
1. production of gas
2. change in color
3. production of heat / loss of heat
4. creation of light

Classification of Matter

Name _____

WHY? Everything in this room is made up of matter. The "matter" may be pure or it may be a mixture. How can you tell by looking at it? What if you could see the particles that make up the matter? This activity asks you to explore the smallest chemical units of matter. You should be able to determine why a substance is classified as an element or a compound and understand the difference between a pure substance and a mixture.

Model 1



1) If *R* represents "round" and *T* stands for "triangle", what does the *Sq* represent? square

2) Find the blocks labeled "?" and write the appropriate label above each of these blocks. (there are 3 to do)

3) What do you think it means when the shapes are touching each other? molecule

4) Several squares in Model 1 have "subscripts". What does the 2 mean in "TSq_2R"?

two squares are connected

5) A "mixture" is a combination of 2 or more different things that are not bonded together. How can you identify the mixtures shown in Model 1?

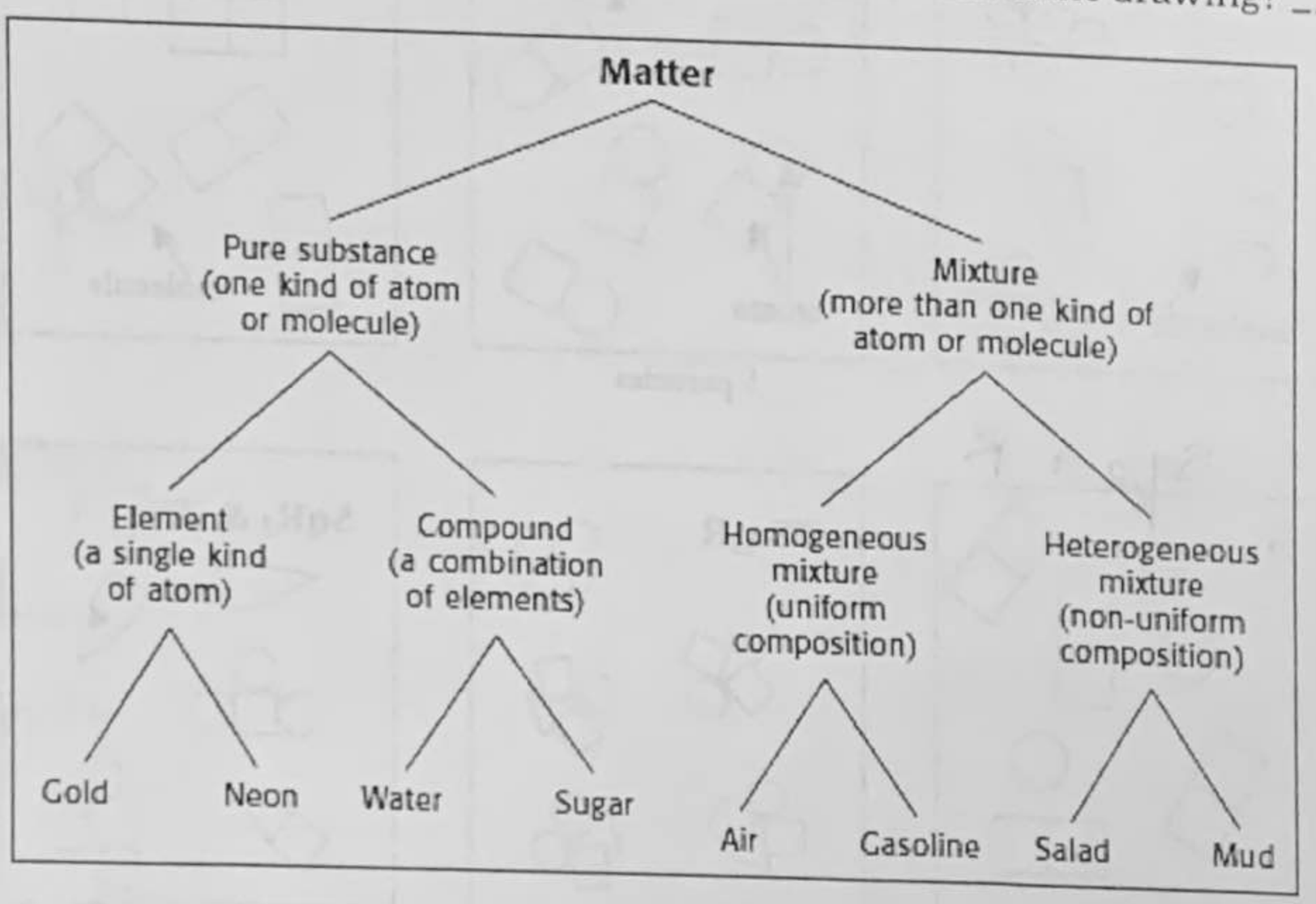
more than one particles

Complete the chart to show your understanding of atoms and molecules.

#	Code	How many different types of *molecules*?	How many different types of *atoms*?
6	RSq	1	2
7	Sq_2	1	1
8	T & RSq & R	3	3
9	TSq_2R	1	3
10	SqR_3 & TSq	2	3

12) Can a particle be a single atom? yes Can a particle be a molecule? yes

13) How many different kinds of particles are in the drawing represented by the code T & RSq & R in Model 1? 3 How many total particles are in this same drawing? 8



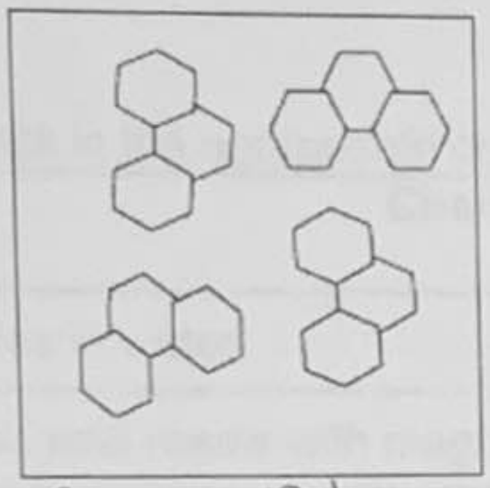
Vocabulary

- Element- only one kind of atom
- Compound- 2 or more kinds of atoms bonded together
- Pure substance- either an element or a compound; homogeneous
- Mixture- 2 or more things combined together but not chemically bonded
- Solution- 2 or more substances that are dissolved; a solute in a solvent; homogeneous mixture

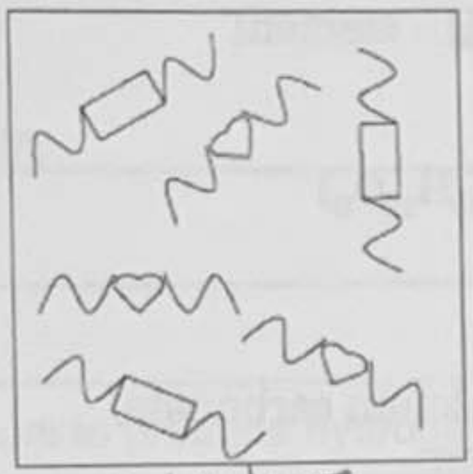
14) Using the Concept Map and the Vocabulary above, classify each of the 9 drawings in **Model 1** as an ELEMENT, COMPOUND, or MIXTURE. Write the correct label below each of the drawings.

Assessment Questions:

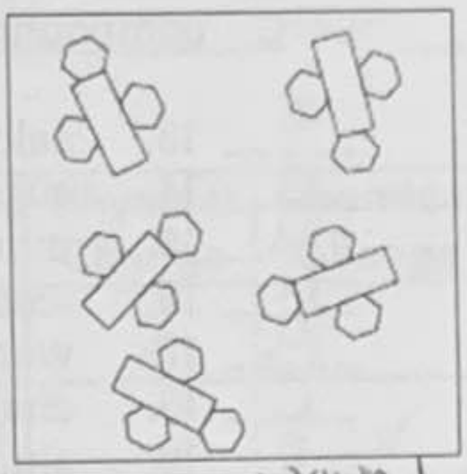
1. Identify each of the drawings below as an element, a compound or a mixture.



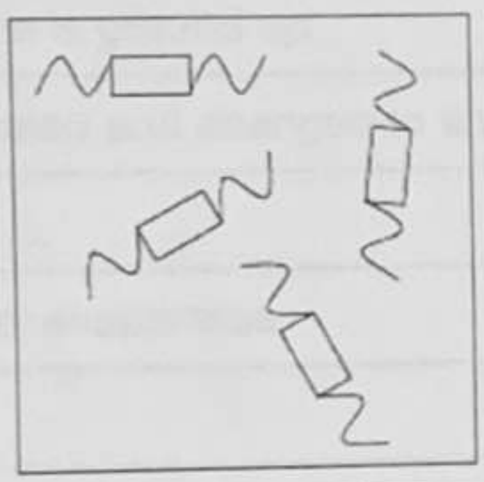
compound



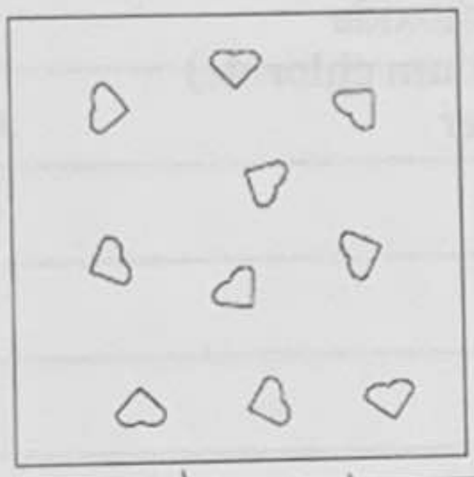
mixture



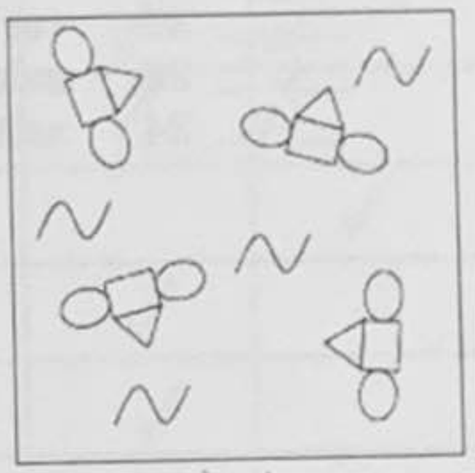
compound



compound



element



mixture

2. Identify the common household items shown below as an element (E), a compound (C), or a mixture (M). The chemical formulas are shown to help you decide how these should be classified.

a) gold (Au) E	g) sugar ($C_{12}H_{22}O_{11}$) C
b) salt water (NaCl & H_2O) M	h) sodium chloride (NaCl) C
c) granite (SiO_2 & $KAlSi_3O_3$ & $K_3Si_3O_{10}$) M	i) battery acid (H_2SO_4) C
d) oxygen (O_2) E	j) vinegar (H_2O & $HC_2H_3O_2$) M
e) air (N_2 & O_2 & CO_2 ...) M	k) water (H_2O) C
f) drain cleaner (Al & NaOH) M	l) baking soda ($NaHCO_3$) C

I. Identify each material below as:
HE – heterogeneous (must be a heterogeneous mixture) or
HO – homogeneous (element, compound, or homogeneous mixture)

HO 1. water
HO 2. oxygen
HE 3. vegetable soup
HE 4. notebook paper
HO 5. salt water
HE/HO 6. orange juice
HE 7. bread
HE 8. a cupcake

HO 9. air
HE 10. wood
HO 11. silver
HO 12. salt (sodium chloride)

II. Identify each material below as:
M – mixture (heterogeneous or homogeneous),
C – compound, or E – element

E 13. calcium
C 14. sugar ($C_{12}H_{22}O_{11}$)
M 15. mud
M 16. iced tea
M 17. wood
C 18. chalk (calcium carbonate)
E 19. aluminum
M 20. pencil
M 21. chocolate
C 22. carbon dioxide
C 23. salt (sodium chloride)
M 24. salt water

Physical and Chemical Changes

Name: _____

Date: _____ Hour: ___

Place a check in the appropriate column:

Change	Physical Change	Chemical Change
Salt dissolves in water.	✓	
Hydrochloric acid reacts with magnesium to produce hydrogen gas.		✓
A piece of copper is cut in half.	✓	
A sugar cube is ground up.	✓	
Water is heated and changed to steam.	✓	
Iron rusts.		✓
Ethyl alcohol evaporates.	✓	
Ice melts.	✓	
Milk sours (goes bad).		✓
Sugar dissolves in water.	✓	
Sodium and potassium react violently with water.		✓
Pancakes cook on a griddle.		✓
Grass grows on a lawn.		✓
A tire is inflated with air.	✓	
Food is digested in the stomach.	✓	
Water is absorbed by a paper towel.	✓	
Ethyl alcohol boils at 79°C.	✓	
Paper burns.		✓
Water freezes at 0°C.	✓	
Fireworks explode.		✓
Alka-Seltzer gives off carbon dioxide when added to water.		✓
Clouds form in the sky.	✓	

Part B

Read each scenario. Decide whether a physical or chemical change has occurred and give evidence for your decision. The first one has been done for you to use as an example.

	Scenario	Physical or Chemical Change?	Evidence...
1.	Umm! A student removes a loaf of bread hot from the oven. The student cuts a slice off the loaf and spreads butter on it.	Physical	No change in substances. No unexpected color change, temperature change or gas given off.
2.	Your friend decides to toast a piece of bread, but leaves it in the toaster too long. The bread is black and the kitchen if full of smoke.	C	color change production of smoke
3.	You forgot to dry the bread knife when you washed it and reddish brown spots appeared on it.	C	color change
4.	You blow dry your wet hair.	P	change in state liquid → gas
5.	In baking biscuits and other quick breads, the baking powder reacts to release carbon dioxide bubbles. The carbon dioxide bubbles cause the dough to rise.	C	production of a gas
6.	You take out your best silver spoons and notice that they are very dull and have some black spots.	C	color change
7.	A straight piece of wire is coiled to form a spring.	P	change in shape
8.	Food color is dropped into water to give it color.	P	- mixing two substances, can be sepeated through evaporation
9.	Chewing food to break it down into smaller particles represents a _____ change, but the changing of starch into sugars by enzymes in the digestive system represents a _____change.	P+C	- changing size - change of matter
10.	In a fireworks show, the fireworks explode giving off heat and light.	C	production of heat + light

Part C: True (T) or False (F)

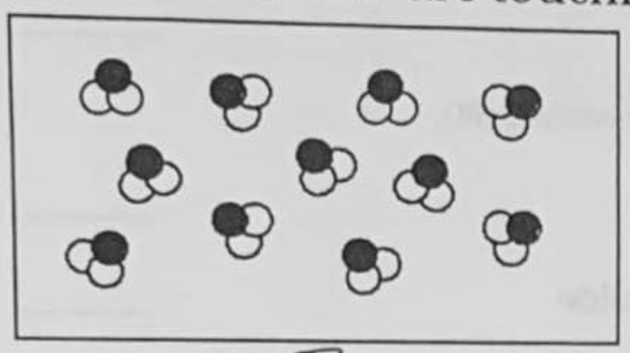
1.	F	Changing the size and shapes of pieces of wood would be a chemical change.
2.	F	In a physical change, the makeup of matter is changed.
3.	T	Evaporation occurs when liquid water changes into a gas.
4.	T	Evaporation is a physical change.
5.	F	Burning wood is a physical change.
6.	F	Combining hydrogen and oxygen to make water is a physical change.
7.	T	Breaking up concrete is a physical change.
8.	F	Sand being washed out to sea from the beach is a chemical change.
9.	F	When ice cream melts, a chemical change occurs.
10.	F	Acid rain damaging a marble statue is a physical change.

Elements, Compounds, and Mixtures

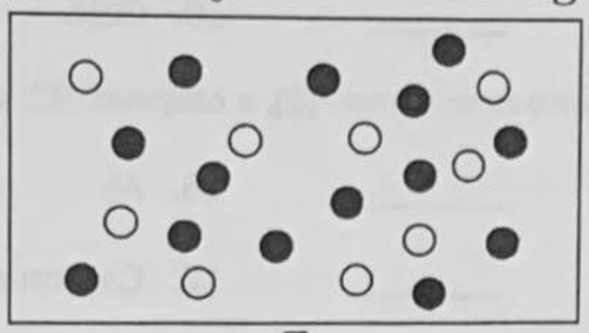
Classify each of the pictures below by placing the correct label in the blanks below:

A= Element
B= Compound
C= Mixture of elements
D= Mixture of compounds
E= Mixture of elements and compounds

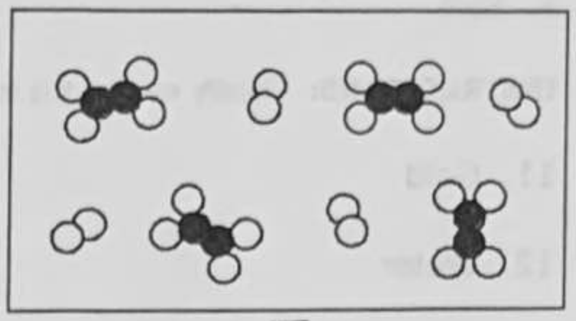
Each circle represents an atom and each different color represents a different kind of atom. If two atoms are touching then they are bonded together.



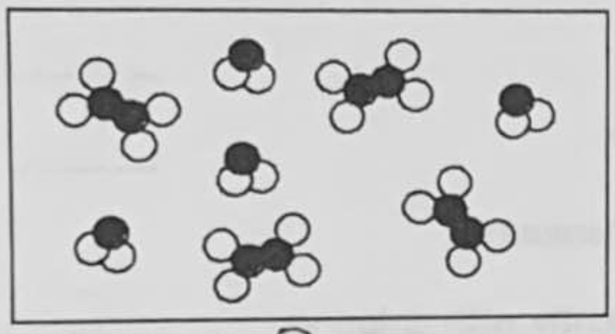
1) B



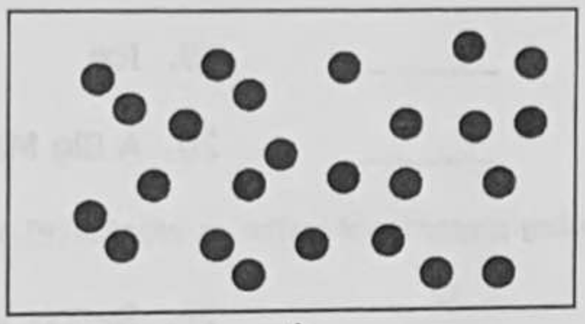
2) C



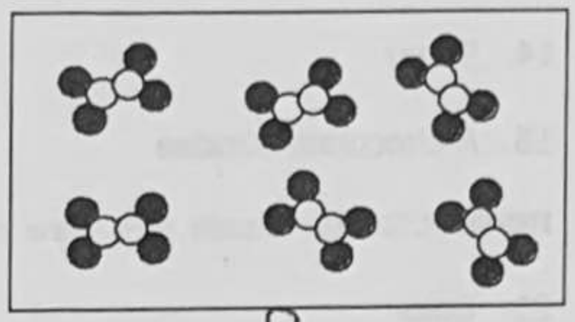
3) E



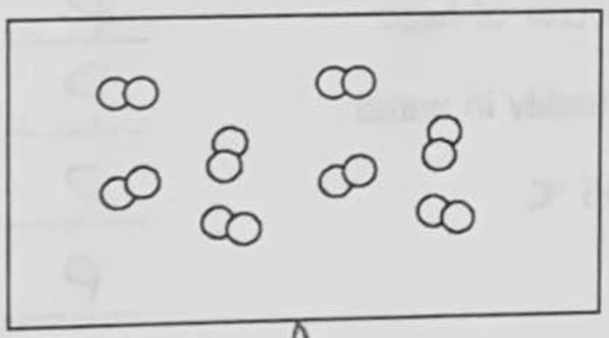
4) D



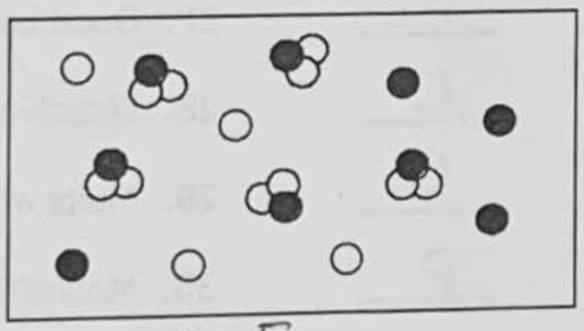
5) A



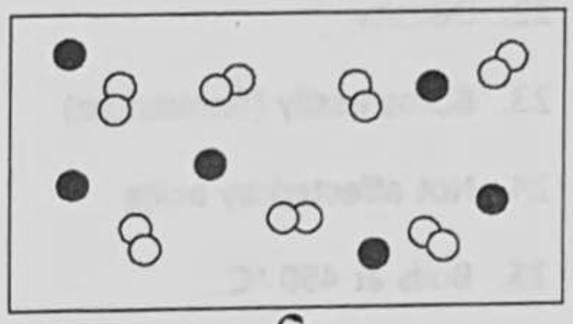
6) B



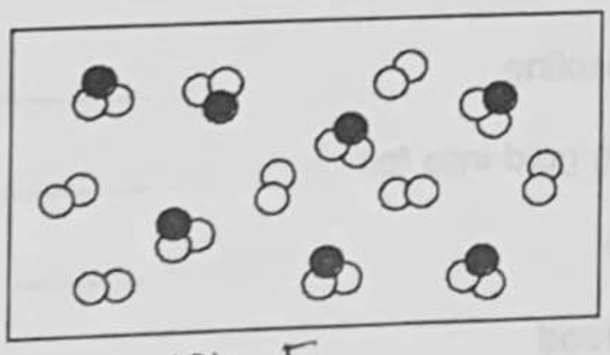
7) A



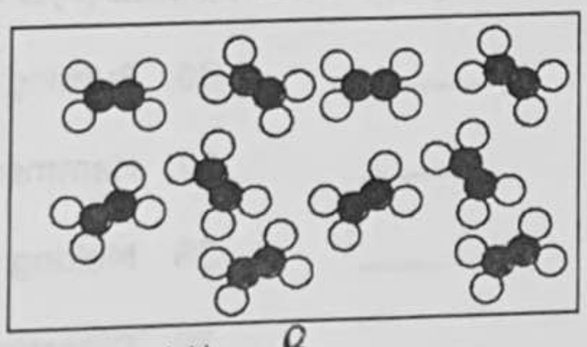
8) E



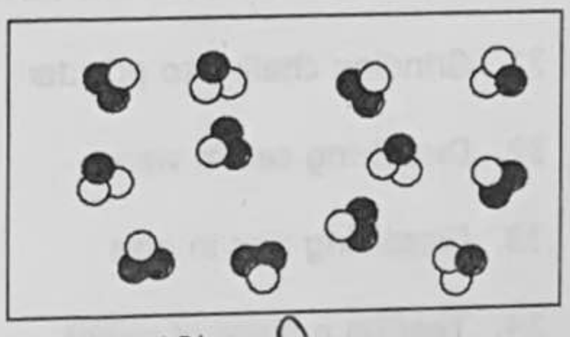
9) C



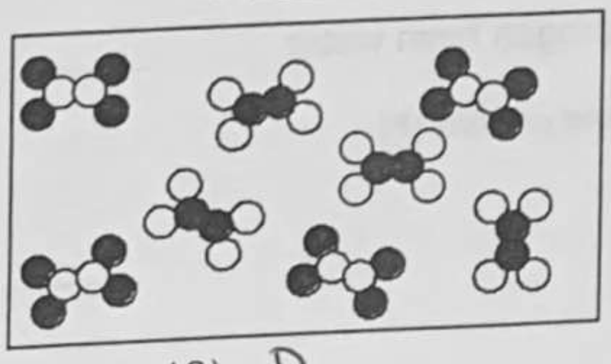
10) F



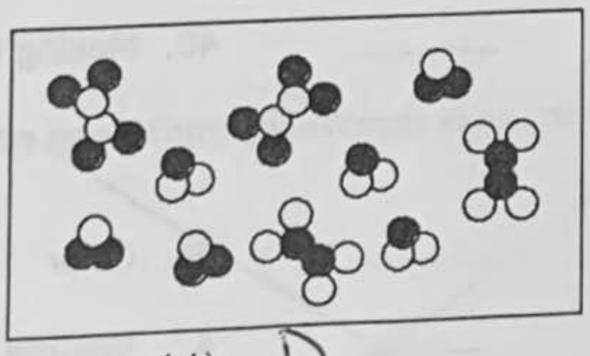
11) B



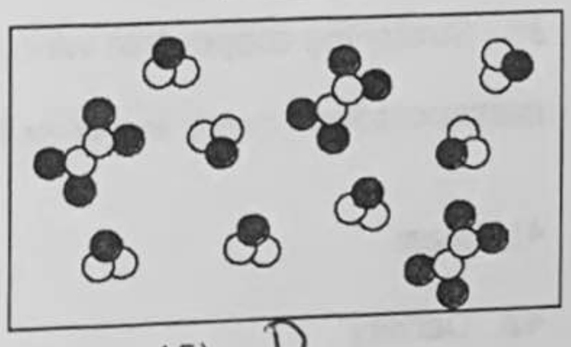
12) D



13) D



14) D



15) D

NAME _____

Chemistry I Worksheet
Classification of Matter and Changes

INSTRUCTIONS: Write **E** in the blank if the material is *heterogeneous* or **O** if it is *homogeneous*.

1. Wood HE
2. Freshly-brewed black coffee HO
3. Water HO
4. Lucky Charms® HE
5. Salt HO
6. Dirt HE
7. Sausage-and-mushroom pizza HE
8. Air HO
9. Milk HO
10. Gold HO

INSTRUCTIONS: Classify each of the following as an *element* [**E**], a *compound* [**C**], or a *mixture* [**M**].

11. Gold e
12. Water C
13. Seawater M
14. Sugar C
15. A chocolate sundae M
16. Air M
17. Carbon dioxide C
18. Silver E
19. Ice C
20. A Big Mac® M

INSTRUCTIONS: Classify each of the following properties of matter as *physical* [**P**] or *chemical* [**C**].

21. Color P
22. Density P
23. Burns easily (flammable) C
24. Not affected by acids C
25. Boils at 450 °C P
26. Reacts violently with chlorine C
27. Good conductor of heat P
28. Dissolves readily in water P
29. Melts at 145 °C P
30. Malleable P

INSTRUCTIONS: Classify each of the following changes in matter as *physical* [**P**] or *chemical* [**C**].

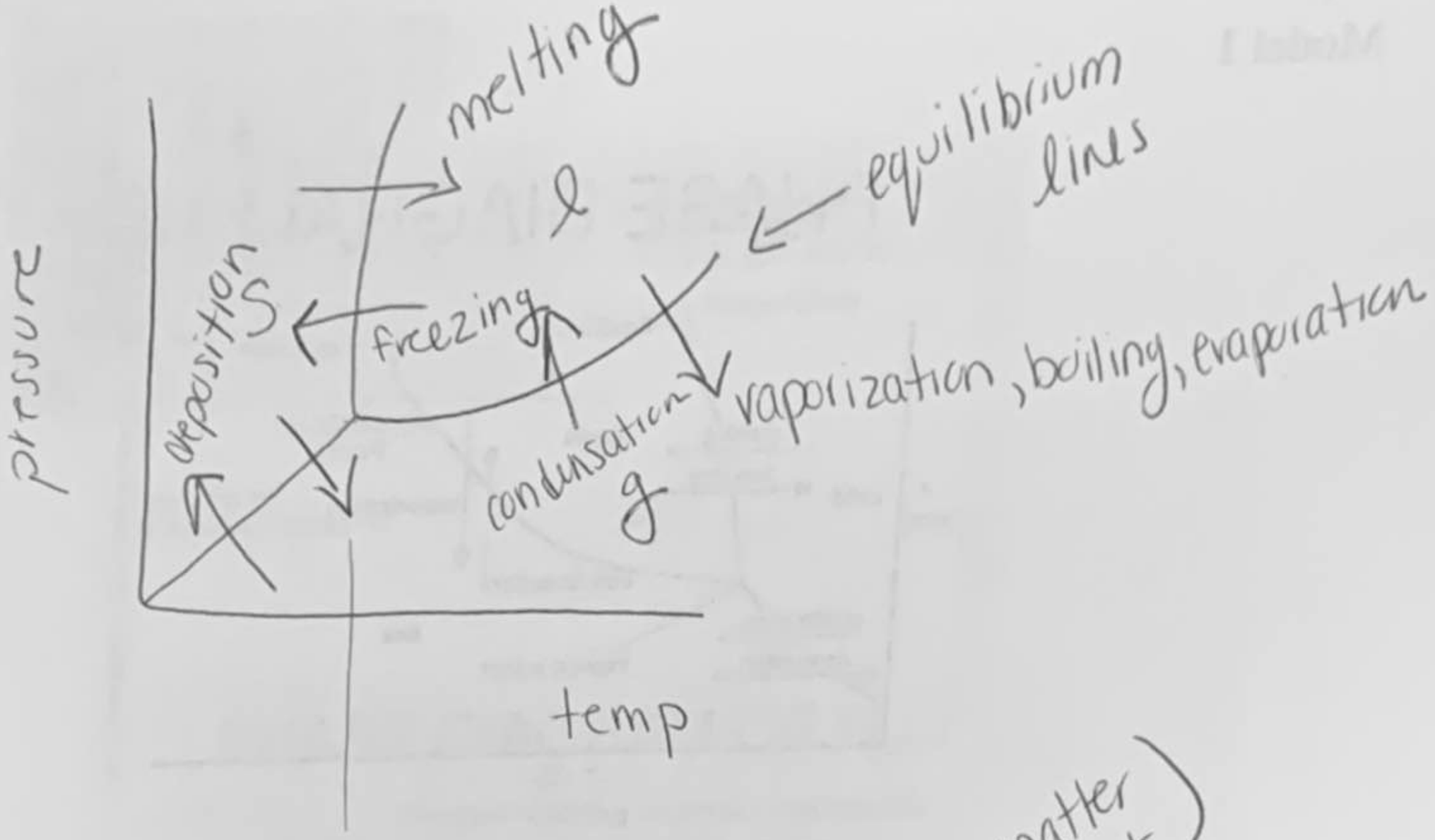
31. Grinding chalk into powder P
32. Dissolving salt in water P
33. Dissolving zinc in acid C
34. Tearing a piece of paper P
35. Stretching copper into wire P
36. Burning gasoline C
37. Hammering gold into foil P
38. Melting ice P
39. Digesting food C
40. Making hydrogen from water C

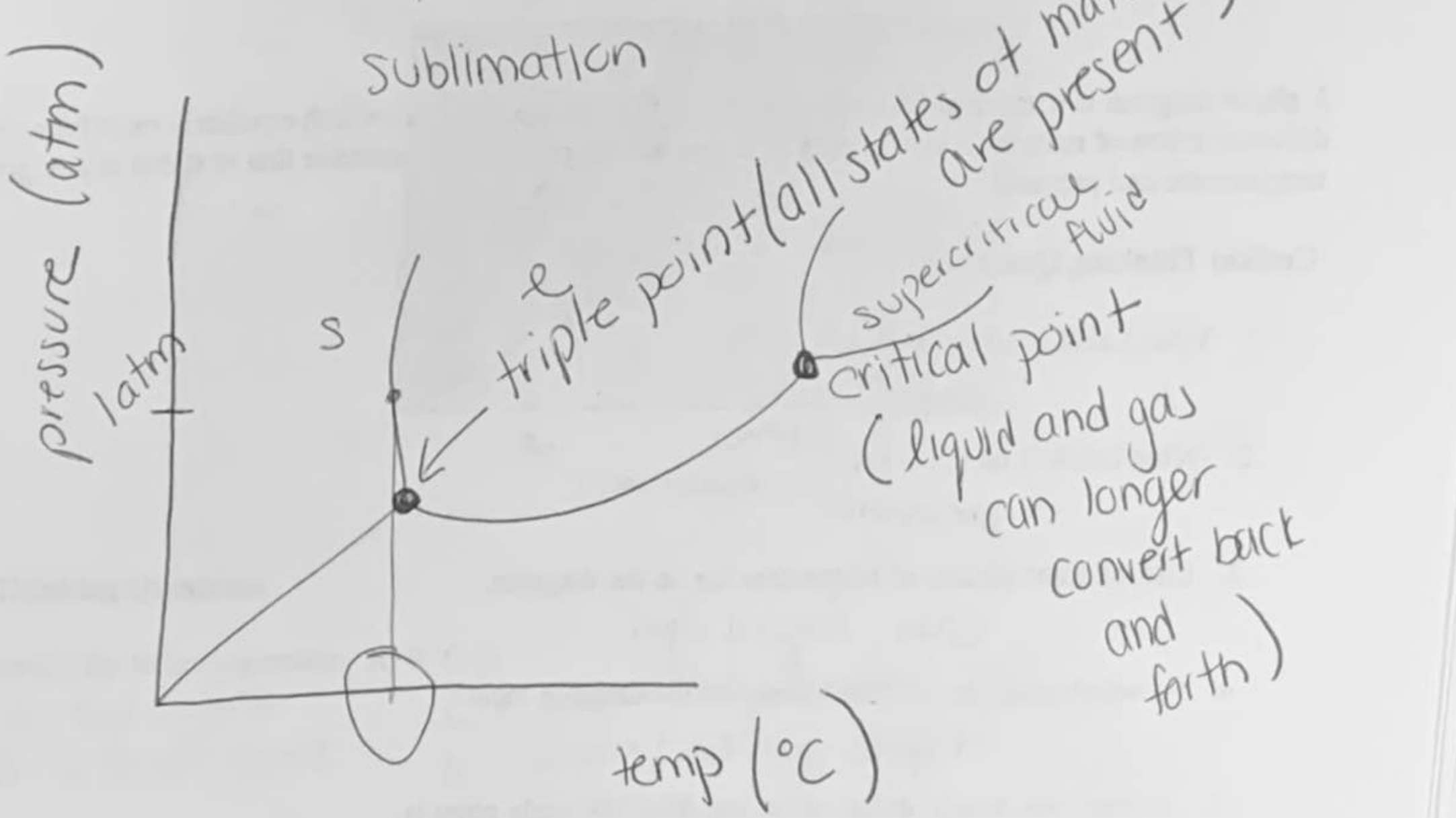
INSTRUCTIONS: Classify each of the following as an *intensive property* [**I**] or an *extensive property* [**E**].

41. Mass
42. Density
43. Melting point
46. Color
47. Volume
48. Length

11

Notes: Phase Diagrams



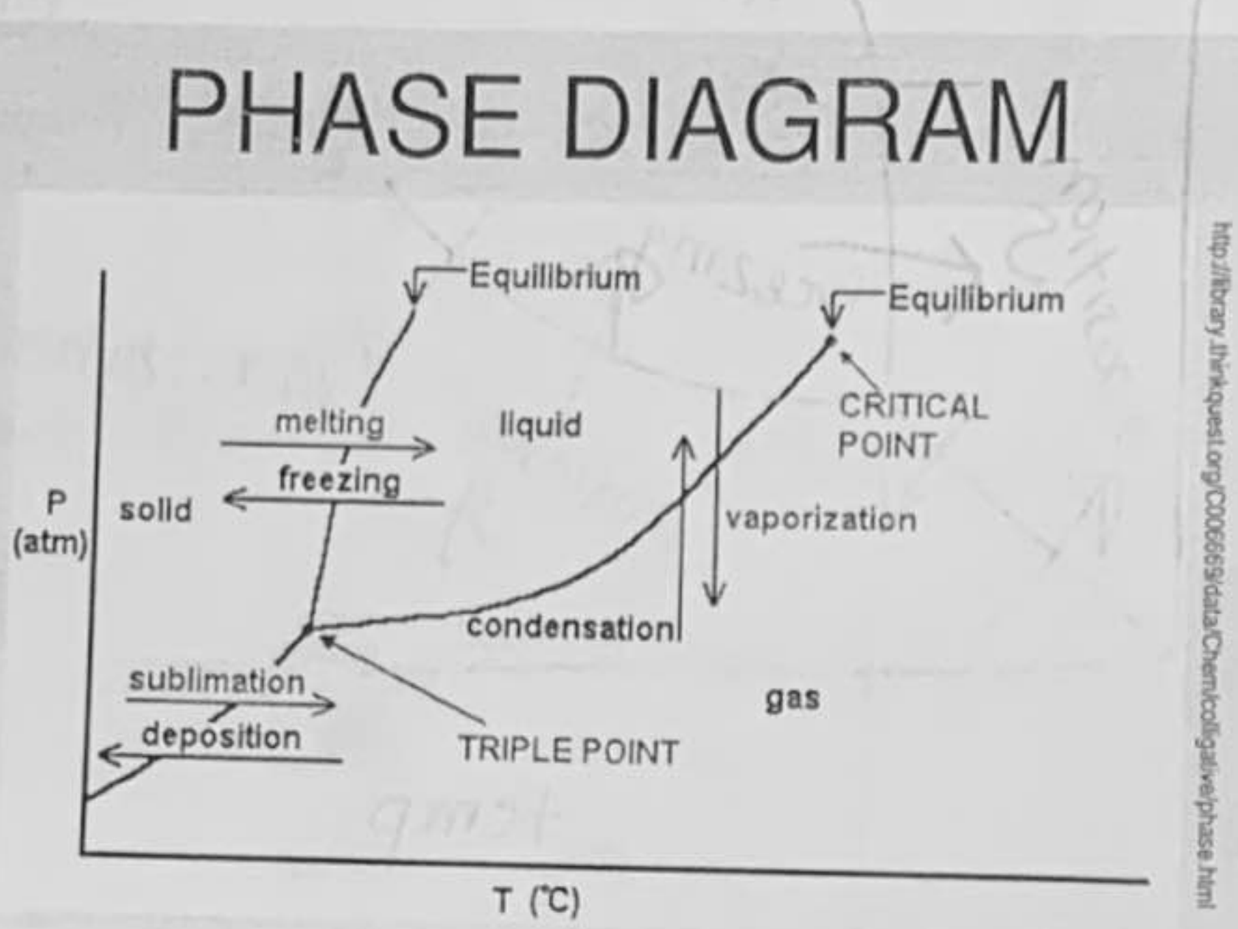


"normal" melting / boiling point
(1 atm) → find the phase change
→ determine the temp

Phase Diagram POGIL

Name:_____ Date:_____

Model 1



A phase diagram is a graphical way to summarize the conditions under which equilibria exist between the different states of matter. It also allows us to predict the phase of a substance that is stable at any given temperature and pressure.

Critical Thinking Questions

1. What Label is on the x-axis?

   temp

2. What Label is on the y-axis?

   pressure

3. List the three phases of matter that are on the diagram.

   solid, liquid, gas

4. At which point do all three phases on the diagram meet?

   triple point

5. In your own words, define what you think the triple point is.

   where all 3 states of matter are present

6. The line extending from the triple point to the critical point stops. What does this mean in terms of phase change?

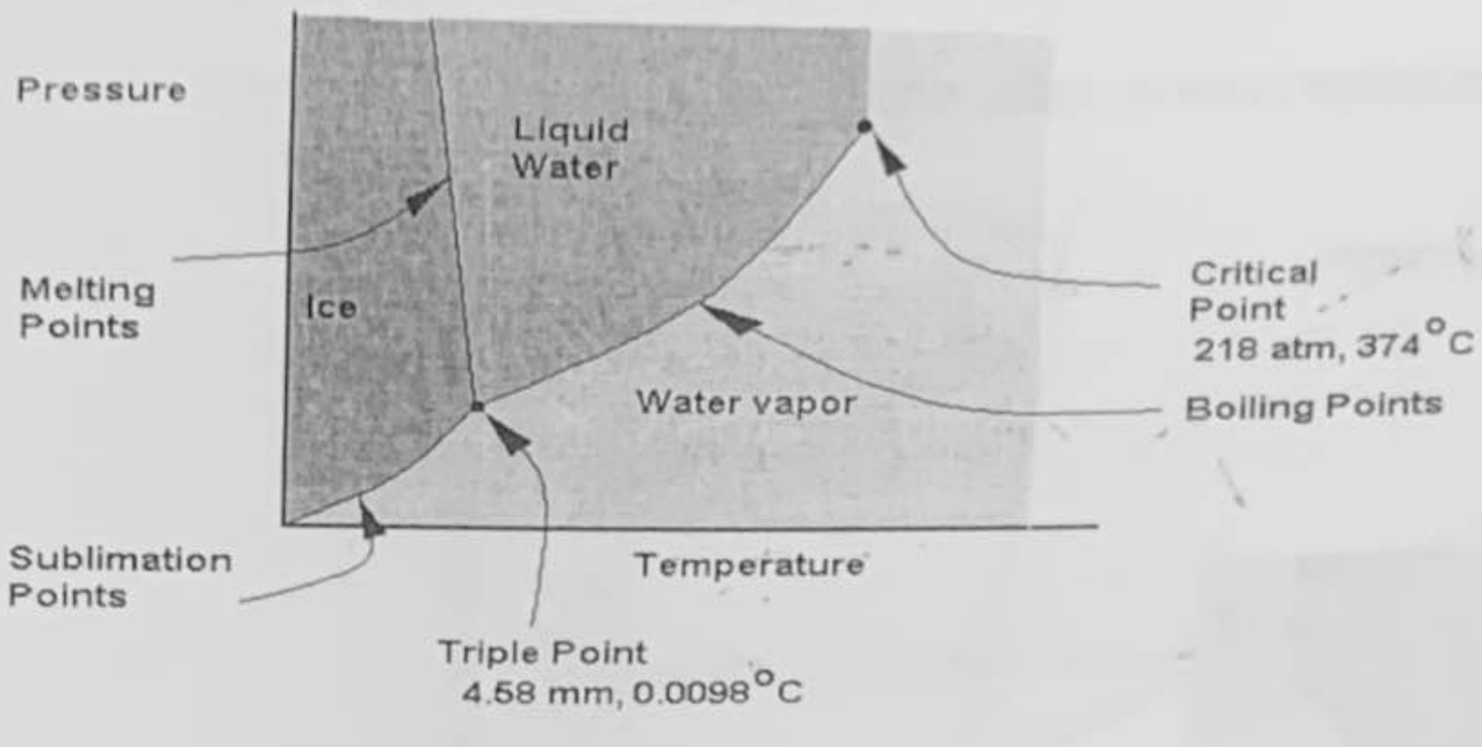
   it no longer occurs

7. In your own words, define what you think the critical point is.

   The point where liquid and gas can no longer convert into each other

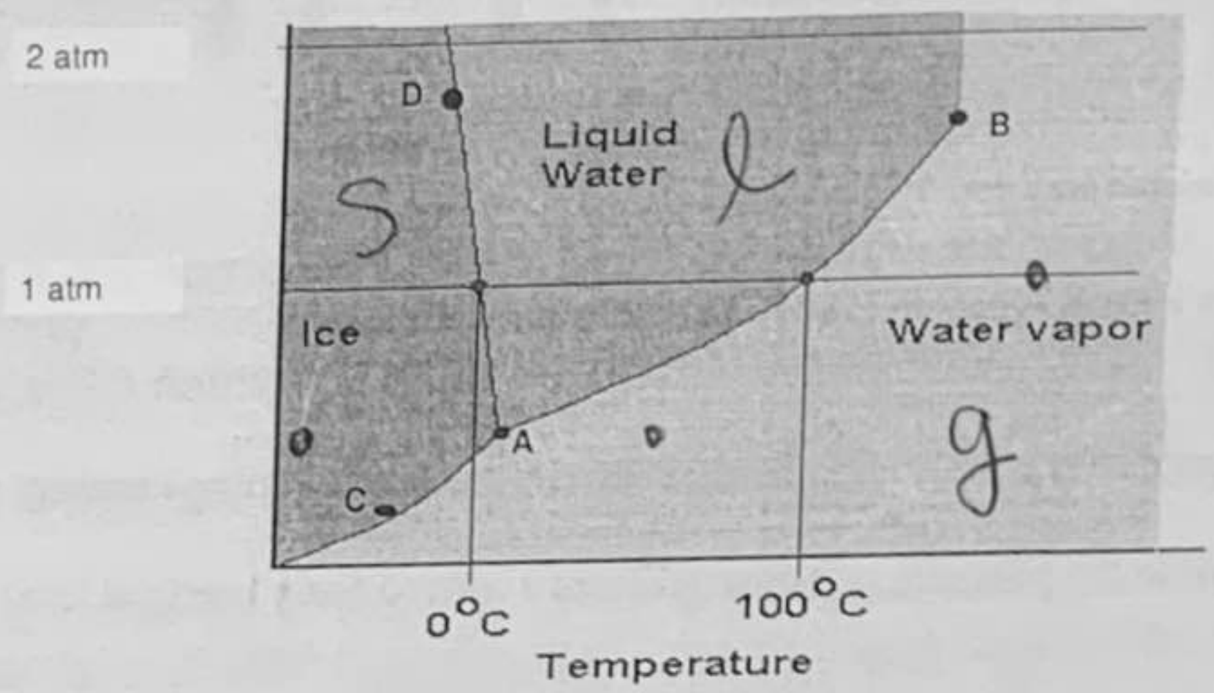
Model 2

Phase Diagram for Water



PHASE DIAGRAM OF H_2O

Normal Melting and Boiling Points



Critical Thinking Questions

8. Identify the following points: A, B, C, D

A = triple point
B = critical point
C = sublimation / deposition point
D = melting / freezing point

9. If the line AD represents the melting/freezing line for water, what would the AB line represent? What would the AC line represent?

$\overline{AB}$ = boiling / condensation line
$\overline{AC}$ = sublimation / deposition line

10. Given the phase diagram above, what phase would water be in if it had the following properties:

a. 50 °C, and 0.5 atm pressure

gas

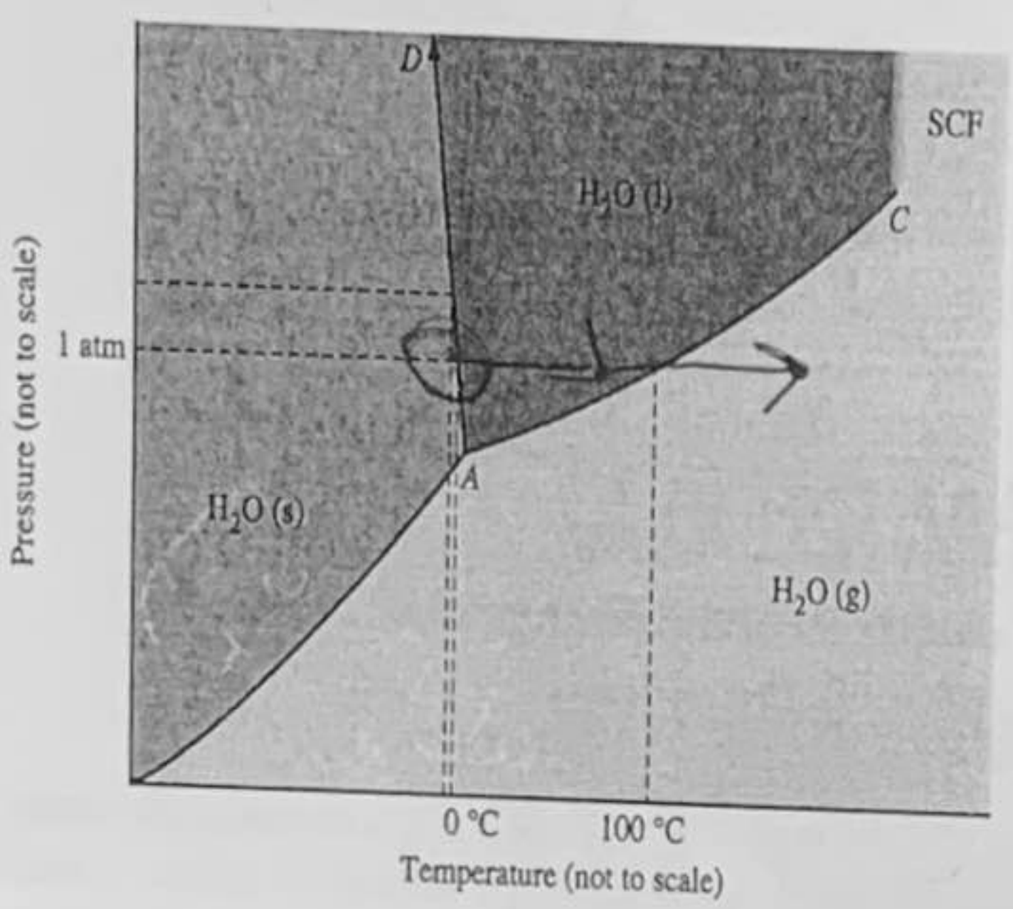
b. -50°C, and 0.5 atm pressure

Solid

c. 125 °, and 1.0 atm pressure

gas

Model 3



11. In the diagram above, what do (s), (l), and (g) represent?

Using the phase diagram of the liquid above, describe any changes in phase present when H_2O is:

12. kept at 0°C while the pressure is increased from 1 atm to 5atm (vertical line)

s → l melting

13. Kept at 1.00 atm while the temperature is increased from 0 °C to 125 °C. (horizontal line)

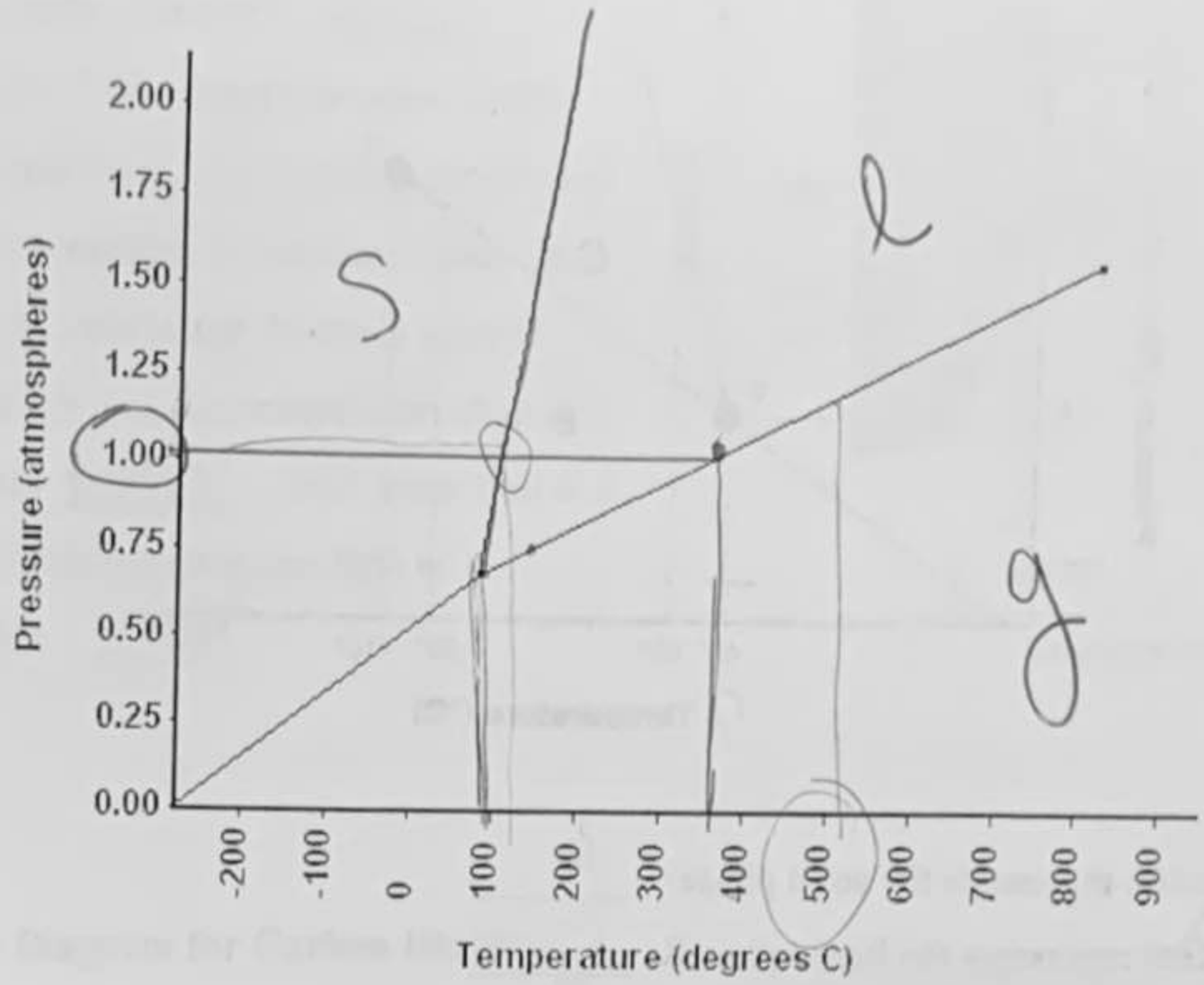
s

s → l → g

melting evaporation

Phase Diagram Worksheet

Refer to the phase diagram below when answering the questions on this worksheet:



1) What is the normal freezing point of this substance? 100°C

2) What is the normal boiling point of this substance? 350°C

3) What is the triple point of this substance? 0.55atm, 100°C

4) If I had a quantity of this substance at a pressure of 2.00 atm and a temperature of 300° C and lowered the pressure to 0.5 atm, what phase transition(s) would occur?

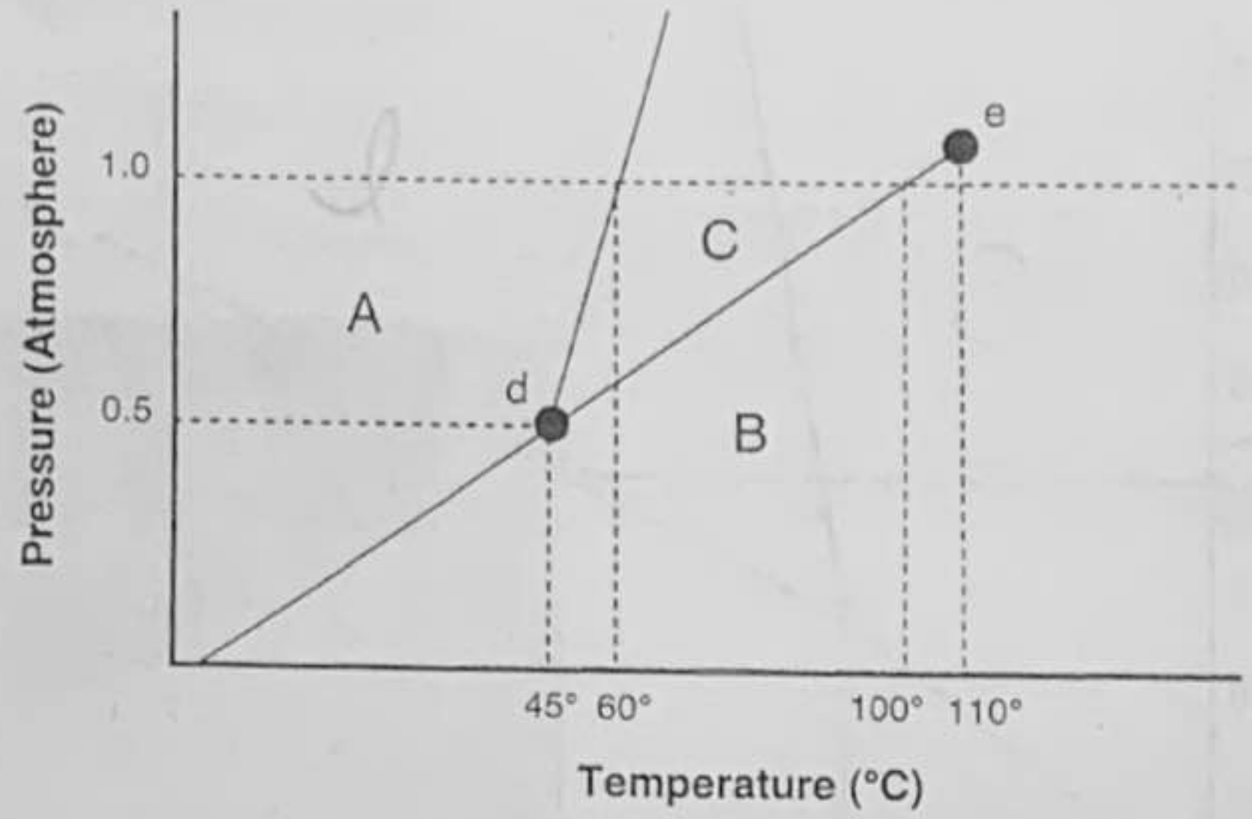
liquid → gas (evaporation)

5) If I had a quantity of this substance at a pressure of 0.75 atm and a temperature of -100° C, what phase change(s) would occur if I increased the temperature to 600° C? At what temperature(s) would they occur?

S → l (at 100°C) and then l → g (at 150°C)
melting evaporation

PHASE DIAGRAM WORKSHEET

Part A – Answer the questions below in relation to the following phase diagram.



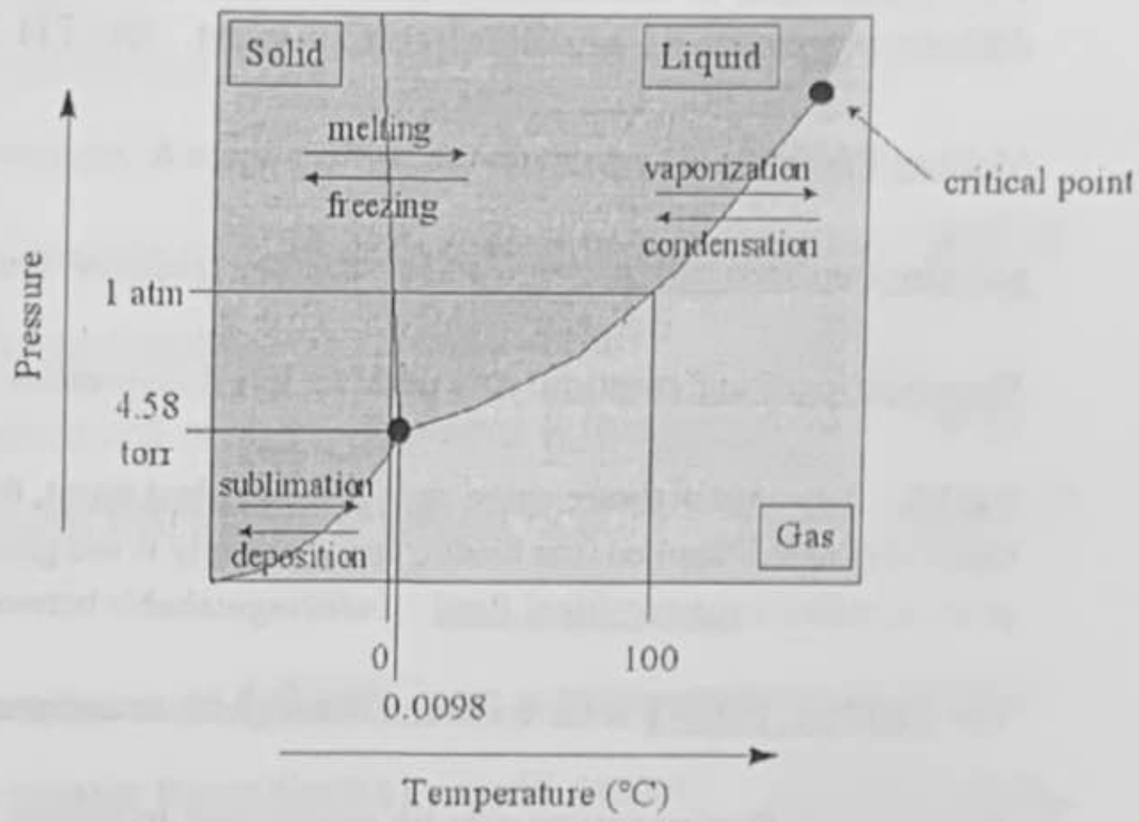
1. Which section represents the solid phase? A
2. What section represents the liquid phase? C
3. What section represents the gas phase? B
4. What letter represents the triple point? d In your own words, what is the definition of a triple point?
   where all 3 states of matter are present
5. What is this substance's normal melting point, at 1 atmosphere of pressure? 60°C
6. What is this substance's normal boiling point, at 1 atmosphere of pressure? 100°C
7. Above what temperature is it impossible to liquefy this substance, no matter what the pressure? 110°C
8. At what temperature and pressure do all three phases coexist? 45°C + 0.5atm
9. At a constant temperature, what would you do to cause this substance to change from the liquid phase to the solid phase? increase pressure
10. What does sublimation mean?
    solid → gas
11. What does deposition mean? gas → solid

Part B – Phase Diagram for Water.

12. At a pressure of 1 atmosphere, what is the normal freezing point of water? 0°C

13. What is the normal boiling point of water, at one atmosphere of water? 100°C

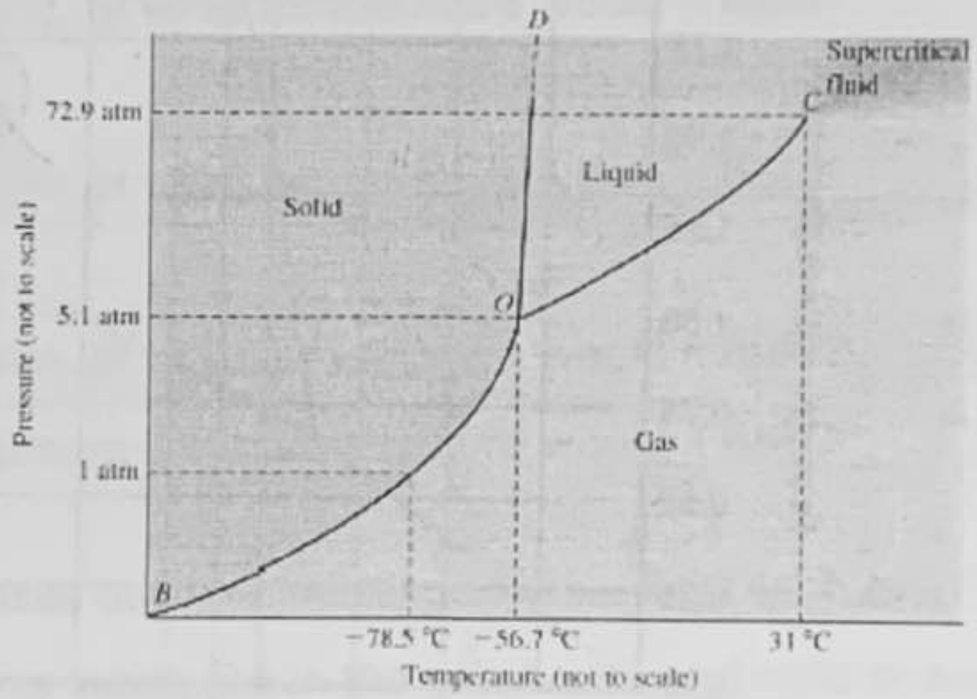
14. Albuquerque, NM is approximately 5,500 feet above sea level, which means the normal atmospheric pressure is less than 1 atm. In Albuquerque, will water freeze at a lower temperature or a higher temperature than at 1 atmosphere? higher Will water boil at a higher or lower temperature, than at 1 atmosphere? lower



Part C – Phase Diagram for Carbon Dioxide.

15. At 1 atmosphere and room temperature (25°C), would you expect solid carbon dioxide to melt to the liquid phase, or sublime to the gas phase? gas

16. Some industrial processes require carbon dioxide. The carbon dioxide is stored on-site in large tanks as liquid carbon dioxide. Assuming the tanks are at sea level (1 atm), how could carbon dioxide be liquefied? increase pressure



Phase Diagram Worksheet #1

A **phase diagram** is a graphical way to depict the effects of **pressure** and **temperature** on the phase of a substance:

The CURVES indicate the conditions of temperature and pressure under which "equilibrium" between different phases of a substance can exist. BOTH phases exist on these lines:

Melting/Freezing: Any point on this line (pressure & temperature) the substance is both **solid** and **liquid**

Sublimation/Deposition: Any point on this line (pressure & temperature) the substance is both **solid** and **gas**

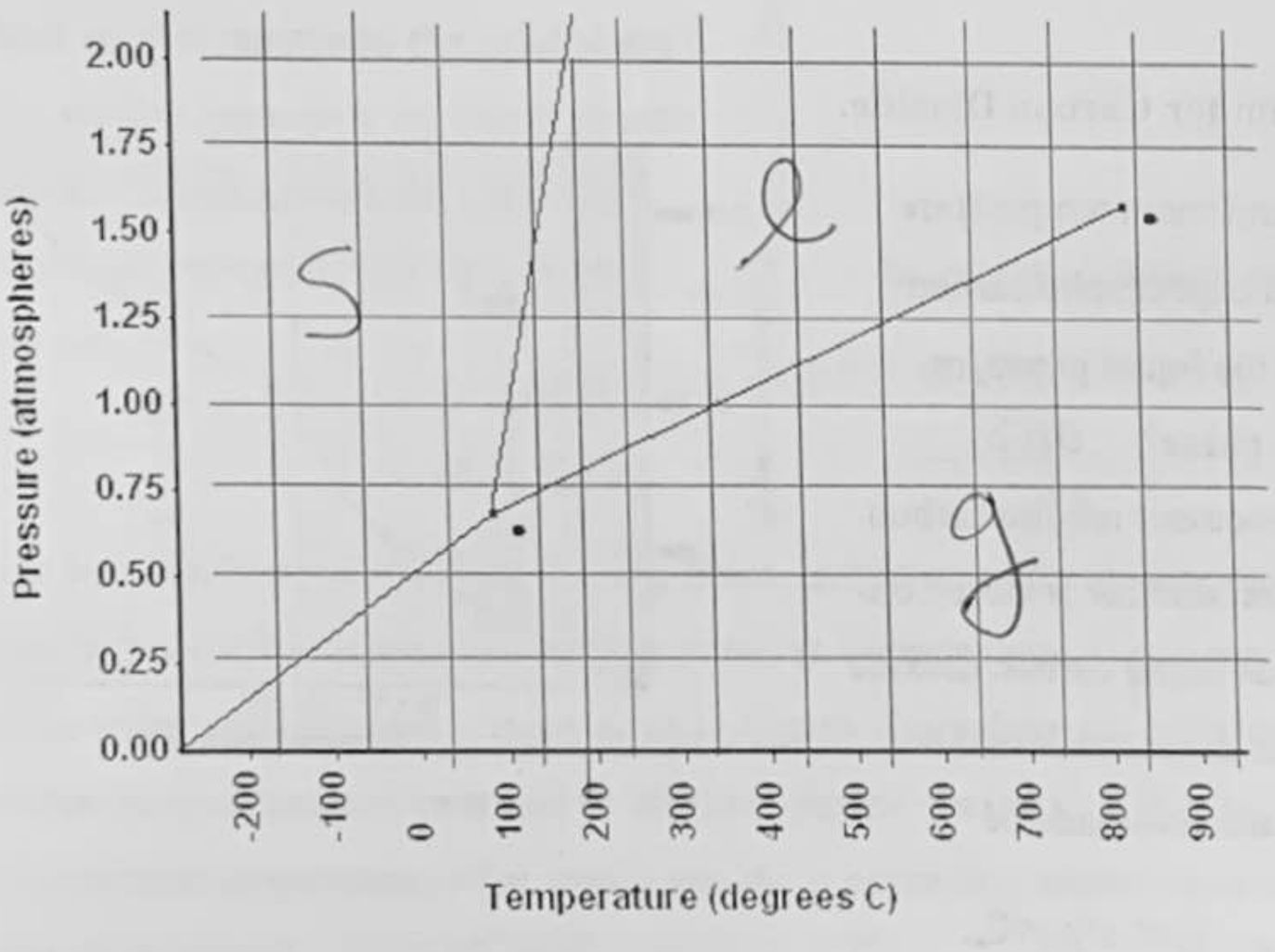
Vaporization/Condensation: Any point on this line (pressure & temperature) the substance is both **liquid** and **gas**

NOTE: the vapor pressure curve ends at the **critical point,** the temperature above which the gas cannot be liquefied no matter how much pressure is applied (the kinetic energy simply is too great for attractive forces to overcome). Any substance beyond this critical point is called a **supercritical fluid** – *indistinguishable* between gas or liquid (*neither one*)

The **TRIPLE POINT** is the condition of temperature and pressure where ALL THREE phases exist in equilibrium (solid, liquid, gas)

Remember that pressure can be expressed in many units where: **1 atm = 101.3 kpa = 760 mmHg**

NOTE: "*Normal*" refers to Standard Pressure.



~~1) What are the values for temperature and pressure at STP? T= _____, P= _____~~

2) What is the *normal* freezing point of this substance? 100°C

3) What is the *normal* boiling point of this substance? 325°C

4) What is the *normal* melting point of this substance? 100°C

5) What is the phase (s, l, g) of a substance at **2.0 atm** and 100 °C? S

6) What is the phase (s, l, g) of a substance at **0.75 atm** and 100 °C? ℓ

What is the phase (s, l, g) of a substance at **0.5 atm** and 100 °C? g

What is the phase (s, l, g) of a substance at 1.5 atm and **50 °C**? S

What is the phase (s, l, g) of a substance at 1.5 atm and **200 °C**? l

0) What is the phase (s, l, g) of a substance at 1.5 atm and **800 °C**? g

1) What is the condition of the **triple point** of this substance? T= 90°C, P= 0.70 atm

2) If a quantity of this substance was at an initial pressure of 1.25 atm and a temperature of **300° C** was lowered to a pressure of 0.25 atm, what phase transition(s) would occur? evaporation

13) If a quantity of this substance was at an initial pressure of 1.25 atm and a temperature of **0° C** was lowered to a pressure of 0.25 atm, what phase transition(s) would occur? sublimation

14) If a quantity of this substance was at an initial pressure of **1.0 atm** and a temperature of 200° C was lowered to a temperature of **-200° C**, what phase transition(s) would occur? freezing

15) If a quantity of this substance was at an initial pressure of **0.5 atm** and a temperature of 200° C was lowered to a temperature of **-200° C**, what phase transition(s) would occur? deposition

16) If this substance was at a pressure of 1.25 atm, at what temperature would it **melt**?
100°C

17) If this substance was at a pressure of 1.25 atm, at what temperature would it **boil**? 550°C

18) If this substance was at a pressure of 0.75 atm, at what temperature would it **melt**? 95°C

19) If this substance was at a pressure of 0.75 atm, at what temperature would it **boil**? 150°C

20) At what temperature do the gas and liquid phases become indistinguishable from each other? 810°C

21) At what pressure would it be possible to find this substance in the gas, liquid, **and** solid phase? 0.70 atm

22) If I had a quantity of this substance at a pressure of 1.00 atm and a temperature of -100° C, what phase change(s) would occur if I **increased the temperature** to 600° C? At what temperature(s) would they occur? (***NOTE**: multiple answers needed for this question*)
melting (100°C) and boiling (325°C)

22) If I had a quantity of this substance at a pressure of 2.00 atm and a temperature of -100° C, what phase change(s) would occur if I **decreased the pressure** to 0.25 atm? At what pressure(s) would they occur? (***NOTE**: multiple answers needed for this question*)
sublimation (0.40 atm)

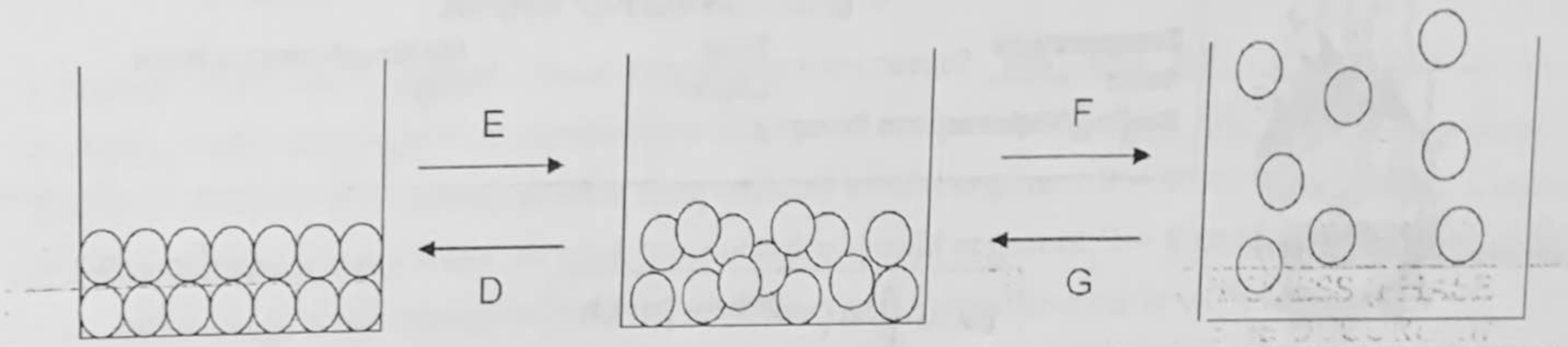
Physical Behavior of Matter
Heating and Cooling Curves

OBJECTIVES:

- Be able to distinguish between molecules in each phase of matter
- Predict phases of matter by location on a heating/cooling curve graph
- Create a cooling curve when given data and identify phase changes, E changes

Model 1 represents molecules in the three phases of matter. Based on what you already know about these phases, complete the table that follows. A word bank has been provided for the last column.

MODEL 1: PHASE CHANGE PARTICLE DIAGRAM



Word Bank for Column 3:

Gas Melting/Fusion Vaporization Solid Freezing Liquid Condensation

COLUMN 1	COLUMN 2	COLUMN 3
	DESCRIBE THE PARTICLE DIAGRAM	WHAT PHASE IS THIS?
PARTICLE DIAGRAM A	molecules packed together vibrating	solid
PARTICLE DIAGRAM B	molecules a little more spread out sliding	liquid
PARTICLE DIAGRAM C	molecules very far apart bouncing around	gas

	IS HEAT BEING ADDED OR RELEASED (TAKEN AWAY)?	WHAT PROCESS (PHASE CHANGE) IS OCCURING?
ARROW E (FROM A TO B)	added	melting
ARROW F (FROM B TO C)	added	evaporation
ARROW G (FROM C TO B)	released	condensation
ARROW D (FROM B TO A)	released	freezing

Some portions of this pogil were authored by: Erin Graham; Revised by: Josephine Parlagreco, Lizabeth Tumminello Edited by Linda Padwa and David Hanson, Stony Brook University. Regents questions from June 2009 NYS exam. Heating Curves from GCSD website.

Look at the word ENDOTHERMIC. Based on the prefix endo-, do you think energy is being added (entering), or being released (exiting)? added

Which phase change processes indicate an ENDOTHERMIC reaction? melting, evaporation

Look at the word EXOTHERMIC. Based on the prefix exo-, do you think energy is being added (entering), or being released (exiting)? released

Which phase change processes indicate an EXOTHERMIC reaction? freezing, condensation

MODEL 2: HEATING CURVE GRAPH

The following graph shows what happens to water as it goes from ice to liquid water to water vapor. Use the word bank and heating curve graph below to identify these phases and phase changes.

WORD BANK

Temperature	Time	Melting/Freezing Point
Solid	Liquid	Gas
Boiling/Vaporization Point		

boiling/vaporization point

3. gas

melting/freezing point

2. liquid

1. solid

Y axis Label: temperature

X axis Label: time

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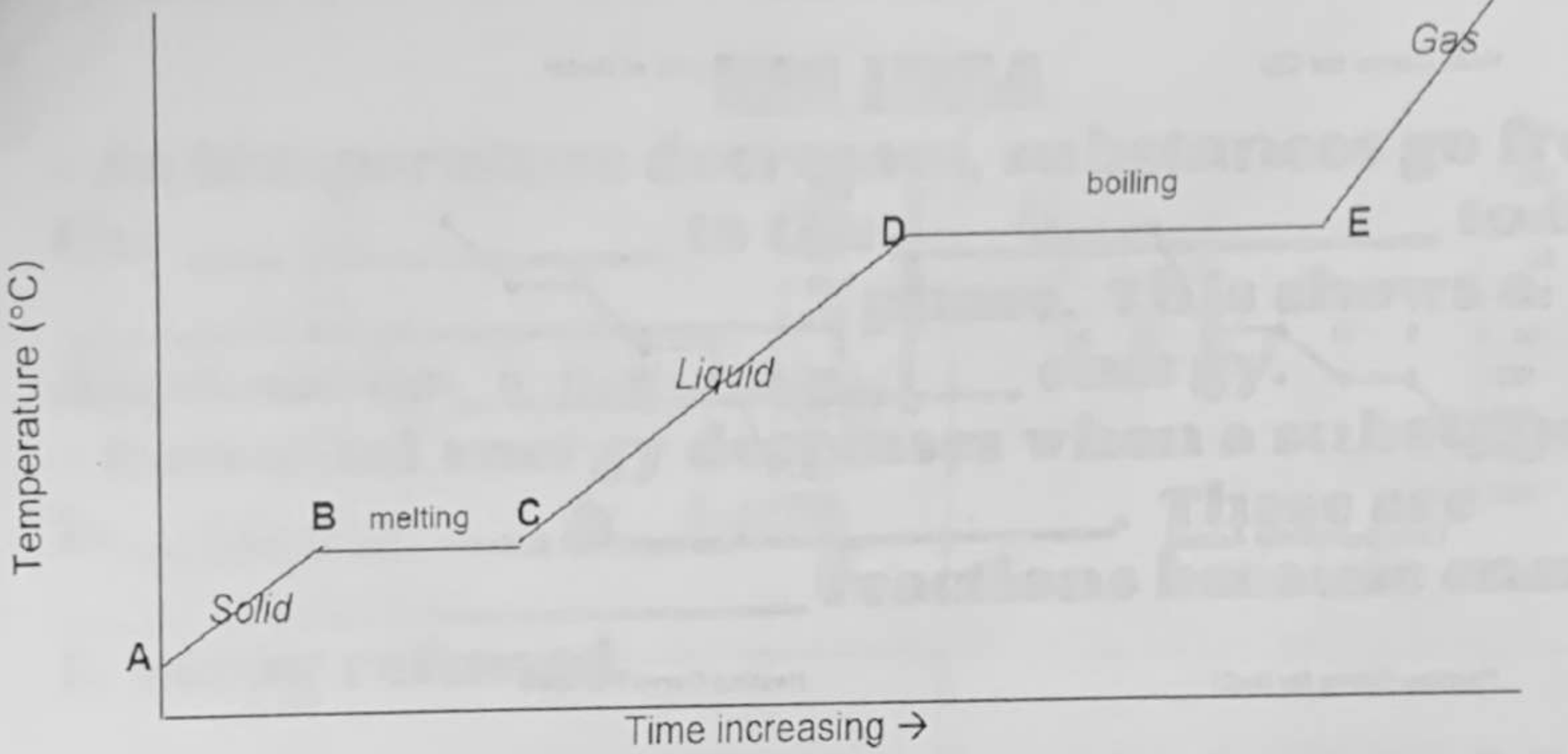
Model 2: Temperature of a Substance as Heat is Added Over Time



1. During which line segment(s) does temperature increase? AB, CD, EF
2. During which line segment(s) is there no change in temperature? BC, DE
3. If this substance were water, at what temperature would segment B – C occur? 0°C
4. If this substance were water, at what temperature would segment D – E occur? 100°C
5. **Kinetic energy** is the energy of motion. It can be used interchangeably with the word temperature. Which line segment(s) show an increase in kinetic energy? AB, CD, EF
6. **Potential energy** is stored energy. When kinetic energy is not increasing, but heat is still being added to the system this potential energy increases. Which line segment(s) show this?

   BC, DE
7. Compare segments B – C and D – E. Why is segment D – E is longer than B – C?

   D-E requires more energy than B-C does

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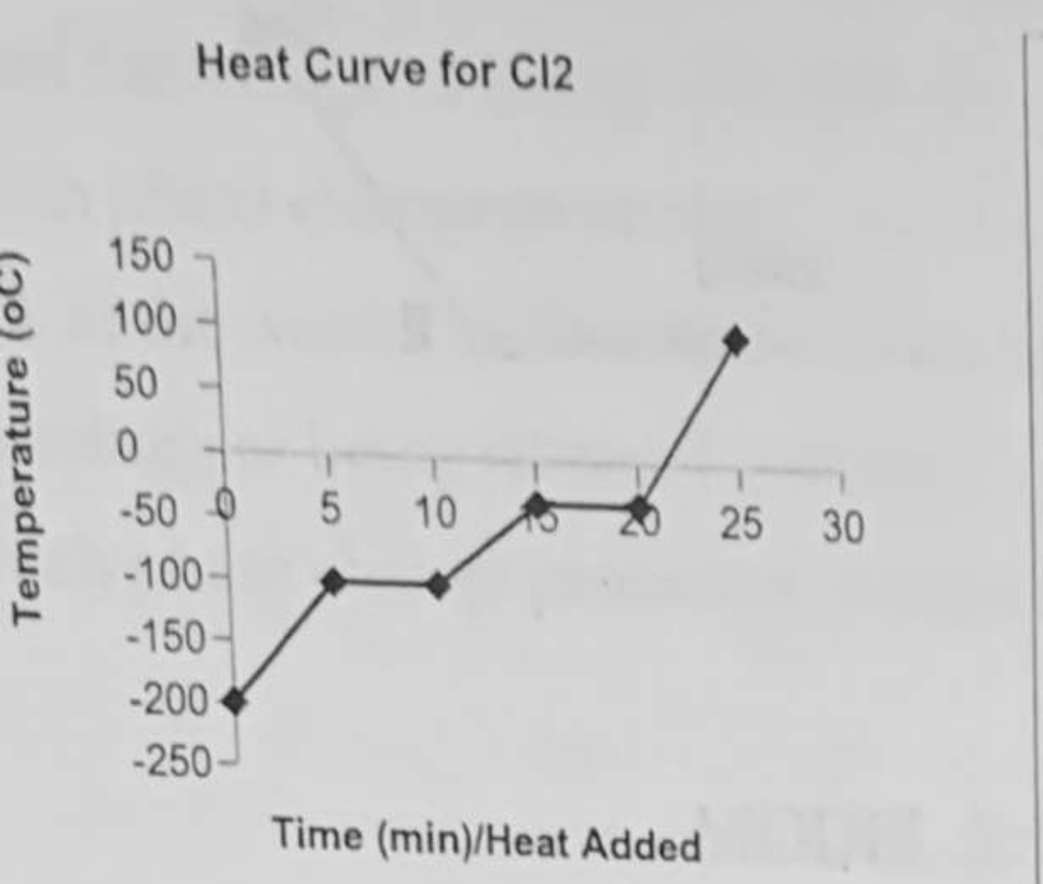

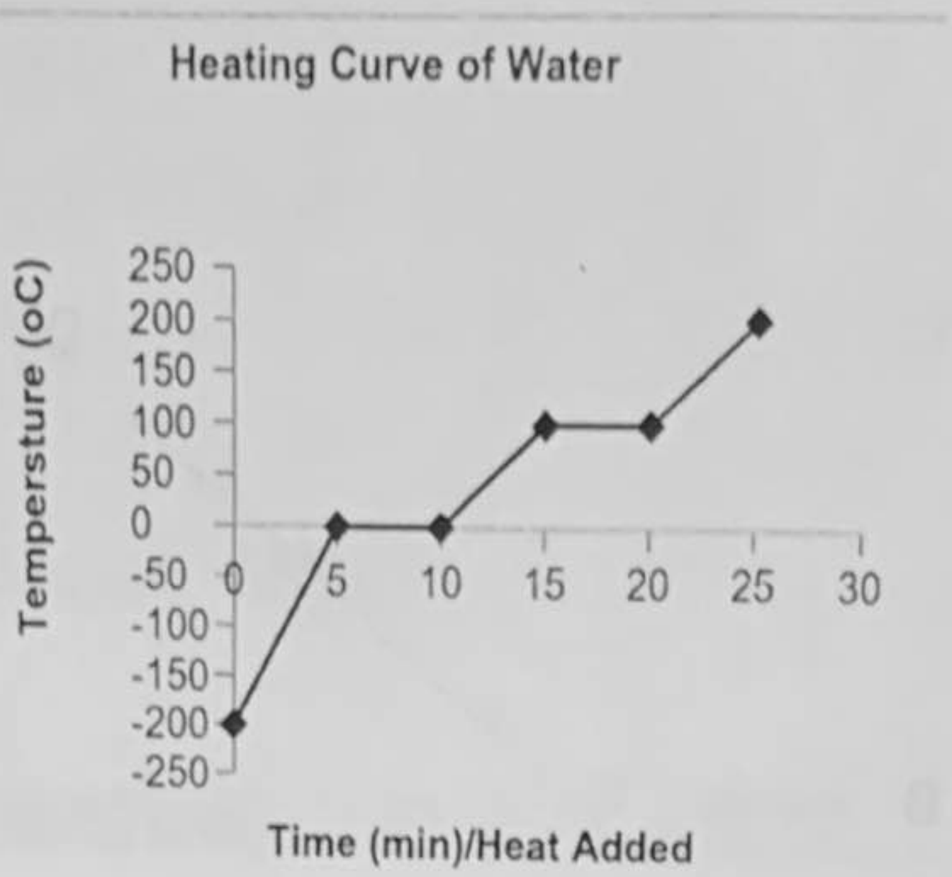

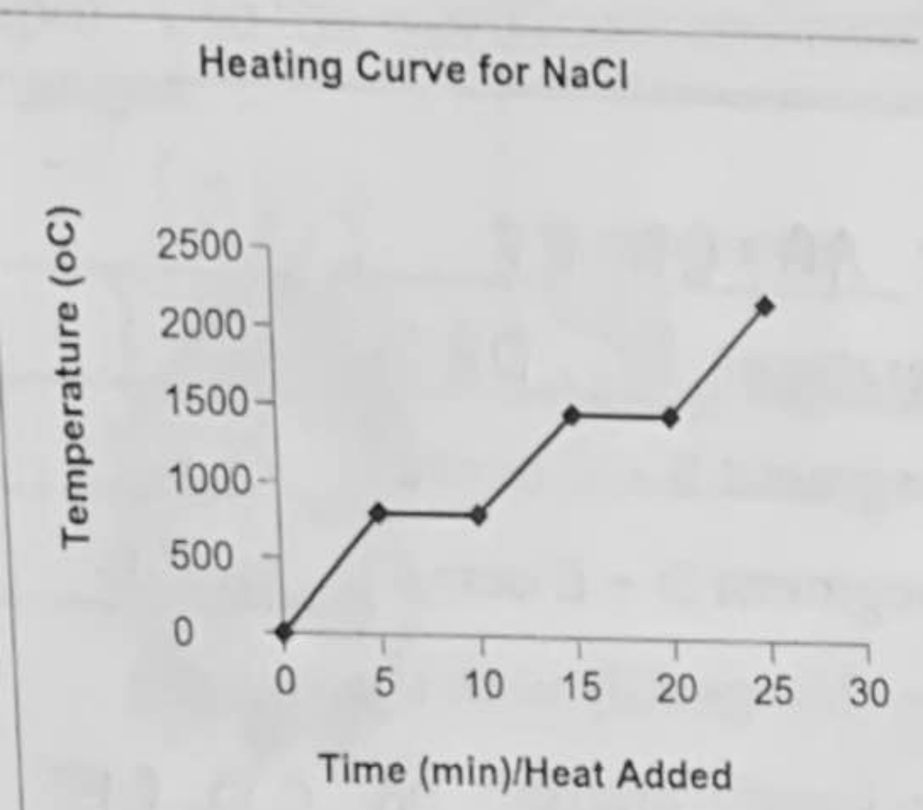

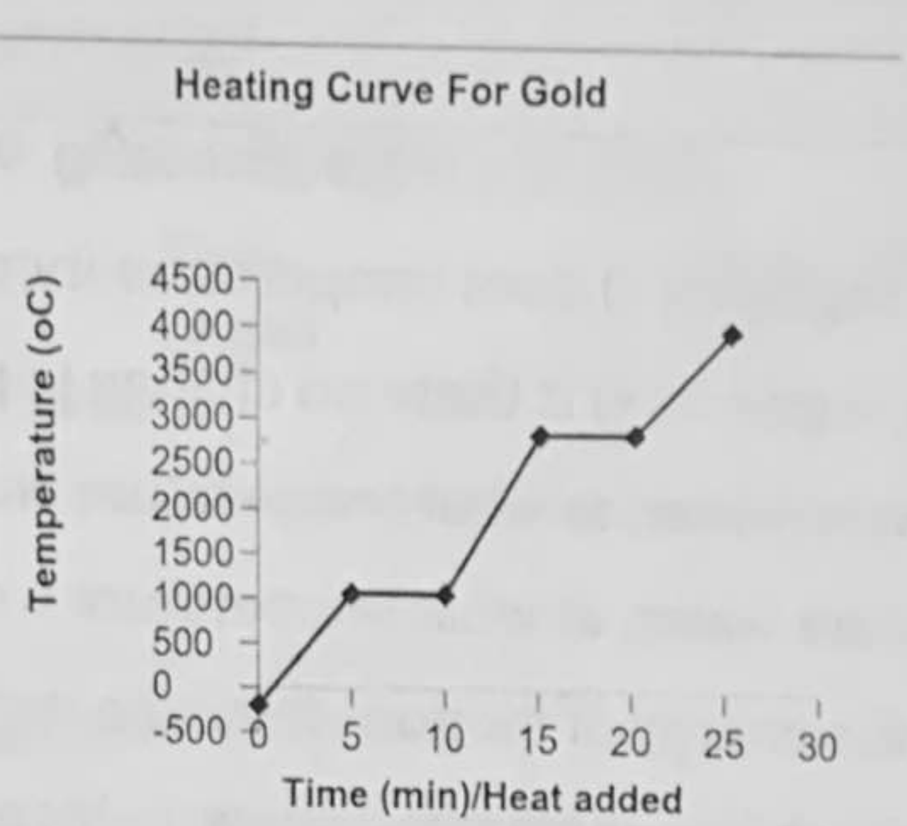

1. Which substance does have the highest boiling point? gold
2. What is the boiling point of this substance? 3000°C
3. At what temperature range is NaCl a solid? 0 - 800°C
4. What is the melting point for Cl_2? -100°C
5. Which substance is a liquid at room temperature? water (25°C)
6. What phase is Cl_2 in at room temperature? gas
7. What is NaCl's boiling point? 1500°C
8. What phase is water in at -100°C? solid
9. What temperature is Cl_2 at after being heated for 20 minutes? -50°C

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BIG IDEA

– As temperature decreases, substances go from the _____gas_____ to the _____liquid_____ to the _____solid_____ phase. This shows a decrease in _____kinetic energy_____ energy.
– Potential energy decreases when a substance is _____condensing_____ & _____freezing_____. These are _____exothermic_____ reactions because energy is being released.

BIG IDEA

– As temperature increases, substances go from the _____solid_____ to the _____liquid_____ to the _____gas_____ phase. This shows an increase in _____kinetic_____ energy.
– Potential energy increases when a substance is _____melting_____ & _____boiling_____. These are _____endothermic_____ reactions because energy is being added.

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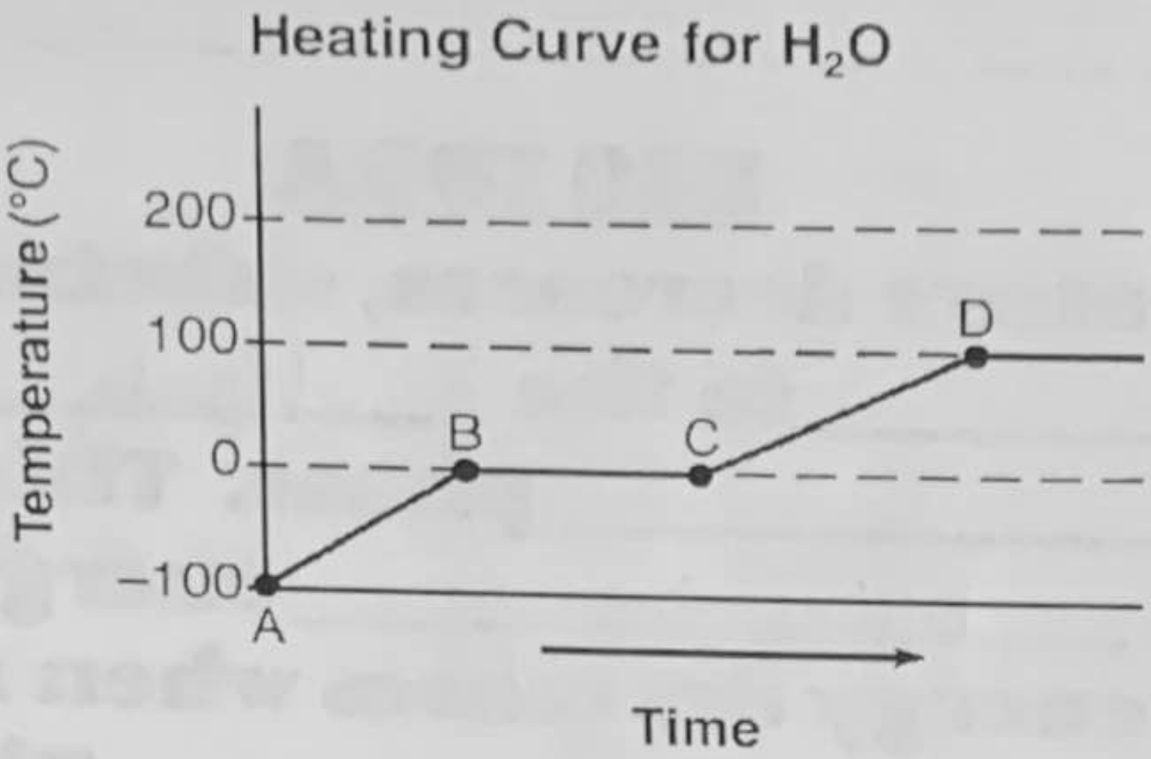
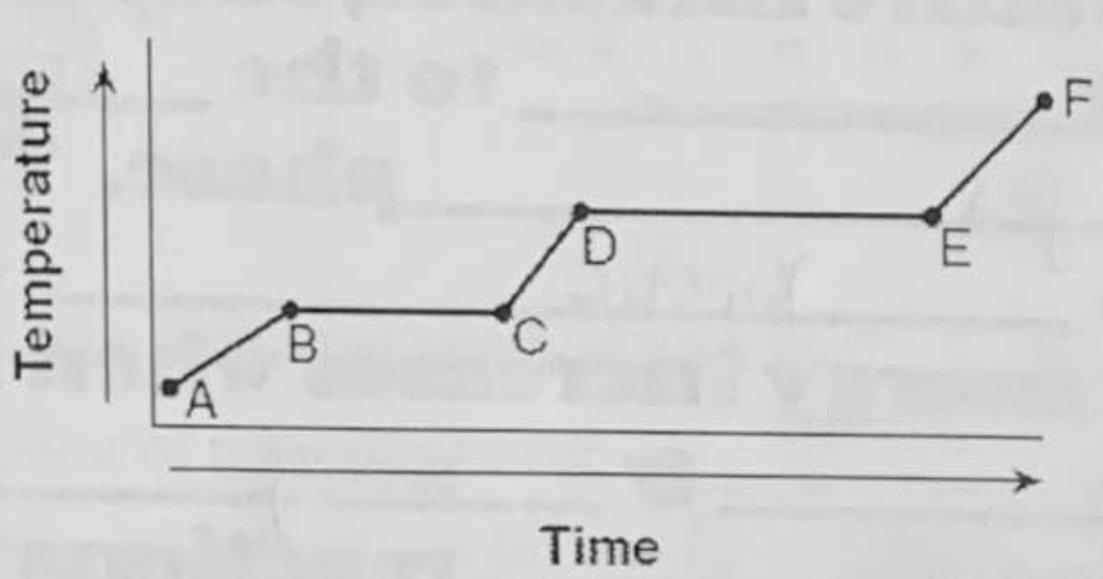


1. Which statement correctly describes the energy of the particles of the sample during interval *BC*?

C (a) Potential energy decreases and average kinetic energy increases.
(b) Potential energy increases and average kinetic energy increases.
(c) Potential energy increases and average kinetic energy remains the same.
(d) Potential energy remains the same and average kinetic energy increases

3. Which line segment is a liquid, only? CD

Use the following graph to answer questions 4 and 5. The graph below represents the uniform heating of a substance, starting with the substance as a solid below its melting point.



4. Which line segment represents an increase in potential energy and no change in average kinetic energy?

(a) $\overline{AB}$ (b) $\overline{BC}$ (c) $\overline{CD}$ (d) $\overline{EF}$

5. CIRCLE ONE: This graph represents an (endothermic / exothermic) reaction.

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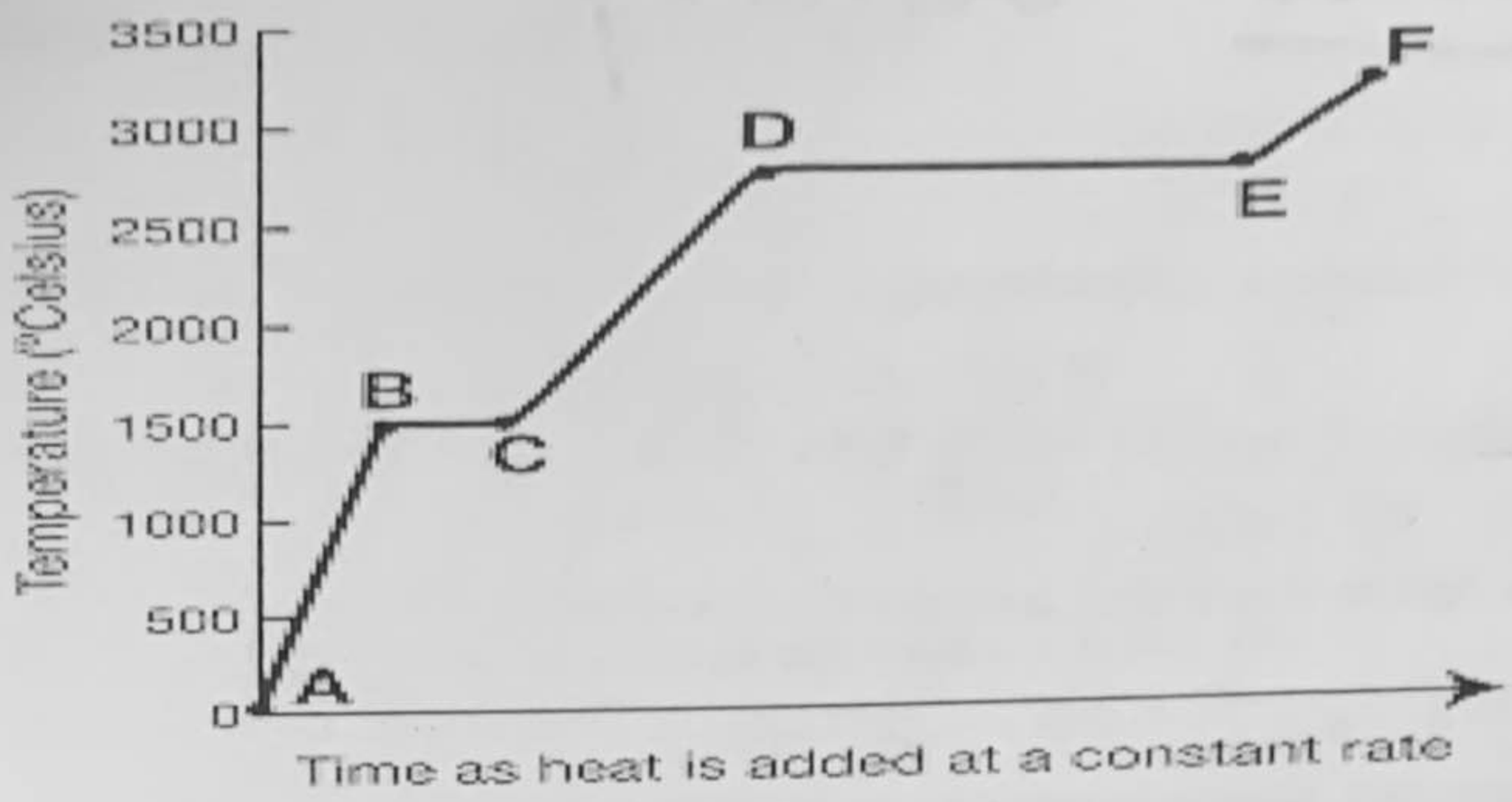


1. What is the freezing point temperature of the substance? 1500°C
2. What is the boiling point temperature of the substance? 3000°C
3. What is the melting point temperature of the substance? 1500°C
4. What letter(s) represents the range where the solid is being warmed? A → B
5. What letter(s) represents the range where the vapor/gas is being warmed? E → F
6. What letter(s) represents the range where the liquid is being warmed? C → D
7. What letter(s) represents the melting of the solid? B → C
8. What letter(s) represents the vaporization of the liquid? D → E
9. What letter(s) show a change in potential energy? B → C , D → E
10. What letter(s) show a change in kinetic energy? A → B , C → D , E - F
11. What letter(s) represents condensation? E → D
12. What letter(s) represents freezing? C → B

density = $\frac{\text{mass}}{\text{volume}}$

UNITS OF DENSITY
g/cm^3 or g/mL

1) Find the density of a wood block that has a volume ~~of 5.0 cm^3~~ and a mass of 30.5 g.

$D = m/V$ $\quad X = \frac{30.5g}{5.0cm^3} =$ 6.1 g/cm³

2) ~~Which has~~ the greater mass – 10 cm^3 of copper or 5 cm^3 of mercury? (find density in reference packet)

Copper $\quad 8.92 = \frac{X}{10} \quad X = 89.2g$ } Mercury $\quad 13.5939 = \frac{X}{5} \quad X = 67.9g$

3) Calculate the mass of a wooden block that is 4 cm long, 2 cm wide, 6 cm high, and has a density of 0.5 g/cm^3. (hint: find the volume of a block first) Volume = L x w x h

Volume = 4 cm x 2cm x 6cm
= $48cm^3$ $\quad D = m/V \quad 0.5 = \frac{X}{48cm^3} \quad X =$ 24g

4) In the table below are the mass and volume of some mineral samples. Calculate the density of sample B.

Sample	Mass (g)	Volume (mL)
A	19.5	6.54
B	12.4	3.1
C	6.8	3.4

$D = m/V$

$D = 12.4/3.1 =$ 4 g/mL

5) What volume would a rock occupy if it had a mass of 31.2 g and a density of 10.4 g/cm^3?

$D = m/V \quad x. 10.4 = \frac{31.2}{X} \cdot X \quad \frac{10.4 \cdot X}{10.4} = \frac{31.2}{10.4} \quad X = 3\ cm^3$

6) The density of oak is 0.7 g/cm^3, and the density of pine is 0.4 g/cm^3. Compare the masses of a 30 cm^3 block of each type of wood.

oak $\quad .7 = \frac{X}{30} \quad X = 21g$ | pine $\quad .4 = \frac{X}{30} \quad X = 12g$

7) How large a container would you need to hold 195 g of a liquid that has a density of 1.3 g/mL?

$D = \frac{m}{V} \quad x. 1.3g/mL = \frac{195g}{X} \cdot X \quad \frac{1.3 \cdot X}{1.3} = \frac{195}{1.3} \quad X =$ 150 mL

8) A jeweler suspects that a piece of gold jewelry in his collection is fake. If the volume of the piece of jewelry is 6 cm^3, and its mass is 109 g, is the piece fake? Why or why not?

$D = \frac{m}{V} = \frac{109g}{6cm^3} =$ 18.2 g/cm³ → Fake b/c the density of gold is 19.31 g/cm³

9) Substances A and B have the same volume, but the mass of B is twice as great as the mass of A. How do the densities of the two substances compare?

Double the mass = double the density if the volume stays the same. B would have a larger density

10) 28.5 g of metal is added to a graduated cylinder containing 45.50 mL of water. The water level rises to the 49.10 mL mark. From this information, calculate the density of this metal. Identify the metal.

volume → 49.10 − 45.50 = 3.6 $\quad D = \frac{28.5g}{3.6mL} =$ 7.92 g/mL Iron

11) Calculate the density of a metal that has a mass of 36.457 g and a volume of 13.5 cm^3. Identify the metal.

$D = m/V \quad X = \frac{36.457g}{13.5cm^3} =$ 2.7 g/cm³ Aluminum

[redacted] Density

Show all work and correct units.

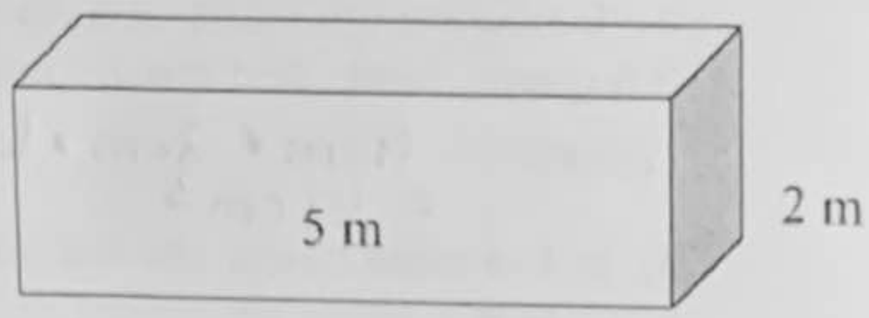
1. A rock has a mass of 210 grams and occupies a volume of 70 cm^3. What is its density?

$D = \frac{210g}{70cm^3} = 3\ g/cm^3$

2. How does the volume occupied by a cubic centimeter (cm^3) compare with the volume occupied by a milliliter (ml)?

they are the same! $mL = cm^3$

3. A rectangular solid of unknown density is 5 meters long, 2 meters high and 4 meters wide. The mass of this solid is 300 grams. Given this information for this homogeneous (alike throughout) material, calculate its density.



(Hint: What is it's volume?)

Volume = $L \times w \times h$

$V = 5 \times 2 \times 4$

$V = 40cm^3$

$D = m/V$

$D = 300g/40cm^3 = 7.5\ g/cm^3$

4. An unknown substance from planet X has a density of 10 g/ml. It occupies a volume of 80 ml. What is the mass of this unknown substance?

$D = \frac{m}{V}$ $\quad 10\ g/mL = \frac{X}{80mL}$ $\quad X = 800\ g$

5. A piece of copper is found on the side of the road with a mass of 35.0 grams. Calculate its volume.

Hint: Use your reference packet!

$X \cdot 8.92 = \frac{35.0}{X} \cdot X$ $\quad X = 3.9\ mL$

$\frac{X \cdot 8.92}{8.92} = \frac{35.0}{8.92}$