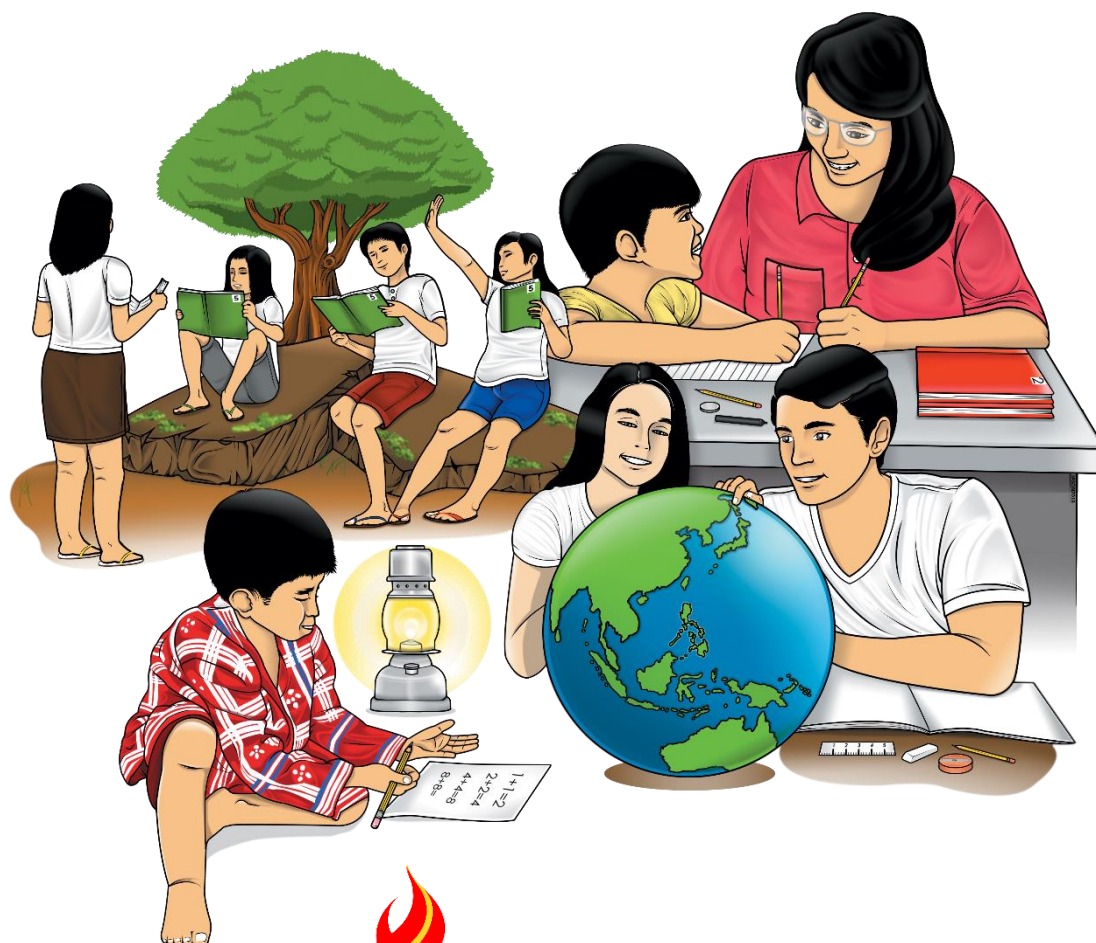


Physical Science

Quarter 1 – Module 4:

Polarity of Molecules and Its Properties



Personal Development
Alternative Delivery Mode
Quarter 1 – Module 4: Polarity of Molecules and Its Properties
First Edition, 2020

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Physical Science

Quarter 1 – Module 4:

Polarity of Molecules and Its Properties

Introductory Message

For the facilitator:

Welcome to the Physical Science 11/12 Alternative Delivery Mode (ADM) Module on Polarity of Molecules and Its Properties!

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

In addition to the material in the main text, you will also see this box in the body of the module:



Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator, you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the Physical Science 11/12 Alternative Delivery Mode (ADM) Module on Properties of Molecules based on its Polarity!

The hand is one of the most symbolic parts of the human body. It is often used to depict skill, action and purpose. Through our hands we may learn, create and accomplish. Hence, the hand in this learning resource signifies that you as a learner is capable and empowered to successfully achieve the relevant competencies and skills at your own pace and time. Your academic success lies in your own hands!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:



What I Need to Know

This will give you an idea of the skills or competencies you are expected to learn in the module.



What I Know

This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correctly (100%), you may decide to skip this module.



What's In

This is a brief drill or review to help you link the current lesson with the previous one.



What's New

In this portion, the new lesson will be introduced to you in various ways such as a story, a song, a poem, a problem opener, an activity or a situation.



What is It

This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.



What's More

This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.



What I Have Learned

This includes questions or blank sentence/paragraph to be filled in to process what you learned from the lesson.



What I Can Do

This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns.



Assessment

This is a task which aims to evaluate your level of mastery in achieving the learning competency.



Additional Activities

In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned. This also tends retention of learned concepts.



Answer Key

This contains answers to all activities in the module.

At the end of this module you will also find:

References

This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!



What I Need to Know

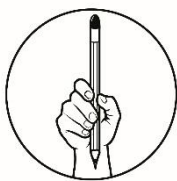
This module was designed and written with you in mind. It is here to help you master the concept of polarity of molecules. The scope of this module permits it to be used in different learning situations. The language used recognizes the varied vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module is divided into three lessons, namely:

- Lesson 1 – Properties of Molecules based on its Polarity

After going through this module, you are expected to:

1. define solubility, miscibility and polarity;
2. identify the different types of intermolecular forces of attraction;
3. explain how polarity of molecules related to its properties



What I Know

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following is TRUE of polar molecules?
 - i. Have high boiling point
 - ii. Have high melting point
 - iii. low surface tension
 - iv. High vapor pressure
 - a. I only
 - b. I and II only
 - c. II and III only
 - d. IV only

2. Which of the following intermolecular forces of attraction (IMFA) is arranged from strongest to weakest?
 - a. H- bonding – dipole-dipole – London forces
 - b. London-forces – dipole-dipole – H-bonding
 - c. Dipole-dipole – London forces – H- bonding
 - d. H-bonding – London forces – dipole-dipole

For numbers 3-6, consider the choices below:

- | | |
|------------------|-------------------|
| a. boiling point | c. Viscosity |
| b. solubility | d. vapor pressure |
-
3. Refers to the resistance of a liquid to flow.
 4. Is temperature at which the liquid starts to boil.
 5. Defined as the pressure exerted by a substance when in its gaseous state.
 6. The ability of a substance to be dissolved in another substance to form a solution.

 7. The following are examples of viscous substances EXCEPT:
 - a. blood
 - b. honey
 - c. vinegar
 - d. syrup

8. Which of the following is NOT TRUE about water?
- a. has high surface tension
 - b. has high boiling point
 - c. has low viscosity
 - d. becomes denser when freezes
9. Which of the following substances will most likely be miscible in water?
- a. Benzene (C_6H_6)
 - b. Ethyl alcohol ($\text{C}_2\text{H}_5\text{O}$)
 - c. carbon tetrachloride (CCl_4)
 - d. toluene ($\text{C}_6\text{H}_5\text{CH}_3$)

Which of the following will dissolve in polar solvents?

- a. nonpolar solvents and ionic compounds
- b. c. nonpolar solvents and ionic compounds
- d. all of the above

True or False: Write T if the statement is true, otherwise write F.

10. The floating of ice on liquid water is an indication that ice has higher density than liquid water.
11. The volatility of a substance depends on its vapor pressure.
12. Alcohol is less volatile than vinegar.
13. Between water (H_2O) and carbon tetrachloride (CCl_4), water has higher boiling point.
14. Vapor pressure is inversely proportional to the strength of intermolecular forces present.

Lesson

1

Properties of Molecules based on its Polarity

From the previous module, you learned how to determine the polarity of bonds using the concept of electronegativity. Also, you learned that polarity of molecules is affected by both the polarity of bonds and its molecular shape or geometry.



What's In

Let us have some warm up exercise for our nerve cells before we proceed to the presentation of our lesson. You will perform a simple activity that will help you recall some basic concepts related to polarity of molecules. Have some fun!



Notes to the Teacher

There are numerous terms or concepts being studied in science and most of them are either difficult to spell out or pronounce. As teachers, we should think of engaging activities that would motivate our students to learn and at the same time increase their vocabulary skills and spelling ability. Below is an example of an activity you could employ in your class.

WORD CRYPTOGRAM

Directions: Unscramble the letters by placing the correct letter sequence in the shaded boxes to come up with the correct answer for each number. Use the numbered boxes to complete the answer to the riddle below.

1.

L	E	C	M	O	U	L	E
1				5	6		

2.

O	P	A	L	R		O	D	N	B
		3		9					

3.

O	N	L	E		A	P	I	R
	2		14			8		16

4.

N	A	R	O	P	O	L	N		B	D	O	N
					7					12		

5.

A	C	E	G	T	R	O	T	L	I	Y	E	I	T	E	N	V
11								15	4	10						17

6.

M	A	T	O
			13

RIDDLE: It shows the three-dimensional arrangement of bonding groups of atoms around a central atom.

1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16	17

Can you define the following words/terms that you have decoded?



What's New

Analyze the lyrics of the song, “Tubig at Langis”, and answer the questions below.

TUBIG AT LANGIS

Sharon Cuneta

Tubig at langis, ang katayuannati'yyan ang kawangis
Pilitinmangmagsam'y may mahahapis
Ganyang-ganyantayongdalawa
Ang panuntunan'ymagkaiba
Langis at tubig, 'di mapagsama ng tunaymangpag-ibig
Hinanakit ang s'yanglagingmananaig
Mahal na mahal man kita
May mahal ka namangiba

Chorus:

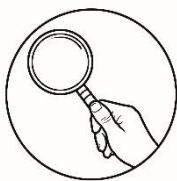
Tubig at langis
Idarang man sinit, 'di rin tatamis
Dahil ang halo'yluha'tpaghihinagpis
Ang kirot ay di maalis kung labis
Bakitnanaig ang dusasaligayasa 'ting daigdig ?
May dasalbaakonghindiN'yanarinig ?
Papelnatinsapag-ibig
Ako'ylangis, ika'ytubig

Repeat Chorus:

Bakitnanaig ang dusasaligayasa 'ting daigdig ?
May dasalbaakonghindiN'yanarinig ?
Papelnatinsapag-ibig
Ako'ylangis, ika'ytubig
Ako'ylangis, ika'ytubig

Guide Question:

1. What is the message of the song?
2. If you add oil to the water, what will happen? Will it create a single homogenous phase or will it form two layers? Why?
3. Why do you think water and oil cannot be mixed even when heated? Support your answer.



What is It

A. Polarity, Solubility, and Miscibility

One of the practical applications of polarity of molecule in real-life scenario is manifested on the solubility and miscibility of substances to form solution.

Solubility is defined as the ability of a solid substance to be dissolved in a given amount of solvent while **miscibility** is the ability of the two liquids to combine or mix in all proportions, creating a homogenous mixture.

The general rule to remember about the solubility and miscibility of molecular compounds can be summarized in a phrase, “*like dissolves like*” or “*like mixes with like*”. This means that polar substances will only be dissolved or mixed with polar substances while nonpolar substances will be soluble or miscible with another nonpolar substance.

Now I want you to try the exercises below in order to assess how much you have understood the solubility (and miscibility) rule of substances in relation to their polarity.

Which of the following substances below will most likely mix with each other?

- a. water (H_2O) and chloroform (CHCl_3)
- b. benzene (C_6H_6) and chloroform (CHCl_3)
- c. water (H_2O) and vinegar (CH_3COOH)
- d. acetone ($\text{C}_3\text{H}_6\text{O}$) and toluene ($\text{C}_6\text{H}_5\text{CH}_3$)
- e. carbon tetrachloride (CCl_4) and water (H_2O)

What chemistry concept did you use in answering the question above? If you answered polarity of molecules, then you are on the right track. Great job! Benzene and chloroform are both nonpolar compounds while water and vinegar are both polar compounds, thus they are miscible to each other. However, the rest is a combination of polar and nonpolar molecules and therefore will not mix and instead will form two layers even if shaken or carefully stirred.

B. Bond Strength and Physical Properties of Covalent Compounds

From the previous module, you learned the *intramolecular forces of attraction*, the attractive force that binds atoms together. In this module, you will learn another type of attractive force, the *intermolecular forces of attraction* (IMFA) which exists between molecules.

In this lesson, we will not discuss IMFA in so much detail because it will be tackled to you in the next module. We will just focus on the following salient points of IMFA and its effect on the physical properties of covalent compounds:

1. There are several types of IMFA and below they are arranged from STRONGEST to WEAKEST.
Ion-dipole → H-bonding → dipole-dipole → dipole-induced dipole → London forces of attraction
2. The strength of IMFA greatly affects the physical properties of substances such as boiling point, melting point, vapor pressure, surface tension, etc.

Before we move further, try to perform the exercise below to test your ability to analyze concepts and principles that you have learned from the discussion.

Put a check (/) to those properties applicable for polar molecule.

- | | |
|---------------------------|---|
| ___ 1. High boiling point | ___ 7. High vapor pressure |
| ___ 2. Low boiling point | ___ 8. Low vapor pressure |
| ___ 3. High melting point | ___ 9. High surface tension |
| ___ 4. Low melting point | ___ 10. Low surface tension |
| ___ 5. High volatility | ___ 11. H-bonding & dipole-dipole present |
| ___ 6. Low volatility | ___ 12. London dispersion is present |

How well did you perform in this exercise? Continue reading for you to find out the correct answers for this activity.

From the above discussion you learned that there are several types of IMFA and their relative strength as compared to other types. Strong intermolecular forces tend to yield solids and liquids while weak intermolecular forces favor formation of gases.

Table 1 shows the comparison of the various types of IMFA while table 2 shows the physical properties of polar and nonpolar molecules as affected by the type of IMFA present.

Table 1. Summary of Types of Intermolecular Forces of Attraction (IMFA)

Type of IMFA	Interacting Substances	Examples
Ion-dipole	Ion (cation or anion) and a polar molecule	NaCl dissolved in H ₂ O; Ca ²⁺ and PCl ₃
Hydrogen bonding	Polar molecules containing H chemically bonded to a small and highly electronegative nonmetal atom such as N, O, and F	H ₂ O, NH ₃ , CH ₃ OH
Dipole –dipole	Polar molecules	CH ₃ F and H ₂ S; HCl;
Dipole-induced dipole	Polar and nonpolar molecules	HI and CH ₄
London forces	All substances and solely for nonpolar molecules and noble gases	O ₂ , N ₂ , He gas, Br ₂

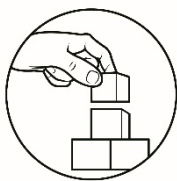
Table 2. General Properties of polar and nonpolar molecules

Polar molecules	Nonpolar molecules
• IMFA type: H-bonding and dipole-dipole	• IMFA type: London dispersion
• exist as solids or liquids at room temperature	• exist as gases at room temperature
• High boiling point	• Low boiling point
• High melting point	• Low melting point
• High surface tension	• Low surface tension
• Low vapor pressure	• High vapor pressure
• Low volatility	• High volatility
• Soluble in water	• Insoluble in water

Let us define the physical properties of substances:

- A. *Boiling point*: temperature at which the vapor pressure and atmospheric pressure of a liquid substance are equal.
- B. *Melting point*: temperature at which solid becomes liquid. At this point, the solid and liquid phases exist in equilibrium.
- C. *Surface tension*: energy needed to increase the surface area by a unit amount;
- D. *Viscosity*: the resistance of the liquid to flow
- E. *Vapor pressure*: pressure exerted by a substance in its gaseous state.
- F. *Volatility*: measures the rate at which a substance vaporizes (changes from liquid to gas)

In the simplest sense, boiling point, melting point, viscosity and surface tension increase as the strength of intermolecular forces increases. On the other hand, vapor pressure and volatility decrease with increasing strength of IMFA. London dispersion forces increase as the molecular mass of a substance increases. Unlike in H-bonding, as the molar mass increases, the boiling point, melting point, viscosity and surface tension decrease.



What's More

Activity 1. Strength of IMFA and Physical Properties of Covalent Compounds

For each pair of molecules, identify the one with the higher boiling point (BP), melting point (MP), viscosity (V), surface tension (ST) and vapor pressure (VP). Briefly explain your choice.

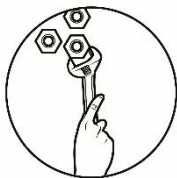
	BP	MP	V	ST	VP
$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$ Methane, CH_4					
$\begin{array}{c} :\ddot{\text{Cl}}: \\ \\ :\ddot{\text{Cl}}-\text{C}-\ddot{\text{Cl}}: \\ \\ :\ddot{\text{Cl}}: \end{array}$ carbon tetrachloride, CCl_4					
$\begin{array}{c} \cdot\cdot \\ \text{S} \\ \cdot\cdot \\ / \quad \backslash \\ \text{H} \quad \text{H} \end{array}$ Dihydrogen sulfide, H_2S					
$\begin{array}{c} \cdot\cdot \\ \text{O} \\ \cdot\cdot \\ / \quad \backslash \\ \text{H} \quad \text{H} \end{array}$ water, H_2O					
$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\ddot{\text{O}}-\text{H} \\ \\ \text{H} \end{array}$ Methanol, CH_3OH					
$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\ddot{\text{O}}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$ ethanol, $\text{CH}_3\text{CH}_2\text{OH}$					
$\begin{array}{c} \text{H} \quad :\ddot{\text{O}}: \\ \quad \\ \text{H}-\text{C}-\text{C}=\ddot{\text{O}}\text{H} \\ \\ \text{H} \end{array}$ Acetic acid, CH_3COOH					
$\begin{array}{c} \text{H} \quad \text{O} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \quad \text{H} \end{array}$ acetone, CH_3OCH_3					

Adapted from Punzalan and Monserat (2016)



What I Have Learned

1. Distinguish intramolecular forces of attraction and intermolecular forces of attraction.
2. In your own words, explain the Solubility Rule.
3. Compare and contrast polar and non-polar molecules based on its physical properties.
4. What relationship can you derive between the strength of IMFA and the physical properties of covalent molecules?



What I Can Do

- A. Using the concept of bond polarity and solubility, explain why water (H_2O) and vinegar are miscible, but vinegar and oil are immiscible.
- B. Using the concept of intermolecular forces of attraction, explain why butter melts at room temperature but solidifies when refrigerated.
- C. Explain the importance polarity of molecules to biological processes such as in the structure of proteins and phospholipids.



Assessment

Multiple Choice: Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following IMFAs is considered as the weakest?
 - a. H-bonding
 - b. Ion-dipole
 - c. Dipole-dipole
 - d. London forces
2. The boiling point of water is greater than dihydrogen sulfide because of _____.
 - a. Dipole-dipole bond
 - b. H-bonding
 - c. London dispersion
 - d. Ion-dipole
3. Which of the following substances will dissolve most likely in water?
 - a. Oil
 - b. Carbon tetrachloride (CCl_4)
 - c. Vinegar (CH_3COOH)
 - d. Hexane (C_6H_{14})
4. Which of the following molecules has high melting point?
 - a. CHCl_3
 - b. CCl_4
 - c. BCl_3
 - d. BeCl_2
5. _____ refers to the energy required to increase the surface area by a unit amount.
 - a. Viscosity
 - b. Surface tension
 - c. Vapor pressure
 - d. Density
6. Which of the following statements is TRUE about nonpolar molecules
 - a. Have high boiling point
 - b. Have high melting point
 - c. Have low surface tension
 - d. Have low vapor pressure

7. Which of the following substances is miscible in hexane (C_6H_{14})?
- Acetone (C_3H_6O)
 - Vinegar (CH_3COOH)
 - Chloroform ($CHCl_3$)
 - Methanol (CH_3OH)
8. The following are intermolecular forces of attraction EXCEPT:
- H-bond
 - Dipole-dipole
 - Covalent bond
 - London forces
9. Which of the following properties has indirect relationship with the strength of IMFA?
- Boiling point
 - Melting point
 - Surface tension
 - Vapor pressure
10. In which of the following solvents would molecular iodine (I_2) be most soluble?
- Vinegar
 - Water
 - Ethyl alcohol
 - Carbon tetrachloride

True or False: Write T if the statement is true, otherwise write F.

- H-bonds are broken when ice melts.
- Molecules with H-bonds have higher boiling point than molecules with dipole-dipole bond.
- In covalent molecules, vapor pressure decreases with decreasing strength of intermolecular forces.
- When the attractive forces holding particles together are greater, you have to get to a higher temperature to break those forces, so the melting point is higher.
- The strength of dispersion (London) forces tends to increase with increased molecular weight.



Additional Activities

1. Briefly explain why water is considered as the universal solvent.
2. Using the concept of IMFA, account for the difference in boiling point and melting point of the following molecular substances:

Substance	Boiling point (°C)	Melting point (°C)
Helium gas, He	-269	-272
Methane, CH ₄	-162	-184
H ₂ O	100	0
Ethanol, C ₂ H ₅ OH	78	-117



Answer Key

<p>What I Know</p> <p>1. C 2. A 3. C 4. A 5. D 6. B 7. C 8. D 9. B 10. B 11. F 12. T 13. F 14. T 15. F</p>	<p>What's More</p> <p>WORD CRYPTOGRAM</p>	<p>Assessment</p> <p>1. D 2. B 3. C 4. A 5. B 6. C 7. C 8. C 9. D 10. D 11. F 12. T 13. F 14. T 15. F</p>
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<p>What's More</p> <p>1. M O L E C U L E 2. P O L A R B O N D 3. L O N E P A I R 4. N O N P O L A R B O N D 5. E L E C T R O N E G A T I V I T Y 6. A T O M RIDDLE M O L E C U L A R 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17</p>	
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What I have Learned

1. Distinguish intramolecular forces of attraction and intermolecular forces of attraction.
Answer: Intramolecular forces of attraction exist within a molecule. Ionic, covalent and metallic bonds constitute the intramolecular forces of attraction. On the other hand, intermolecular forces of attraction are forces of attraction between molecules. Ion-dipole, H-bond, dipole-dipole and London forces are examples of intermolecular forces of attraction.
2. In your own words, explain the Solubility Rule.
Answer: Solubility rule states that "like dissolves like." This means that polar solutes are soluble (miscible) only to polar solvents while nonpolar solutes are only soluble (miscible) to nonpolar solvents. Intramolecular forces exist *between* atoms within a molecule. Ionic, covalent and metallic bonds constitute the intramolecular forces

What's More

	BP	MP	V	ST	VP	
	CH ₄	CCl ₄ Because it is polar molecule and IMF type is dipole - dipole which is stronger than London forces	H ₂ O Because it is polar molecule and IMF type is H-binding which is stronger than dipole-dipole	H ₂ S	Methane, CH ₄ carbon tetrachloride, CCl ₄ <div><div><div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div></div>	Dihydrogen sulfide, H ₂ S <div><div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div>
					CH ₃ OH Both have H-bonding but methanol has lower molar mass than ethanol	CH ₃ CH ₂ OH
					Methanol, CH ₃ OH ethanol, CH ₃ CH ₂ OH <div><div><div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div></div>	
CH ₃ OCH ₃ Both have H-bonding however acetone has lower molar mass than acetic acid	CH ₃ COOH					
					Acetic acid, CH ₃ COOH acetone, CH ₃ OCH ₃ <div><div><div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div></div></div></div>	

What I Can Do

- A. Using the concept of bond polarity and solubility, explain why water (H_2O) and vinegar are miscible, but vinegar and oil are immiscible.
Possible answer: Water and vinegar are both polar substances therefore they are miscible to each other. On the other hand, vinegar is polar while oil is a nonpolar substance, therefore they will not mix.

- B. Using the concept of intermolecular forces of attraction, explain why butter melts at room temperature but solidifies when refrigerated.
Possible answer: Butter is composed of complex mixture of fatty acids held together by a weak attractive van der Waals interaction called London forces. The physical change of melting requires heat that disrupts the London forces of attraction between fatty acids. As the amount of heat increases, more London forces are disrupted and fats begin to vibrate, rotate and move freely. On the other hand, when you placed the butter inside the freezer, the temperature decreases and more London forces gets assembled between fatty acids thus butter becomes solid.

What I have Learned

3. Compare and contrast polar and non-polar molecules based on its physical properties.

Answer:

Polar molecules	Nonpolar molecules
• IMFA type: H-bonding and dipole-dipole	• IMFA type: London dispersion
• exist as solids or liquids at room temperature	• exist as gases at room temperature
• High boiling point	• Low boiling point
• High melting point	• Low melting point
• High surface tension	• Low surface tension
• Low vapor pressure	• High vapor pressure
• Low volatility	• High volatility
• Soluble in water	• Insoluble in water

4. What relationship can you derive between the strength of IMFA and the physical properties of covalent molecules?

Answer: Boiling point, melting point, viscosity and surface tension increase with increasing strength of IMFA. Vapor pressure increases with decreasing strength of IMFA. Therefore, BP, MP, V and ST are directly proportional to the strength of IMFA while VP is inversely proportional to the strength of IMFA.

What I Can Do

C. Explain the importance polarity of molecules to biological

processes such as in the structure of proteins and phospholipids.
Possible answer: Proteins are macromolecules having polar and nonpolar ends which are essential for life processes to occur. It can form a long chain and it also has the ability to bend to form various shapes. The shape of proteins is affected by attraction and repulsion among its polar and nonpolar groups. Once its shape has been altered or modified, it can no longer perform its basic function. Phospholipids, on the other hand, are present in the cell membrane. It has a hydrophilic (water-loving) end and hydrophobic (water-fearing) end. When placed in water, it forms a micelle wherein its hydrophilic part has a close contact with water while its hydrophobic part is oriented inward. In this way, the cell membrane can perform its function of being selectively permeable membrane effectively.

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