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Office Hours: 10:00 a.m. – 2:00 p.m.

Chemistry Learning Packet

Learning Packet Overview
In this packet you will find review activities in multiple forms including videos, simulations, and texts. Remember to use all your resources to help you, including the links that I provide in this packet as refreshers. It is entirely up to you how you want to complete this packet. You can make edits directly in the document, write them down on a separate piece of paper, or edit through an iPad/tablet. You can even do a mix of the three. Some questions will be easier than others to edit in the document, so it is recommended to have paper and a writing utensil nearby. This packet includes NO NEW material, only a mix of concepts we have learned since August.

Necessary Materials
• Paper (notebook paper or white paper) • Pencil/pen • scientific calculator (can use an online one or on your phone if necessary) • if available, chemistry notebook (don't worry if you left it at school, there are still resources here that will help you)

How students will be successful	How caregivers can help students be successful
Students will be successful if: • They manage time wisely and finish a section a day (can go in any order you want, but suggested dates are given) • They have minimal distractions while they work to finish faster • Message/call friends or myself (see my contact info at the top) for help when they are stuck	Caregivers can help students be successful by: • Provide a distraction free environment for the student to work efficiently • Support them with positivity and provide any necessary materials

Tuesday, March 24: The Water Molecule

Step 1: Watch the following video below. If the video doesn’t play, click on this link.

If you cannot view the video or need text, here is the transcript: Water is an interesting substance with a chemical makeup that gives it some unique physical properties. A water molecule has an oxygen atom with two hydrogen atoms connected to it by covalent bonds. The v-shape that the molecule makes is caused by the way that the oxygen atom’s valence electrons repel one another. These covalent bonds are made up of a pair of electrons and are the key to many of water’s unusual properties. Oxygen is more electronegative than hydrogen. This means that its positive nucleus pulls harder on the negative electrons in the covalent bonds than the hydrogen's nucleus. As a result the oxygen atom develops a partial negative charge which leaves the hydrogens with a partial positive charge. These partial charges create a positive end and a negative end to the molecule, making it what chemists call polar. The opposite charges of these polar molecules are attracted to each other, causing them to loosely stick together. The attractions between the water molecules are called hydrogen bonds. These hydrogen bonds give water a boiling point that is about 200 degrees higher than it should be when compared to other similar substances. The result is that water is a liquid at room temperature, but other similar molecules like hydrogen sulfide, hydrogen selenide, and hydrogen telluride are all gases. The polar nature of water molecules is also the reason that some substances dissolve in water while others don’t. Take salt and oil for example. Salt is made up of charged particles called ions. In this case we have positive sodium ions and negative chloride ions. In solid salt the ions are attracted to one another. The partial charges on the water molecules cause them to be attracted to the ions. When the ions are completely surrounded by the water molecules, the salt dissolves. Unlike salt, oil is predominantly nonpolar. This means that it doesn't carry any charges, so there's nothing to attract the polar water molecules to it. This is why water and oil do not mix. So water’s high boiling point and the way it interacts with different substances comes down to the polar nature of water molecules. Water's properties are all great examples of what we observe on the macroscopic level being influenced by what goes on at the molecular level and how we link the properties of chemical substances to those structures.

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Step 2: Answer the following questions. (enter space where needed if doing electronically)

1. What kind of bonds are in water molecules?

2. What shape does a water molecule have?

3. Which atom in water is more electronegative, hydrogen or oxygen?

4. Which element, hydrogen or oxygen, is the partially positive end of water molecules?

5. What is the attraction between water molecules called?

6. How do these attractions make water different from other similar compounds?

7. What allows water to dissolve salt?

8. What prevents water from mixing with oil?

Step 3: Draw a water molecule being attracted to another water molecule. Label the partial charges and elements (by symbol) and clearly show which elements are attracted to each other in the molecules.

After completing steps 1-3, you are done for today!

Wednesday, March 25: Heating Curve of Water

Directions: READ the following passages and answer the questions.

Background
The three states of matter are solid, liquid, and gas. To change from one state to another, energy is either added to or removed from the system. In this investigation, you will look at heating up water.

1. Does heating up water involve adding or removing energy? Explain.

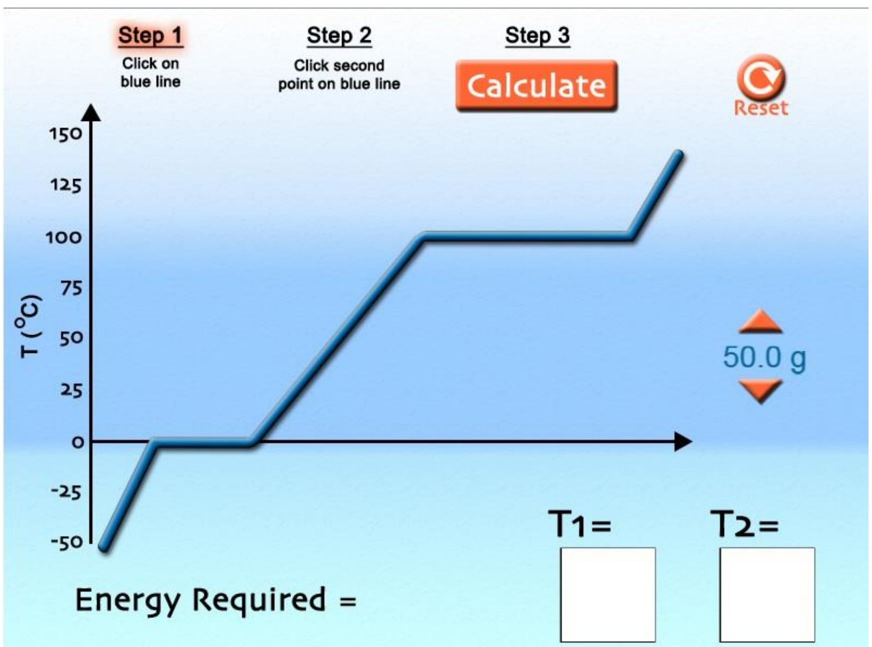
In the squares below, draw how you think particles are arranged in the three states of matter. Use spheres to represent the particles and label each box with the state of matter it represents.

_________ _________ _________

When changing from one state to another, what happens to particles <u>in terms of energy</u>?

Procedure

1. Visit teachchemistry.org/heating-curve. You should see this on your screen.



2. On the heating curve above, label the states of matter. Include the state changes. (you may draw your own curve on paper and label or label this document using text boxes)

3. Choose an initial point on the graph in the solid state. This is your starting temperature. Choose a second point that is also in the solid state. Draw the two particle diagrams in the squares. Explain why the diagrams look the way they do.

Hint: for #4-6, you can refresh your memory using the following formula $q=c\times m\times\Delta T=c\times m\times(T_{final}-T_{initial})$ and this link *keep in mind the units are different for the simulation's answer but everything else is the same*:

4. Calculate the energy required to heat up 65.0 g of the sample. Show your work. Use 2.09 J/g^{o}C as the specific heat value (click "calculate" button to check your answer). To do this, simply divide by 1000.

5. Click "reset". Choose another initial point on the graph, but this time in the liquid state. This is your starting temperature. Choose a second point that is in the gas state. Draw the two particle diagrams in the squares. Explain why the diagrams look the way they do.

6. Calculate the energy required for 30.0 g of water to undergo this state change. Use 4.19 J/g^{o}C as the specific heat value (click "calculate" button to check your answer). Note, you will have to convert your calculated answer from J to kJ. To do this, simply divide by 1000.

After completing #1-6, you are finished for today!

Thursday, March 26th: Valence Electrons

Step 1: Go to this link to access an interactive periodic table to help answer the questions #1-3.

1. Click on Ca and Br. How many valence electrons does each element have? (hint: valence electrons are the number of electrons in outermost shell)
   a. Remove a valence electron from Ca. What is its charge?
   b. Remove another valence electron from Ca. Now what is its charge?
   c. Which element is smaller?

2. Click on Na and O. How many valence electrons does each element have?
   a. Remove a valence electron from Na. What is its charge?
   b. Which element is smaller?

3. Click on Rb and Ar. How many valence electrons does each element have?
    a. Remove a valence electron from Rb. What is it's charge?
    b. Why can't you remove more than one electron from Rb?
    c. Which element has a stable octet already?

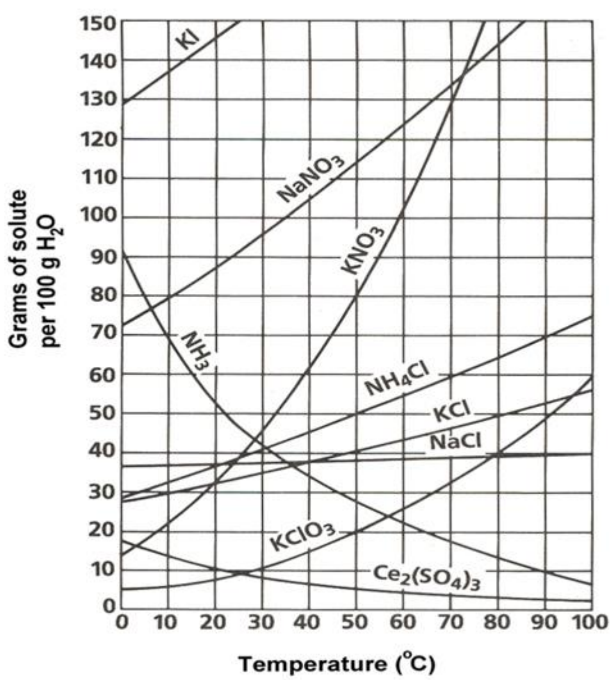
For #4-5, use the following video for refreshing on Lewis Dot structures.

4. Draw the Lewis Dot structures for the following elements:
    a. H
    b. Ca
    c. Cl
    d. O
5. Draw the Lewis Dot structures for the following bonds:
    a. H_2O
    b. CO_2
    c. NH_3
    d. CH_4

After completing #1-5, you are done for today!

Friday, March 27th: Solubility Curves

Use the following graph to answer questions #1-4. For a refresher, click this link.



1.To make a **saturated** solution, at what temperature will 120 g of $NaNO_3$ dissolve into 100 mL of water?

a. 45°C
b. 67°C
c. 55°C
d. 20°C

2. To make a **saturated** solution, how many grams of NH_3 can be dissolved at 60°C?

a. 32 g
b. 22 g
c. 12 g
d. 84 g

3.To make a **saturated** solution, at what temperature will 130 g of KNO_3 dissolve into 100 mL of water?

e. 70°C
f. 35°C
g. 22°C
h. 10°C

4. To make a **saturated** solution, how many grams of $Ce_2(SO_4)_3$ can be dissolved at 20°C?

a. 0 g
b. 5 g
c. 10 g
d. 25 g

For questions 5-8, calculate the molarity of the following solutions and include the final unit. Use this link to refresh your memory.

5. 0.493 moles of HCl in 1 L of solution (water)

6. 0.384 moles of NH_3 in 0.5 L of solution (water)

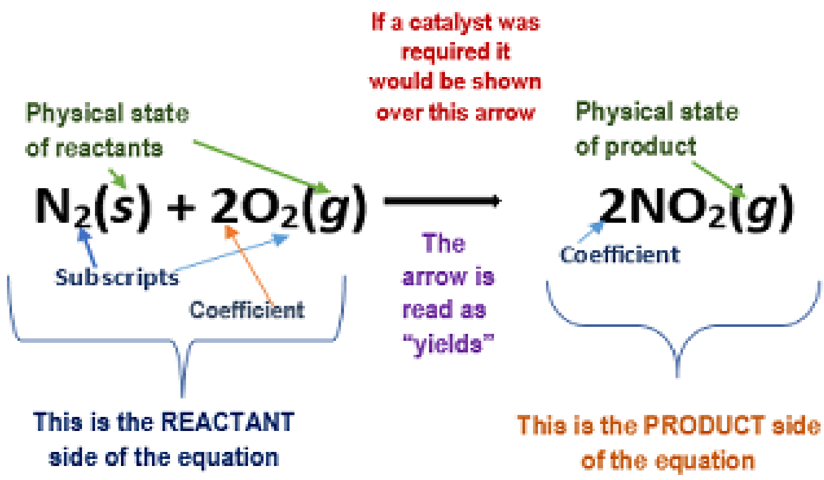
7. 0.111 moles of HCl in 0.25 L of solution (water)

8. 0.801 moles of NH_3 in 2 L of solution (water)

After completing #1-8, you are done for the day!

Monday, March 30th: Writing Chemical Equations

Use the following image below to refresh your knowledge on chemical equations.



Directions: For each of the following equations, list the reactants, products, solid compounds (if any), liquid compounds (if any), gaseous compounds (if any), and aqueous compounds (if any).

Example:

$N_{2(s)}$ + $O_{2(g)}$ -----> $NO_{2(g)}$

Reactants: N_2 and O_2

Products: NO_2

Solids: N_2

Liquids: none

Gases: O_2

Aqueous: None

1. $KClO_{3\,(s)} + P_{4(l)} \rightarrow P_4O_{10(s)} + KCl_{(l)}$
2. $SnO_{2(s)} + H_{2(g)} \rightarrow Sn_{(aq)} + H_2O_{(l)}$
3. $KOH_{(aq)} + H_3PO_{4(aq)} \rightarrow K_3PO_{4(s)} + H_2O_{(l)}$
4. $KNO_{3(aq)} + H_2CO_{3(aq)} \rightarrow K_2CO_{3(s)} + HNO_{3(l)}$
5. $Na_3PO_{4(s)} + HCl_{(g)} \rightarrow NaCl_{(s)} + H_3PO_{4\,(g)}$
6. $TiCl_{4\,(g)} + H_2O_{(l)} \rightarrow TiO_{2(s)} + HCl_{(l)}$

After completing #1-6, you are done for the day!

Tuesday, March 31st: Physical vs Chemical Changes

Background: Keeping the difference between physical and chemical properties as well as changes can be a challenge! This worksheet will help you do this.

First, define the following terms. Google is your friend if you forgot. 😉

VOCABULARY WORD DEFINITION
Physical Property - **Characteristics of matter that can be seen through direct observation such as density and melting point**
Physical Change - **Change in which the identity of the substance does NOT change**
Chemical Property - ____
Chemical Change - ____

Part 1: Each word is used once. Define the word when done!

Vocabulary words

Boiling point	Ability to rust	Melting point	Brittleness	Reactivity with vinegar
elasticity	Flammability	Density	Transparency	ductility

Chemical Property	Definition
	Level of ability to burn
	Reacts with oxygen to produce rust

Physical Property	Definition
	The property of letting light pass through something

Part 2: Physical or Chemical Change? Indicate with a 'P' or a 'C' which type of change is taking place.

1. _____________ glass breaking
2. _____________ hammering wood together
3. _____________ a rusting bicycle
4. _____________ melting butter

10. _____________ mixing salt and water
11. _____________ mixing oil and water
12. _____________ water evaporating
13. _____________ cutting grass

5. ____________ separating sand from gravel
6. ____________ bleaching your hair
7. ____________ frying an egg
8. ____________ squeeze oranges for juice

9. ____________ melting ice

14. ____________ burning leaves
15. ____________ fireworks exploding
16. ____________ cutting your hair
17. ____________ crushing a can

18. ____________ boiling water

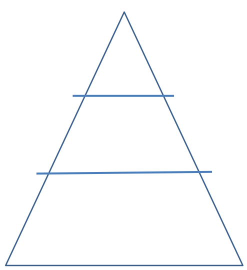
After completing both parts 1 and 2, you are done for today!

Wednesday, April 1st: Intermolecular Forces (link for refresher. *note: in the video, Van der Waals is the same as London Dispersion Forces)

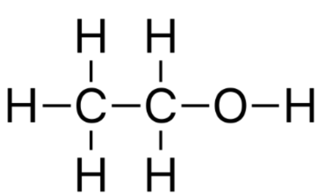
1. List all the intermolecular forces found in molecules.
    a.
    b.
    c.

2. List the three different types of Hydrogen Bonds.
    a.
    b.
    c.

3. Fill out the following pyramid of intermolecular forces using the three answers you wrote for #1.

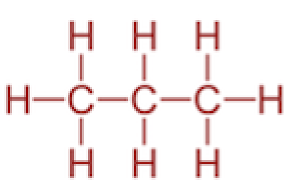


4. What types of interactions can form between molecules of ethanol? Identify them on the molecule.



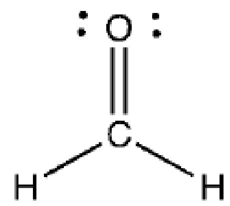
a. Is ethanol (molecule above) soluble in water? Why or why not? (soluble means able to dissolve)

5. What types of interactions can form between molecules of propane? Identify them on the molecule.



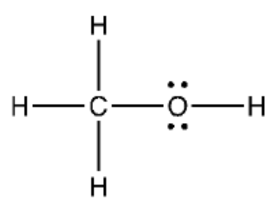
a. Is propane (molecule above) soluble in water? Why or why not?

6. What types of interactions can form between molecules of the one below? Identify them on the molecule.



a. Is this molecule polar or nonpolar? How do you know?

7. What types of interactions can form between molecules of the one below? Explain how you know.

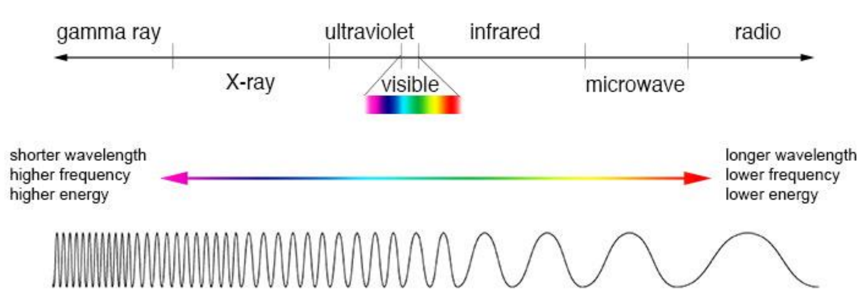


a. Is this molecule polar or nonpolar? How did you know?

After completing #1-7, you are done for the day!

Thursday, April 2nd: Electromagnetic Spectrum

Part 1: Use the following image to help you answer the questions below.

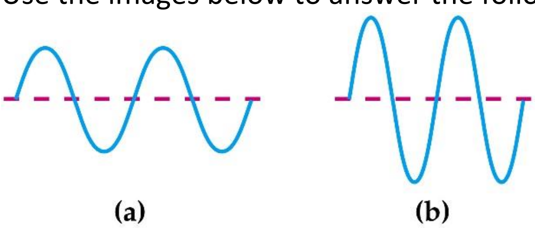


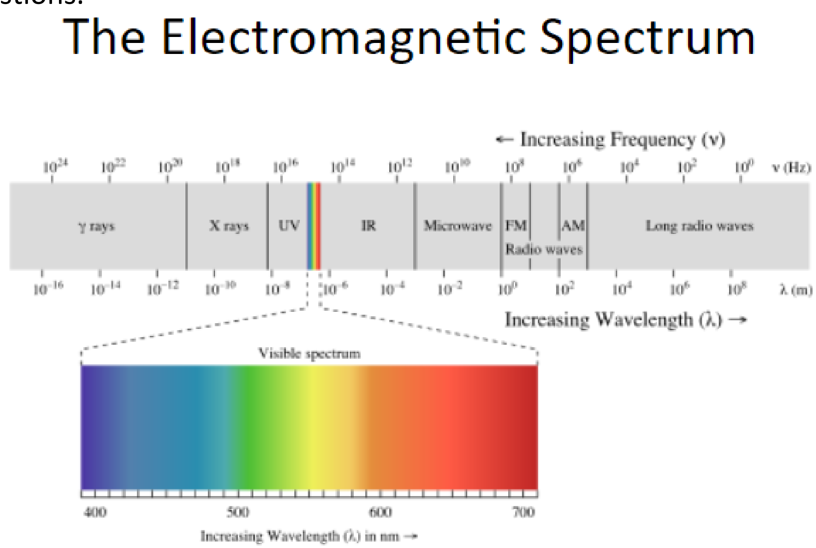
1. Which of the following types of electromagnetic (EM) radiation has the longest wavelength?
    a. X-rays
    b. Visible light
    c. Infrared
    d. Gamma rays

2. Which of the following types of electromagnetic (EM) radiation has the highest frequency?
    a. X-rays
    b. Visible light
    c. Infrared
    d. Gamma rays

3. Which of the following types of electromagnetic (EM) radiation has the highest energy?
    a. X-rays
    b. Visible light
    c. Infrared
    d. Gamma rays

Use the images below to answer the following questions.





4. Which of the waves above – a or b – has the higher intensity? _________________ **b**

5. Which of the waves above – a or b – has the higher frequency? _________________ **b**

6. Which of the waves above – a or b – has the longer wavelength? _________________ **a**

Part 2: Watch the following video (only need first 2 minutes but the rest of the video tells you a lot about oil and acrylic paints!) to answer the questions below.

1. What are the 3 types of paint mentioned in the video?
2. Where may have you used water colors?

3. Water Colors are water based, that means that water is the _________.
4. What part gives paint its color?
5. We see different colors and different pigments because of the way the molecules in them _________ or _________ light.
6. If a pigment absorbs specific colors, can we see them?
7. If a pigment reflects specific colors, can we see them?

Once you are done with both parts 1 and 2, you are done for the day!

Friday, April 3rd: Bill Nye!

Part 1: Watch the video below. If video doesn't work, go to this link.

Answer the following questions:

1. **What makes iron rust and blood turn red?**
2. **What happens to the wool when it reacts to the oxygen in the air?**
3. **How did he get the wool to react with oxygen that way?**
4. **When electrons recombine with other electrons, what happens to the energy of a reaction?**

Part 2: Watch the video below. If the video doesn't work go to this link.

Answer the following questions.

1. **True or False: Anything with molecules have heat.**
2. **Molecules in cold things move __________ than molecules in warm things.**

3. Did the flaming match have more heat energy or the ice swan?
4. More molecules means there is more ___________________.

Part 3: Watch the video below. If the video doesn't work go to this link.

1. What happens when white light is passed through a prism?
2. True or False: White light is a mixture of all the colors of a spectrum.
3. Can the individual colors of a rainbow be broken down into more colors?
4. Why is a black cloth warmer than a white cloth?

Yay, you've finished!

Please free to give me any feedback on this packet for the possibility of future virtual activities (ex. Was it easy to navigate and understand? More videos? Less videos? Layout? Etc.)