

EXPLORING INTERACTIONS OF MATTER WITH LIGHT

LEARNING GOALS

- Describe how a set of example molecules interacts with light of varying energy
 - Identify characteristics of molecules that are associated with an interaction with light
 - Construct a set of guidelines that generalize how molecules react with light of varying energy
 - Apply these guidelines to predict the reactivity with light for any small molecule
-

PART 1: GETTING STARTED

- A. Download the Molecules and Light simulation:
<http://phet.colorado.edu/en/simulation/molecules-and-light>
- B. Working in groups of 3, **explore** all of the controls in the simulation for about 5 minutes. Click on different things and figure out what each one does. Discuss with your partners and decide on a brief (1-2 sentences) summary of what the simulation does and shows.

PART 2: "LIGHT" IN THE SIMULATION

Rank the electromagnetic radiation in the simulation in terms of energy, wavelength, and frequency.

- A. Energy
- B. Wavelength
- C. Frequency

PART 3: INTERACTION OF LIGHT AND MATTER

- A. Examine how different photons in the simulation affect each molecule. Record your observations for each combination in a few descriptive words.

	Microwave	Infrared	Visible Light	Ultraviolet
CO				
N ₂				
O ₂				
CO ₂				
H ₂ O				
NO ₂				
O ₃				

- B. Which molecule(s) were **not** affected by **any** of the radiation in the sim?
Why might this be important? (Hint: think about what molecules are commonly found in our air and atmosphere)

- C. Examine your observations above and summarize the effects of each kind of radiation on the molecules in the simulation.

	Microwave	Infrared	Visible Light	Ultraviolet
Effect(s) on Molecules				

PART 4. MOLECULES IN THE SIMULATION

The interaction of light with a molecule depends on characteristics of the molecule. The presence of nonbonding lone-pair electrons or bond dipoles are two examples. Identify at least 2 more characteristics.

PART 5: GENERALIZED OBSERVATIONS

Return to your earlier classification and try to identify molecular characteristics associated with a particular interaction with electromagnetic radiation.

Type of Radiation	Which Molecules were affected? Hint: Drawing Lewis structures may help.	General Rule to Predict Activity
Microwave		
Infrared		
Visible		
Ultraviolet		

PART 6: PREDICTING REACTIVITY WITH LIGHT

Consider the molecule assigned to your group and predict how it will interact with light based on your observations in the simulation with other molecules.

Hint: It may be helpful to use the “Molecule Polarity” simulations to explore the shape and polarity of your molecule: <http://phet.colorado.edu/en/simulation/molecule-polarity>

Assigned Molecule	Microwave	Infrared	Visible	Ultraviolet