Hour 1

1. Evan, Aaron M, Vicky, Za’Mariyah
2. Taylor, Komal
3. Henry, Marissa, Clare
4. Tashawnna, Bryce, Frida
5. Joseph, Yeabi, Cameron S
6. Cooper, Oleg, Charlie, Kevin
7. Addie, Jay, Kian, Aidan
8. Brandon, Aaron W, Max

Hour 2

1. Nehemiah
2. Omari, Melanie, Tristan, Carly
3. Marisa, Lataysia, Cameron M, Lundy
4. Fiona, Euna, Justin, Kieran
5. Mikayla, Aniyah, Marco, Jessie
6. Anaiya, Jordyn, Daniel, Katie T
7. Joseph A, Cameron W, Corwin
8. Julia Y, Alex H, Katie S, Jennifer

How do we use radiation in our lives and is it safe for humans?

Slide J

Create an Initial Model

On your own

Make a model of the **parts** and **interactions** in the system that will explain:

- why the music was affected when the device was inside the microwave oven, especially when the speaker was farther away

Slide L

Provide Feedback on Initial Models

On your own

- How well does your partner's model explain why the music was affected when the device was inside the microwave oven?
- Use a check mark to represent what you agree with
- Use a question mark to represent what you are not sure about
- Write down any feedback and questions

Slide M

Incorporating Peer Feedback

With your partner

Discuss your feedback on your partner’s model, and listen carefully to your partner’s feedback on your model.

On your own

Use your partner’s feedback to revise your own model.

Slide O

Gathering More Experiences

Home Learning

Ask your friends and family about their experiences with microwave ovens and wireless technology.

1. What ideas or questions do they have about microwave technology?
2. Do they prefer to cook with a microwave oven, or with a different device? Why?
3. What other experiences have they had of a wireless signal being deleted?

Slide Q

What is unique about a microwave oven?

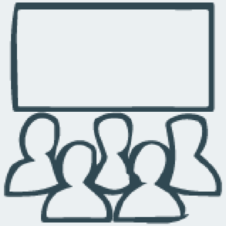
Warm Up

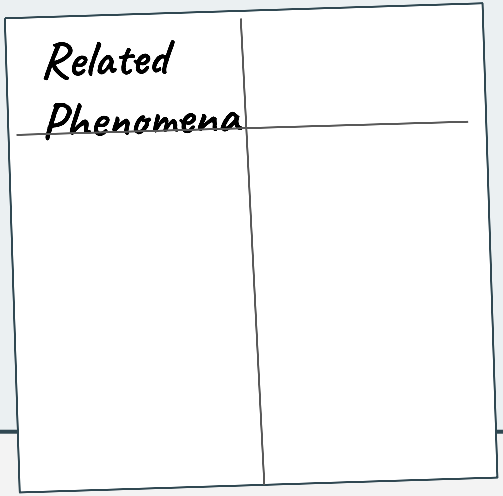
- How are microwave ovens different from other cooking devices?
- Would another type of cooking device affect a wireless signal the same way as the microwave oven? Why or why not?
- Add any wonderings that come up to your Notice and Wonder chart.

→ Be ready to share your ideas with the class

Slide P

Broadening to Related Phenomena



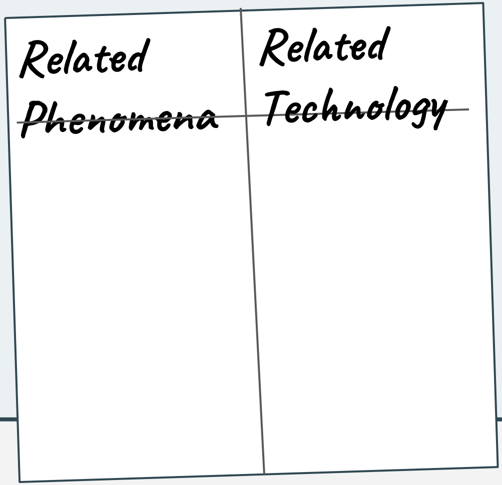


With your class

- What related phenomena (examples) have we experienced or heard about in which a wireless signal is distorted?
- What other phenomena (examples) related to microwave ovens have we experienced or heard about?

Slide R

Broadening to Related Technology



On your own

- What are some other human-made technologies that you think might use similar structures or mechanisms to function?
- How do you know?

Slide S

Developing Questions for the DQB

On your own

Consider the resources you have gathered over the past few days, including:

- your Notice and Wonder chart
- the *Microwave Oven Manual*
- our class consensus model
- conversations with friends/family
- our Related Technology and Phe

Write 1 question per sticky note.

Write in marker-- big and bold.

Put your initials on the back in pencil.

Slide T

Building the DQB

1. Choose a volunteer to go first. This student reads their question and then posts it on the DQB.
2. Raise your hand if you have a question that is related. The first volunteer selects the next student whose hand is raised. The student who is called on reads their related question, says why or how it relates, and then puts it onto the DQB with the original question.
3. That student who added the sticky note selects the next student, who will read another related sticky note and post it, and then call on the next student.
4. Continue until everyone has at least 1 question on the DQB.

Slide U

Ideas for Investigations and Data

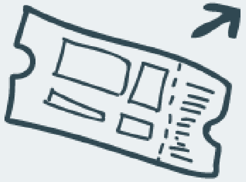
On your own

What additional **investigations** could we carry out and what **data** could we collect to figure out the answers to our questions?

➔ Be ready to share with the class and make a public record.

Slide V

Exit Ticket



On your own

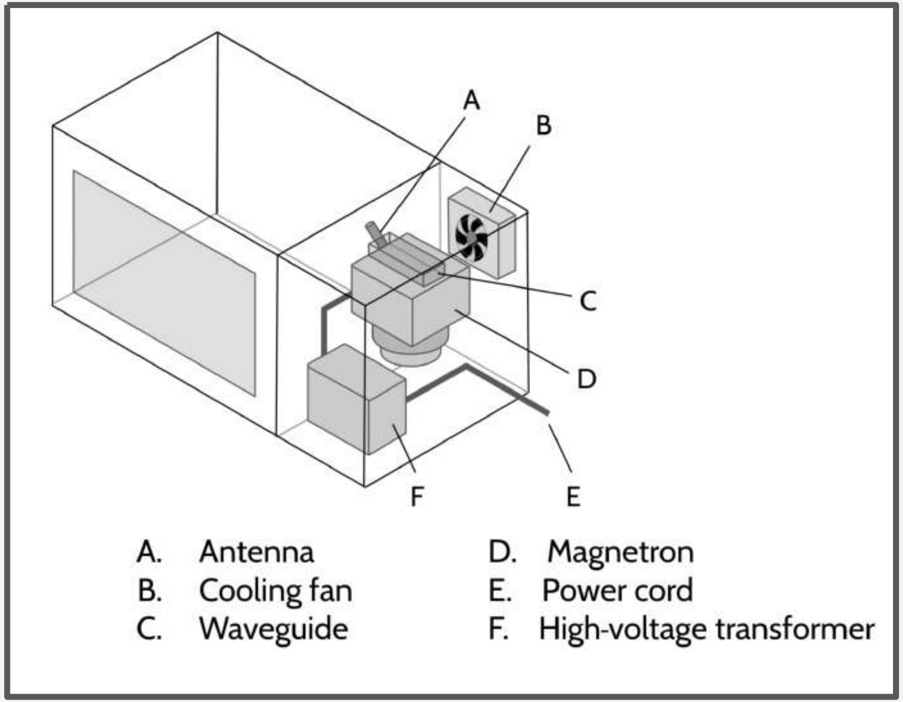
- What is an investigation we could do that could help us understand more about the **structure** of a microwave oven? What could this investigation tell us?
- What is an investigation we could do that could help us understand more about the **function** of a microwave oven? What could this investigation tell us?

Lesson 3

- Slinky Wave Exploration
- Wave Relationships
- PhET Waves on a string
- Relationships
- Glossary

Slide A

What is inside a microwave oven?



Warm Up

What do you notice about the parts of a microwave in the diagram?

Take out your Magnetron reading from yesterday.

Slide B

What does the magnetron do?

On your own

Continue to notice and wonder as we watch a video of a magnetron being dissected.

- What **parts or materials** seen especially important?

Slide C

Look Inside the Microwave Oven

Turn and Talk

How might the parts of the magnetron work together to produce electromagnetic radiation?

Slide G

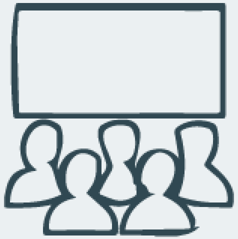
Investigate Energy in the Microwave Oven

Turn and Talk

Consider your answers throughout the reading to help you discuss these questions:

- What ideas or questions do you have about how electric fields transfer energy from the magnetron antenna into the matter inside the microwave oven?
- What objects have we worked with that could show us evidence of electric fields changing inside the oven’s cooking area?

Investigate Energy in the Microwave Oven

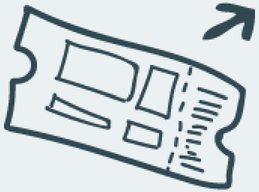


With your class

- What do you notice happens to the bulb when the microwave oven is running?
- What does this evidence tell us is happening in the middle of the microwave oven?

Slide J

Navigate



Modeling Assessment

- What do you think is happening between the magnetron antenna and the light bulb to transfer energy all the way across the microwave oven?
- Connect to our Magnetron reading and video

Answer by sketching a model with pictures and words.

Slide A

Navigate

WARM UP

What does it mean when we say “electromagnetic radiation” or “microwave radiation”?

Discuss what you know about the meaning of each of the following words:

- electromagnetic
- microwave
- radiation

Navigate

WARM UP

How could a slinky help us explain waves?

What are some ways we could experiment with the slinky?

Slide H

Plan an Investigation

Turn and Talk

Use our model to answer this question:

- How can we change the amount of energy transferred by a wave through this system?
- What are the limitations of our slinky spring for further exploration of this question?

Plan an Investigation

Scientists develop and use computer simulations to make controlled observations of the behavior of a system when different variables are manipulated.

Turn and Talk

- What would you want to be able to visualize or measure in a computer simulation of the waves on the particle slinky spring system we used in class?
- What variables would you want to be able to change?

- In lab- look at slinky energy transfer
- Create a model of what you see in your notebook
- Do the wave investigation
- Define wave terms together- Wednesday after grade check in
- Create equations
- Practice and reading for Thursday and Friday

Slide P

Construct an Explanation for Amplitude

With a partner

Write a conclusion statement for **amplitude** that describes how changes in it affected the other variables.

E.g., “When _______ increases), then ___________________.”

Also note how **amplitude** affects or does not affect the amount of energy transferred by the wave.

Compare Explanations for Amplitude

With your class

- How does changing **amplitude** affect the other variables?
- How can we visually represent this?
- Does changing **amplitude** affect how much energy is transferred by the wave?
    - If so, does increasing amplitude increase or decrease the energy transferred?

Slide S

Construct an Explanation for Frequency

On your own

Write a conclusion statement for **frequency** that describes how changes in it affected the other variables.

E.g., "When _______ increases, then ___________________."

Also note how **frequency** affects or does not affect the amount of energy transferred by the wave.

Slide T

Compare Explanations for Frequency

With your class

- How does changing **frequency** affect the other variables?
- How can we visually represent this?
- Does changing **frequency** affect how much energy is transferred by the wave?
    - If so, does increasing frequency increase or decrease the energy transferred?

Slide V

Construct an Explanation: Damping & Tension

On your own

Write conclusion statements for both **damping** and **tension**. Each should describe how changes affected the other variables.

E.g., "When ________ increases, then ______________________."

Also note how **damping** and **tension** affect or do not affect the amount of energy transferred by the wave.

Compare Explanations for Damping & Tension

With your class

- How does changing **damping** or **tension** affect the other variables?
- How can we visually represent this?
- Does changing **damping** or **tension** affect how much energy is transferred by the wave? If so, how?
  - If so, does increasing damping and/or tension increase or decrease the energy transferred?

Define the Word and Describe what happens when you increase the variable

- **Amplitude-**
- **Wavelength-**
- **Wave Speed-**
- **Frequency-**
- **Damping-**
- **Tension-**
- Crest-
- Trough-

Equation for Wave Speed-

Define the Word and Describe what happens when you increase the variable

- Amplitude- height of the wave
- Wavelength- horizontal size of the wave (crest to crest)
- Wave Speed- distance of the wave traveled over a period of time
- Frequency- amount of waves per second (inverse is period of the wave)
- Damping- friction, can’t travel across as well
- Tension- how grouped together the particles are
- Crest- top of the wave
- Trough- bottom of the wave

Equation for Wave Speed- wavelength x frequency

Wave Definitions

- Amplitude- height of wave (from equilibrium to crest)
- Wavelength- length of wave from crest to crest
- Wave Speed- distance traveled of the wave over time, how fast it’s going
- Frequency- number of waves over one second
- Damping- how fast the wave loses power
- Tension- space between particles, how tight or loose the string/spring is
- Crest- top of the wave
- Trough- bottom of wave

Equation for Wave Speed- wavelength x frequency

Create a Problem

Create a situation with a frequency and wavelength… determine the wave speed

Tuesday 3/12

1. Complete Wave Investigation and answer question on Google Classroom (Critical Thinking score) on Google Classroom using at least three pieces of evidence
2. Complete Light as a Wave Reading
3. Complete Wave Worksheet Packet

Slide A

Navigate

Warm Up

What kinds of things would you like to see in a simulation that could help us figure out how energy transfers from a microwave oven's antenna into food?

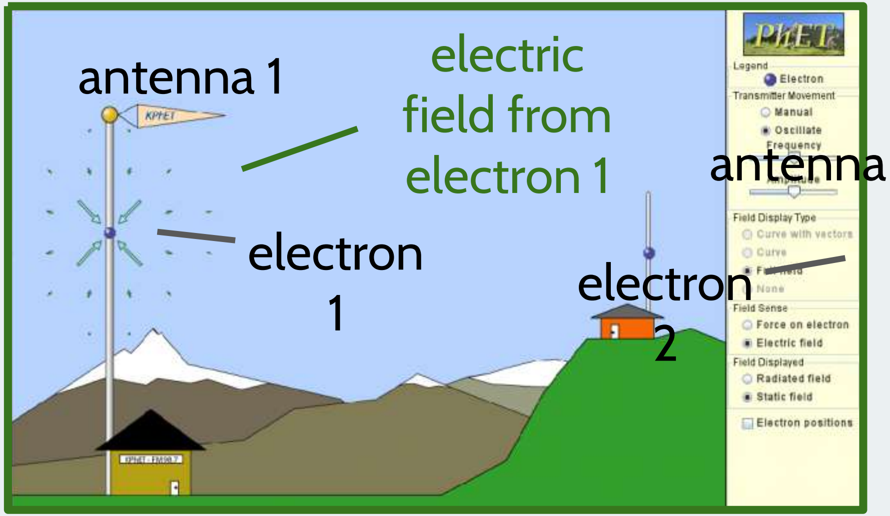
→ Be ready to share with the class!

Slide B

Explore Static Fields

With your class

- What do you notice?



Adapted from: PhET Interactive Simulations

- How does this compare to the microwave oven?
- What can we tell about the matter in the antenna from this image?

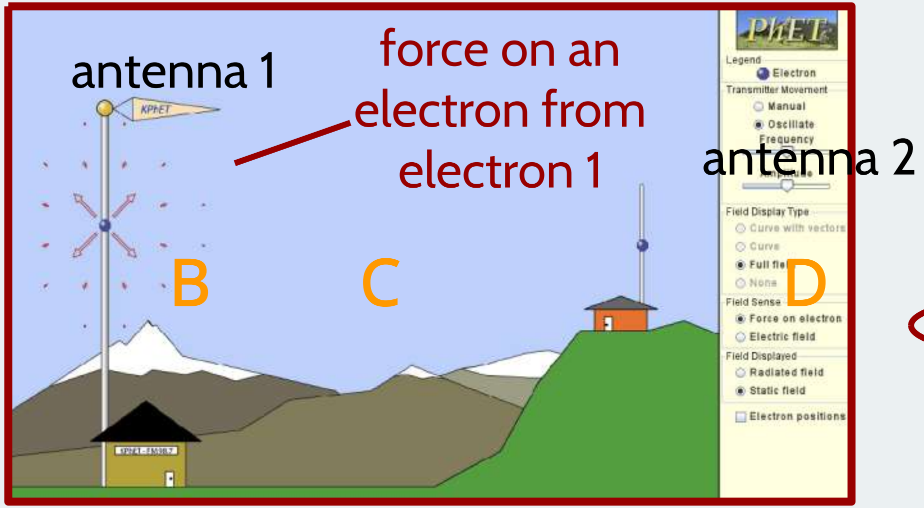
Slide C

Explore Force on an Electron

With your class

- What do you notice?

- How close does electron 2 need to be to feel a force from electron 1?



Adapted from: PhET Interactive Simulations

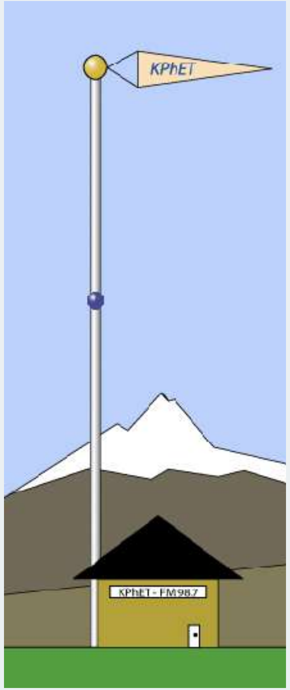
Slide D

Consider Frequency and Amplitude

With your class

- Move your arm up and down to imitate the movement of the electron in the transmitting antenna.

- Show with your arm how the movement would change if we increased:
    A. the frequency
    B. the amplitude



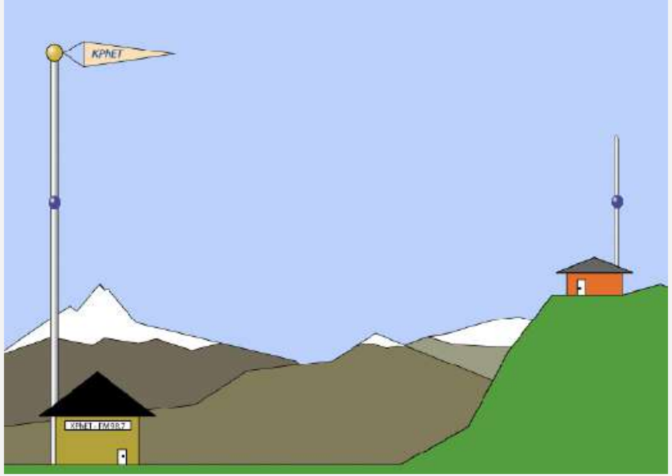
PhET Interactive Simulations

Slide E

Identify Evidence of Energy Transfer

Turn and Talk

- What evidence do we have of energy transfer?
- How would we start to model this?



PhET Interactive Simulations

With your class

Use boxes and arrows to develop an initial model of energy transfer in the system.

Identify Initial Patterns

On your own

1. Load the simulation.
2. Adjust it to the menu settings described in Part 1 of your handout.
3. Fill in Part 1 to describe the changes you notice in different parts of the system.
4. Consider what your visualization shows clearly and what seems unclear.

OpenClipart

Do not go on to Part 2 without your Jigsaw group!

Slide G

Make Sense of Patterns Together

With your group

- Each person gets up to 1 minute to share answers to Questions 1-4 from their assigned field visualization.
- 1 person (or more) takes notes in the Summary Table: Question 5 in Part 2.
- Use your tea
answer Questions 6-8 in the handout.

→ Be ready to share your ideas with the class!

Slide H

Build Understanding about Fields

With your class

- What patterns did we see at B, C, D, and E?
- What can we conclude about *how much* energy transfers as the electric field radiates from left to right?
- What changes can we make to our consensus model of energy transfer?
- What are the limitations of the simulation for explaining how the antenna transfers energy to other parts?

Slide I

Read about Light

On your own

Read *Light as a Wave*.

- Part 1: As you read, draw a ⋆ next to:
  - a hypothesis that was tested
  - the result of that test
- Part 2: Underline all ideas that could help us explain **why the electric field *radiates* only when charged particles move.**

Slide J

Navigate

Exit Ticket

- Write your name at the top of the reading.
- Answer the questions in Part 1 of the reading.
- Turn in your reading to your teacher.

Slide K

Navigate

Turn and Talk

- What patterns from our work with radio waves did the reading help us explain?
- What new patterns did we see?

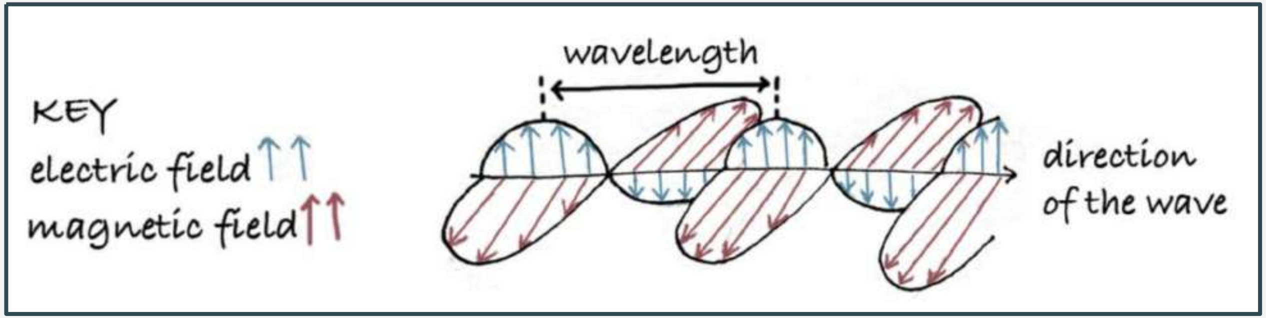
➔ Be ready to share your ideas with the class!

Slide L

Make Sense of 2 Fields

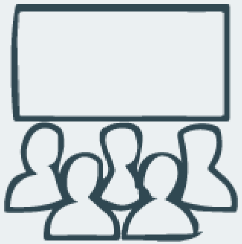
Turn and Talk

- What do you notice in this diagram from the reading?
- What would change if you could animate the drawing?
- How would this animation look for just 1 arrow?



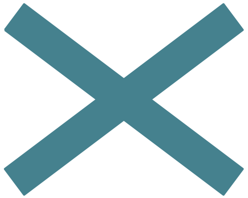
Slide M

Arrows “Toward” and “Away”



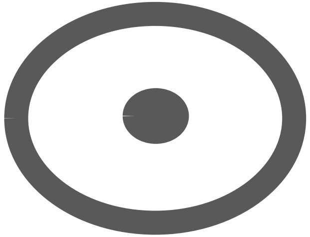
With your class

When physicists model fields, sometimes they need to show arrows pointing “toward” or “away”. Often they use the following notations:



away from you

“side view”



toward you

Adapted from: OpenClipart (PublicDomain)

Slide N

Make Sense of Magnetic Field Changes

With your class

Let’s focus on the magnetic field.

A. What do you notice at 1 point in space? What would we see from a “Top view”?

B. What do you notice at 2 points next to each other? What would we see at all points in space?

C. What do you see when we select “Total energy radiates in ALL directions?” What does this suggest?

Slide O

Make Sense of 2 Fields Together

Turn and Talk

Study the field drawing in the reading and compare what you see to the simulation.

D. How do electric and magnetic fields change as the wave travels?
E. Is energy transferring through the electric fields, magnetic fields, or both? How do you know?
F. What are the limitations of this model? What doesn't it show

→ Be ready to share your ideas with the class!

Slide P

Carry Out a Demonstration

Scientists Circle

How could we use physical equipment to investigate how changes in electric fields affect magnetic fields, or vice versa?

Available equipment:

hand-crank generator, wire coil, alligator clips, compasses, nail, magnets, LED

Slide Q

Carry Out a Demonstration

With a partner

Make predictions:

Generator, Wire Coil, Compasses: *If changing electric fields cause changes in magnetic fields, then cranking the generator back and forth should...*

Wire Coil, Magnets, LED: *If changing magnetic fields cause changes in electric fields, then moving the magnets inside the coil of wire should...*

Slide R

Make Sense of Observations

Scientists Circle

- What happened when we used the generator to change the direction of the electric field in the wire?
- What happened when we used spinning magnets to change the direction of the magnetic field in the wire?
- How might this help us understand what

Revise the Energy Transfer Model

Turn and Talk

Study our consensus model in progress. Based on new evidence, what would you add to show:

- How do changes at one place cause changes at other places in the system?
- How does the vibrating electron at A cause energy to transfer?
- What do we call this system of changing electric and magnetic fields?

➔ Be ready to share your ideas with the class!

Slide T

Update Your Personal Glossary

On your own

Use words and/or pictures to add your own definitions for *electromagnetic radiation* and *electromagnetic waves* to your Personal Glossary.

Set Up the Unit Progress Tracker

On your own

Make your first entry by filling in the 3 columns of the Progress Tracker handout:

- What patterns or results did we see or experience that helped us figure something out?
- What caused these patterns or results?
- How does this help us further our models or answer our questions on the DQB?

Slide V

Navigate

Exit Ticket

- Use words and/or pictures to make a prediction about what microwave radiation would do when it encounters matter.

Warm Up and Agenda

Warm Up: Describe how water might absorb, reflect and transmit light waves

Agenda:

1. Warm Up
2. Review Transmission Vocabulary
3. Revise Initial Models with vocabulary and concepts from in class
4. Start Investigation #1

Revise Models

Revise models to include new vocabulary and using concepts from our PhET simulations.

Inquiry Labs

Investigation 1: How does microwave radiation interact with water and ice?

- What are variables we could test? What could we measure?
- How could you set up this experiment with independent, dependent and control variables with multiple trials?

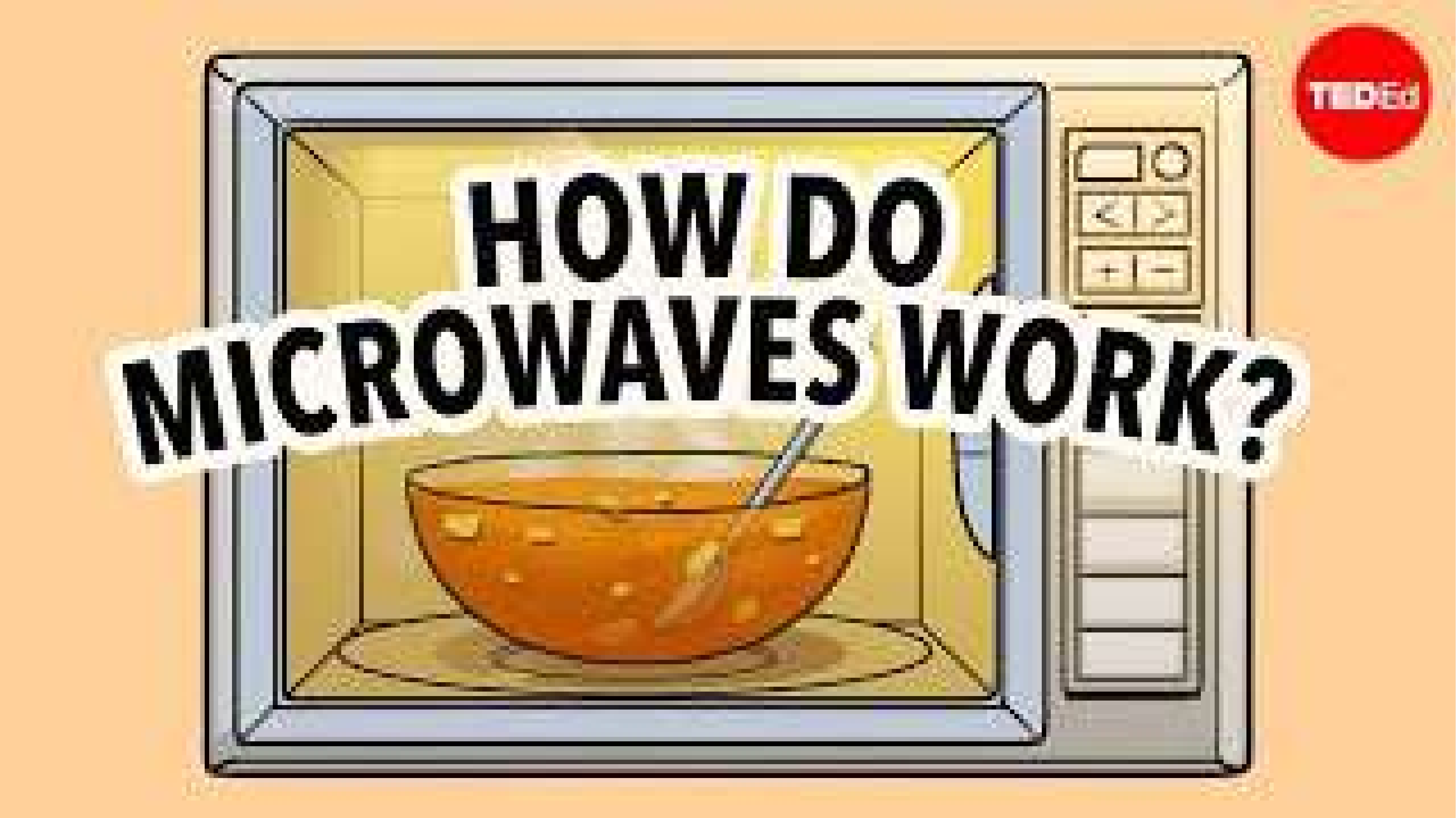
Inquiry Labs

Investigation 1: How does microwave radiation interact with water and ice? Let's say we also have three containers: glass, ceramic and plastic

- What are variables we could test?
- What could we measure changed about those variables?
- Describe and draw an experiment you could execute.

Warm Up

Take out Investigation #1 from yesterday and work on your write up (15 minutes)


TED-Ed
HOW DO
MICROWAVES WORK?

Inquiry Labs

Investigation 2: How can we test water and ice in three different containers and their interactions with light?

- How could we change the water/ice inside?
- How could we change where the containers are placed?
- What could we measure?
- What controls do we have?

Investigation #2

3 containers (black, silver, white)

- (Near) Boiling Water
- Ice Water
- Room Temperature Water

One set (9 containers) in front of a grow light and 9 containers in front of the window

Slide A

Interactions with Water

Turn and Talk

How does electromagnetic radiation interact with water in a microwave oven?

What evidence do we have for this interaction?

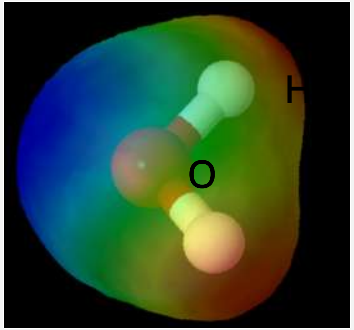
Slide D

Zooming In on the Matter

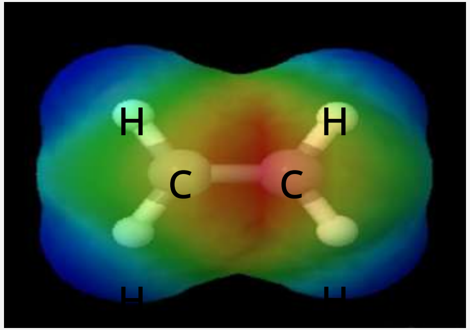
With your class

What do you notice about these models?

How is the matter similar? How is it different?



Water molecule



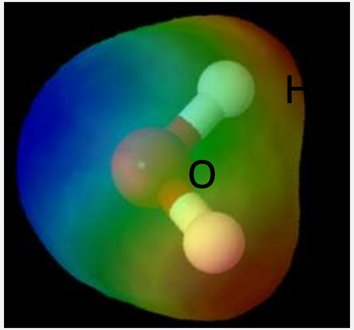
Microwave-safe plastic (ethylene) molecule

Adapted from: Jmol

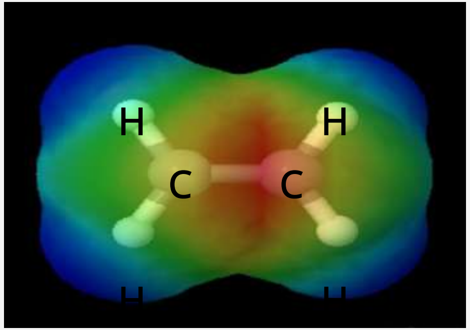
Zooming In on the Matter

With your class

How do you predict the charge (+ or –) will be distributed in each



Water molecule



Microwave-safe plastic (ethylene) molecule

Adapted from: Jmol

More (more -)

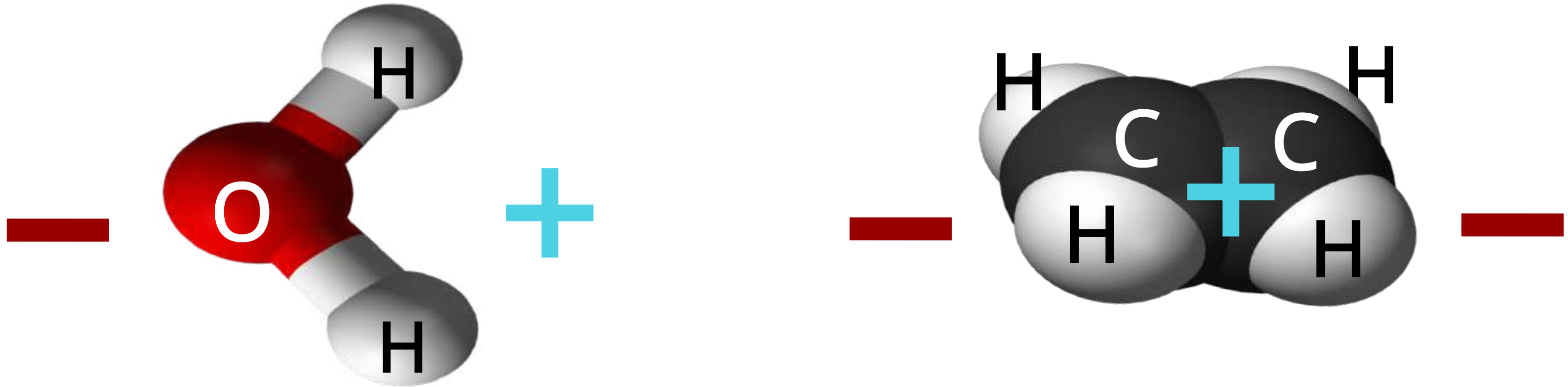
Fewer (more +)

Slide F

Make an Inference

Turn and Talk

Given what we know about EM radiation and electric fields, how do you predict each particle would behave in a microwave oven?



Adapted from: Ben Mills

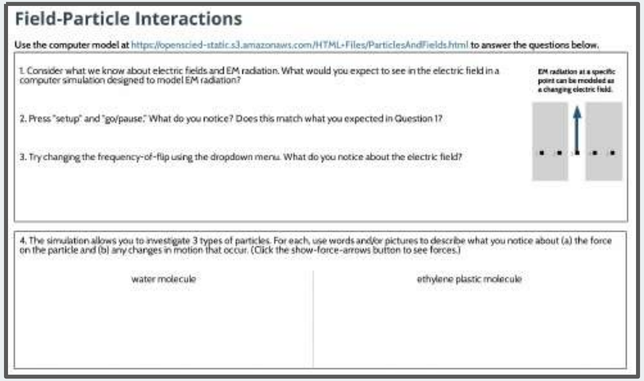
Slide G

Investigate a Computer Model

With your group

Make observations in a computer model of a changing electric field to explain changes in matter when EM radiation:

- absorbs into matter
- transmits through matter
- reflects off of matter



Field-Particle Interactions

Use the computer model at https://openscied-static.s3.amazonaws.com/HTML+Files/ParticlesAndFields.html to answer the questions below.

1. Consider what we know about electric fields and EM radiation. What would you expect to see in the electric field in a computer simulation designed to model EM radiation?

2. Press "setup" and "go/pause." What do you notice? Does this match what you expected in Question 1?

3. Try changing the frequency-of-flip using the dropdown menu. What do you notice about the electric field?

EM radiation at a specific point can be modeled as a changing electric field.

4. The simulation allows you to investigate 3 types of particles. For each, use words and/or pictures to describe what you notice about (a) the force on the particle and (b) any changes in motion that occur. (Click the show-force-arrows button to see forces.)

water molecule	ethylene plastic molecule

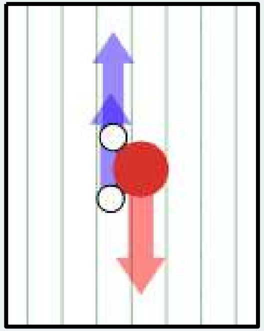
→ Be ready to share your ideas with the class.

Slide H

Explain Water in the Microwave Oven

With your class

- What changes in the water molecule were caused by changing the field? Why?

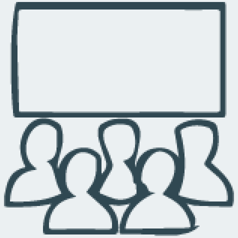


- Do EM radiation waves absorb into, transmit through, or reflect off of the water? How do we know?
- How does this help explain some of the macroscopic changes we observed in our microwave oven experiments?

Wilensky, U. (1999). NetLogo. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

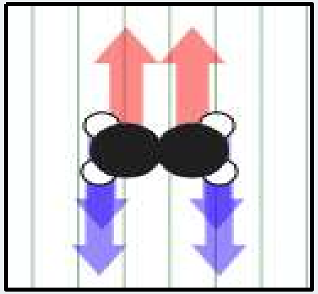
Slide I

Explain Plastic in the Microwave Oven



With your class

- How did the ethylene respond to the changing field? Why?



- Do EM radiation waves absorb into, transmit through, or reflect off of the ethylene? How do we know?
- How does this help explain some of the macroscopic changes we observed in our microwave oven experiments?

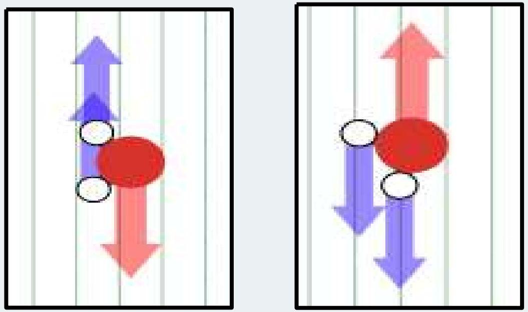
Wilensky, U. (1999). NetLogo. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

Slide J

Consider Differences in Frequency

With your class

- What did you notice about how water molecules respond when we increase frequency?



- We have seen in the past that higher frequency transfers more energy when amplitude stays the same. Does this agree with the new model we see in this simulation? Why or why not?

Wilensky, U. (1999). NetLogo. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

Slide K

Modeling Individually

Using the simulation...

A. *Why does water heat up in the microwave oven?*

B. *Why doesn't the microwave-safe plastic heat up in the microwave oven?*

- Sketch a quick model to show ideas about why some substances heat up in the microwave oven while others don't. Show key components, such as: **fields, charges, interactions and forces**

Navigation

With a partner

- Compare sketches
- Brainstorm key components we would need in a consensus model to clearly explain:
    - *Why water heats up in the microwave oven.*
    - *Why the microwave-safe plastic does not heat up in the microwave oven.*
- Write your ideas in your science notebook.

Slide M

Develop a Consensus Model

With your class

What key components will we need in our consensus model?

Slide N

Develop a Consensus Model

With your class

- What changes or interactions between these components do we need to show?
- What connection to macroscopic evidence are we trying to explain?

Testing Our Model

With your class

- Can our model help explain why aluminum foil is safer to use in the microwave oven under certain conditions but dangerous in others?
- What other products have you seen with metal in them that are designed to go in the microwave oven?

Slide P

Evaluate Information

With a partner

Read through each row of the Evaluating Information Checklist with a partner.

- Which categories do you think will be easy to identify from an article?
- Which categories do you think will be more difficult?
- Why do you think that?

➔ Be ready to share your ideas with the class.

Slide Q

Evaluate Validity and Reliability of Claims

With your class

Read the following paragraph:

"When you use a microwave oven, radiation passes through materials like paper, glass, and plastic, but it gets absorbed by the water content in food. The radiation makes the water molecules inside the food wiggle around, which creates heat and cooks the food."

- Use the Evaluating Information Checklist to

Slide R

Evaluate Validity and Reliability of Claims

With a partner

- Use the Evaluating Information Checklist to evaluate the validity and reliability of the reading.
- Use ✓ or ✗ or ? if you're not sure.

Example

	Source:	1	2
Valid: *Valid* claims are supported by evidence and consistent with scientific ideas.	Does the author back up their claims with evidence? *Underline sections where the author presents evidence.*	✗	
	Are the claims consistent with your own experiences and understanding? *List relevant experiences you've had, or relevant terms you understand.*	✓	
	Are the claims consistent with science ideas we have figured out in class? *Using a different color, underline the science ideas that each author is using to support their claim(s).*	✓	

Slide S

Consider Why This Matters

On your own

Based on your evaluation, are the claims made in the reading:

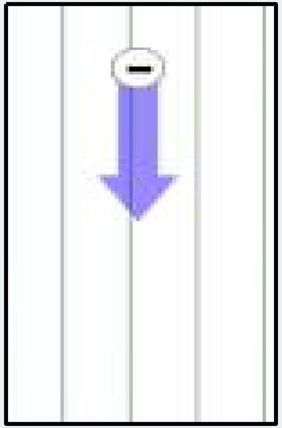
- reliable?
- valid?

➔ Be ready to share your ideas with the class.

- Explain your answers, using details from the Evaluating Information Checklist and the reading.
- Why is it important to pay attention to the **validity** and **reliability** of the claims we read?

Slide T

Consider Aluminum Particle Structure



With your class

- How could we use the simulation of electrons in aluminum to verify claims made in the readings?
- What do you notice when we run the simulation of an electron?
- What do you notice when we run the simulation of electrons in aluminum?

Wilensky, U. (1999). NetLogo. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

Personal Glossary and Progress Tracker

On your own

1. Use words and/or pictures to add your own definition for *polar molecule* to your Personal Glossary.

2. Make a record of your ideas right now in your Progress Tracker to explain why some materials heat up in the microwave oven and others do not.

Slide V

Navigate

Turn and Talk

Does our particle-scale model for what heats up and what stays cool in the microwave oven explain the patterns we observed of hot and cool spots when we

Warm Up in Notebook

Besides microwaves, what other types of electromagnetic radiation do we have? What do you know about them?

Slide B

Other Types and Uses of EM Radiation

With your group

Orient to the EM Radiation Cards.

- What type of information is on these cards?
- What variables do we recognize that we have worked with before?
- What do you notice about the numbers and units used for each of those variables?

→ Be ready to share your noticings with the class.

Slide C

Self-Reflect

The size of cells in our body is often measured in µm.

- 1 µm = 0.01 mm = 0.000001 m

Consider the units being used for describing these waves:

- 1 GHz = 1,000,000,000 cycles/sec
- 1 nm = 0.00001 mm = 0.000000001 m

Think Time

What does seeing units like GHz for frequency and nm for wavelength tell us about the scales involved with these types of waves?

Slide D

Review Scientific Notation

The frequency of gamma rays is greater than:

$$3.0 \times 10^{10}\ \text{GHz} = 30{,}000{,}000{,}000\ \text{GHz}$$

The decimal has moved 10 places to the right.

We added $\times 10^{10}$.

Slide E

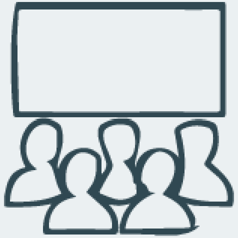
Identify Trends in Quantitative Variables

With your group

- Sort the cards by one of the quantitative variables to identify trends in the others on your whiteboard.

Slide F

Organize Types of EM Radiation

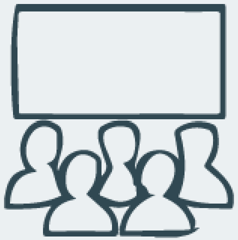


With your class

- Which type of EM radiation has the **shortest wavelength**?
- Which type of EM radiation has the **longest wavelength**?
- Which type of EM radiation has the **lowest frequency**?
- How great are the differences in wavelength and frequency between them?
- Where are the other EM Radiation Cards located in relation to these extremes?

Slide G

Organize Types of EM Radiation



With your class

- How does the speed of each EM radiation type compare?
- Is this in line with the relationship between frequency and wavelength that we just found?

Slide H

Make Sense of EM Radiation Speed Values

wave speed = frequency * wavelength

With your group

How does the mathematical model we developed (above) help us explain the differences we see in wave properties for different types of EM radiation?

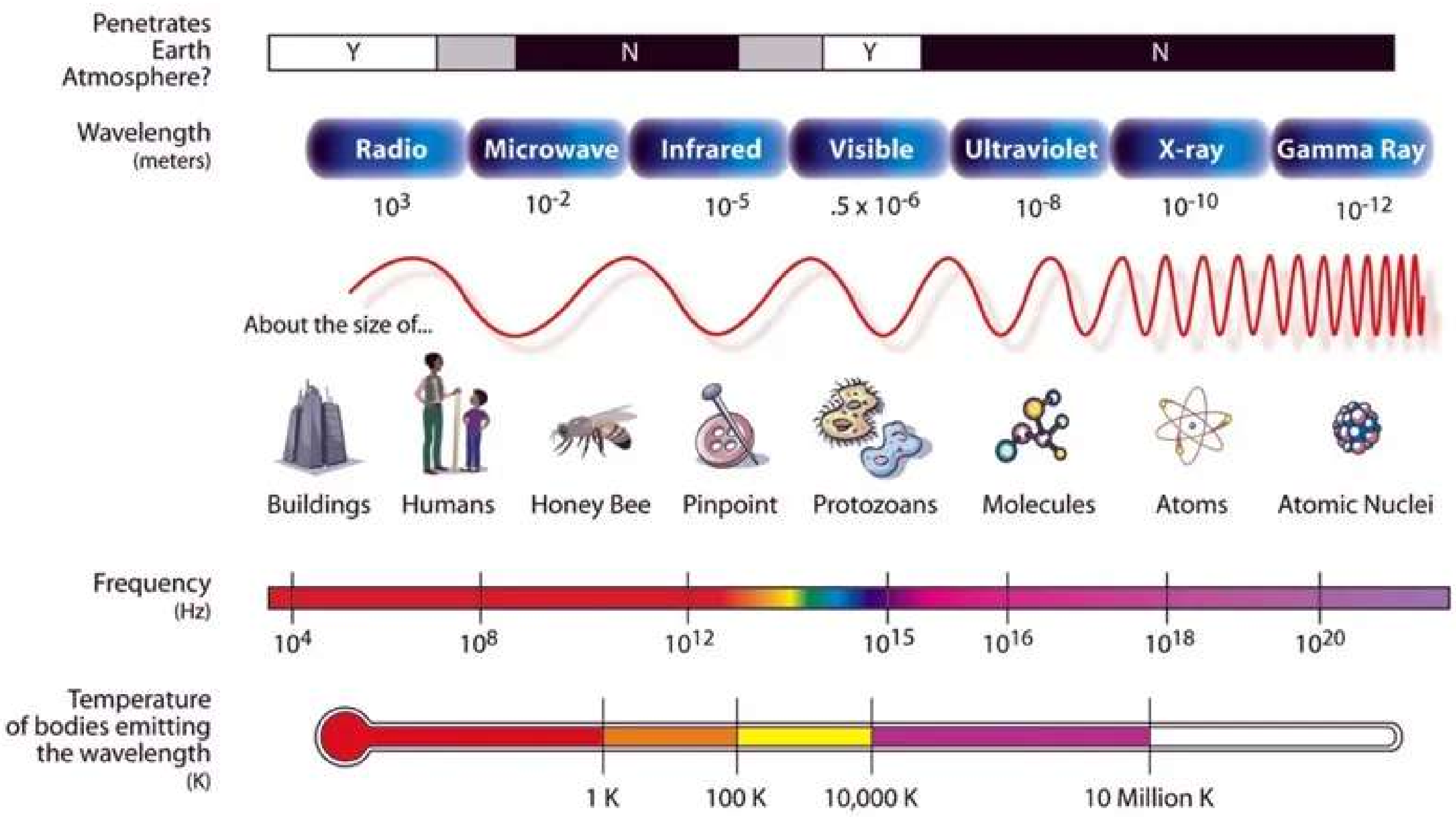
Exit Ticket (on GC)

Choose one part of the electromagnetic spectrum (except for microwave). Using evidence from the cards, explain **why the frequency and wavelength of that part of the EM Spectrum explain the uses for this type of radiation.**

Encryption

With your group create an encrypted binary code for the phrase “good morning”.

THE ELECTROMAGNETIC SPECTRUM



5G Assessment Part 1

- Part 1: Exploration 5G and what the frequency means
- Part 2: Exploring social media posts
- This is due Wednesday end of class for a critical thinking and communication grade