Slide A

Examine DQB Questions

Scientists Circle

Consider these questions individually for a moment:

- What category(ies) of DQB questions do we still have left to answer?
- How could we answer some of the questions in each of these categories?

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.

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

Individual 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?

Review Scientific Notation

The frequency of gamma rays is greater than:

3.0×10^{10} GHz = 30,000,000,000 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.
- Describe these trends in **Part 1** of your handout.

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?

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?

Make Sense of EM Radiation Speed Values

wave speed = frequency * wavelength

With your group

- Record what you discover about this question in **Part 2** of your handout:

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

➔ Be ready to share your ideas with the class.

Identify Relationships

With your group

- Identify some of the ways that EM radiation types are used.
- Use the information on the cards and the guiding questions in **Part 3** of your handout to identify connections between the uses of EM radiation types and their properties.
- Be ready to present an argument out loud about why we can use some EM radiation types for some applications.

Slide J

Navigate

Individual Think Time

- Review the argument you developed with your group last time.
- Be ready to present your argument to a partner.

Slide K

Presenting Our EM Radiation Arguments

With a partner

1. Each student will have 1 minute to present their argument.

2. The other student will have 1 minute to ask questions and give feedback about the ideas presented.

Slide L

Revise Argument Based on Feedback

On your own

- Based on the discussion you had with your partner, revise your argument in **Part 4** of your handout.

Discuss EM Radiation Uses and Interactions

With your class

- Are there any relationships between the frequencies and wavelengths of EM radiation types and their interactions with matter?
- How do interactions of EM radiation with matter help explain its use in some applications?
- Why are some EM radiation types used for some applications but not others?

Define Electromagnetic Spectrum

Turn and Talk

What does the word *spectrum* mean to you?

With your class

What conclusions can we make about a particular type of EM radiation by looking at where it falls in the electromagnetic spectrum?

Update Personal Glossary

On your own

Use words and/or pictures to add your own definition for *electromagnetic spectrum* to your Personal Glossary.

Ask Questions

On your own

- Record any new questions that you have about the different types of EM radiation.

- *Write 1 question per sticky note.*
- *Write in marker-- big and bold.*
- *Put your initials on the back in pencil.*

Examine DQB Questions

Scientists Circle

Consider these questions individually for a moment:

- To which category(ies) of DQB questions should we assign our new questions?
- What new categories do we need?

➔ Be ready to share your questions (and new categories, if needed) for our DQB.

Synthesize Ideas about Wave Interference

In your notebook

Add your updated model to your Progress Tracker.

Progress Tracker

Lesson #	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?

Navigate: Exit Ticket

Exit Ticket

Why do we think some forms of high-frequency EM radiation (ultraviolet, X-rays, and gamma rays) cause more damage than others?

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