Radio, microwaves and infrared

Student activity • observation and reasoning

YEAR 10 / LESSON 62 / PHYSICS + SCIENCE (DOUBLE AWARD)

The question

How do different parts of the electromagnetic spectrum carry energy and information?

Order spectrum cards and compare radio, microwave and infrared applications without operating heating sources.

Equipment

- Original spectrum, application and schematic-image cards
- Booklet and calculator

Paper and diagram activity only. Do not open microwave ovens, test door interlocks, use infrared heaters or concentrate sunlight. No radiation source or deliberate human exposure is part of this lesson.

Course coverage: Shared Physics / Double Award: 3.10–3.13. Electromagnetic spectrum, uses and heating hazards.

Plan, model or apparatus sketch

Draw a labelled wave, ray or apparatus diagram appropriate to this activity.

Method and reasoning

Read the whole sequence before starting

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1. Arrange the seven electromagnetic regions from radio to gamma rays. Add arrows for increasing frequency and decreasing wavelength and insert visible colours from red to violet.

2. State that all electromagnetic waves travel at the same speed in vacuum. Use $c = f\lambda$ to calculate wavelength for an invented 100 MHz radio signal with $c = 3.00 \times 10^{8}$ m s^{-1}.

3. Match radio broadcasting, microwave satellite communication and cooking, and infrared heating and thermal imaging to their regions. Explain the energy transfer or information carried in each case.

4. Compare a diagram of a microwave oven with one of a satellite link. Explain why a common wave category does not imply identical power, exposure or equipment.

5. Use a supplied schematic thermal image to explain detection of infrared emission. State that its colours represent a chosen display scale, not visible colours emitted by a room-temperature person.

6. Match excessive microwave exposure with internal heating and intense infrared exposure with burns. Explain suitable controls such as intact shielding and controlled source power without conducting exposure trials.

Cleanup

- Return cards and keep corrected spectrum diagrams.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Radio waves, microwaves and infrared are electromagnetic waves, not sound. Heating depends on absorption and exposure. The 100 MHz calculation is fictional practice and gives 3.00 m. Thermal images require interpretation of calibration, emissivity and reflected radiation; this activity makes no medical assessment.

Region	Use and mechanism	Hazard / control
Radio		
Microwave		
Infrared		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Order the seven regions from longest wavelength.

2. What happens to frequency as wavelength decreases in vacuum?

3. Find λ at 100 MHz.

4. Give a microwave communication use.

5. What does a thermal camera detect?

6. Name one microwave and one infrared exposure hazard.