



**LAND MANAGEMENT, ENVIRONMENT & SOLID-WASTE:
INSIDE EDUCATION AND BUSINESS IN CENTRAL ASIA
ERASMUS-EDU-2023-CBHE Project Number: 101129032**

MICRO-CREDENTIAL

LAND MANAGEMENT IN CENTRAL ASIA

11.- Electromagnetic Radiation and Energy Interaction

Quiz

Week 11 – Electromagnetic Radiation



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Quiz: Week 11 - Electromagnetic Radiation

Assessment type: Multiple-choice quiz

Total questions: 30

Recommended time: 35-45 minutes

Scoring: 1 point per question, 30 points total

Instruction to students: Choose the best answer for each question. Each question has one correct answer.

Source base: This compact quiz is aligned with the seven Week 11 presentations on the nature of electromagnetic radiation, the electromagnetic spectrum, radiation-matter interaction, spectral characteristics of natural objects, reflection/absorption/transmission, spectral behavior of vegetation-soil-water, and the Week 11 electromagnetic energy review.

Question Distribution

Part	Presentation topic	Questions	Share
A	Nature of Electromagnetic Radiation	4	13%
B	Electromagnetic Spectrum	5	17%
C	Radiation-Matter Interaction	4	13%
D	Spectral Characteristics of Natural Objects	5	17%
E	Reflection, Absorption, and Transmission	4	13%
F	Spectral Behavior of Vegetation, Soil, and Water	4	13%
G	Electromagnetic Energy Review	4	13%
Total		30	100%

Student Copy

Part A. Nature of Electromagnetic Radiation

1. In remote sensing, why is electromagnetic radiation important?

- A. It carries measurable information from the Earth surface to the sensor.
- B. It replaces the need for atmosphere correction.
- C. It makes all land surfaces appear equally bright.
- D. It prevents sensors from recording wavelengths.

2. Which statement correctly describes electromagnetic radiation?

- A. It can travel only through water.
- B. It is energy that travels through space as electric and magnetic fields.
- C. It is always visible to the human eye.
- D. It is produced only by radar sensors.

3. What is the relationship between wavelength and frequency when the speed of light is constant?

- A. Longer wavelength means higher frequency.
- B. Shorter wavelength means lower frequency.
- C. Wavelength and frequency change in opposite directions.
- D. They are unrelated in remote sensing.

4. Which pair best describes passive and active remote sensing?

- A. Passive sends its own pulse; active uses only sunlight.
- B. Passive uses natural energy; active provides its own energy.
- C. Both always use thermal infrared only.
- D. Both can operate only during daytime.

Part B. Electromagnetic Spectrum

5. Which spectral region is approximately visible to the human eye?

- A. 0.4-0.7 micrometers
- B. 1.3-2.5 micrometers
- C. 8-14 micrometers
- D. Centimeter wavelengths

6. Near-infrared bands are especially useful for vegetation studies because healthy leaves usually:

- A. absorb nearly all NIR energy.
- B. reflect strongly in NIR due to internal leaf structure.
- C. emit microwave radiation.
- D. become invisible in false-color imagery.

7. Shortwave infrared bands are commonly useful for detecting:

- A. leaf and soil moisture differences.
- B. only human eye color.
- C. GPS position error.
- D. sensor orbit height only.

8. Thermal infrared remote sensing mainly records:

- A. reflected blue light.
- B. emitted energy related to surface temperature and emissivity.
- C. radar backscatter from rough surfaces.
- D. the exact crop species without validation.

9. Microwave radar is valuable in many monitoring tasks because it can often:

- A. observe through clouds and operate day or night.
- B. measure only visible color.
- C. ignore surface roughness completely.
- D. work only under direct sunlight.

Part C. Radiation-Matter Interaction

10. Which set lists the main interaction processes between radiation and matter?

- A. Reflection, absorption, transmission, emission, and scattering.
- B. Printing, copying, labeling, and saving.
- C. Projection, buffering, geocoding, and digitizing.
- D. Cropping, rotating, clipping, and merging.

11. Why does atmospheric correction matter in quantitative image analysis?

- A. It converts every image into a true-color photograph.
- B. It removes all classification errors automatically.

- C. It helps estimate surface reflectance instead of top-of-atmosphere signal.
- D. It makes radar and optical data identical.

12. A spectral signature is best defined as:

- A. a single brightness value from one pixel.
- B. a material response pattern across wavelengths.
- C. a file name for a satellite image.
- D. a manual drawing of a land parcel.

13. The red edge in vegetation spectra refers to:

- A. a sharp transition from red absorption to high NIR reflectance.
- B. a thermal anomaly in bare soil.
- C. a radar shadow on steep slopes.
- D. a water absorption feature in blue light.

Part D. Spectral Characteristics of Natural Objects

14. Healthy vegetation usually shows which pattern?

- A. High red reflectance and low NIR reflectance.
- B. Low red reflectance and high NIR reflectance.
- C. High NIR reflectance and high SWIR reflectance under all moisture conditions.
- D. No difference between visible and NIR bands.

15. Open water is often easy to separate from land in NIR and SWIR because water generally:

- A. reflects strongly in those regions.
- B. absorbs strongly and appears dark in those regions.
- C. has the same response as dry soil.
- D. always becomes brighter than vegetation.

16. Soil spectral behavior is highly variable mainly because soil reflectance depends on:

- A. moisture, texture, organic matter, minerals, and roughness.
- B. satellite name only.
- C. the color of the map legend.
- D. the number of pages in a report.

17. Snow and clouds can both appear bright in visible bands, but SWIR information helps because:

- A. snow and clouds have identical SWIR behavior.
- B. visible light cannot be recorded by satellites.
- C. snow reflectance usually decreases strongly in SWIR compared with visible bands.
- D. SWIR removes all shadows automatically.

18. Why should spectral signatures not be treated as fixed permanent fingerprints?

- A. They change with moisture, season, health, atmosphere, geometry, and scale.
- B. They never vary between dates.
- C. They are unrelated to material properties.
- D. They are used only for printed photographs.

Part E. Reflection, Absorption, and Transmission

19. The simple surface energy balance for incident energy is commonly written as:

- A. $E_i = E_r + E_a + E_t$
- B. NDVI = Blue + Thermal
- C. Frequency = Area / Distance
- D. Pixel = Band x Orbit

20. Specular reflection is most likely to occur from:

- A. a very smooth surface such as calm water or shiny roofing.
- B. a dense forest canopy only.
- C. dry rough soil only.
- D. all natural surfaces equally.

21. Absorption features in spectral curves are useful because they may indicate:

- A. composition, moisture, pigments, or biological condition.
- B. file compression quality only.
- C. the map projection automatically.
- D. the number of classes in a legend.

22. Atmospheric windows are important because they are wavelength regions where:

- A. the atmosphere transmits enough energy for useful observation.
- B. all clouds disappear permanently.
- C. sensors stop receiving any signal.
- D. water and soil have identical reflectance.

Part F. Spectral Behavior of Vegetation, Soil, and Water

23. NDVI works because it uses the contrast between:

- A. red absorption and NIR reflection in vegetation.
- B. thermal emission and GPS accuracy.
- C. blue light and radar shadow.
- D. soil texture and map scale only.

24. A wet soil surface often appears darker than dry soil because:

- A. water increases absorption and lowers reflectance.
- B. wet soil always reflects more visible light.
- C. soil moisture has no spectral effect.
- D. thermal infrared becomes invisible.

25. Turbid water can be brighter than clear water in visible bands because:

- A. suspended sediment or algae can increase visible backscatter.
- B. turbidity increases NIR reflectance above vegetation.
- C. water stops absorbing all infrared energy.
- D. the sensor ignores visible wavelengths.

26. For crop monitoring, the best image date is usually selected according to:

- A. crop growth stage, field conditions, clouds, and the target question.
- B. the shortest filename.
- C. the highest possible map north arrow.
- D. the oldest available image only.

Part G. Electromagnetic Energy Review

27. Which sequence best represents the remote sensing signal chain?

- A. Source - atmosphere - target - sensor - data - interpretation.
- B. Map - legend - scale bar - north arrow - printer.
- C. Field - tractor - harvest - market - report.
- D. Pixel - paragraph - slide - table - footer.

28. Which spectral region is most directly linked with surface temperature mapping?

- A. Thermal infrared.
- B. Visible blue only.
- C. Near-infrared only.
- D. Radio communication bands only.

29. Which statement best explains why band selection is not random?

- A. Bands are chosen because specific wavelengths respond to specific physical properties.
- B. All bands measure the same property.
- C. Band order is selected only for slide design.
- D. A sensor can measure all wavelengths equally through the atmosphere.

30. Before trusting a classification or index map, students should check:

- A. sensor, date, bands, preprocessing, field context, and validation.
- B. only the color of the title.
- C. only whether the map looks attractive.
- D. only the file size.

Student Answer Sheet

Q	Answer	Q	Answer	Q	Answer
1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Instructor Answer Key

Q	Correct	Q	Correct	Q	Correct
1	A	11	C	21	A
2	B	12	B	22	A
3	C	13	A	23	A
4	B	14	B	24	A

Q	Correct	Q	Correct	Q	Correct
5	A	15	B	25	A
6	B	16	A	26	A
7	A	17	C	27	A
8	B	18	A	28	A
9	A	19	A	29	A
10	A	20	A	30	A

Compact Marking Guide

Total: 30 points. One correct answer = 1 point. No negative marking. Suggested interpretation: 27-30 excellent mastery; 23-26 good understanding; 18-22 satisfactory understanding; below 18 requires revision of spectrum regions, radiation-matter interaction, and spectral behavior of vegetation, soil, and water.

References for Content Alignment

- Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. *Remote Sensing and Image Interpretation*. Wiley.
- Jensen, J. R. *Introductory Digital Image Processing: A Remote Sensing Perspective*. Pearson.
- Campbell, J. B., & Wynne, R. H. *Introduction to Remote Sensing*. Guilford Press.
- University of Twente / ITC. *Principles of Remote Sensing* educational materials.
- Penn State GEOG 480. Remote sensing course materials on electromagnetic radiation, sensors, and resolution.
- NASA Earthdata and NASA Earth Observatory educational resources on the electromagnetic spectrum and remote sensing.
- USGS Landsat missions and surface reflectance documentation; ESA Sentinel-2 MSI documentation.

Note: This is a compact testing version. It intentionally removes the long remediation bank, extended case questions, and detailed explanations from the previous 80-question version in order to fit a shorter classroom quiz format.