LU1: Nature & Properties of Light
Test with answers in yellow
46 points

1. Visible light is the largest portion of the electromagnetic spectrum.
   a. True b. False

2. Which of the following has the highest energy per photon?
   a. Violet Light b. Infrared Light
   c. Ultraviolet Light d. Green Light

3. The fact that the sky is blue during the day can be attributed to which property of light?
   a. absorption b. transmission
   c. reflection d. scattering

4. _____ light is made up of many frequencies.
   a. white b. blue
   c. red d. laser

5. A quantum or packet of energy with a characteristic frequency, energy, phase, and direction is a _____.
   a. Proton b. electron
   c. photon d. neutron

6. The characteristic of lasers that is put to use in construction systems used to level dropped ceilings is:
   a. coherence b. frequency
   c. directionality d. wavelength
   e. monochromaticity

7. Which of the following colors corresponds to the longest wavelength?
   a. violet b. blue
   c. green d. red

8. When all of the electric vectors oscillate in the same orientationit is called _____.
   a. circular polarization b. spontaneous emission
   c. atomic electric linearity d. linear polarization

9. Laser light is nearly single frequency, or color, so it is said to be _____.
   a. coherent b. monochromatic
   c. directional d. divergent
   e. intense

10. When an atom contains the lowest amount of energy that is available to it, the atom is said to be _____.
   a. coherent b. at excited atomic state
   c. at atomic ground state d. spontaneously emitting

11. There are opportunities for Photonics Technicians in which of the following industries?
   a. medical b. commercial
   c. aerospace d. manufacturing
   e, all of the above

12. The distance over which the wave repeats itself is _____.
   a. coherence b. frequency
   c. directionality d. wavelength
   e. monochromaticity

13. A photon can be considered a **particle** and a **wave**.
   a. True b. False

14. Light that passes through small openings or grazes a sharp edge always does this:
   a. Reflects b. Refracts
   c. Diffracts d. Deflects

15. Which of the following does NOT happen when light makes a transition into an optical material?
   a. Scatter b. Absorb
   c. Condense d. Transmit

16. When light is generated by a source, the range of wavelengths it puts out is call its _____.
   a. absorption spectra b. transmission spectra
   c. reflection spectra d. emission spectra

17. A _____ is a perfect emitter and a perfect absorber and is sometimes referred to as a Thermal Radiator.
   a. Blackbody b. Whitebody
   c. Redbody d. Blackberry

18. When light is scattered by large molecules like water droplets and all wavelengths scatter the same it is called _____ scatter.
   a. Rayleigh b. Raman
   c. Mie d. Molecular

19. It is safe to look directly into any laser beam as long as you don't do it for over 2 hours.
   a. True b. False

20. What is the term that denotes the type of reflection is the most dangerous?
   a. Specular b. Divergence
   c. Spectacular d. Diffuse

21. The maximum displacement of a wave is the _____.
   a. wavelength b. period
   c. frequency d. amplitude

22. The time it takes a wave to repeat is the _____.
   a. wavelength b. period
   c. frequency d. amplitude

23. The distance over which a wave repeats is called _____.
   a. wavelength b. period
   c. frequency d. amplitude

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24. _____ is the wave interaction which creates an increase in intensity.
a. index of refraction b. spatial coherence
c. wavefront d. constructive interference

25. The _____ of an optical element is the angle of incidence where no parallel polarized light is reflected.
a. critical angle b. Brewster's angle
c. incident angle d. refracted angle

26. The ratio of the velocity of light in a vacuum to it's velocity in a material is the _____.
a. index of reflection b. temporal coherence
c. polarization d. index of refraction

27. The oscillation orientation of the electric field vector in space is the _____.
a. phase b. polarization
c. destructive interference d. amplitude

28. A measure of how well an optical element polarizes the beam is known an the _____.
a. polarization value b. degree of polarization
c. extinction ratio d. polarization ratio

29. Three types of polarization as discussed in class are _____, _____, and _____.
a. unpolarized, horizontal, vertical
b. linear, circular, elliptical
c. vertical, horizontal, circular
d. vertical, horizontal, 45 degrees

30. If a beam contains no changes in intensity in its cross-section, it is said to be _____.
a. speckle free b. temporally coherent
c. monochromatic d. spatially coherent

31. _____ refers to how closely a source approximates a single frequency.
a. index of refraction b. wavefront
c. temporal coherence d. spatial coherence

32. Light travels through a ruby laser rod at a rate of 174 x 10^6 m/s. What is the index of refraction?
a. 1.724 b. 0.580
c. 5.220 d. 1.501

33. An argon laser beam (488nm) travels through a 10mm thick window (n=1.558). What is the velocity of light in the window?
a. 2 x 10^7 m/s b. 6.14 x 10^{14} m/s
c. 1.93 x 10^8 m/s d. 1.62 x 10^{-15} m/s

34. A HeNe laser (632.8nm) has a frequency of _____.
a. 632.8 x 10^{14} Hz b. 1.08 x 10^{14} Hz
c. 4.74 x 10^{14} Hz d. 2.865 x 10^{-14} Hz

35. An Er:YAG solid state laser emits a frequency of 1.02 x 10^{14} Hz. Find its wavelength.
a. 488 nm b. 390 nm
c. 2.94□m d. 632.8 nm

36. The beam from a diode pumped solid state laser pointer with wavelength of 532 nm strikes a still water surface at an incident angle of 55° with respect to the normal. (3 points)
a. What angle does the reflected beam make with respect to the normal to the water surface?
55^0
b. Why?
With respect to the normal, the reflected angle equals the incident angle.
c. What angle does the refracted beam make with respect to the normal to the water surface?
41.36°

37. A beam of photons from a lab investigation are found to have energy of 1.1042 × 10^{-15} Joules/photon. (3 points)
a. What is the frequency of light from these photos?
1.667 X 10^{18} Hz
b. What is the wavelength of light from these photons?
0.180 nm
c. What type of Electromagnetic emission (e.g., infrared, visible, etc.) are these photons?
X-Ray

38. A beam from a CO_2 laser has λ = 10600 nm. (5 points)
a. Is this laser beam visible?
NO
b. What is the wavelength of this beam inside a lens having an index of refraction *n* = 1.52?
6970 nm
c. What is the speed of the laser light within the lens?
1.97 X 10^8 m/s
d. What is the frequency of the laser light before it enters the lens? Within the lens?
28.2 THz Frequency remains unchanged