CHAPTER 14

LIGHT AND SOUND IN THE ATMOSPHERE

MULTIPLE CHOICE QUESTIONS

 As the Sun's rays travel through the atmosphere, they are by cloud droplets or ice crystals, or by raindrops. a. scattered b. reflected c. refracted *d. All of these are correct. e. None of these is correct.
 2. The spectrum of visible light bounds the region of intensity of light emitted by the Sun. *a. maximum b. minimum
 3. Our perception of the color of most objects on Earth is that of the visible wavelength bands by the object. a. emitted *b. reflected 4. The blue of the daytime sky is due primarily to selective scattering of visible solar radiation by
a. atmospheric aerosols b. clouds *c. nitrogen and oxygen molecules d. water droplets
 5. If air molecules only scattered the wavelengths of visible light, the sky would be red. *a. longest b. shortest
6. Violet light is scattered much more efficiently than red light in the optical effect known asa. Mie scattering.*b. Rayleigh scattering.
 7. Because of scattering, the setting Sun turns the horizon on a clear evening. a. white b. yellow *c. red

d. blue

e. violet

8. The cloud-free highly rarefied atmosphere of the Moon is

- a. white.
- b. green.
- c. blue.
- *d. black.
- e. red.

9. Scattering of light is wavelength dependent if the radius of the scattering particles is ______ the wavelength of the scattered light.

*a. much less than

b. much larger than

10. Most atmospheric aerosols scatter visible solar radiation

a. primarily at the violet end of the spectrum.

b. primarily at the red end of the spectrum.

*c. with equal efficiency at all wavelengths.

11. Mie scattering explains

a. the blue of the daytime sky.

*b. enhanced red and orange sunsets following a volcanic eruption.

12. A halo around the Sun is caused by refraction of sunlight by

a. raindrops.

b. liquid cloud droplets.

*c. ice crystals composing high, thin clouds.

d. All of these are correct.

e. None of these is correct.

13. A type of cloud that may produce a halo around the Sun or Moon is

- a. any warm cloud.
- b. stratus.

c. nimbostratus.

d. cumulonimbus.

*e. cirrostratus.

14. The speed of light is _____ in air than in water

a. smaller

*b. greater

c. equal

15. The probability of seeing a halo is greatest if clouds composed of

a. liquid droplets are in the same areas of the sky as the Sun.

b. liquid droplets are in the sky opposite the Sun.

*c. ice crystals are in the same area of the sky as the Sun. d. ice crystals are in the sky opposite the Sun.

16. The most commonly seen halo has a radius of about _____ degrees about the Sun or Moon. *a. 22

b. 46

c. 66

d. 7

17. At sunrise in middle latitudes, look for a sundog toward the _____.

a. north

b. south

*c. east

d. west

18. Rainbows are caused by _____ of sunlight by falling raindrops.

a. reflection

b. refraction

*c. both refraction and internal reflection

d. diffraction

e. None of these is correct.

19. The color that is refracted (bent) the most as sunlight enters a raindrop is *a. violet.

b. blue.

c. green.

d. yellow.

e. red.

20. A rainbow _____ forms when the sky is completely cloud covered.

a. sometimes

b. usually

*c. never

21. A rainbow appears to an observer who ______ and _____.
a. is facing the Sun has his or her back to a distant rain shower
*b. has his or her back to the Sun is facing a distant rain shower

22. In a secondary rainbow, double reflection causes the colors to be*a. in reverse order as compared to the primary rainbow.b. in the same order as the primary rainbow.

23. A corona is caused by _____ of moonlight around water droplets that compose a thin layer of altocumulus or stratocumulus clouds.a. reflectionb. refraction

c. scattering *d. diffraction e. absorption

24. A rainbow is most likely to be seena. during mid-day shower activity in the summer.*b. a few hours before sunset when it is raining to the east of the observer.c. a few hours before sunset when it is raining to the west of the observer.d. whenever sunlight strikes falling raindrops.

25. In the primary rainbow, light rays interact with each raindrop by

a. reflecting once and refracting once.

b. reflecting twice and refracting once.

*c. reflecting once and refracting twice.

d. reflecting twice and refracting twice.

26. A glory is caused by _____ of sunlight by cloud water droplets.

a. reflection

b. refraction

c. diffraction

*d. All of these optical processes contribute.

e. None of the above is correct.

27. ______ is the slight bending of a light wave as it moves along the boundary of an object, such as a water droplet.

a. Refraction

b. Reflection

*c. Diffraction

28. Sunlight is refracted as it travels through the atmosphere. Hence, the image of the setting or rising Sun that we see is slightly ______ in the sky than it would be without an atmosphere.

a. lower

*b. higher

29. Illumination during ______ twilight is just adequate for outdoor activities without the need for artificial lighting.

a. astronomical

b. nautical

*c. civil

d. Mie

e. Rayleigh

30. The green flash

a. appears briefly at the lower edge of the Sun at sunset or sunrise.

b. is best seen on a cloudy evening.

*c. is primarily the consequence of refraction and scattering of sunlight. d. All of the above are correct. e. None of the above is correct. 31. Sound waves _____ require a transmitting medium. *a. do b. do not 32. Low frequency sound waves can propagate ______ distances than high frequency sound waves. *a. longer b. shorter 33. As wind speed increases, the speed of sound waves propagating through the atmosphere a. does not change *b. increases c. decreases 34. Sound waves travel faster in ______ then in ______ air. a. cold.....warm *b. warm.....cold c. always travels the same speed 35. ______ of sound waves in the atmosphere explains the formation of acoustic shadows. a. Scattering b. Absorption c. Adsorption d. Diffraction *e. Refraction 36. If 15 seconds elapse between lightning flash and the sound of thunder, the lightning is about _____ km away. a. 15 b. 12 c. 9 *d. 5 37. An aircraft traveling at a speed ______ that of sound may produce a sonic boom. a. less than *b. greater than 38. A fog bow forms in a similar fashion to a rainbow, but is a. narrower and appears almost white.

b. narrower and has more brilliant colors.

*c. broader and appears almost white.

d. broader and has more brilliant colors.

39. In an inferior mirage, objects appear ______ than we usually see them.

*a. lower

b. higher

40. In a superior mirage, objects appear ______ than normal. a. lower *b. higher

41. Fata Morgana, an optical phenomenon in which images of distant objects are distorted vertically so that they resemble castles or walls with spires, involves a. inferior mirages only.

b. superior mirages only.

*c. the simultaneous occurrence of superior and inferior mirages.

42. At Washington, DC, length of daylight on an equinox isa. slightly less than 12 hours.b. exactly 12 hours.*c. slightly more than 12 hours.

43. Scintillation is especially noticeable on ______ nights when rapid, small-scale fluctuations in air density alter the path of starlight through the atmosphere.
a. cold, cloudy
*b. cold, clear
c. warm, cloud
d. warm, clear
44. Illumination is at the highest level during ______ twilight.
a. astronomical
b. nautical
*c. civil

45. Crepuscular rays can be seen when looking ______ the Sun.

*a. in the same direction as

b. in the direction opposite that of

46. The green flash typically lasts the longest at _____ latitudes, where the Sun rises and sets the slowest.
*a. polar
b. tropical

47. Lightning causes a(n) ______ that produces sound waves heard as thunder.

- a. sonic boom
- b. green flash
- *c. shock wave
- d. acoustic shadow

48. Heat lightning can be observed when

*a. thunderstorm cells are more than 20 km away.

b. a thunderstorm cell is in the immediate area and the air temperature exceeds 95 °F.

49. A pilot of a supersonic aircraft _____ hear the plane's sonic boom. a. can *b. cannot

*b. cannot

50. The pitch of aeolian sound ______ with higher wind speeds.

a. decreases

*b. increases