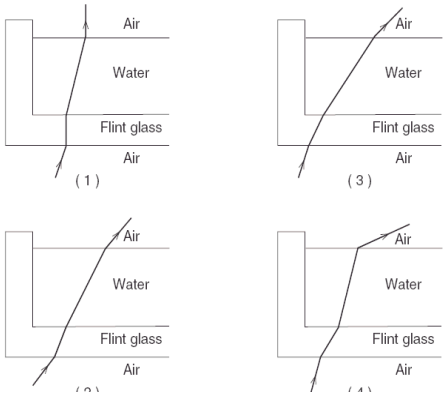
Unit 4 Conceptual Questions

Please answer questions on Scantron form 882-ES. Otherwise your will receive a zero. Poorly erased responses will not be re-graded. Turn in two days before unit exam. You are encouraged to work together and discuss these questions!!!

For TRUE of FALSE questions choose A for TRUE or B for FALSE.

1. Which diagram best represents the path taken by a ray of monochromatic light as it passes from air through the materials shown?



2. A diverging lens of focal length f is placed is placed in water. The **magnitude** of the focal length of the lens in water is _____ the focal length in air.
   a. less than
   b. greater than
   c. same as
   d. infinite compared to

3. When light of one wavelength from air hits a smooth piece of glass at an angle, which of the following will not occur?
   a. reflection b. refraction c. dispersion d. All of the above.

4. When an astronomer uses a telescope to view events on a star that is 1000 light years away, this means that
   a. the astronomer is viewing events that are 1000 years into the future.
   b. the astronomer is viewing events that are 2000 years into the future.
   c. the astronomer is viewing events that are 1000 years into the past.
   d. the astronomer is viewing events that are 2000 years into the past.

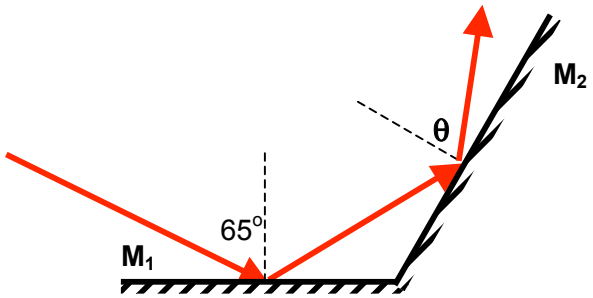
Compared to red light, blue light

5. travels faster in glass a. T b. F

6. travels faster in vacuum a. T b. F

7. A handful of white sand-like material is poured into a beaker of clear oil and vanishes from sight as it passes into the liquid. We can conclude that
   a. the material dissolved.
   b. This phenomenon is impossible and could not have happened.
   c. The oil and material have mutually decomposed.
   d. The oil has the same index of refraction as the material.
   e. None of the above.

8. Two plane mirrors are separated by 120° as shown below. If a ray strikes M_1 at 65°, at what angle, q, does the light leave M_2?
   a. 25°
   b. 55°
   c. 65°
   d. 130°



9. You are given two lenses, a converging lens with focal length + 10 cm and a diverging lens with focal length 20 cm. Which of the following would produce a virtual image that is larger than the object?
   A. Placing the object 5 cm from the converging lens.
   B. Placing the object 15 cm from the converging lens.
   C. Placing the object 25 cm from the converging lens.
   D. Placing the object 15 cm from the diverging lens.
   E. Placing the object 25 cm from the diverging lens.

10. **True** or **False**: Light and radio waves travel at the same speed through a vacuum.

11. **True** or **False**: The index of refraction of water is the same for all wavelengths in the visible spectrum.

12. A ray of light passes from glass into air, striking the surface at a 20° angle of incidence. Of the following quantities, choose all that change as the light enters the air.
   a. Wavelength
   b. Frequency
   c. Propagation speed
   d. Propagation direction
   e. None

13. Rainbows are due to
   a. reflection from the surface of raindrops.
   b. refraction and reflection by raindrops.
   c. refraction and reflection by ice crystals.
   d. interference between different wavelengths of light.

14. An object is placed between the center of curvature and focal point of a concave mirror. As a result, the image is:
   a. real, inverted, enlarged.
   b. Virtual, upright, enlarged.
   c. Real, upright, reduced.
   d. Virtual, inverted, reduced.

15. For convex mirrors, images are always:
   A. reduced, upright, virtual
   B. enlarged upright, virtual
   C. reduced, inverted, real
   D. enlarged, inverted, real

16. As an object is moved from a great distance toward the focal point of a concave mirror, the image moves from:
    a. a great distance toward the focal point and is always real.
    b. the focal point toward a great distance from the mirror and is always real.
    c. the focal point toward a great distance from the mirror and is always virtual.
    d. the focal point to a position immediately adjacent to the mirror and is always real.

17. Myopic (nearsighted) persons sometimes claim to see better underwater without corrective lenses. Why?
    a. The accommodation of the eye lens is better under water.
    b. Refraction at the water cornea interface is less than that of the air-cornea interface.
    c. Refraction at the water cornea interface is greater than that of the air-cornea interface.
    d. No reason; this effect is only an illusion and not really true.

18. A nearsighted person wears a corrective lens and would like to examine an object at close distance. Which statement is correct?
    a. The corrective lenses give an enlarged image and should be worn while examining the object.
    b. The corrective lenses give a reduced image and should be removed.
    c. The corrective lenses result in a magnification of unity; it does not matter whether they are worn or removed.

19. The proper corrective lens to allow a farsighted person to read a book moves the focal point of his eye
    a. away from the retina b. toward the retina

20. A scientific supply catalog advertises a material having an index of refraction of 0.85. Is this a good product to buy?
    a. Yes b. No c. Not enough information provided

21. When you look (longingly) at Megan Fox or Zac Efron, the image on your retina is
    a. inverted b. upright

22. To keep George in focus as he moves toward you, the focal point in your eyes moves
    a. toward the back of your head
    b. toward the front of your head
    c. the focal point does not move

23. Which of the following is not a phenomenon common with transverse and longitudinal waves?
    a. interference
    b. diffraction
    c. polarization
    d. refraction
    e. reflection

24. When two waves interfere destructive, what happens to the energy in the light waves?
    a. It goes to where constructive interference occurs.
    b. It is converted into heat.
    c. It disappears.

25. What minimum path difference is needed to induce a phase shift of 180 degrees in light of wavelength 600nm?
    a. 10nm b. 250nm c. 300nm d.1200nm

26. When two waves come together, CREST MATCHING CREST, we have
    a. constructive interference b. destructive interference

27. Light travels to your eye from two holes in a screen. The light from one hole travels exactly 4 wavelengths, and the light from the other hole travels exactly 7-1/2 wavelengths. Thus, when they reach your eye, they interfere
    a. constructively b. destructively c. depends on the wavelength

28. What happens to the separation of bright bands of the double slit interference pattern if the slit separation increases?
    a. Increases B. decreases C. remains the same

29. Why is it that we can hear but not see around corners?
    a. Because sound waves are longitudinal
    b. Because wavelengths of visible light are small in comparison to the objects it is interacting with.
    c. Because diffraction doesn't occur in sound waves.
    d. Because sound waves cannot be polarized.

30. When two waves interfere destructive, what happens to the energy in the light waves?
    a. It goes to where constructive interference occurs.
    b. It is converted into heat.
    c. It disappears

31. Light is emitted in small "lumps" called
    a. protons
    b. photons
    c. peons
    d. gluons
    e. hadrons

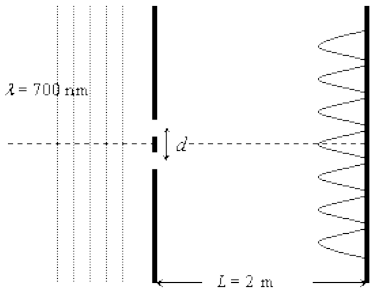
32. When a parallel beam of light is diffracted at a single slit,
    a. the shadow is always sharp.
    b. the narrower the slit, the narrower the central diffraction maximum.
    c. the narrower the slit, the wider the central diffraction maximum.
    d. the width of the central diffraction maximum is independent of the width of the slit.
    e. None of these is correct.

33. A phase difference of 270^o corresponds to a wavelength difference of
    a. $3\lambda/4$ b. $4\lambda/3$ c. $3\lambda/2$ d. 3λ

34. When two light waves are out of phase by _____ at a location in space, destructive interference will occur.
    a. 270^o b. 360^o c. 540^o c. 630^o e. 720^o

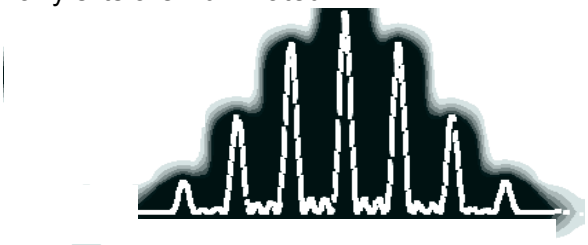
35. If two waves combine at a location in space, point P, have a phase difference of that of the previous two questions, this means one wave traveled _____ more than the other as they propagate from their source to point P.
    a. $3\lambda/4$ b. $4\lambda/3$ c. $3\lambda/2$ d. 3λ

36. Light (wavelength λ = 700 nm) is incident on a barrier containing two slits, as shown. The interference pattern is observed on a screen placed a distance L = 2 m behind the barrier. If the spacing between adjacent interference maxima is 1 mm, what is the separation d between the slits?
    a. d = 0.5 mm
    b. d = 0.7 mm
    c. d = 1.0 mm
    d. d = 1.4 mm
    e. d = 2.0 mm



37. Which one of the following would increase the spacing between adjacent interference maxima in the previous question?
    a. Shine green light (525 nm) instead.
    b. Add a third slit, also a distance d from the bottom slit.
    c. Make the slits narrower.
    d. Increase the spacing of the slits
    e. None of the above.

38. Monochromatic light illuminates, at normal incidence, a multiple slit arrangement with a slit spacing d and slit width a, giving rise to the intensity pattern below. Note that there are 2 secondary maxima between adjacent principle maxima, and that the m = 4 interference maxima coincides with the 1st diffraction minima. How many slits are illuminated?
    a. 3
    b. 4
    c. 5
    d. 6



39. You are driving through the lovely California farmlands. Off in the distance, you see a car, with some sort of structure on the roof, either a roof rack, or police lights. Assume you are looking with visible light (wavelength centered at ~500 nm), and that the diameter of your pupil is 3 mm. Approximately how far away is the vehicle when you can just resolve whether or not it is a police car? Assume that being able to tell the difference is roughly equivalent to being able to resolve two features separated by 10 cm, and that your vision is diffraction-limited (i.e., no lens aberrations).
    a. 1/8km b. 1/2km c. 2km

40. On a brighter afternoon, your pupils contract (get smaller). In this case, purely due to diffraction, the distance L for which you could resolve the type of vehicle
    a. Increases b. decreases c. stays the same