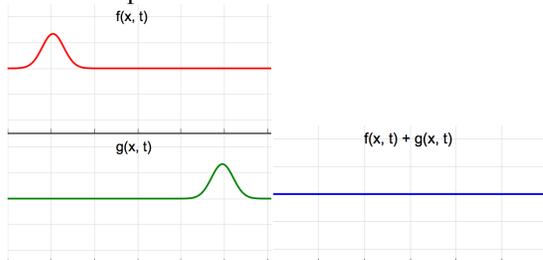


Questions on Wave Behavior *

1. Give a definition of the law of reflection.
2. Do sound waves obey the law of reflection? Explain.
3. A police officer has a new sound gun that stuns the criminal. They can see their suspect who is around the corner, reflected in a mirror. Should she simply aim at the image of the target? Explain.
4. Trucks sometimes have a sign on the back that says "If you can't see me in my mirror, I can't see you." Explain the physics here.
5. Why is the image in a mirror reversed left to right but not top to bottom? (A drawing might help your explanation.)
6. Some storefront windows are angled so the bottom is further in and the top comes out towards the street. Explain how this would help reduce glare on a bright day. (A drawing might help your explanation.)
7. What is the difference between diffuse reflection and specular reflection?
8. Why are matte finishes for photos and books generally better than glossy finishes?
9. Why do sound studios often have the walls covered with egg carton shaped foam?
10. Why is it harder to see the road at night in the rain?
11. Give a definition of the law of refraction.
12. How does refraction depend on the speed of a wave?
13. Give some examples of common, everyday objects that use refraction to operate.
14. Why are images blurry underwater if you don't have goggles?
15. Why are images not blurry underwater if you are wearing goggles?
16. If a fish wore goggles to come above the surface, why would it want to have goggles filled with water?
17. If you place a glass test tube in water you can still see it but if you place it in soybean oil it disappears. What does this tell you about the speed of light in glass, water and soybean oil?
18. If you want to spear a fish under water from the shore should you aim below it, at it or above it? Explain.
19. If you want to zap a fish with a laser, should you aim below it, at it or above it? Explain.
20. Why does a pond or lake with very clear water look shallower than it really is? Explain using a diagram.
21. Suppose color X bends more when passing through glass than color Y. Which moves slower in the glass?
22. What is total internal reflection? When does it occur?
23. What modern technology depends on total internal reflection?
24. On a windy day, why can you hear someone clearly if they are downwind but can't hear them as well if they are upwind?
25. Why is it difficult to hear someone on the other side of a lake during the day when the air above the lake is cool but very easy to hear voices at night when the air above the lake is warmer than air higher up? (Hint: Sound travels faster in warmer air.)
26. What is 'heat lightning'? Why don't we hear it like ordinary lightning?
27. What is dispersion and what causes it?



28. The top picture on the left is a pulse moving to the right, the bottom pulse is moving to the left. In the picture on the right, draw what the two pulses will look like when they overlap.
29. What is constructive and destructive interference? When does each occur?
30. How does path difference cause constructive and destructive interference?
31. Explain how the phenomena of beats occurs.
32. Why do some bird feathers appear to be iridescent, changing color when viewed from different angles?
33. What causes the different colors on a CD disk?
34. What causes the different colors on a soap bubble?

35. Suppose you are standing directly in front of a pair of stereo speakers. Why would you expect the sound not to be quite as loud if you move slightly to the left or right?
36. What is diffraction? Give some examples.
37. Under what circumstances do you expect to see the effects of diffraction?
38. Why can you hear sound from the other room, even when you cannot see into the room?
39. Why does light not bend when it passes through a doorway but sound does?
40. What is scattering?
41. Why is the sky blue?
42. What is the Doppler effect?
43. A friend hears an ambulance go by and says this is an example of the Doppler effect because the sound got louder and then softer. Correct your friend's mistaken definition of the Doppler effect.
44. Give an example of the Doppler effect for light and one for sound.
45. Does the Doppler shift depend on whether the source or the receiver is moving?
46. Does the speed of the wave change when there is a Doppler shift? Explain.
47. We can easily hear the Doppler shift of a car passing by but we do not notice the Doppler shift of light from its headlamps. Why is that?
48. Originally radar was just used to find the distance to a plane or thundercloud by measuring how long it took for the signal to return. What additional information does measuring the Doppler effect give you?
49. Explain how Doppler radar works.
50. How do we know the universe is expanding?

* Many of these ideas came from *Conceptual Physics* 11th Ed. by Paul Hewitt (Addison Wesley, 2011).