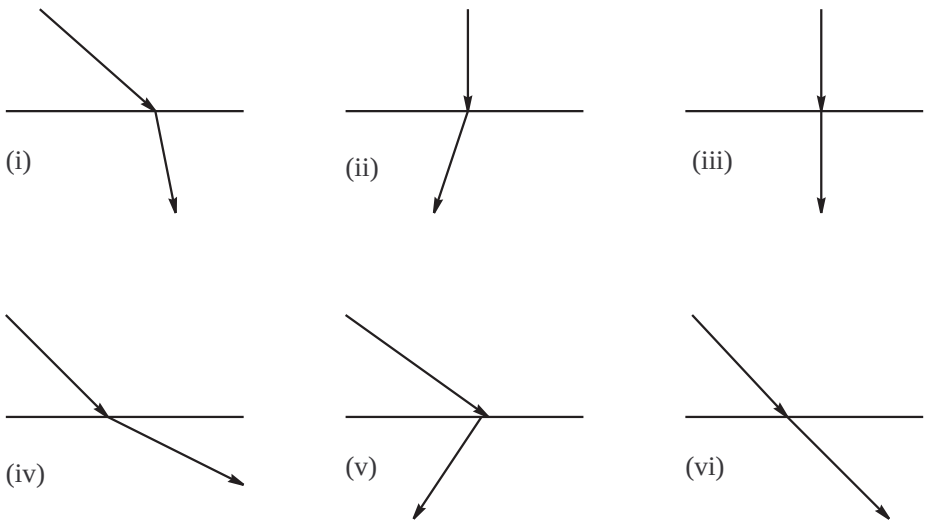
1. Each of the diagrams below are intended to show examples of refraction as a ray of light passes from one medium to another.

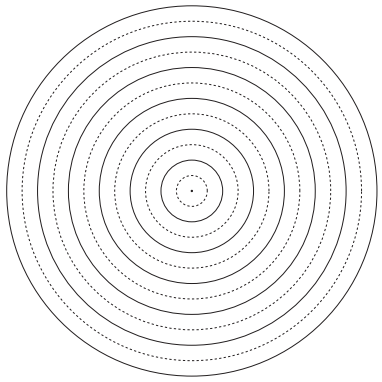


(a) Some diagrams represent physically impossible situations. Identify these and explain why they cannot occur.

(b) For each of the diagrams which represent physically possible situations use a straight edge to draw incident and transmitted wave fronts that are consistent with the rays and the boundary drawn.

(c) Indicate in which medium the speed of light is greater. If it is not possible to tell for any of the diagrams explain why not.

2. The diagram on the right represents a snapshot of the wavefronts of a periodic circular wave in a portion of a ripple tank. The dark circles represent crests and the dashed circles troughs.



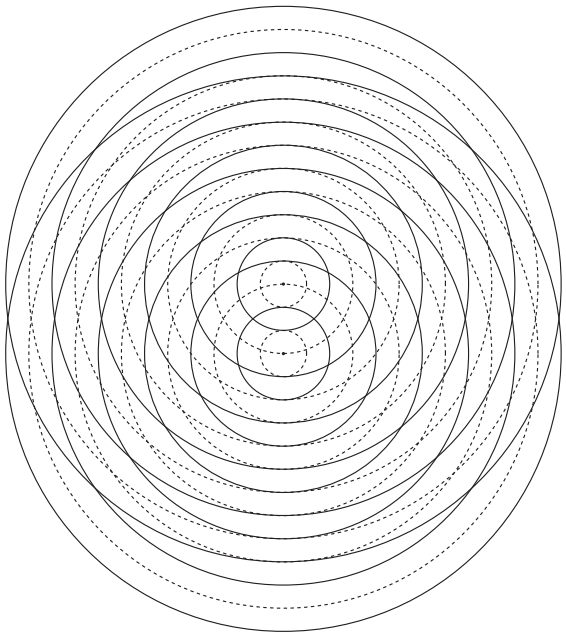
How would the diagram differ after

(a) one half a period?

(b) one whole period?

(c) a quarter period?

3. The diagram shows a snapshot of the wave fronts in water due to two small sources.



(a) How do the frequencies compare?

(b) How far apart are the two sources? Express your answer in terms of wavelength.

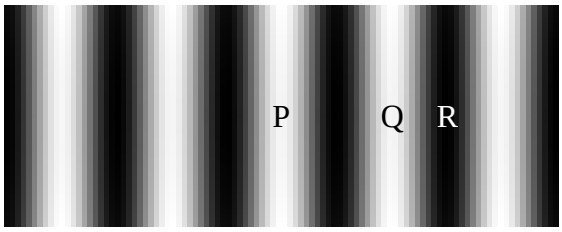
(c) Mark all points where a crest meets a crest with one color. What happens to the water at these points?

(d) Mark all points where a trough meets a crest with another color. What happens to the water at these points?

(e) Mark all points where a trough meets a trough with a third color. What happens to the water at these points?

4. On the diagram above you should find points arranged in lines. Lines along which troughs meet crests are called *nodal lines*. Pick a few points on each nodal line and determine the difference in the distance from that point to each source, in units of wavelength? What do you notice? Repeat this analysis for the lines along which crests meet crests and troughs meet troughs. These are called lines of *maximum constructive interference*.

5. Red light, with wave length λ is incident on two slits. The light passing through the slits forms a fringe pattern of bright and dark bands on a screen which is a distance 2.2 m from the slits. The fringe pattern is shown on the right. The point P is at the center of the pattern directly opposite the slits. P and Q are maximum intensity and R is a minimum intensity fringe.



(a) Explain why there are dark and light fringes.

(b) What is the difference in path length from each of the two slits to the point P? The point Q? The point R? Express your answer in terms of the wavelength λ.

(c) How would the fringe pattern changed if the screen were moved closer to the slits?

(d) How would the fringe pattern change if the wave length of the light were doubled?

(e) Suppose the width of the slit on the right were decreased without changing the distance between the centers. Would the brightness of at Q increase,decrease or stay the same? What about R? Explain?

(f) How would the fringe pattern change if the distance between the two slits were decreased?