

# Practice Quiz 6

These are Q's from old quizzes. I do not guarantee that the Q's on this year's quiz will be the same, or even similar.

- B You see an airplane straight overhead at an altitude of 5.2km. Sound from the plane, however, seems to be coming from a point back along the plane's path at a 35 degree angle to the vertical. What is the plane's speed, assuming a sound speed of 330 m/s?
- A) 100m/s      B) 200m/s      C) 300m/s      D) 400m/s      E) 500m/s

- E When a sound wave passes from air to water, what properties of the wave will change?
- A) the frequency  $f$ .  
B) the wavelength  $\lambda$ .  
C) the speed  $v$  of the wave.  
D) both  $f$  and  $\lambda$   
E) both  $v$  and  $\lambda$

D

What is the speed of light in a material for which the critical angle with air is 61 degrees?

- A)  $0.8c$                       B)  $0.9c$                       C)  $c$                       D)  $1.1c$                       E)  $1.2c$

B

You are standing 2.3m horizontally from the edge of a 4.5m deep lake, with your eyes 1.7m above the water surface. A diver holding a flashlight at the lake bottom shines the light so you can see it. If the light in the water makes a 42 degree angle with the vertical, at which horizontal distance is the diver from the edge of the lake?

- A) 3m                      B) 5m                      C) 7m                      D) 9m                      E) 11m

D

A light ray propagating through water ( $n=1.33$ ) strikes a parallel slab of glass ( $n=1.62$ ) with thickness  $d=6\text{cm}$

at an incident angle of 40 degrees. What's the angle the light ray makes in the water with the normal to the interface after it exits the glass slab?

- A) 25 degrees              B) 30 degrees              C) 35 degrees              D) 40 degrees              E) 45 degrees

D

High quality optical fiber is rated at 0.25dB/km. By what factor does the light intensity change after traversing 10km through such a fiber?

- A) 1.28  
B) 0.78  
C) 0.75  
D) 0.5  
E) less than 10% of the light is left after 10km

A

A laser beam with wavelength 633nm is propagating in air when it strikes a transparent material at an incidence angle of 50 degrees. If the angle of refraction is 27 degrees, what is the wavelength in the material?

- A) 400 nm                      B) 500 nm                      C) 600 nm                      D) 700 nm                      E) 800 nm

**B** A cylindrical tank 2.4m deep is full to the brim with water ( $n=1.33$ ). Sunlight first hits part of the bottom of the tank when the rising sun makes a 22 degree angle with the horizon. Find the tanks diameter.

- A) 1.5m                      B) 2.5m                      C) 3.5m                      D) 4.5m                      E) 5.5m

Mr. Evil is throwing a temper, and shooting fish in a pond with a large caliber gun while standing on the shore. To successfully kill a fish, should he ...

- C**
- A) aim directly at the image.
  - B) aim slightly above the image.
  - C) aim slightly below the image.

**B** Blue and red laser beams strike an air -glass interface with incidence angle of 50 degrees. If the glass has refractive indices of 1.680 and 1.621 respectively for the blue and red light, what will be the angle between the two beams in the glass?

- A) 0                      B) 1 degree                      C) 2 degrees                      D) 3 degrees                      E) 4 degrees

The mach angle of a shock wave associated with the sonic boom of a low flying plane is 70 degrees. What is the speed of the airplane? (Speed of sound in air = 330m/s)

- A) 1000 km/h
- B) 3000 km/h
- A C) 5000 km/h
- D) 7000 km/h
- E) 500 km/h

A light ray is propagating in a crystal with a wave length of 540nm. It strikes the interior surface of the crystal at an incidence angle of 34 degrees, and emerges into air at 76 degrees to the surface normal. What is the light's wave length in air?

- D A) 500 nm
- B) 450 nm
- C) 630 nm
- D) 940 nm

When light travels from air into water,

- A) its wavelength changes, but its velocity and frequency do not change.
- E B) its frequency changes, but its velocity and wavelength do not change.
- C) its velocity, wavelength and frequency all change.
- D) its velocity changes, but its frequency and wavelength do not change.
- E) its velocity and wavelength change, but its frequency does not change.

A ray in glass is incident onto a water-glass interface, at an angle of incidence equal to half the critical angle for that interface. The indices of refraction for water and the glass are 1.33 and 1.55, respectively. The angle that the refracted ray in the water makes with the normal is closest to:

- A)  $35^\circ$
- B)  $25^\circ$
- C)  $40^\circ$
- D)  $30^\circ$
- E)  $45^\circ$

Dispersion of electromagnetic waves

- A) refers to the fact that waves radiate out in all directions from a point source.
- B) refers to the phenomenon wherein a ray changes direction when it passes from one material into another.
- C) accounts for the fact that the sky is blue.
- D) results from the fact that waves of different frequencies travel at different speeds in matter.
- E) is the underlying phenomenon utilized in some types of sunglasses.

A light ray propagating through water ( $n=1.33$ ) strikes a parallel slab of glass ( $n=1.55$ ) with thickness  $d=4\text{cm}$

C at an incident angle of 30 degrees. What's the angle the light ray makes in the water with the normal to the interface after it exits the glass slab?

- A) 35 degrees      B) 25 degrees      C) 30 degrees      D) 45 degrees      E) 40 degrees

A thick glass plate ( $n = 1.53$ ) lies on the bottom of a tank of water ( $n=1.33$ ). A light ray enters water from air, making an angle of 72 degrees with the normal in air. What angle does the ray make with the normal when it is in the plate?

D A) 10 degrees      B) 20 degree      C) 30 degrees      D) 40 degrees      E) 50 degrees

Red light has a longer wavelength than blue light. Compare their frequency.

- A) Red frequency is larger than blue frequency.  
B) Red frequency is smaller than blue frequency.  
B C) They have the same frequency.  
D) There's not enough information given.

