**SOLUTION FOR PHYSICS 4**

**(Midterm)**

**April 2013**

**1)**

a) The frequency detected by an observer riding on submarine B as the subs approach each other:

b) The frequency detected by an observer riding on submarine B as the subs recede from each other:

**2)**

We have: Two adjacent natural frequencies of an organ pipe:

(Since = +2)

* = 50 (Hz)

The length of the pipe:

**3)**

We have:

When the relative intensity at same location to 64% of the maximum intensity:

* = 0,6435

⇨

**4)**

1. The condition for first constructive interference of red bands

The condition for first constructive interference of violet bands

We have:

b) The film thickness at the position of

+ Violet:

+ Red:

c) The wedge angle of the film

**June 2013**

**1)**

a) The fundamental frequency of the pipe:

* The length of the pipe:

In case that one end is now closed:

b) The wavelength:

c) The new fundamental frequency:

**2)**

According to the Doppler’s effect, we have:

⇨ (m/s)

**3)**

The position of the first-order bright fringe of red light interference:

The position of the first-order bright fringe of blue light interference:

Therefore: The distance between the first-order bright fringes for the two wavelength:

**4)**

a) The angular position:

We have:

⬄

Since m is an integer number ⇨ m = {-113,-112,….,112,113} (not including m = 0 )

Therefore: On a very large screen, there are totally 226 dark fringes

b) The most distant dark fringe from the central bright fringe ⇨ m = 113

Therefore:

⇨

**5)**

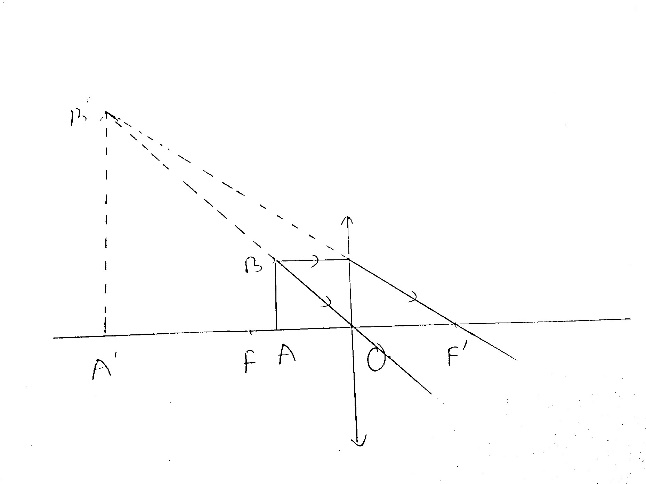
a) We have: This lens is converging ⇨

Virtual image :

⬄

The magnification:

Conclusion: The image is upright



**July 2014**

**1)**

a) The fundamental frequency:

The wavelength: =

Since: This sound is audible

b) We have: Normal human can hear between 20 Hz and 20000 Hz

Since n is an odd number => n = {1,3,5}

Therefore: The highest audible harmonic of this person’s canal is the fifth harmonic

**2)**

The wavelength:

For the constructive interference :

Since

Therefore: =

For the destructive interference :

Since

Therefore: =

The distance between constructive interference point and destructive interference point

Conclusion: You must walk 0,1246m toward speaker B to move to a point of destructive interference

**3)**

The angular position of first diffraction minima:

Since

Conclusion: When , the central maximum completely fills the screen ⇨ Cannot see the fringe pattern

**4)**

We have: 15 fringes per centimeter

The distance between each fringe:

The thickness of an abitrary bright fringe

The thickness of the next bright fringe

Therefore:

The angle of the wedge:

**5)**

The condition for bright fringes of interference:

We have:

Since k is an integer number ⇨

Conclusion: On a very large screen, there are totally 39 bright fringes that can be observed

b) The most distant bright fringe ⇨

Therefore:

⇨

**July 2017**

**1)**

a) According to the Doppler effect, when the train approaches the crossing

b) According to the Doppler effect, when the train has passed the crossing

**2)**

The position of second-order maximum of blue light interference:

The position of minimum of another visible light interference:

Since it locates at the same location of second-order maximum of blue light interference:

We have:

(k is an interger)

Therefore: The wavelength of the visible light: =

Conclusion: That light is orange light

**3)**

We have: 15 fringes per centimeter

The distance between each fringe:

The thickness of an abitrary bright fringe

The thickness of the next bright fringe

Therefore:

The angle of the wedge:

**4)**

The grating spacing:

The condition for the first order pricipal maxima of diffraction:

We have:

Therefore:

⇨

**2018**

**1)**

a) When the car is behind the train, the frequency that the driver from the car observes from the train:

b) When the car is in front of the train, the frequency that the train passenger observes from the car:

**2)**

The two reflected waves from the line of contact are in phase (they both undergo the same phase shift), so the line of contact is at a bright fringe.

Condition for constructive interference:

=>

We have:

**3)**

a) The condition for maximum intensity:

The first-order diffraction maximum:

Because of the extremely small spacing d, it requires shorter wavelength (in X-rays) to observe diffraction pattern and determine the crystal’s structure.

b) We have:

Condition for the incident angle:

⬄

Conclusion: There is only the interference maxima from these planes at 34,50

**4)**

a) We have: Thin-lens equation for lens 1:

⬄

Since This image is real

b) The distance between lens 1 and lens 2:

Thin-lens equation for lens 2:

⬄

**April 2018**

**1)**

a) The frequency of the sound measured by a stationary observer standing at the canyon wall

b) The frequency of the reflected sound from the ambulance’s siren as heard by the injured rock climber in the ambulance:

**2)**

We have:

Since: The intensity is inversely proportion to the square of the distance

Therefore: =



Therefore: The distance between two friends from the loudspeaker on stage:

⇨

**3)**

We have: Condition for constructive interference:

⬄

**4)**

a) The grating spacing:

The second-order angle of diffraction :

b) When the entire apparatus is immersed in water:

The wavelength:

The new second-order angle of diffraction:

⇨

**November 2018**

**1)**

a) The frequency is detected by an observer on B as the submarines approach each other:

b) We have: The reflected sound is equal to the incident sound:

Therefore: The frequency of the reflected sound detected by an observer on sub A:

**2)**

a) The angle of the third-order maximum of the diffraction pattern:

Number of rulings per centimeter =

Conclusion: There are 3532 rulings per centimeter for the grating

b) We have: The condition for maximum intensity:

We have:

Since m is an integer number ⇨

Conclusion: There are 11 primary maximas that can be observed in this situation

**3)**

The position of bright fringes of green light interference:

The position of bright fringes of blue light interference:

Since a bright fringe of the green light coincides with a bright fringe of the blue light:

Therefore: The minimum distance:

**4)**

a) Thin-lens equation for lens 1:

⬄

Thin-lens equation for lens 2:

Since

The distance between lens 1 and lens 2:

