JAFFNA HINDU COLLEGE

Risk Holiday Self - Education Worksheet - 2020

Grade – 12 (2021) | Physics

Name/Index No : ……

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The Doppler effect

f - Real frequency v - Velocity of sound

u_o - Velocity of observer u_s – Velocity of source

Then the expression for the apparent frequency for both approaching each other

$$f_1 = \left(\frac{v + u_o}{v - u_s}\right) f$$

1) Write the expressions for the following situations

I. Source approaching a stationary observer.
II. Observer approaching a stationary source of sound.
III. Observer receding from a stationary source.
IV. Both receding from each other.
V. Source approaching a receding observer.
VI. Observer approaching a receding source.

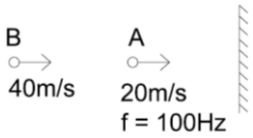
2) Find the apparent change in frequency of sound

I. When the source of sound goes pass a stationary observer.
II. When the observer goes pass a stationary source of sound.

3) When the source is approaching the listener with a velocity the apparent frequency = n', when the listener is approaching the source with the same speed apparent frequency = n", the relation between n', n" is

a) n'= n"
b) n'> n"
c) n"> n'
d) n"≥ n'
e) None of the above

4)

1. 

$20ms^{-1}$ and emits its horn of f = 1000Hz & $V_B = 40ms^{-}$

1. In B, the driver hears a note from the reflector is ?
   I. 833Hz
   II. 882Hz
   III. 938Hz
   IV. 1056Hz
   V. 1188Hz

2. In B, driver leaves a note directly from A is ?

   I. 833Hz
   II. 882Hz
   III. 938Hz
   IV. 1056Hz
   V. 1188Hz

5) Reflector moving with velocity V directly towards a stationary sound source S of frequency f. The waves reflected back to S have the frequency f ' is ?

I. $\left(\frac{C}{C-V}\right)f$
II. $\left(\frac{C+V}{C}\right)f$
III. $\left(\frac{C}{C+V}\right)f$
IV. $\left(\frac{C+V}{C-V}\right)f$
V. $\left(\frac{C-V}{C+V}\right)f$

6) Describe

a. The Doppler effect
b. Beats as observed with sound waves

An ultrasonic burglar alarm in still air transmits a signal at a frequency of 4.5×10^4 Hz. Part of which is reflected by the burglar to a receiver alongside the transmitter. The burglar moves towards the transmitter at $1ms^{-1}$.

Calculate ?

I. The frequency of the signal received by the burglar.
II. The frequency detected by the receiver alongside the transmitter.

III. The beat frequency between the signal reflected from the burglar and the original signal from the transmitter

IV. The alarm is triggered by any beat frequency greater than 5Hz. Estimate the minimum velocity of approach of burglar to activate the alarm ?

7) An engine travelling at constant speed towards a tunnel emits a short burst of sound of frequency = 400Hz which is reflected from the tunnel entrance. Engine driver hears an echo of frequency = 500Hz. 2 seconds after the sound emitted. Speed of sound = $340ms^{-1}$.

I. Calculate the speed of the engine ?

II. Its distance from the tunnel when the driver hears the echo ?

8) A train approaching a tunnel in a vertical cliff emits a loud whistle of frequency f. If the speed of sound is ten times the speed of train, the frequency of the echo heard by a person on the train would exceed f by

I. f/10

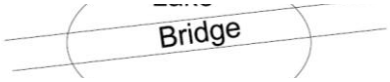
II. f/9

III. f/5

IV. 2f/9

V. f/4

9) A walks across the bridge at a steady speed of $1.0ms^{-1}$ dropping one stone into the water at the end of each second. So that each stone produces a crest, Ripples from the stones travel outwards at a steady speed of $2ms^{-1}$.



a. B is standing on the bridge ahead of A, she measures the wavelength, speed, frequency of the ripples. What answers does she get ?

b. C is on the bridge behind A. What answers does he get for wavelength (λ), speed (v), frequency (f) ?

c. A now sits at the centre of the bridge and drops stone into the water at a rate of one per second. C starts off at the far end of the bridge and walks towards A at steady speed $1.0ms^{-1}$. What will C think wavelength (λ), speed (v), frequency (f) of the ripple are ?

d. B starts off next to A and walks away from him at $1.0ms^{-1}$. What answers does she get for wavelength (λ), speed (v), frequency (f) of the ripple ?

10) Starting from the rest an observer moves with a constant acceleration towards a stationary source emitting a sound of frequency f_o. which of the graph shows correctly represents the variation of the apparent frequency f of sound as heard by the observer with time t ?

t t t

11) A star which emits yellow colour light accelerates towards earth, colour appeared to the observer on earth as ?

I. Blue
II. Red
III. Yellow
IV. Orange
V. None of the above

12) in the sun's spectrum a line of wavelength 589.00nm differs by 7.8×10^{-3}nm, when opposite edges of the sun are observed across the equatorial diameter. Estimate the speed of the rotation of the sun ? $C = 3.00 \times 10^{8} ms^{-1}$

Sound Intensity level

1) A noise level meter reads the sound level in a room to be 85dB. What is the sound intensity in the room ? $\sqrt{10} = 3.16$, $\sqrt{5} = 2.24$

2) Two sound waves have intensities of 10μW/cm^2 and 500 μW/cm^2 . How many decibels is the louder sound above the other ?

3) Find the ratio of the intensities of the two sounds if one is 5dB louder than the other? $\sqrt{10} = 3.16$, $\sqrt{5} = 2.24$
   i. 0.5 ii. 2.24 iii. 3.16 iv. 5 v. 10

4) A tiny sound source emits sound uniformly in all directions. The intensity level at a distance of 2.0m is 100dB. How much sound power is the source emitting ?
   i. 0.01 ii. 0.05 iii. 0.5 iv. 1 v. 5

5) One typist typing furiously in a room gives rise to an average sound level of 60dB. What will be the decibel level when 10 equally typists are working ?
   i. 70 ii. 90 iii. 100 iv. 110 v. 120

6) Two sound waves of the same frequency f have respective amplitudes of 3units & 1unit and are travelling in opposite directions in the same straight line. At a particular place in that line, the resultant wave will vary in loudness. The ratio $\left(\frac{maximum\ loudness}{minimum\ loudness}\right)$ is
   i. 9/1 ii. 6/1 iii. 9/2 iv. 4/1 v. 1.5/1

7) At a distance 20m from a small source, the amplitude of the sound heard is 0.012mm, at a distance 30m from the source the amplitude in mm is ?
   i. 0.0002 ii. 0.004 iii. 0.006 iv. 0.008 v. 0.012

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