Pabna University of Science and Technology

Department of

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Assignment On

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Course Title: Physics

Submitted by:	**Submitted to:**
Name: Md. Raihanul Haque	Dr. Md. Aftabuzzaman Nahid
ID : 200129	
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Dept. of CSE, PUST	

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Q-01: Describe the particle properties of Wave.

:- Wave particle duality is the concept on quantum machanics that every particles on quantum entity may be described an either particles on a wave.

particles properties of wave:

① photo electron effect:
~~ph~~ perhapes the most famous demonstation of the particle property of wave in the photo electron effect. The surface at a metal in illuminated with UV light leading of the emission of electron. This occurance is called photo electric effict. In their wave act like particles.

(ii) Black body radiation:

A black body is an idealization in physics that pictures a body that absorbs all electromagnetic radiation incident on it irrespective of its frequency or angle.

To stay in thermal equilibrium a black body must emit radiation at the same rate as it absorbs so it must also be a good emitter of radiation emitting electro-magnetic wave of as many frequencies as it can absorb i.e all the the frequencies. The radiation emitted by the black body is known as black body radiation.

(iii) X-Rays:

X-Rays consist of high energy photons. A highly penetrating radiations of unknown nature was produced when fast electrons strike on matter. These radiations come to be known as x-rays - it travel in stright line. x-rays are unaffected by electric and magnetic fields. It passes readily through opaque materials.

X-Rays are EM wave, EM radiation with wavelength from about 0.01 about 10nm falls into the category of X-Rays

~~X~~ Rays production is inverse of photo-electron effect.

Q-2: Explain Doppler effect and derive the formula of frequency for the different moving conditions of source and observer?

:- The main reason that we experience the Doppler effect is that as the wave source moves toward the observer, each new wave crest that is formed from that source is emitted from a location that is closer to the observer.

Therefore, as the source move closer and closer the waves will now take Less time to reach the observer or the time between the arrivals of new wave crests is reduced. This further causes an increase in frequency. Similarly, when the source of waves is going away, the waves are emitted from a farther location thus increasing the arrival time between each new wave. This Leads to a reduction in frequency.

We can sumarize that the Doppler effect could result from several factors such as;

(i) The motion of the observer.

(ii) The motion of the source.

(iii) The motion of the medium.

This is mainly true for sound waves. Whereas for waves that can travel in any medium, such as light, we need to consider only the relative difference in velocity between the source and observer.

consider two stationary observers x and y in, Located on either side of a stationary source. Each observer hears the same frequency, and that frequency produced by the stationary source.

Now consider a stationary observer x with a source moving away from the observer with a constant speed $v_s < v$. At time $t = 0$, the source sends out a sound wave, indicated in black. This wave moves out at the speed of sound v. The position of the sound wave at each time interval of period T_s is shown as dotted lines.

After one period, the source has moved $\Delta x = v_s T_s$ and emits a second sound wave, which moves out at the speed of sound.

The source continues to move and produce sound waves, as indicated by the circles numbered 3 and 4. Notice that as the waves move out, they remained centered at their re-spective point of origin.

Using the fact that the wavelength is equal to the speed times the period, and the period is the inverse of the frequency, we can derive the observed frequency.

$$\lambda_o = \lambda_s + \Delta x$$

$$v T_o = v T_s + v_s T_s$$

$$\frac{v}{f_o} = \frac{v}{f_s} + \frac{v_s}{f_s} = \frac{v + v_s}{f_s}$$

$$f_o = f_s \left(\frac{v}{v + v_s}\right).$$

Once again, using the fact that the wavelength is equal to the speed times the period, and the period, and the period is the inverse of the frequency.

$$\lambda_o = \lambda_s - \Delta x$$

$$v T_o = v T_s - v_s T_s$$

$$\frac{v}{f_o} = \frac{v}{f_s} - \frac{v_s}{f_s} = \frac{v - v_s}{f_s}$$

$$f_o = f_s \left(\frac{v}{v - v_s} \right).$$

When a source is moving and the observer is stationary, the observed frequency is

$$f_o = f_s \left(\frac{v}{v \mp v_s} \right),$$

$$\lambda_s = v T_o + v_o T_o$$

$$v T_s = (v + v_o) T_o$$

$$v \left(\frac{1}{f_s} \right) = (v + v_o) \left(\frac{1}{f_o} \right)$$

$$f_o = f_s \left(\frac{v + v_o}{v} \right).$$

If the observer is moving away from the source, the observed frequency can be found

$$\lambda_s = v T_o - V_o T_o$$

$$v T_s = (v - V_o) T_o$$

$$v\left(\frac{1}{F_s}\right) = (v - V_o)\left(\frac{1}{F_o}\right)$$

$$f_o = f_s\left(\frac{v - v_o}{v}\right).$$

The equations for an observer moving toward or away from a stationary source can be combined into one equation:

$$f_o = f_s\left(\frac{v \pm v_o}{v}\right).$$

Finally we can be summarized in one equation and is further illustrated in _

$$f_o = f_s\left(\frac{v \pm V_o}{v \mp v_s}\right).$$

The general form of the Doppler effect formula is expressed as:

$$f = \left(\frac{c \pm v_r}{c \mp v_s}\right) f_0$$

c = propagation speed of wave in the medium.

v_r = Speed of the receiver relative to the medium, +c if the receiver is moving towards the source, -c if the receiver is moving away.

v_s = Speed of the source relative to the medium, +c if the source is moving away -c if the source is moving toward the receiver.

There is the main Doppler effect equation. However, this equation can change in different situations. It is adjusted or modified depending on the velocities -

of the observer or the source of the sound. we will see the Different Doppler effect formulas in several cases or situations.