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General Physics I, Quiz 6
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Quiz-5 Solution

1. **Solution :** ***(Similar to problem no.8, chap.18, text book 8th edition)***

(a)The path difference of the wave, $\Delta x = \sqrt{15^2 + 10^2} - 15 = 3.02m$

The wavelength of sound produced in loud speaker is

$\lambda = \frac{v}{f} = \frac{343}{350}m = 0.98m \qquad \therefore \frac{\Delta x}{\lambda} = \frac{3.02}{0.98} = 3.08$

$\therefore$ phase difference is $\Delta\Phi = \frac{2\pi \times \text{path diffence}}{\lambda}$

$= 2\pi(3.08) = 19.36\text{rad}$

Here
$v = 343m/s$
$f = 350Hz$

(b) The minimal condition can get by the following condition

$\frac{2n-1}{2} = \frac{\Delta x}{\lambda}$ where n =N , So the closest frequency can be found from the ratio,

$\frac{\Delta x}{\lambda} = \frac{5}{2} or \frac{7}{2}$. If $\frac{5}{2}$, then $\frac{3.02}{\frac{343}{f}} = \frac{5}{2}$ or, $f = 286Hz$, For $\frac{7}{2}$, $f = 400Hz$

2. **Solution:** ***(Similar to problem no29, chap.19, text book 8th edition)***

(a) For initial state $P_iV_i = nRT_i$

$$(1atm)V_i = nR(10+273)K.......................(1)$$

After compressing 30% , for the final state $P_fV_f = nRT_f$

$$P_f(0.30V_i) = nR(40+273) ....(2)$$

Deviding equation $(2) \div (1)$

$$\frac{P_f(0.30V_i)}{(1atm)V_i} = \frac{nR(40+273)K}{nR(10+273)K}, \quad or\ P_f = 3.7atm$$

(b) After being driven the car , if internal volume increses 2% the volume becomes $(1+20\%) = 1.02$ where 1 is initial volume. So after compressing 30% of air the volume will be considered $V_d = (1.02\times\ 0.30V_i)$.

So we can get , $P_dV_d = nRT_d$, or , $P_d = \frac{nR(85+273)K}{1.02\times 0.30V_i} = \frac{P_fV_f(85+273)K}{T_f(1.02\times 0.30V_i)} = \frac{3.7atm\times(0.30V_i)\times 358K}{313K\times(1.02\times 0.30V_i)}$

$$\therefore P_d = 4.14atm$$

3. Solution: ***(Similar to problem no.(15+14), chap.17, text book 8th edition)***

(a) The first law of thermodynamics

E=Q+W or dE=dQ+dW , This law follows - the law of conservation of energy.

(b) Latent heat: Latent heat is the energy released or absorbed by a body or a thermodynamic system during a constant-temperature process. A typical example is a change of state of matter, meaning a phase transition such as the melting of ice or the boiling of water.

Here , Energy Q= m S$\Delta\theta$, where S= Specific heat, m= mass , $\Delta\theta$= Change of temperature

$$Q = Q_1(-10^0 \text{ C ice to } 0^0C \text{ ice}) + Q_2(0^0 \text{ C ice to } 0^0C \text{ water}) + Q_3(0^0 \text{ C water to } 25^0C \text{ water})$$

$$= 50\times10^{-3}[2100(0-(-10)) + 3.3\times10^5 + 4200(25-0)]$$

$$= 22800\text{J}$$