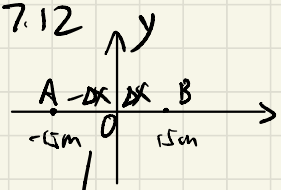
7.10

(1) $I = \frac{1}{2}\rho\omega^2 A^2 u$

$= 8\times10^{-4}\ W/m^2$

(2) $P = I \cdot S = 1.2\times10^{-6}\ W$

7.12



$y_A = A\cos\left(\omega\left(t-\frac{x+\Delta x}{u}\right)\right)$

$y_B = A\cos\left(\omega\left(t+\frac{x-\Delta x}{u}\right)+\pi\right)$

$= -A\cos\left(\omega\left(t+\frac{x-\Delta x}{u}\right)\right)$

以A、B中点为坐标原点 $\Rightarrow y_A + y_B = A\cos\omega\left(t-\frac{x+\Delta x}{u}\right) - A\cos\omega\left(t+\frac{x-\Delta x}{u}\right)$

$= 2A\cdot\sin\omega\left(t-\frac{\Delta x}{u}\right)\sin\frac{x}{u}\omega$

↑ 与t无关

$\Rightarrow \frac{x}{u}\omega = k\pi$ $(k=0,\pm1,\pm2,\cdots)$

$x = \frac{k\pi\cdot u}{\omega} = \frac{k\pi\cdot u}{2\pi\nu} = \frac{ku}{2\nu} = 2k$

$\Rightarrow$ 各点x坐标为 $0, \pm2m, \pm4m, \cdots, \pm14m$

7.14

(1) $y(t,0)=A\cos(\omega t-\frac{\pi}{2})$

$\Rightarrow y(t,x)=A\cos(\omega t-\frac{\pi}{2}-\omega\frac{x}{u})$

$=A\cos(2\pi\nu(t-\frac{x}{u})-\frac{\pi}{2})$

(2) $y'(t,\frac{3\lambda}{4})=-y(t,\frac{3\lambda}{4})$

$=-A\cos(2\pi\nu(t-\frac{1}{u}\cdot\frac{3\lambda}{4})-\frac{\pi}{2})$

$=A\cos(2\pi\nu(t-\frac{1}{u}\cdot\frac{3\lambda}{4})+\frac{\pi}{2})$

$y'(t,x)=A\cos(2\pi\nu(t+\frac{x}{u}-\frac{3\lambda}{2u})+\frac{\pi}{2})$

$=A\cos(2\pi\nu(t+\frac{x}{u})-3\pi+\frac{\pi}{2})$

$=A\cos(2\pi\nu(t+\frac{x}{u}-\frac{\pi}{2})$

静止点位置(波节): $x=\frac{3\lambda}{4},\frac{\lambda}{4}$

7.15

基频: $\nu_1=\frac{u}{2d}=1.14\times10^6\ Hz$

7.17

$\Delta t=5min=300s=x\cdot(\frac{1}{v_s}-\frac{1}{v_p})$

$\Rightarrow x=7.2\times10^3 m$

7.19

$T=4.0s \quad A=0.6m, \quad \lambda=2.5m$

(1) $u=\frac{\lambda}{T}=\frac{2.5}{4} m/s$

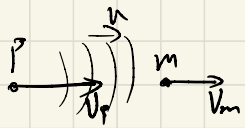
(2) $T'=T=4.0s \quad R=A=0.6m$

$v=\frac{2\pi}{T'}R=0.94 m/s < u$

7.20

$v_m=80km/h=22.2m/s$

$v_p>120km/h=33.3m/s$



$\nu=400Hz, \quad u=330m/s$

$\nu_R=\frac{u-v_m}{u-v_p}\nu=415Hz$

7.22

$\nu=1.8\times10^4 Hz, \quad u=1.154\times10^3 m/s$

$\nu'=\frac{u+v_{船}}{u}\nu$

$\nu''=\frac{u}{u-v_{船}}\nu'$

$\nu''-\nu=(\frac{u+v_{船}}{u-v_{船}}-1)\nu=220Hz$

$\Rightarrow v_{船}=9.4m/s$

7.25

(1) $\sin\alpha=\frac{u}{v_s}=\frac{1}{2.3}$

$\alpha=\arcsin\frac{1}{2.3}=26^\circ$

(2) $\tan\alpha=\frac{h}{v_s t}$

$\Rightarrow t=\frac{h}{v_s\tan\alpha}=13.6s$

7.33

(1) $\frac{\xi_x^2}{A_x^2} + \frac{\xi_y^2}{A_y^2} = \sin^2(\omega t - kx) + \cos^2(\omega t - kx) = 1$

(2)

接触时，质元 $\xi_x = 0$，ξ_y 最大

$\Rightarrow v_y = \frac{\partial \xi_y}{\partial t} = \omega A_y \cos(\omega t - kx) = 0$

$v_x = \frac{\partial \xi_x}{\partial t} = -\omega A_x \sin(\omega t - kx) = -\omega A_x$

$\Rightarrow v = v_x = -\omega A_x$