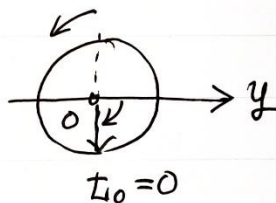
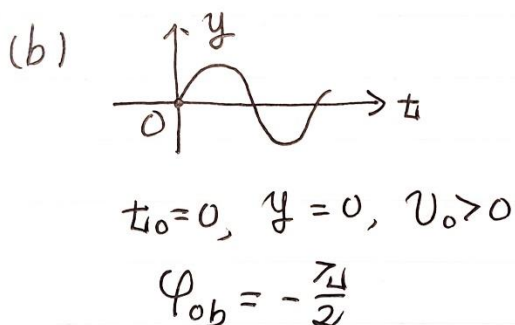
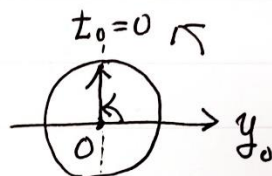
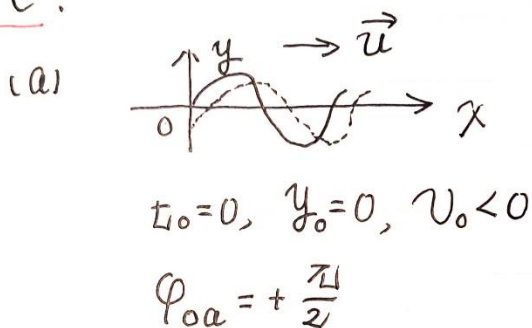


10. 机械波 (-)

1. B. $T = \frac{2\pi}{\omega} = \frac{1}{3} \text{ s}$

2. C.



3. B.

4. $\Delta\varphi = \frac{\omega}{u} (x_2 - x_1) = \frac{\omega}{u} \Delta x$

$\Delta x = \frac{u}{\omega} \Delta\varphi = \frac{u}{2\pi\nu} \Delta\varphi = \frac{5}{3} = 1.67 \text{ s}$

5. 设O点: $y_0 = A \cos(\omega t + \varphi_0')$

$$y = A \cos\left[\omega\left(t - \frac{x}{u}\right) + \varphi_0'\right]$$

P点: $x_P = l$.

$$y_P = A \cos\left[\omega\left(t - \frac{x_P}{u}\right) + \varphi_0'\right]$$

$$y_P = A \cos(\omega t + \varphi_0)$$

$$-\frac{\omega}{u} x_P + \varphi_0' = \varphi_0$$

$$\varphi_0' = \varphi_0 + \frac{\omega}{u} x_P = \varphi_0 + \frac{\omega}{u} l$$

$$\Rightarrow y = A \cos\left[\omega\left(t - \frac{x}{u}\right) + \varphi_0 + \frac{\omega}{u} l\right]$$

$$= A \cos\left[\omega\left(t - \frac{x-l}{u}\right) + \varphi_0\right]$$

或: O点比P点, 相位超前, $\omega \Delta t = \omega \frac{l}{u}$

$$\Delta\varphi = \overset{\downarrow}{\varphi_0'} - \overset{\downarrow}{\varphi_0} = \omega \Delta t = \omega \frac{l}{u}$$

$$\Rightarrow \underline{\varphi_0' = \varphi_0 + \frac{\omega}{u} l}$$

$$6. \Delta\varphi = \omega \Delta t = \omega \frac{\Delta x}{u} = \frac{2\pi}{T} \cdot \frac{\Delta x}{u} = \frac{2\pi}{\lambda} \Delta x$$

$$\Rightarrow u = 30 \text{ m/s}, \quad \lambda = 6 \text{ m}$$

$$7. y = 0.05 \cos(20\pi t - 3\pi x) \text{ (m)}$$

$$1). A = 0.05 \text{ m}, \quad u = \frac{20}{3} \text{ m/s},$$

$$\omega = 20\pi, \quad \omega = 2\pi\nu \rightarrow \nu = 10 \text{ Hz}$$

$$\lambda\nu = u \rightarrow \lambda = \frac{2}{3} \text{ m}$$

$$2) v = \frac{\partial y}{\partial t} = -\pi \sin(20\pi t - 3\pi x) \text{ (m/s)}$$

$$v_m = \pi \text{ (m/s)}$$

$$8. \text{ 设 } O \text{ 点, } y_0 = A \cos(\omega t + \varphi_0)$$

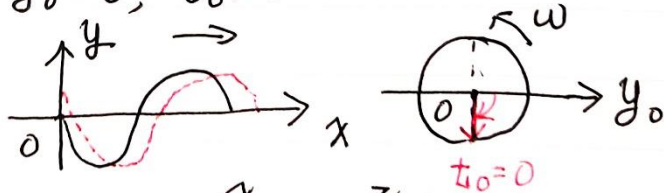
$$y = A \cos\left[\omega\left(t - \frac{x}{u}\right) + \varphi_0\right]$$

$$1). A = 0.10 \text{ m}, \quad u = 100 \text{ m/s}, \quad \lambda = 4 \text{ m}$$

$$\lambda\nu = u \Rightarrow \nu = \frac{u}{\lambda} = 25 \text{ Hz}, \quad \omega = 2\pi\nu = 50\pi \text{ s}^{-1}$$

$$O \text{ 点, } t_0 = 0 \text{ 时, } y_0 = 0, \quad v_0 > 0$$

$$\Rightarrow \varphi_0 = -\frac{\pi}{2}$$



$$y = 0.10 \cos\left[50\pi\left(t - \frac{x}{100}\right) - \frac{\pi}{2}\right] \text{ (m)}$$

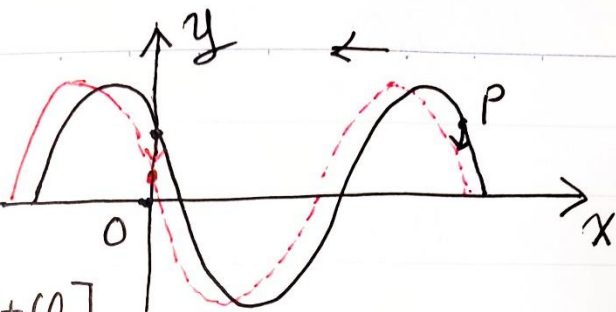
$$2) x_p = 2 \text{ m, 代入, } y_p = 0.10 \cos\left(50\pi t - \frac{3}{2}\pi\right) \text{ (m)}$$

9. 沿 x 轴负向传

设: 0 点:

$$y_0 = A \cos(\omega t + \varphi_0)$$

$$y = A \cos\left[\omega\left(t + \frac{x}{u}\right) + \varphi_0\right]$$



$$A = 0.10 \text{ m}, \quad u = 50 \text{ m/s}$$

$$\lambda = 2 \times 50 = 100 \text{ m}$$

$$\lambda u = u$$

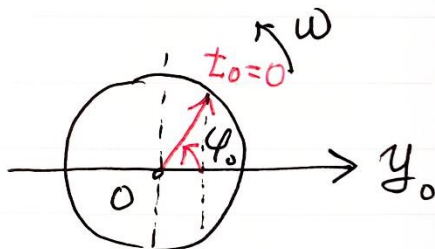
$$\Rightarrow u = \frac{u}{\lambda} = \frac{1}{2} \text{ Hz}$$

$$\omega = 2\pi u = \pi \text{ s}^{-1}$$

$t_0 = 0$ 时, 0 点:

$$y_0 = \frac{A}{2}, \quad v_0 < 0$$

$$\Rightarrow \varphi_0 = \frac{\pi}{3}$$



$$y = 0.10 \cos\left[\pi\left(t + \frac{x}{50}\right) + \frac{\pi}{3}\right] \text{ (m)}$$

10. 已知: $u = 30 \text{ m/s}$.

A点: $y_A = 3 \times 10^{-2} \cos(3\pi t) \text{ (m)}$

1) A点为原点O, 则 $y_0 = y_A = 3 \times 10^{-2} \cos(3\pi t)$

$$y = 3 \times 10^{-2} \cos\left[3\pi\left(t - \frac{x}{30}\right)\right] \text{ (m)}$$

2) B点为原点O: $y_0 = A \cos(\omega t + \varphi_{0B})$

A点: $x_A = -5 \text{ m}$, $y_A = 3 \times 10^{-2} \cos(3\pi t)$

$$y = A \cos\left[\omega\left(t - \frac{x}{u}\right) + \varphi_{0B}\right]$$

$$= 3 \times 10^{-2} \cos\left[3\pi\left(t - \frac{x}{30}\right) + \varphi_{0B}\right]$$

A点: $x_A = -5 \text{ m}$ 代入.

$$y(x_A) = 3 \times 10^{-2} \cos\left[3\pi\left(t - \frac{-5}{30}\right) + \varphi_{0B}\right]$$

$$= 3 \times 10^{-2} \cos\left(3\pi t + \frac{\pi}{2} + \varphi_{0B}\right)$$

$$\frac{\pi}{2} + \varphi_{0B} = 0 \Rightarrow \varphi_{0B} = -\frac{\pi}{2}$$

$$y = 3 \times 10^{-2} \cos\left[3\pi\left(t - \frac{x}{30}\right) - \frac{\pi}{2}\right]$$

或: A比B相位超前:

$$\Delta\varphi = \varphi_A - \varphi_B = 0 - \varphi_{0B} = \omega \cdot \Delta t = \omega \cdot \frac{\Delta x}{u}$$

$$\Rightarrow \varphi_{0B} = -3\pi \times \frac{5}{30} = -\frac{\pi}{2}$$

11. 机械波 (=)

1. C.

2. B.

3. C.

$$\text{设: } PR = r_1, \quad QR = r_2$$

$$\begin{aligned} \Delta\varphi &= (\varphi_{02} - \varphi_{01}) - \frac{2\pi}{\lambda} (r_2 - r_1) \\ &= \frac{2\pi}{\lambda} (r_1 - r_2) = \frac{2\pi}{\lambda} \overline{PQ} = 5\pi \end{aligned}$$

$$A = |A_1 - A_2|$$

4. $\frac{\lambda}{2}, \pi$

5. ① ~~$\nu = 500 \text{ Hz}, \nu_s = 30 \text{ m/s}, u = 330 \text{ m/s}$~~

~~$$\nu' = \frac{u}{u - \nu_s} \nu = 550 \text{ Hz}$$~~

② ~~$\nu' = \frac{u}{u + \nu_s} \nu = 458.3 \text{ Hz}$~~

6. $\bar{P} = \bar{w} u S, \quad I = \bar{w} u$

$$\Rightarrow \bar{P} = I S = 100 \text{ W}$$

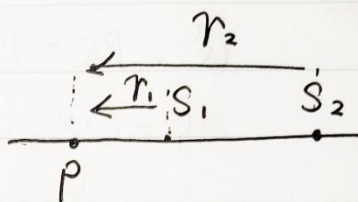
$$\left. \begin{aligned} S &= 4\pi R^2, \quad R = 10 \text{ m} \end{aligned} \right\} \Rightarrow I = 0.08 \text{ W/m}^2$$

$$7. \quad \varphi_{02} - \varphi_{01} = -\pi$$

$$\lambda = 4\text{m}$$

$$\Delta\varphi = (\varphi_{02} - \varphi_{01}) - \frac{2\pi}{\lambda}(r_2 - r_1)$$

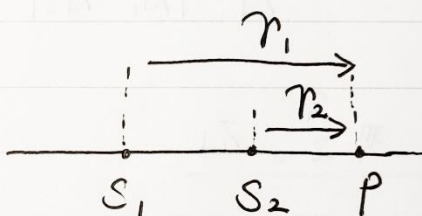
1) S_1 左侧



$$\Delta\varphi = -\pi - \frac{2\pi}{\lambda} \times 10$$

$$= -\pi - \frac{2\pi}{4} \times 10 = -6\pi \leftarrow \text{干涉加强}$$

2) S_2 右侧

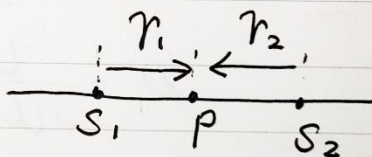


$$\Delta\varphi = -\pi - \frac{2\pi}{4} \times (-10)$$

$$= 4\pi \leftarrow \text{干涉加强}$$

3) S_1, S_2 之间

$$r_1 + r_2 = 10 \Rightarrow r_2 = 10 - r_1$$



$$\Delta\varphi = (\varphi_{02} - \varphi_{01}) - \frac{2\pi}{\lambda}(r_2 - r_1)$$

$$\Rightarrow \Delta\varphi = -\pi - \frac{2\pi}{4}(10 - 2r_1) = \pi(r_1 - 6) = (2k+1)\pi$$

$$\Rightarrow r_1 = 2k + 7, \quad k = 0, \pm 1, \pm 2, \dots$$

$$0 \leq r_1 \leq 10$$

$$r_1 = 1, 3, 5, 7, 9 \text{ (m)} \leftarrow \text{干涉}$$

$$(k = -3, -2, -1, 0, 1) \quad \text{而静止}$$

8. $\varphi_0 = 0, \varphi_0 = \varphi$

$$\omega = 2\pi\nu, \nu = \frac{\omega}{2\pi} = 1 \text{ Hz}, \lambda = \frac{u}{\nu} = 20 \text{ m}$$

$$1) \Delta\varphi = (\varphi_0 - \varphi_1) - \frac{2\pi}{\lambda}(r_2 - r_1) = \varphi - \pi$$

$$2) \Delta\varphi = \varphi - \pi = 2k\pi, \rightarrow \varphi = (2k+1)\pi$$

$$k = 0, \pm 1, \pm 2, \dots$$

9. 反射波: O点: $y_0 = A\cos(\omega t + \varphi_0)$

$$y_2 = A\cos[\omega(t - \frac{x}{u}) + \varphi_0]$$

$$y_2 = A\cos[2\pi\nu(t - \frac{x}{u}) + \varphi_0]$$

O点: $x_0 = 0$, 波节, 干涉减弱

$$\Delta\varphi(x_0=0) = (2\pi\nu t + \varphi_0) - (2\pi\nu t) = \varphi_0$$

$$\varphi_0 = (2k+1)\pi, k = 0, \pm 1, \pm 2, \dots$$

取: $\varphi_0 = \pi$

$$y_2 = A\cos[2\pi\nu(t - \frac{x}{u}) + \pi]$$

$$y = y_1 + y_2 = 2A\cos(\frac{2\pi}{\lambda}x - \frac{\pi}{2})\cos(2\pi\nu t + \frac{\pi}{2})$$

10、不要求