

30.

$$y_1 = A \cos(\omega t + \frac{\pi}{2}) \quad S.P = 5\lambda \Rightarrow y_1' = A \cos(\omega t - 10\pi + \frac{\pi}{2})$$

$$y_2 = A \cos(\omega t) \quad S.P = 4\lambda \Rightarrow y_2' = A \cos(\omega t - 8\pi)$$

$$y_3 = A \cos(\omega t - \frac{\pi}{2}) \quad S.P = 5\lambda \Rightarrow y_3 = A \cos(\omega t - 10\pi - \frac{\pi}{2})$$

$$y_1' \cdot y_3' \text{ 相位差 } \pi \text{ 抵消} \therefore y = y_2' = A \cos(\omega t)$$

31. $\delta = \frac{d}{D} \Delta x$ 代入题中数据 $\Rightarrow \lambda = \frac{0.6 \text{ mm}}{2.5 \text{ m}} \cdot 2.27 \text{ m} = 0.5448 \times 10^{-6} \text{ m}$
 $= 5.448 \times 10^{-7} \text{ m}$

$$\begin{cases} \Delta x \geq 5 \text{ mm} \\ d = \frac{\delta D}{\Delta x} \end{cases} \Rightarrow d \leq 2.2724 \text{ mm}$$

32. (1) $\lambda = \frac{2L}{3} = 2.0 \text{ m}$

$$v = \lambda f \Rightarrow f = 50 \text{ Hz}$$

(2) $A' = \frac{A}{2} \Rightarrow A' = 0.005 \text{ m}$

$$\omega = 2\pi f \Rightarrow \omega = 100\pi$$

$$k = \frac{2\pi}{\lambda} \Rightarrow k = \pi \text{ m}$$

$$\therefore y_1 = 0.005 \cos(100\pi t + \pi x)$$

$$y_2 = 0.005 \cos(100\pi t - \pi x)$$

33. (1) $\Delta v = |f_1 - f_2|$

$$\begin{cases} f_2 = \frac{v}{v+v_s} f \\ f_1 = \frac{v}{v-v_s} f \end{cases} \Rightarrow v_s = 0.25 \text{ m/s}$$

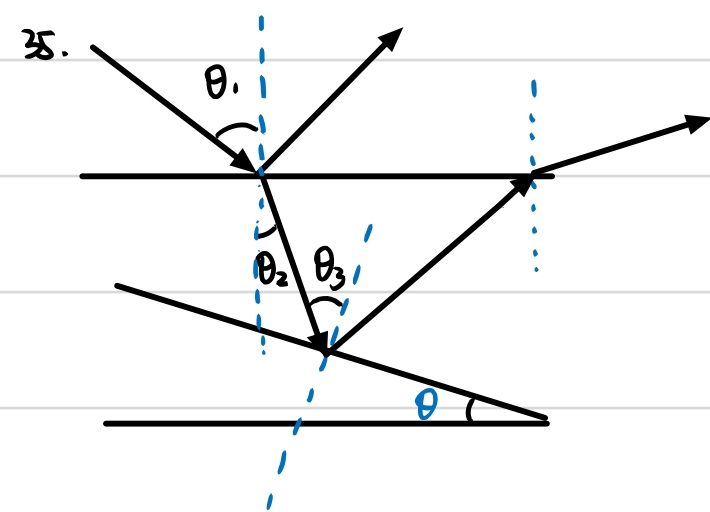
(2) $\Delta v = |f_1 - f_2|$

$$\begin{cases} f_2 = \frac{v+v_R}{v} \cdot \frac{v}{v-v_R} f \\ f_1 = f \end{cases} \Rightarrow f = 3398 \text{ Hz}$$

($v_R = 0.20 \text{ m/s}$)

34. (1) 不断改变入射光角度直至反射光为s偏振光 利用起偏振面测折射率

(2) $n = \tan i_e = 1.60$



记水的折射率 $n' = 1.333$

$$\left\{ \begin{array}{l} \tan \theta_1 = n' \\ \sin \theta_1 = n' \sin \theta_2 \\ \theta_3 = \theta_2 + \theta \\ \tan \theta_3 = \frac{n}{n'} \end{array} \right.$$

$$\left\{ \begin{array}{l} \theta_1 = 33.13^\circ \\ \theta_2 = 36.87^\circ \\ \theta_3 = 48.36^\circ \\ \theta = 11.49^\circ \end{array} \right.$$

36.

$$2d n_{\text{油}} = (2k_1 + 1) \frac{\lambda_1}{2} = (2k_2 + 1) \frac{\lambda_2}{2}$$

$$\lambda_1 < \lambda_2 \text{ 且 } k_1, k_2 \text{ 为整数} \Rightarrow k_2 = k_1 - 1$$

$$\Rightarrow k_1 = 3$$

$$d = \frac{\lambda_1 (2k_1 + 1)}{2 \times 2n_{\text{油}}} = 673.07 \text{ nm}$$

37.

$$\left\{ \begin{array}{l} 2n\Delta d = \lambda \\ \Delta l = \frac{\Delta d}{\sin \theta} \end{array} \right. \Rightarrow \theta = 3.88 \times 10^{-5} \text{ rad}$$

$$\theta \approx \sin \theta$$

$$\sin \theta =$$

38. $\Delta \theta = \arcsin \frac{\lambda}{a} \approx \frac{\lambda}{a}$

$$\left\{ \begin{array}{l} \Delta x_1 = 2f\Delta \theta \\ \Delta x_2 = f\Delta \theta \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} \Delta x_1 = 5.46 \times 10^{-3} \text{ m} \\ \Delta x_2 = 2.73 \times 10^{-3} \text{ m} \end{array} \right.$$

$$39. \quad x_k = z f \frac{\lambda k}{a} \Rightarrow dx_k = -\frac{z f \lambda k}{a^2} da$$

$$40. \quad d = \frac{1 \text{ cm}}{4000} = 2.5 \times 10^{-6} \text{ m}$$

$$d \cdot \sin \theta = k \lambda \in [400k, 760k] \text{ nm.}$$

$$\sin \theta = \frac{k \lambda}{d} \in [0.16k, 0.304k] \quad , k = 1, 2, 3, \dots$$

$$\left\{ \begin{array}{l} 0.304k \leq 1 \\ 0.16k \geq 0.304(k-1) \\ 0.304k \leq 0.16(k+1) \end{array} \right. \Rightarrow k=1$$

$k = 1, 2, 3, \dots$

\therefore 一个完整光谱

41.

$$(1) \quad \theta = \sin \theta = \frac{1.22 \lambda}{d} = 0.000386$$

$$D = 2x \tan \theta \approx 2x\theta = 2.96 \times 10^5 \text{ m.}$$

$$(2) \quad D' = \frac{d_1}{d_2} D = 2.96 \times 10^2 \text{ m}$$

可减少激光发散, 使其更集中. 提升精度.

42.

$$(1) \quad I_2 = \frac{1}{2} I_1 \cos^2 \theta = \frac{3}{8} I_1 \quad \therefore \text{比为 } \frac{3}{8}$$

$$(2) \quad I_2 = \frac{1}{2} I_1 \cdot (90\%) \cdot \cos^2 \theta = \frac{27}{80} I_1 \quad \therefore \text{比为 } \frac{27}{80}$$

43. 记自然光强为 I_1 , 线偏振光强为 I_2 , 偏振片角度与线偏振角度为 θ 有:

$$I = \frac{1}{2} I_1 + I_2 \cos^2 \theta$$

$$\left\{ \begin{array}{l} I_{\min} = \frac{1}{2} I_1 \\ I_{\max} = \frac{1}{2} I_1 + I_2 \end{array} \right. \Rightarrow \frac{I_1}{I_2} = \frac{2}{5}$$

$$\frac{I_{\min}}{I_{\max}} = \frac{1}{6}$$

$$44. \quad m_0^2 - m_0^2 = m_1^2$$

$$\left\{ \begin{array}{l} m_0 c^2 = m_1 c^2 \\ \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} = m \\ \lambda = \frac{h}{p} = \frac{h}{m v} \end{array} \right. \Rightarrow \left\{ \begin{array}{l} v = \frac{\sqrt{3}}{2} c \\ \lambda = 1.40 \times 10^{-2} \text{ m} \end{array} \right.$$

$$45. \quad (1) \quad P_1 = \int_0^{\frac{a}{3}} |\psi_1|^2 dx = \frac{2}{a} \int_0^{\frac{a}{3}} \sin^2 \frac{\pi x}{a} dx = \frac{1}{3} - \frac{\sqrt{3}}{4\pi} \approx 0.196$$

$$(2) \quad P_2 = \int_0^{\frac{a}{3}} |\psi_2|^2 dx = \frac{2}{a} \int_0^{\frac{a}{3}} \sin^2 \frac{2\pi x}{a} dx = \frac{1}{3} + \frac{\sqrt{3}}{8\pi} \approx 0.402$$