# 考前必看：

## 振：

（弹簧振子 $\omega^2=\frac{k}{m}$）

1、
$$\begin{cases} A=\sqrt{x_0^2+\frac{v_0^2}{\omega^2}} \\ \tan\varphi=\frac{-v_0}{\omega x_0} \end{cases}$$
（当 $t=0$，$x=x_0$，$v=v_0$）

2、能量：$E_k=\frac{1}{2}mv^2=\frac{1}{2}m\omega^2A^2\sin^2(\omega t+\varphi)$

$E_p=\frac{1}{2}kx^2=\frac{1}{2}kA^2\cos^2(\omega t+\varphi)$

$=\frac{1}{2}m\omega^2A^2\cos^2(\omega t+\varphi)$

$E=E_k+E_p=\frac{1}{2}m\omega^2A^2$

## 波：

1、
$$\begin{cases} u_{横}=\sqrt{\frac{G}{\rho}},\quad u_{纵}=\sqrt{\frac{E}{\rho}} & 固 \\ u=\sqrt{\frac{K}{\rho}} & 液气 \end{cases}$$

G - 切变模量

E - 杨氏模量

K - 体积模量

2、波函数：$y=A\cos[\omega(t-\frac{x-x_0}{u})+\varphi]$

$=A\cos[2\pi(\nu t-\frac{x-x_0}{\lambda})\varphi]$

3、能量：$dW = \rho w^2 A^2 \sin^2 w(t-\frac{x}{u})\,dV$

能量密度：$w = \frac{dW}{dV} = \rho w^2 A^2 \sin^2 w(t-\frac{x}{u})$

$$\overline{w} = \frac{1}{2}\rho w^2 A^2$$

能流：$P = wuS$

$$\overline{P} = \overline{w}uS$$

能流密度：$I = \frac{\overline{P}}{S} = \overline{w}u = \frac{1}{2}\rho w^2 A^2 u$

4、驻波：

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

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

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

5. 简正模式

二端：$l = n\frac{\lambda_n}{2}$

一端：$l = \frac{2n-1}{2}\frac{\lambda_n}{2}$

6. 多普勒：

$$\nu' = \frac{u \pm v_o}{u \mp v_s}$$

近+远−

近−远+

## 波光

1. 杨氏双缝：$\Delta = d\sin\theta = d\frac{x}{d'} = \begin{cases} k\lambda \\ \frac{2k+1}{2}\lambda \end{cases}$

2. 等倾干涉：$\Delta = 2d\sqrt{n_2^2 - n_1^2\sin^2 i} + \frac{\lambda}{2}$

3. 等厚干涉 $\Delta = 2nd + \frac{\lambda}{2} = \begin{cases} k\lambda \\ \frac{2n+1}{2}\lambda \end{cases}$

$$\theta = \frac{d}{l}$$

4. 牛顿环：$\Delta = 2nd + \frac{\lambda}{2} = \begin{cases} k\lambda \\ \frac{2k+1}{2}\lambda \end{cases}$

$$r = \sqrt{\frac{(\Delta - \frac{\lambda}{2})}{n} R}$$

$$\therefore \quad = \begin{cases} \frac{1}{\sqrt{n}}\sqrt{\frac{2k-1}{2}\lambda R} & 明 \\ \frac{1}{\sqrt{n}}\sqrt{k\lambda R} & 暗 \end{cases}$$

5. 单缝衍射

$$b\sin\theta = \begin{cases} 0 & 中明 \\ k\lambda & 暗 \\ \frac{2k+1}{2}\lambda & 明 \end{cases}$$

6. 圆孔衍射

$$\theta = \frac{1.22\lambda}{D}$$ —— 缝宽

7、光栅

$d\sin\theta = \pm k\lambda$ 明 $k \neq \frac{d}{b}k'$

8、偏振

$I = I_0 \cos^2\alpha$

I 必须是偏振光

布儒斯特：

$\tan i_B = \frac{n_2}{n_1}$，

反射~~垂直~~偏振

$90°$

9、几何光学：

$\frac{n'}{p'} - \frac{n}{p} = \Phi$

$\Phi = \begin{cases} \frac{n'-n}{r} & 单 \\ \Phi_1 + \Phi_2 + \cdots & 多 \end{cases}$

$V = \frac{y'}{y} = \frac{p'/n'}{p/n}$

$\Rightarrow \frac{f'}{p'} + \frac{f}{p} = 1$

$f' = \frac{n'}{\Phi}$ $f = -\frac{n}{\Phi}$

单球面:

$n' = -n$ $\quad \Phi = \frac{2n'}{r}$

$f' = f = \frac{n'}{\Phi} = \frac{r}{2}$

平面折射:

$r \to \infty$

$\Phi = 0$

$\frac{n'}{p'} - \frac{n}{p} = 0$

透镜折射:

when $n' = n = 1$

$f' = -f = \frac{1}{\Phi}$

$\frac{1}{p'} - \frac{1}{p} = \Phi$

$V = \frac{y'}{y} = \frac{p'}{p}$

眼睛:

明视 $= 25cm$

远视: $p = -25cm \to p' =$ 近点, $\Phi > 0$ 凸

近视: $p = \infty \to p' =$ 远点, $\Phi < 0$ 凹

# 量子物理

1、 $M(T) = \sigma T^4$

2、 $T\lambda_m = b$

3、 $E = E_0 + E_k$

$mc^2 = m_0 c^2 + E_k$

4、 $E^2 = p^2c^2 + E_0^2$

5、 $E_n = -\frac{me^4}{8\varepsilon_0^2 h^2}\frac{1}{n^2}$ $\quad r_n = \frac{\varepsilon_0 h^2}{\pi m e^2} n^2$

6、 一维势阱：

$$\psi(x) = \sqrt{\frac{2}{a}} \sin\frac{n\pi}{a}x$$

$$E_n = n^2 \frac{h^2}{8ma^2}$$

7. $n$ $l$ $m_l$ $m_s$

$n = 1, 2, \cdots,$

$l = 0, 1, 2 \cdots, n-1$

$m_l = 0, \pm 1, \pm 2, \cdots \pm l$

$m_s = \pm\frac{1}{2}$

8. 氢原子径向

$$R = \left(\frac{4}{a_0^3}\right)^{\frac{1}{2}} e^{-\frac{r}{a_0}}$$

$$p\,dr = |R|^2 r^2 dr$$

9: $Z_n = 2n^2$

气体动理论：

1、 $pV = NkT$

2、 $p = nm\overline{v_x^2} = \frac{1}{3}nm\overline{v^2}$

$= \frac{2}{3}n\overline{\varepsilon_k}$

$= \frac{1}{3}\rho\overline{v^2}$

3、 $\overline{\varepsilon_k} = \frac{3}{2}kT$

4、 $v_{rms} = \sqrt{\frac{3kT}{m}}$

$\overline{v} = \sqrt{\frac{8kT}{\pi m}}$

$v_p = \sqrt{\frac{2kT}{m}}$

5、 $n = n_0 e^{\frac{-mgz}{kT}}$

$p = p_0$ —

6、 $\bar{Z} = \sqrt{2}\pi d^2 \bar{v} n$

$\bar{\lambda} = \frac{kT}{\sqrt{2}\pi d^2 p}$

热力学

$Q = \nu C_{p,m}(T_2 - T_1)$

$Q = \nu C_{V,m}(T_2 - T_1)$

$C_{p,m} = \frac{i+2}{2}R$

$C_{V,m} = \frac{i}{2}R$

$\gamma = \frac{i+2}{i}$

$$pv^{\gamma} = C$$

$$\int \frac{dQ}{T}$$

$$\textcircled{Q}$$

$$\overline{\psi^2 \psi^2} = |\psi|$$