FORMULÆ
Physics 1020 Exam 1

$$F = -kx$$

$$x(t) = A\cos(\omega t + \delta)$$

$$\text{Spring}: \quad \omega = \sqrt{\frac{k}{m}}; \quad T = 2\pi\sqrt{\frac{m}{k}}$$

$$\text{Pendulum}: \quad \omega = \sqrt{\frac{g}{L}}; \quad T = 2\pi\sqrt{\frac{L}{g}}$$

$$\text{Physical pendulum}: \quad \omega = \sqrt{\frac{Mgh}{I}}; \quad T = 2\pi\sqrt{\frac{I}{Mgh}}$$

$$K = \frac{1}{2}mv^2; \quad U = \frac{1}{2}kx^2; \quad E = \frac{1}{2}kA^2$$

$$y(x,t) = A\cos(\kappa x - \omega t + \delta)$$

$$\omega = 2\pi f; \quad T = \frac{1}{f} = \frac{2\pi}{\omega}; \quad v = f\lambda$$

$$f_n = n\frac{v}{2L} \qquad (n = 1, 2, 3, \ldots)$$

$$f_n = n\frac{v}{4L} \qquad (n = 1, 3, 5, \ldots) \quad \text{(free/fixed)}$$

$$v = \sqrt{\frac{F_T}{m/L}}$$

$$\beta = 10\log_{10}\frac{I}{I_0}; \qquad I_0 = 10^{-12}\ \text{W/m}^2$$

$$I = \frac{P}{A} = \frac{P}{4\pi r^2}$$

$$f' = f\left(\frac{v_{\text{snd}} \pm v_{\text{obs}}}{v_{\text{snd}} \mp v_{\text{source}}}\right);$$

top sign : toward; bottom sign : away

$$x = vt$$

$$v_{\text{snd}} = 331 + 0.6T_c \quad \text{m/s} \quad (T_c \text{ in } ^\circ\text{C})$$

$$v_{\text{snd}} = \sqrt{\frac{\gamma k_B T}{m_a}} = \sqrt{\frac{\gamma RT}{M}}$$

Circle:

$$C = 2\pi r = \pi d$$
$$A = \pi r^2 = \tfrac{\pi}{4}d^2$$

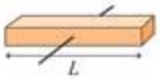
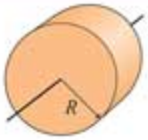
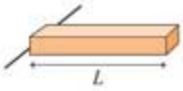
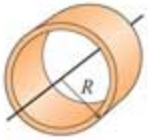
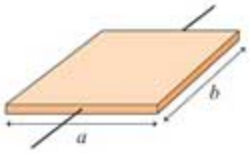
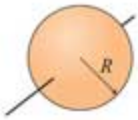
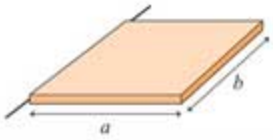
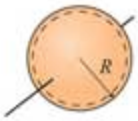
Sphere:

$$A = 4\pi r^2 = \pi d^2$$
$$V = \tfrac{4}{3}\pi r^3 = \tfrac{\pi}{6}d^3$$

Constants:

$$g = 9.80\ \text{m/s}^2$$
$$v_{\text{snd}} = 343\ \text{m/s} \quad (20^\circ\text{C})$$
$$R = 8.3144621\ \text{J mol}^{-1}\ \text{K}^{-1}$$
$$k_B = 1.3806488 \times 10^{-23}\ \text{J K}^{-1}$$

TABLE 7.4 Moments of inertia of objects with uniform density and total mass M

Object and axis	Picture	I	Object and axis	Picture	I
Thin rod, about center		$\frac{1}{12}ML^2$	Cylinder or disk, about center		$\frac{1}{2}MR^2$
Thin rod (of any cross section), about end		$\frac{1}{3}ML^2$	Cylindrical hoop, about center		MR^2
Plane or slab, about center		$\frac{1}{12}Ma^2$	Solid sphere, about diameter		$\frac{2}{5}MR^2$
Plane or slab, about edge		$\frac{1}{3}Ma^2$	Spherical shell, about diameter		$\frac{2}{3}MR^2$

Parallel axis theorem: $I = I_{cm} + MH^2$