1.

a.

$$\frac{\partial^2}{\partial x^2}(A\cos(kx+\omega t)) \stackrel{?}{=} \frac{1}{v^2}\cdot\frac{\partial^2}{\partial t^2}(A\cos(kx+\omega t))$$

$$-Ak^2\cos(kx+\omega t) \stackrel{?}{=} \frac{k^2}{\omega^2}\cdot(-A\omega^2\cos(kx+\omega t))$$

$$1 \stackrel{\checkmark}{=} 1$$

Wave.

b.

$$\frac{\partial^2}{\partial x^2}(A\sin(kx+\omega t)) \stackrel{?}{=} \frac{1}{v^2}\cdot\frac{\partial^2}{\partial t^2}(A\sin(kx+\omega t))$$

$$-Ak^2\sin(kx+\omega t) \stackrel{?}{=} \frac{k^2}{\omega^2}\cdot(-A\omega^2\sin(kx+\omega t))$$

$$1 \stackrel{\checkmark}{=} 1$$

Wave.

c.

$$\frac{\partial^2}{\partial x^2}(A(\cos kx+\cos\omega t)) \stackrel{?}{=} \frac{1}{v^2}\cdot\frac{\partial^2}{\partial t^2}(A(\cos kx+\cos\omega t))$$

$$-Ak^2\cos kx \stackrel{?}{=} \frac{k^2}{\omega^2}\cdot -A\omega^2\cos\omega t$$

$$\cos kx \neq \cos\omega t$$

Not a wave.

d.

$$v_y = \frac{\partial y}{\partial t} \qquad a_y = \frac{\partial v}{\partial t}$$

$$\boxed{v_y = A\omega\cos(kx+\omega t)} \qquad \boxed{a_y = -A\omega^2\cos(kx+\omega t)}$$

2.

$A = 0.00230\ m$
$k = 6.99\ m^{-1}$
$\omega = 742\ s^{-1}$
$l = 1.35\ m$
$m = 0.00338\ kg$

a. $\boxed{\text{Amplitude} = 2.30 \times 10^{-3}\ m}$

b. $\omega = 2\pi f$

$\boxed{f = \frac{\omega}{2\pi} = 118\ s^{-1}}$

c. $\boxed{\lambda = \frac{2\pi}{k} = 0.900\ m}$

d. $\boxed{v = \lambda f = 106\ m/s \text{ in the } -x\text{-direction}}$

e. In the $-x$-direction.

f. $v = \sqrt{\frac{F}{M}}$

$F = v^2 M$

$= v^2 \cdot \frac{m}{l}$

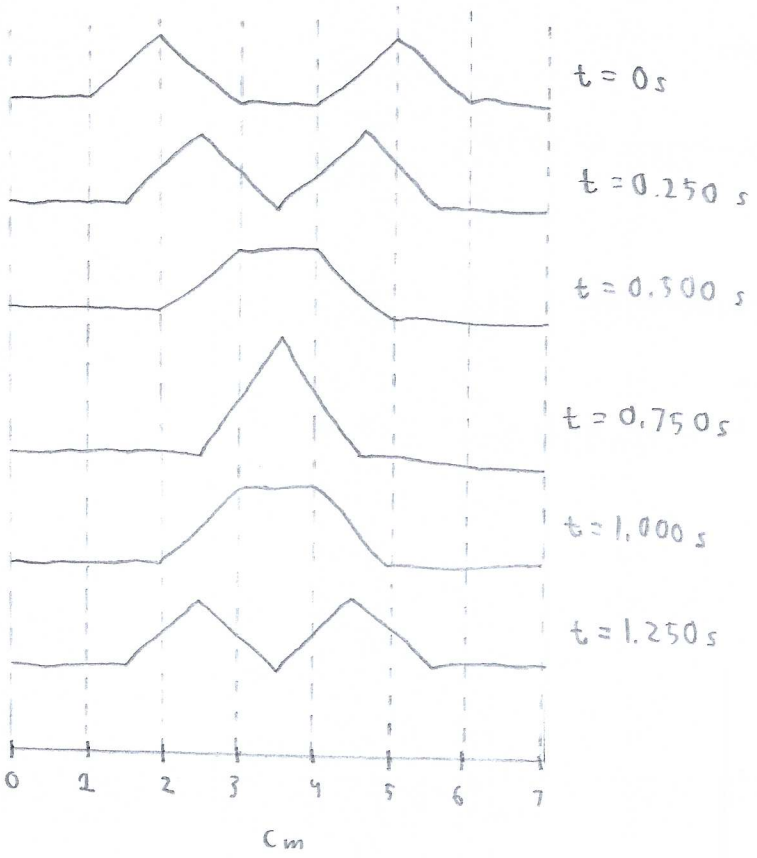
$\boxed{F = 28.1\ N}$

g. $\bar{P} = \frac{1}{2} M v \omega^2 A^2$

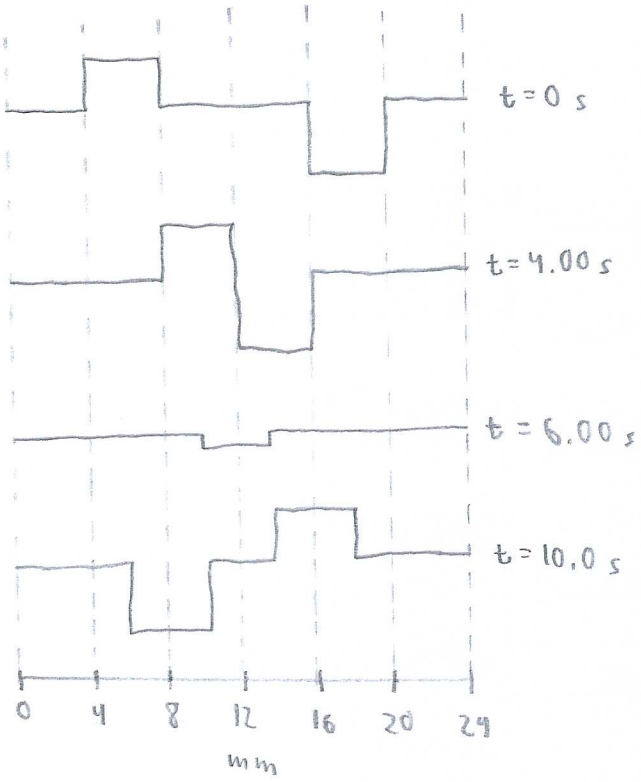
$= \frac{m v \omega^2 A^2}{2l}$

$\boxed{\bar{P} = 0.386\ W}$

3.



4.



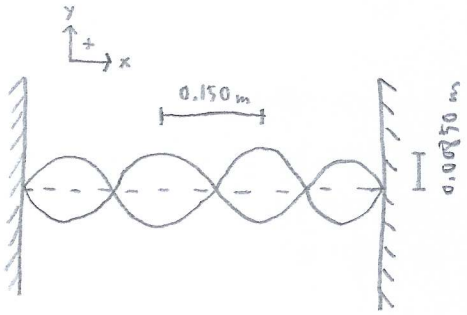
5.

$\lambda = 0.300\ m$

$A = 0.00850\ m$

$T = 0.0750\ s$

a. $\boxed{0.150\ m}$



b. $\boxed{\lambda = 0.300\ m}$

$\boxed{A = 0.00425\ m}$

$v = \lambda f$

$= \lambda \cdot \frac{1}{T}$

$\boxed{v = 4.00\ m/s}$

c. $V_{t,min} = -\omega A$

$= -\frac{2\pi A}{T}$

$V_{t,min} = -0.712\ m/s$	$V_{t,max} = 0.712\ m/s$

d. $\boxed{0.0750\ m}$

6.

$m = 0.00300\ kg$

$l = 2.20\ m$

$v_t = 9.00\ m/s$

$F = 330\ N$

a. $v_t = \omega A$

$= 2\pi f A$

$= 2\pi \cdot \frac{v}{\lambda} \cdot A$

$= \frac{2\pi A}{\lambda} \cdot \sqrt{\frac{F}{M}}$

$= \frac{2\pi A}{2l} \cdot \sqrt{\frac{Fl}{m}}$

$A = \frac{v_t}{\pi} \cdot \sqrt{\frac{ml}{F}}$

$\boxed{A = 0.0128\ m}$

b. $a_{t,max} = \omega^2 A$

$= \left(\pi \cdot \sqrt{\frac{F}{ml}}\right)^2 A$

$= \frac{\pi^2 F A}{ml}$

$\boxed{a_{t,max} = 6320\ m/s^2}$

7.

$y(0,0) = 0.010\ m$

$v_b(0,0) = -0.020\ m/s$

$a_b(0,0) = -0.040\ m/s^2$

a.

$$a_b = -\omega^2 y$$
$$= -4\pi^2 f^2 y$$
$$f = \sqrt{\frac{-a_b}{4\pi^2 y}}$$

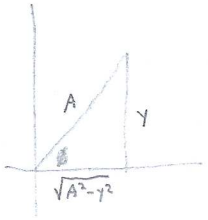
$$\boxed{f = 0.32\ s^{-1}}$$

b.

$$y(0,0) = A \sin(k(0) - \omega(0) + \phi) = A \sin\phi$$
$$v_b(0,0) = A\omega \cos(k(0) - \omega(0) + \phi) = -A\omega \cos\phi$$

$$\sin\phi = \frac{y}{A}$$

$$\frac{v_b}{-A\omega} = \cos\phi = \frac{\sqrt{A^2 - y^2}}{A}$$



$$\frac{v_b^2}{\omega^2} = A^2 - y^2$$
$$A = \sqrt{\frac{v_b^2}{\omega^2} + y^2}$$
$$= \sqrt{\frac{v_b^2}{4\pi^2 f^2} + y^2}$$

$$\boxed{A = 0.014\ m}$$

8.

a. $\sum F_y = 0$

$F_T - F_g = 0$

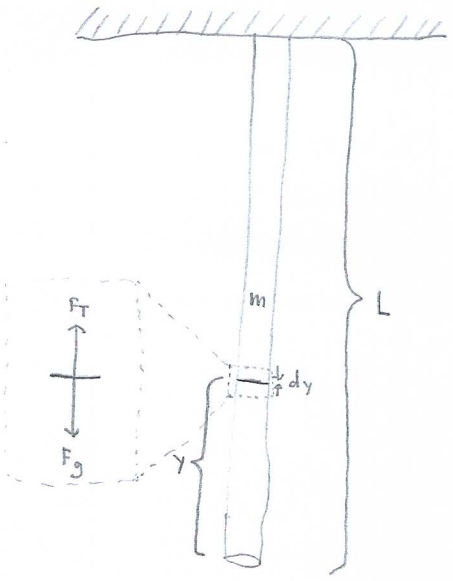
$F_T = m_y g$

$= M_y g$

$v = \sqrt{\frac{F_T}{M}}$

$= \sqrt{\frac{M_y g}{M}}$

$\boxed{v = \sqrt{g y}}$



b. $v = \frac{dy}{dt}$

$dt = \frac{1}{v} dy$

$\int_0^t dt = \int_0^L \frac{1}{v} dy$

$t = \frac{1}{\sqrt{g}} \int_0^L y^{-0.5} dy$

$= \frac{1}{\sqrt{g}} [2\sqrt{y}]_0^L$

$\boxed{t = 2\sqrt{\frac{L}{g}}}$

9.

$$\bar{P}_i \overset{?}{=} \bar{P}_t + \bar{P}_r$$

$$\frac{1}{2} \mu_1 v_i \omega^2 A_i^2 \overset{?}{=} \frac{1}{2} \mu_2 v_t \omega^2 A_t^2 + \frac{1}{2} \mu_1 v_r \omega^2 A_r^2$$

$$\mu_1 \cdot \sqrt{\frac{F}{\mu_1}} \cdot A_i^2 \overset{?}{=} \mu_2 \cdot \sqrt{\frac{F}{\mu_2}} \cdot A_t^2 + \mu_1 \cdot \sqrt{\frac{F}{\mu_1}} \cdot A_r^2$$

$$\sqrt{\mu_1} \overset{?}{=} \sqrt{\mu_2} \cdot \left(\frac{A_t}{A_i}\right)^2 + \sqrt{\mu_1} \cdot \left(\frac{A_r}{A_i}\right)^2$$

$$\overset{?}{=} \sqrt{\mu_2} \cdot \left(\frac{2\sqrt{\mu_1}}{\sqrt{\mu_1} + \sqrt{\mu_2}}\right)^2 + \sqrt{\mu_1} \cdot \left(\frac{\sqrt{\mu_1} - \sqrt{\mu_2}}{\sqrt{\mu_1} + \sqrt{\mu_2}}\right)^2$$

$$\overset{?}{=} \frac{4\mu_1\sqrt{\mu_2} + \sqrt{\mu_1}\left(\mu_1 - 2\sqrt{\mu_1}\sqrt{\mu_2} + \mu_2\right)}{\mu_1 + 2\sqrt{\mu_1}\sqrt{\mu_2} + \mu_2}$$

$$\overset{?}{=} \frac{\sqrt{\mu_1}\,\mu_1 + 2\mu_1\sqrt{\mu_2} + \sqrt{\mu_1}\,\mu_2}{\mu_1 + 2\sqrt{\mu_1}\sqrt{\mu_2} + \mu_2}$$

$$\overset{?}{=} \sqrt{\mu_1} \cdot \left(\frac{\mu_1 + 2\sqrt{\mu_1}\sqrt{\mu_2} + \mu_2}{\mu_1 + 2\sqrt{\mu_1}\sqrt{\mu_2} + \mu_2}\right)$$

$$\overset{\surd}{=} \sqrt{\mu_1}$$