1.

a.

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

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

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

Wave.

b.

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

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

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

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.

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

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

2.

$A = 0.00230$ m

$k = 6.98\ m^{-1}$

$\omega = -742\ s^{-1}$

$\ell = 1.35$ m

$m = 0.00338$ kg

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

b. $\omega = 2\pi f$

$\boxed{f = \frac{\omega}{2\pi} = 118\ Hz}$

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

$F = v^2 M$

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

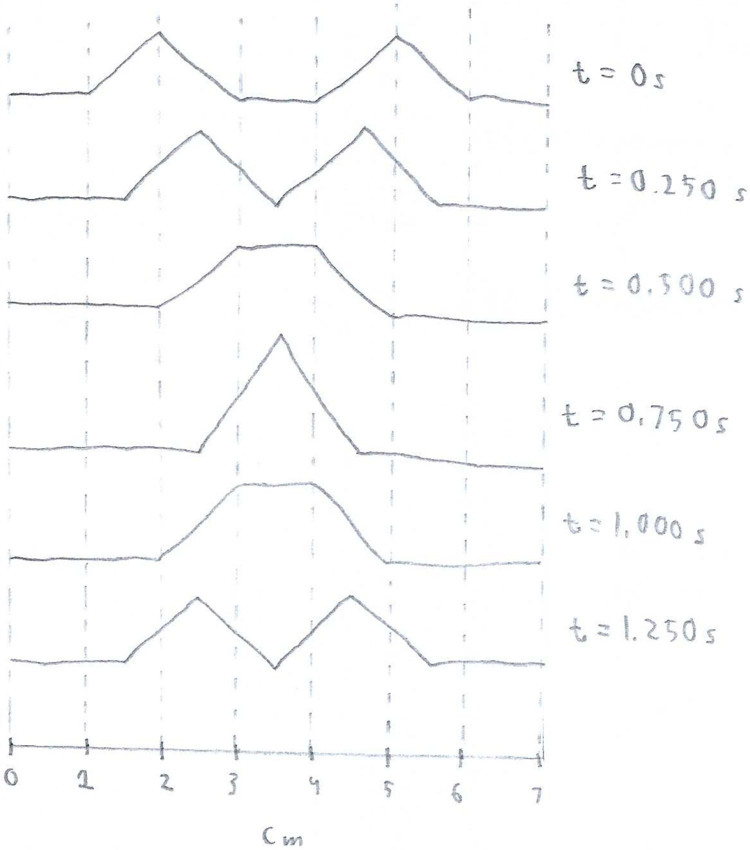
$\boxed{F = 28.1\ N}$

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

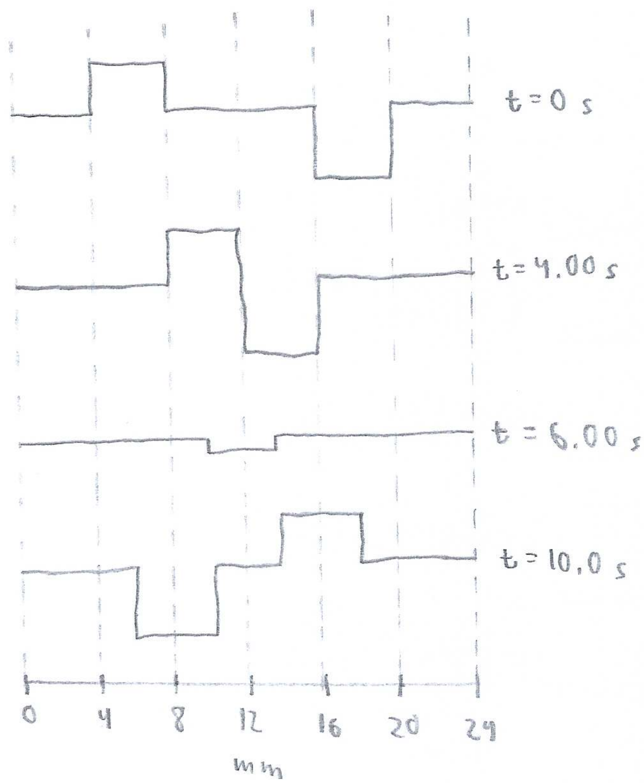
$= \frac{m v \omega^2 A^2}{2 \ell}$

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

3.



4.



6.

$m = 0.00300 \text{ kg}$

$l = 2.20 \text{ m}$

$v_t = 9.00 \text{ m/s}$

$F = 330 \text{ N}$

a.

$$v_t = \omega A$$
$$= 2\pi f A$$
$$= 2\pi \cdot \frac{v}{\lambda} \cdot A$$
$$= \frac{2\pi A}{\lambda} \cdot \sqrt{\frac{F}{M}}$$
$$= \frac{2\pi A}{2l} \cdot \sqrt{\frac{Fl}{m}}$$
$$A = \frac{v_t}{\pi} \cdot \sqrt{\frac{ml}{F}}$$
$$\boxed{A = 0.0128 \text{ m}}$$

b.

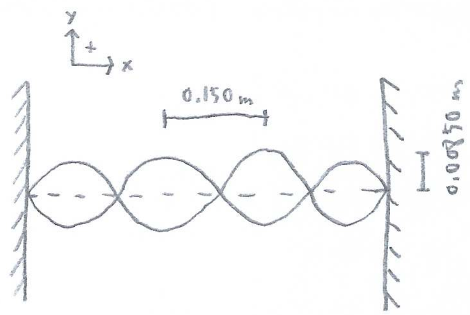
$$a_{t,max} = \omega^2 A$$
$$= \left(\pi \cdot \sqrt{\frac{F}{ml}}\right)^2 A$$
$$= \frac{\pi^2 F A}{m l}$$
$$\boxed{a_{t,max} = 6320 \text{ m/s}^2}$$

5.

$\lambda = 0.300$ m

$A = 0.00850$ m

$T = 0.0750$ s



a. $\boxed{0.150 \text{ m}}$

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

$\boxed{A = 0.00425 \text{ m}}$

$v = \lambda f$

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

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

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

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

$V_{t,min} = 0$ m/s	$V_{t,max} = 0.712$ m/s

d. $\boxed{0.0750 \text{ m}}$

7.

$y(0,0) = 0.010\ m$
$v_t(0,0) = -0.020\ m/s$
$a_t(0,0) = -0.040\ m/s^2$

a.

$a_t = -w^2 y$

$= -4\pi^2 f^2 y$

$f = \sqrt{\dfrac{-a_t}{4\pi^2 y}}$

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

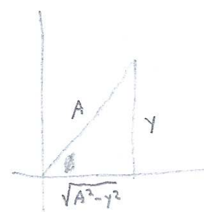
b.

$y(0,0) = A \sin(k(0) - w(0) + \phi) = A \sin\phi$

$v_t(0,0) = A w \cos(k(0) - w(0) + \phi) = -A w \cos\phi$

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

$\dfrac{v_t}{-Aw} = \cos\phi = \dfrac{\sqrt{A^2 - y^2}}{A}$



$\dfrac{v_t^2}{w^2} = A^2 - y^2$

$A = \sqrt{\dfrac{v_t^2}{w^2} + y^2}$

$= \sqrt{\dfrac{v_t^2}{4\pi^2 f^2} + y^2}$

$\boxed{A = 0.014\ m}$

8.

a.

$$\sum F_y = 0$$

$$F_T - F_g = 0$$

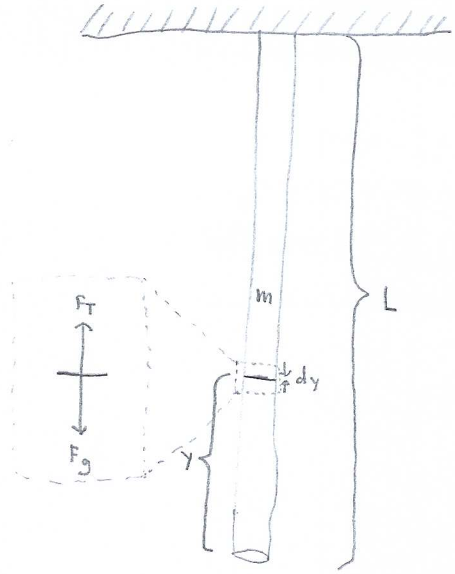
$$F_T = m_y g$$

$$= My g$$

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

$$= \sqrt{\frac{Myg}{M}}$$

$$\boxed{v = \sqrt{gy}}$$



b.

$$V = \frac{dy}{dt}$$

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

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

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

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

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

9.

$$\overline{P}_i \stackrel{?}{=} \overline{P}_t + \overline{P}_r$$

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

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

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

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

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

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

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

$$\stackrel{\checkmark}{=} \sqrt{\mu_1}$$