Name ___WARD___ o

Equations: Newton's 2nd law is $\Sigma F = ma$. The weight equation is $F_g = mg$

If the value in **problems 1-4** is already <u>given</u>, just write and box the final answer (including symbol, equals, number, units). If it <u>needs to be calculated</u>, write the equation, rearrange, substitute, and box the final answer (including symbol, equals, number, units).

1. (5 pts) What is the weight of a 250 000 N rocket? F_g

$$\boxed{F_g = 2.50 \times 10^5 N}$$

2. (5 pts) What is the mass of a 47 000 N bus? F_g

$F_g = mg$ $M = \dfrac{47000N}{9.8\frac{N}{g_2}}$ $\boxed{M = 4.80 \times 10^3 kg}$

$M = \dfrac{F_g}{g}$

3. (5pts) What is the mass of an 11.2 kg bike? m

$$\boxed{M = 11.2 kg}$$

4. (5 pts) What is the weight of a 0.27 kg parrot? M

$F_g = mg$

$= 0.27 kg (9.8 \frac{N}{g_2})$ $\boxed{F_g = 2.65 N}$

5. (10 pts) A force of 1.5 x 10^4 N is applied to a 7.8 x 10^6 N train on level ground. What is the acceleration of the train?

$F = 1.5 \times 10^4 N$ $F_g = mg$ $M = 7.96 \times 10^5 kg$ $\boxed{a = 0.0188 \frac{N}{s_2}}$

$F_g = 7.8 \times 10^6 N$ $M = \dfrac{F_g}{g}$

$a = \underline{\quad} \frac{N}{s_2}$ $F_N \uparrow \xrightarrow{F}$ $= \dfrac{7.8 \times 10^6 N}{9.8 \frac{N}{s_2}}$ $\Sigma \vec{F} = m\vec{a}$

$mg \downarrow$ $a = \dfrac{\Sigma F}{M}$

$= \dfrac{1.5 \times 10^4 N}{7.96 \times 10^5 kg}$
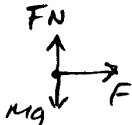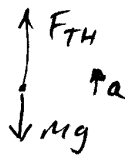
6. (20 pts) A rocket with m = 1500 kg has an engine which is pushing it up with a thrust of 3 x 10^4 N. (a) Draw and label FBD. Show acceleration direction. Use $\Sigma F = ma$. (b) What is the acceleration of the rocket?

$M = 1500 kg$ $\uparrow F_{TH}$ $\Sigma \vec{F} = m\vec{a}$

$F_{TH} = 3 \times 10^4 N$ $\uparrow a$ $F_{TH} - mg = ma$

$a = \underline{\quad} \frac{N}{s_2}$ $\downarrow mg$ $a = \dfrac{F_{TH} - mg}{M}$

$= \dfrac{3 \times 10^4 N - 1500 kg (9.8 \frac{N}{s_2})}{1500 kg}$

$$\boxed{\vec{a} = 10.2 \frac{N}{s_2}, up}$$

7. (25 pts) A mass, m_1 = 6 kg, on a level surface is attached to a mass, m_2 = 4 kg, on an inclined plane that is at an angle of 25°. (a) Draw FBDs and show acceleration direction. (b) Find the acceleration of the masses. (c) Find the tension in the rope.
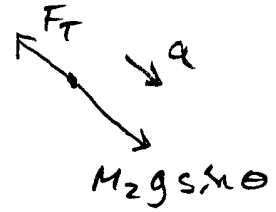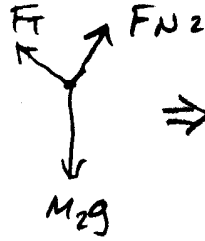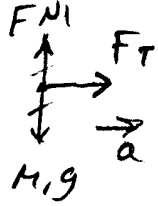
$M_1 = 6 kg$
$M_2 = 4 kg$
$\theta = 25°$

$\sum \vec{F_1} = M \vec{a}$

$F_T = M_1 a$

add

$\sum \vec{F_2} = M_2 \vec{a}$

$-F_T + M_2 g \sin\theta = M_2 a$

$\underline{F_T \qquad\qquad = M_1 a}$

$M_2 g \sin\theta = (M_1 + M_2) a$

$a = \dfrac{M_2 g \sin\theta}{M_1 + M_2}$

$= \dfrac{4 kg (9.8 \frac{M}{5z}) \sin 25°}{6 kg + 4 kg}$

b) $\boxed{\vec{a} = 1.66 \frac{M}{5z}, \text{ downhill}}$

$F_T = M_1 a$

$= 6 kg (1.66 \frac{M}{5z})$

c) $\boxed{F_T = 9.96 N}$

7. (25 pts) A mass, m_1 = 6 kg, on a level surface is attached to a mass, m_2 = 4 kg, on an inclined plane that is at an angle of 25°. (a) Draw FBDs and show acceleration direction. (b) Find the acceleration of the masses. (c) Find the tension in the rope.
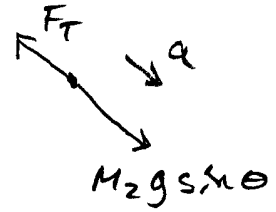
$M_1 = 6 kg$
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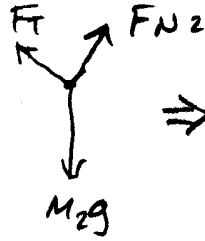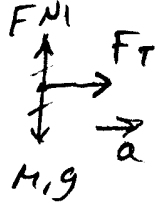$\Theta = 25°$

$$\Sigma \vec{F_1} = M\vec{a}$$
$$F_T = M_1 a$$
add
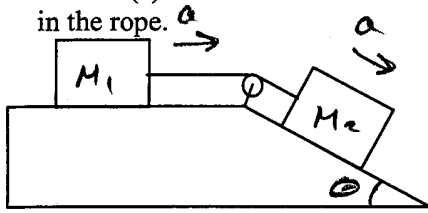
$$\Sigma \vec{F_2} = M_2 \vec{a}$$
$$-F_T + M_2 g \sin\Theta = M_2 a$$
$$\underline{F_T \qquad\qquad = M_1 a}$$
$$M_2 g \sin\Theta = (M_1 + M_2) a$$

$$a = \frac{M_2 g \sin\Theta}{M_1 + M_2}$$

$$= \frac{4kg(9.8 \frac{M}{s^2}) \sin 25°}{6 kg + 4 kg}$$

b) $\boxed{\vec{a} = 1.66 \frac{M}{s^2}, \text{downhill}}$

$$F_T = M_1 a$$
$$= 6 kg (1.66 \frac{M}{s^2})$$

c) $\boxed{F_T = 9.96 N}$

7. (25 pts) A mass, m_1 = 6 kg, on a level surface is attached to a mass, m_2 = 4 kg, on an inclined plane that is at an angle of 25°. (a) Draw FBDs and show acceleration direction. (b) Find the acceleration of the masses. (c) Find the tension in the rope.

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$M_2 = 4 kg$
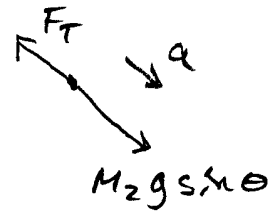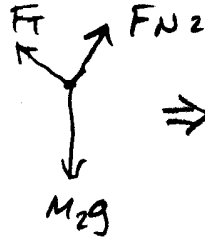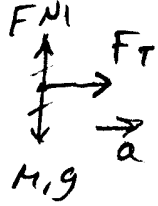$\theta = 25°$

$\Sigma \vec{F}_1 = M \vec{a}$

$F_T = M_1 a$

add

$\Sigma \vec{F}_2 = M_2 \vec{a}$

$-F_T + M_2 g \sin\theta = M_2 a$

$\underline{F_T = M_1 a}$

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