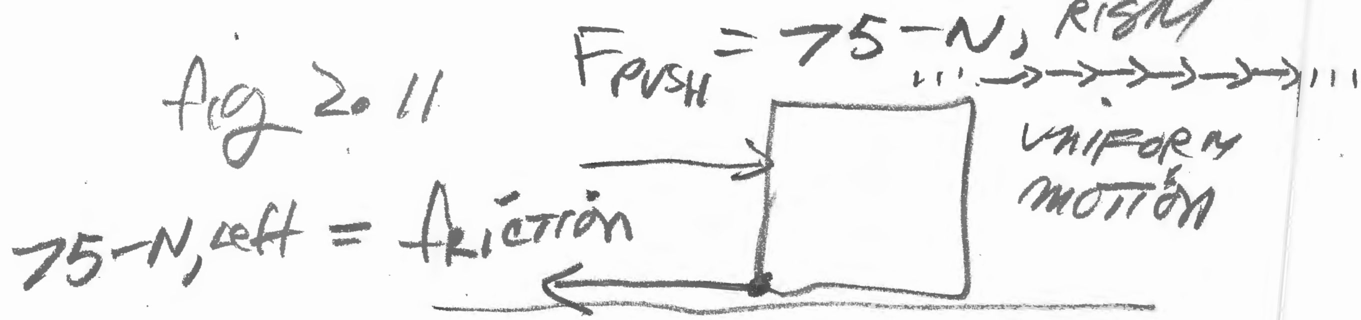
LIST FORCES SO FAR:

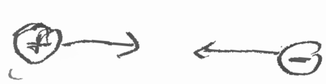
- Tension
- Support force (force of ground) *
- weight
- friction → fig 2.11

fig 2.11



net force = 75 − 75 = 0

- electrical force: unlike charges attract.



* support force ⊥ ground

↑

90° with GROUND

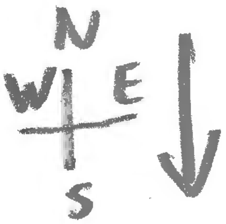
ch 3

Linear motion

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

velocity = speed, direction

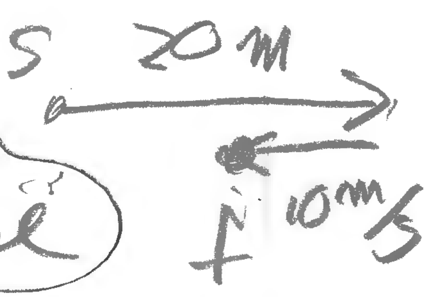
speed = 60 mph ($\frac{\text{miles}}{\text{hour}}$)



velocity = 60 mph, South

$$\text{Average Speed} = \frac{\text{total distance}}{\text{total time}}$$

S = start
f = finish
3 sec. = total time



Average speed

$$= \frac{20m + 10m}{3 sec} = \frac{10m}{s}$$

average velocity

$$\frac{\text{TOTAL displacement}}{\text{TOTAL time}}$$

$$= \frac{10\,m}{3\,sec} = 3.3\,\frac{m}{s}$$

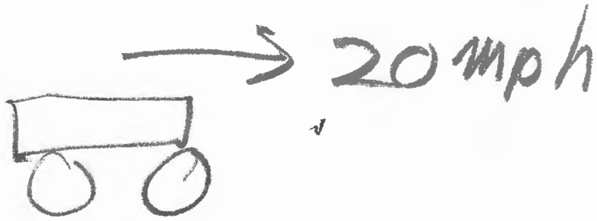
$$= 3.3\,\frac{m}{s},\ \text{RIGHT}$$

---

p 38

Velocity = speed, direction

= 20 mph, right



p38

constant velocity

= same speed, same direction

speed = constant

direction = constant

(uniform motion)

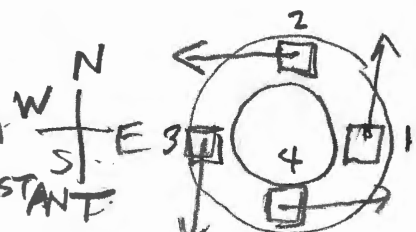
changing velocity (page 38)

(A)

(B)

(C) changing direction

speed = 60 mph = CONSTANT

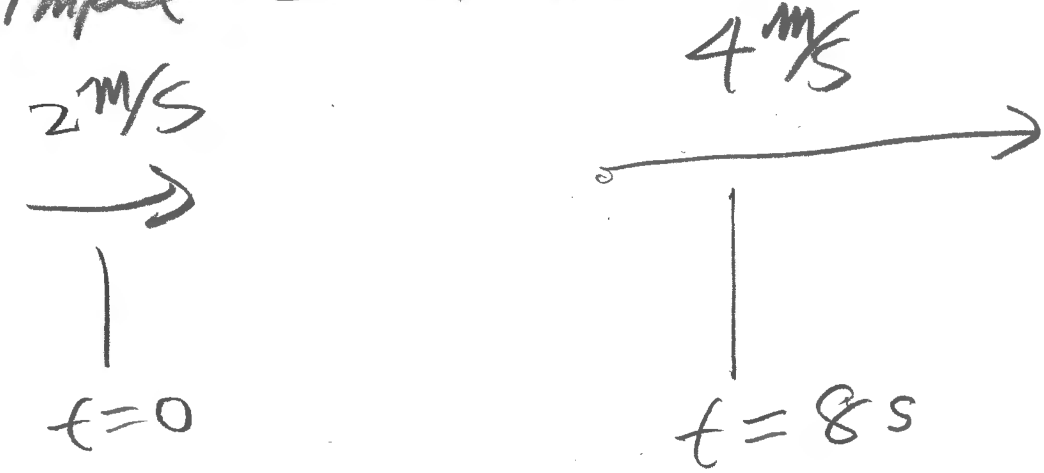


velocity	direction
1	N
2	W
3	S
4	[illegible]

Acceleration =

$$\frac{\text{change in velocity}}{\text{time}}$$

simple example:



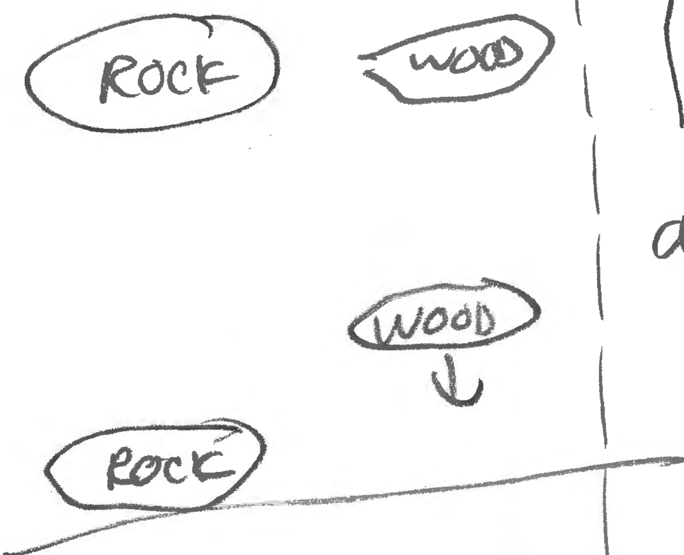
$$\text{acceleration (average)} = \frac{4\frac{m}{s} - 2\frac{m}{s}}{8s - 0} = \frac{2\frac{m}{s}}{8s}$$

$$= \frac{1}{4}\frac{m}{s^2}$$ (right)

p 41

acceleration of gravity:

Aristotle said:



Galileo showed:

$a = -9.8\ \frac{m}{s^2}$

$= 9.8\ \frac{m}{s^2}$, DOWN

ROCK, WOOD HAVE same a.

$$a = \frac{\Delta V}{\Delta t}$$

$$-9.8\frac{m}{s^2} = \frac{\Delta V}{\Delta t} = \frac{\text{change in } V}{\text{time}}$$

$$\Delta V = -9.8\frac{m}{s^2} \cdot \Delta t$$

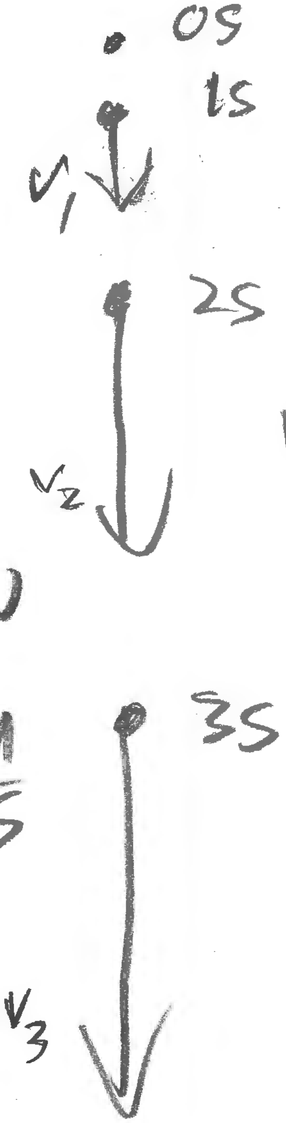
SPECIAL EXAMPLE:
DROP BALL FROM REST:

each second, speed increases $9.8\frac{m}{s}$

	velocity
$t=0$ (REST)	0
V_1 ↓ $t=1s$	$-9.8\frac{m}{s^2}(1s) = -9.8\frac{m}{s}$
V_2 ↓ $t=2s$	$-9.8\frac{m}{s^2}(2s) = -19.6\frac{m}{s}$
V_3 ↓ $t=3s$	$-9.8\frac{m}{s^2}(3s) = -29.4\frac{m}{s}$

speed $= g \cdot t$, $g \approx 10\frac{m}{s^2} \approx 9.8\frac{m}{s}$

Drop from rest:



$v_1 = (10\frac{m}{s^2})\cdot(1s)$, DOWN

$= 10\frac{m}{s}$, DOWN

$v_2 = (10\frac{m}{s^2})\cdot(2s)$, DOWN

$= 20\frac{m}{s}$, DOWN

Note:

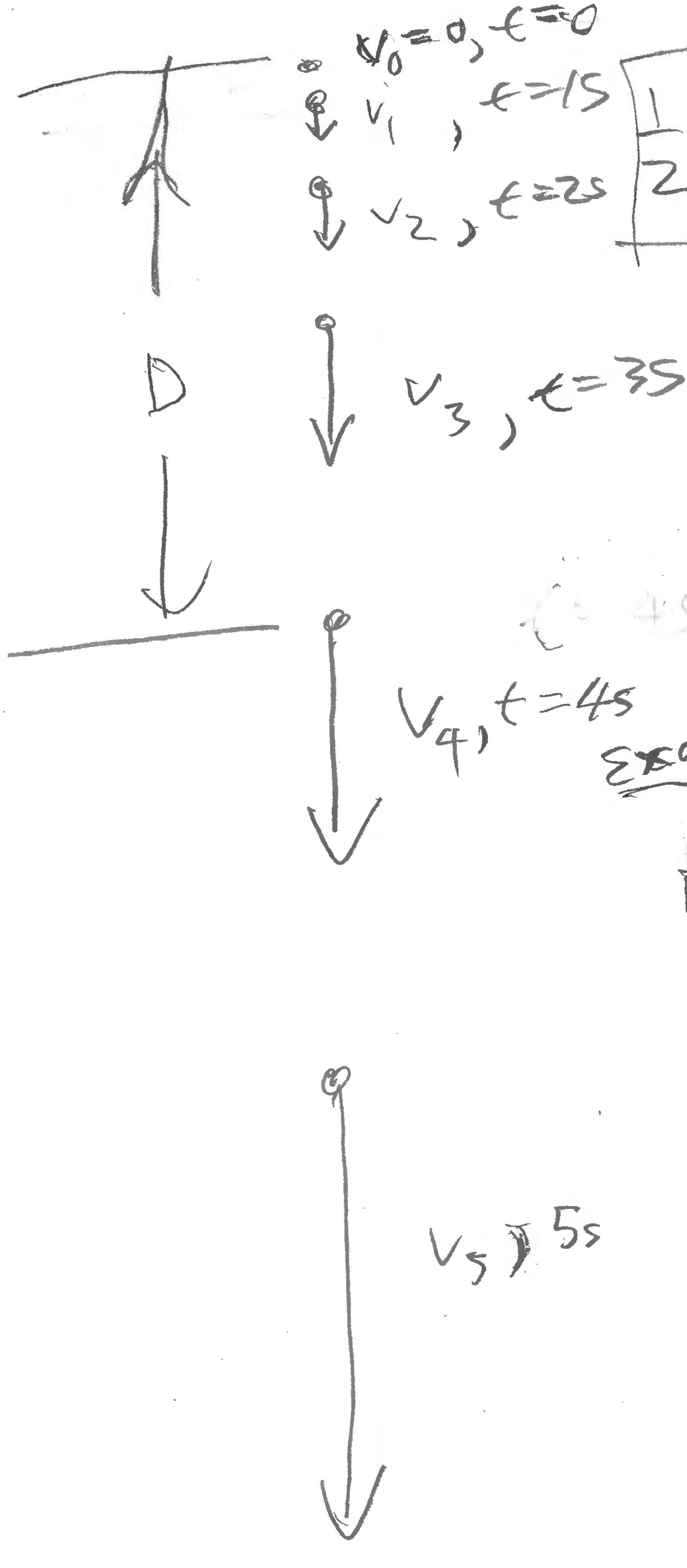
$10\frac{m}{s}$, DOWN

$= -10\frac{m}{s}$

$v_3 = (10\frac{m}{s^2})\cdot(3s)$, DOWN

$= 30\frac{m}{s}$, DOWN

Drop an object



$$\frac{1}{2} g t^2 = D$$

= DISTANCE

Example: D at 4 seconds:

$$D = \frac{1}{2}\left(10\frac{m}{s^2}\right)(4s)^2$$

$$= \frac{1}{2} 10\frac{m}{s^2} \cdot 16 s^2$$

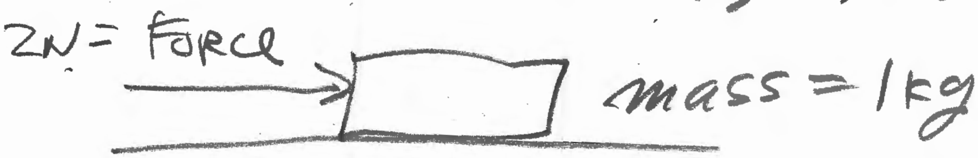
$$= 5\frac{m}{s^2} \cdot 16 s^2$$

$$= 80\ m$$

CH 4

Force causes $\frac{\Delta v}{\Delta t}$ = acceleration

$a = 2\ m/s^2$, right



Box picks up $2\ m/s$ of speed every second.

Force = (mass)·(acceleration)

$= (1kg)(2\frac{m}{s^2})$

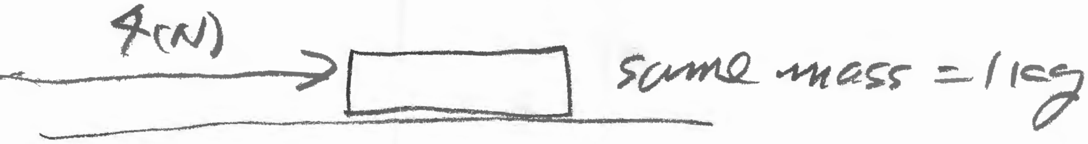
$= 2\ \frac{kg\,m}{s^2}$

$= 2\ (N)$, right

$a = \frac{Force}{mass}$

$= \frac{2N}{1kg} = 2\frac{m}{s^2}$

$4\ m/s^2 = a$



CH 4

FORCE = mass · acceleration

MORE on FORCES:

pages 52-3:

friction

fig 4.4

at rest:

$5(N) = F_{PUSH}$

$f_s = 5(N)$, left

(static friction force)

net force = 0

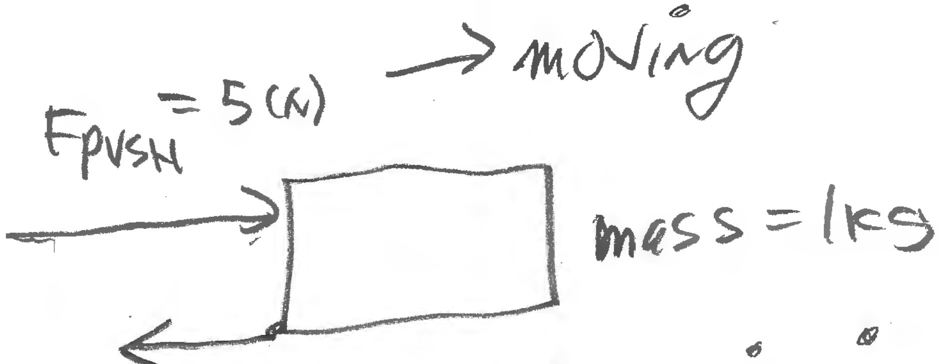
$= 5(N) - 5(N)$

$$a = \frac{FORCE}{mass} = \frac{0}{mass} = 0$$

fig 4.4

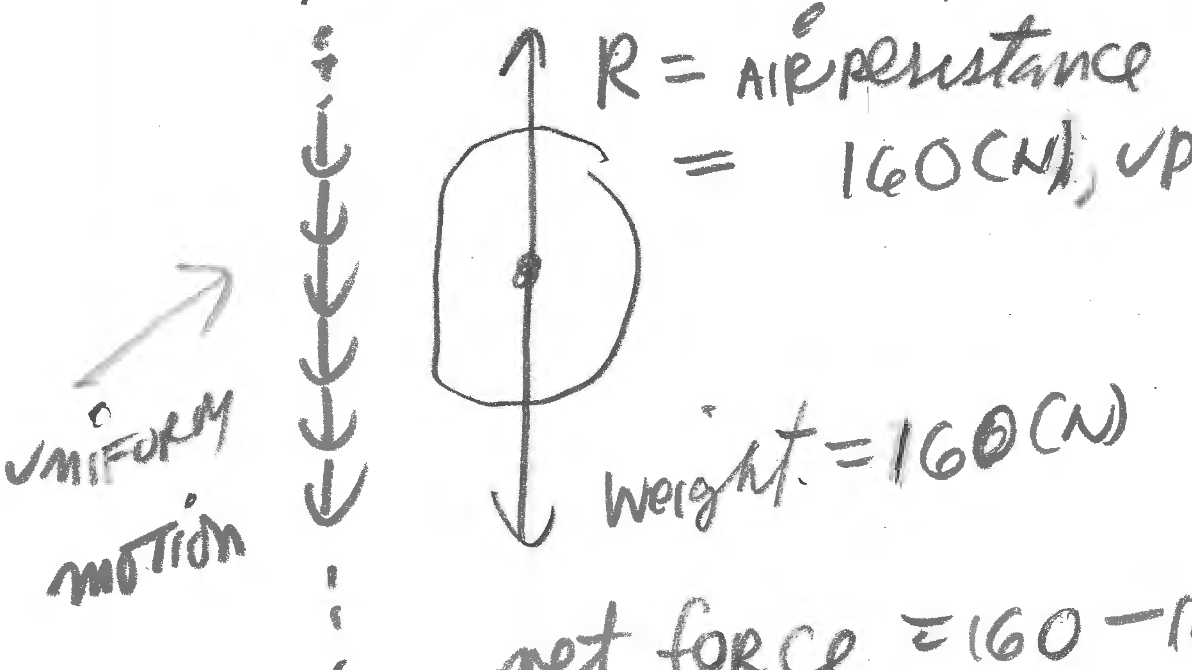
$$a = \frac{5(N) - 2(N)}{1kg} = 3\frac{m}{s^2}$$

p 53



$f_k = 2(N)$, left = kinetic friction

AIR resistance page 53



net force = 160 − 160 = 0

acceleration = 0

p54 mass = inertia

$$a = \frac{\text{Force}}{\text{mass}}$$

Large mass, small a.
small " , large a.

weight = Force of gravity
all objects, same a.

2kg

weight = Force
= mass·acceleration

weight
= (2kg)(9.8 m/s²) DOWN
= 19.6 (N), DOWN

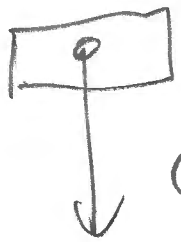
a = 9.8 m/s², DOWN

weight ≠ mass

Fig 4.12

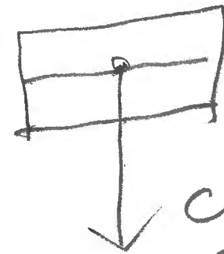
$g = 9.8 \frac{m}{s^2}$

1 BRICK



$g = \frac{F}{[\text{illegible}]}$

2 BRICKS



g (SAME)

$g = \frac{2F}{2m}$

$= \frac{F}{m}$

$= g$ (SAME)

F = weight of 1 brick

$g = \frac{2F}{2m} = \frac{\text{MORE weight}}{\text{MORE mass}}$

= same g

non-free fall : page 59

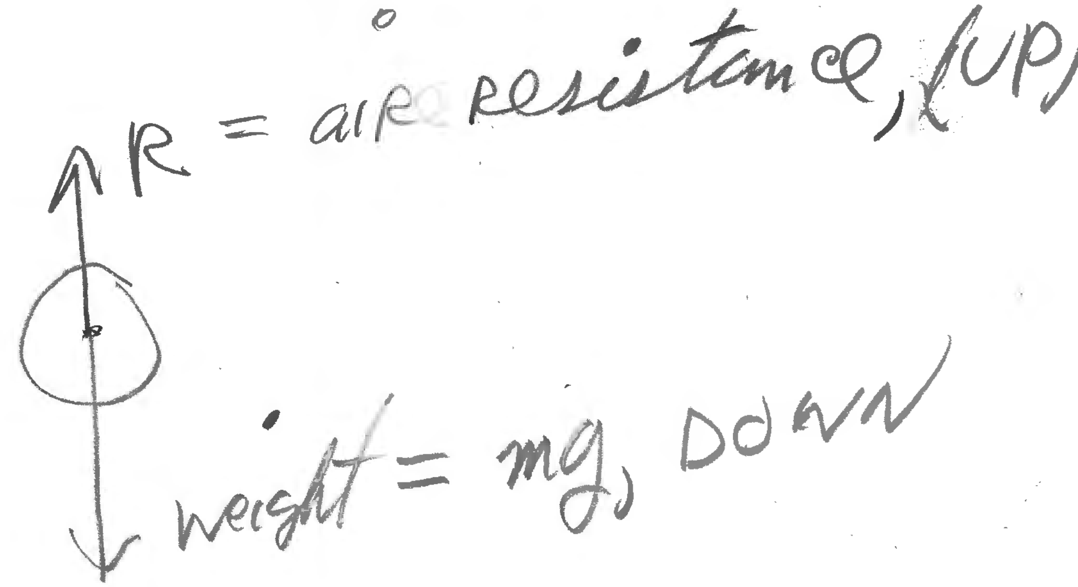
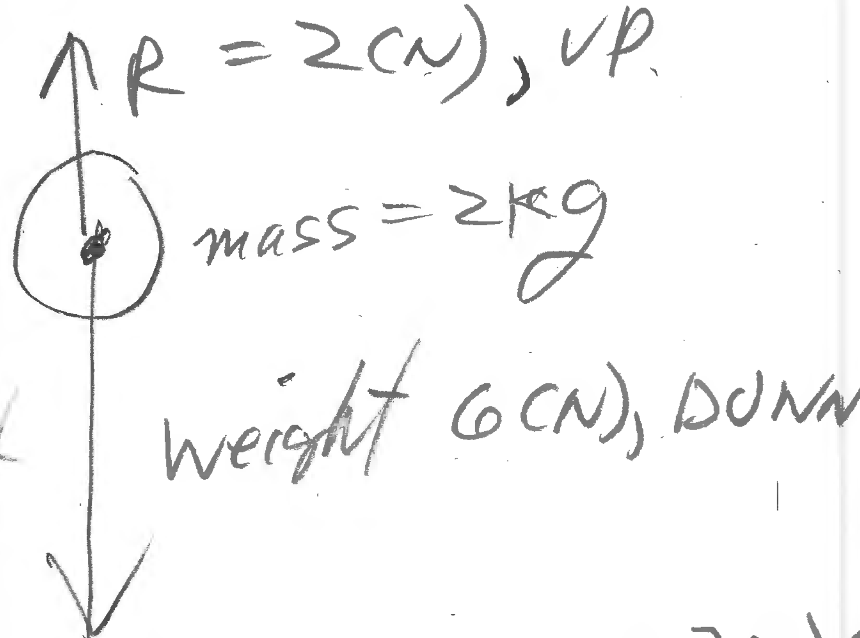


fig 4.14



ma < weight

$$a = \frac{\text{net force}}{\text{mass}} = \frac{6(N) - 2(N)\ (\text{DOWN})}{2kg}$$

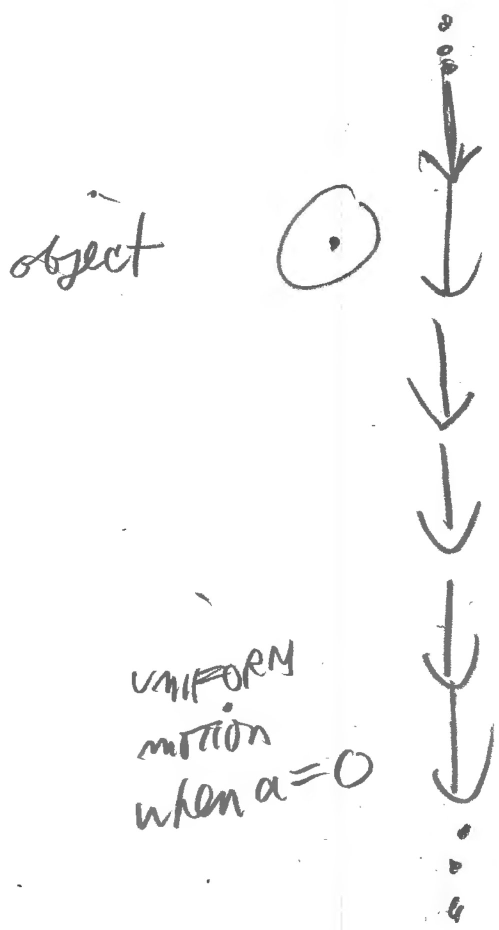
$$= 2\ \frac{m}{s^2},\ \text{DOWN}$$

NOTE: $|a| < 9.8 \frac{m}{s^2}$

Terminal velocity is when $a=0$,

or $R = mg$

$$a = \frac{mg - R}{m} = 0$$



$V_{terminal}$ is usually <u>larger</u> for <u>larger</u> masses.