iFLY
INDOOR SKYDIVING

The Science and Engineering of iFLY


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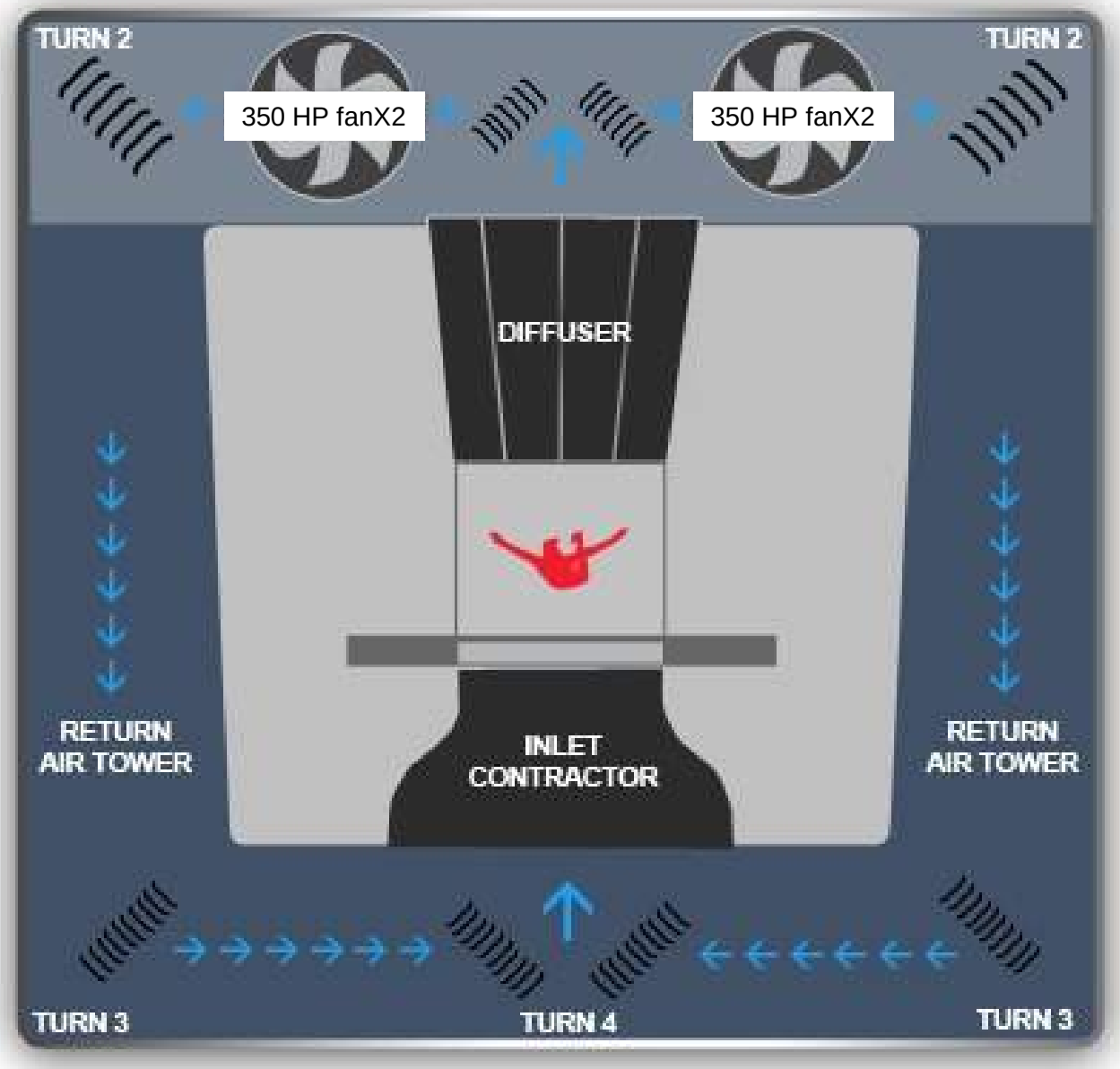
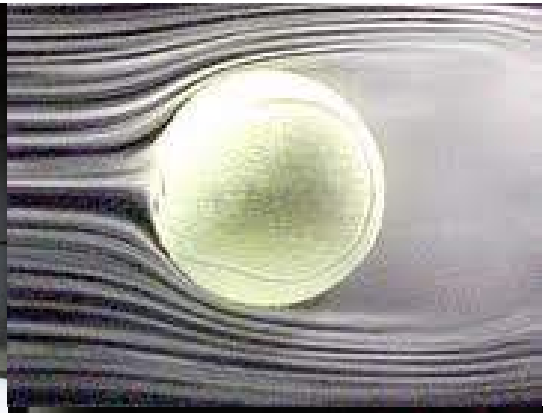
This is a Closed Loop Vertical Wind Tunnel.

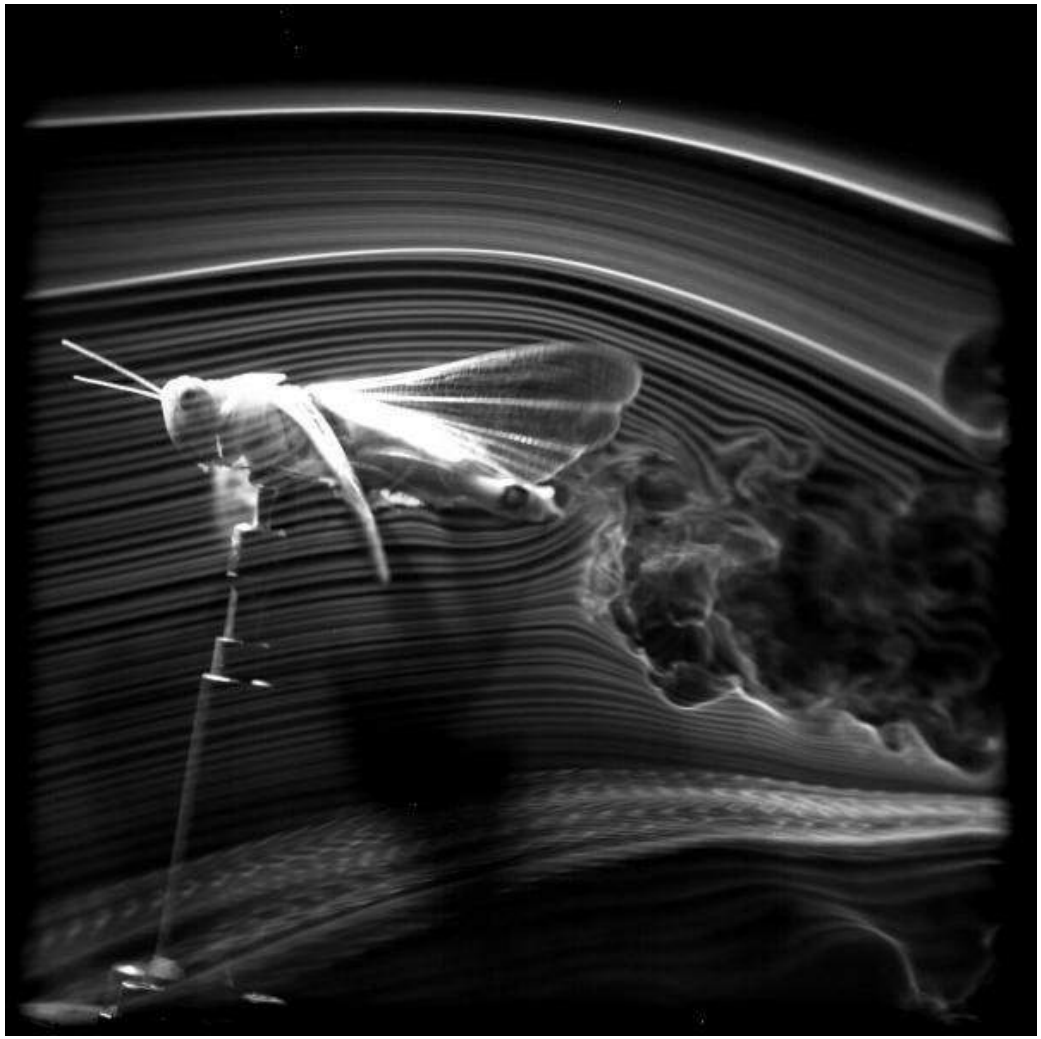


Wind tunnel testing



Wind tunnel testing

Air
is a
fluid.

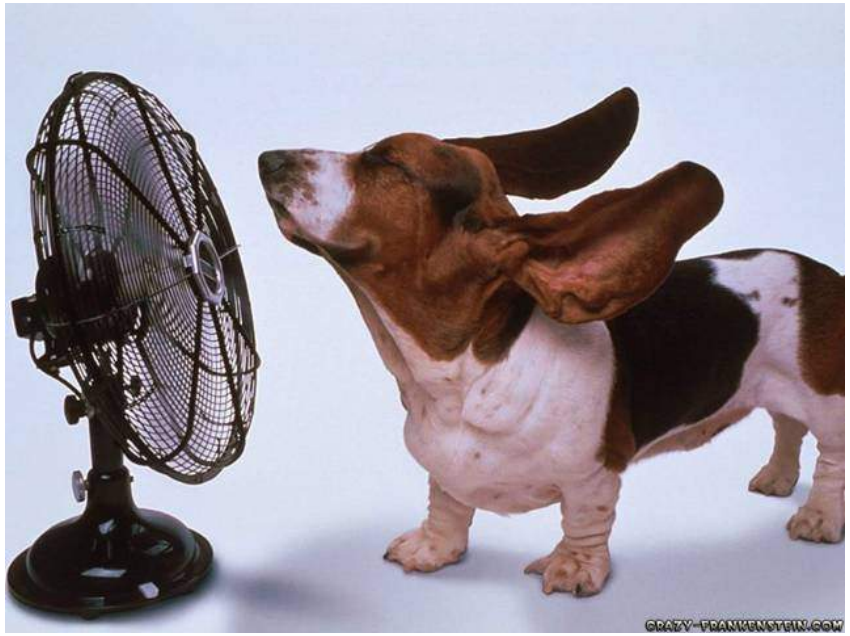


Fluids vs. Solids

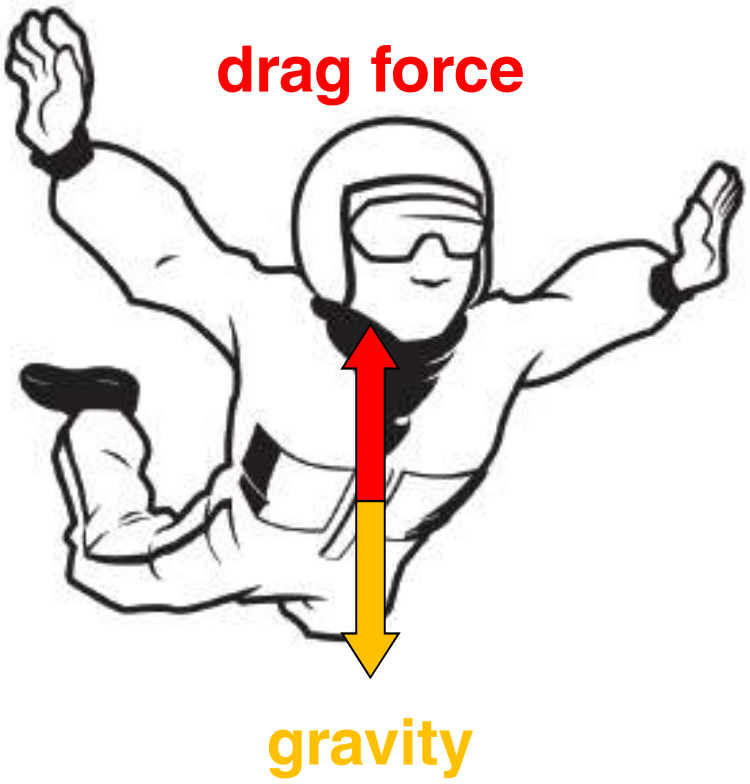
Fluids exert **pressure forces**

Static air pressure

Dynamic air pressure



What forces are acting upon a sky diver in the tunnel?

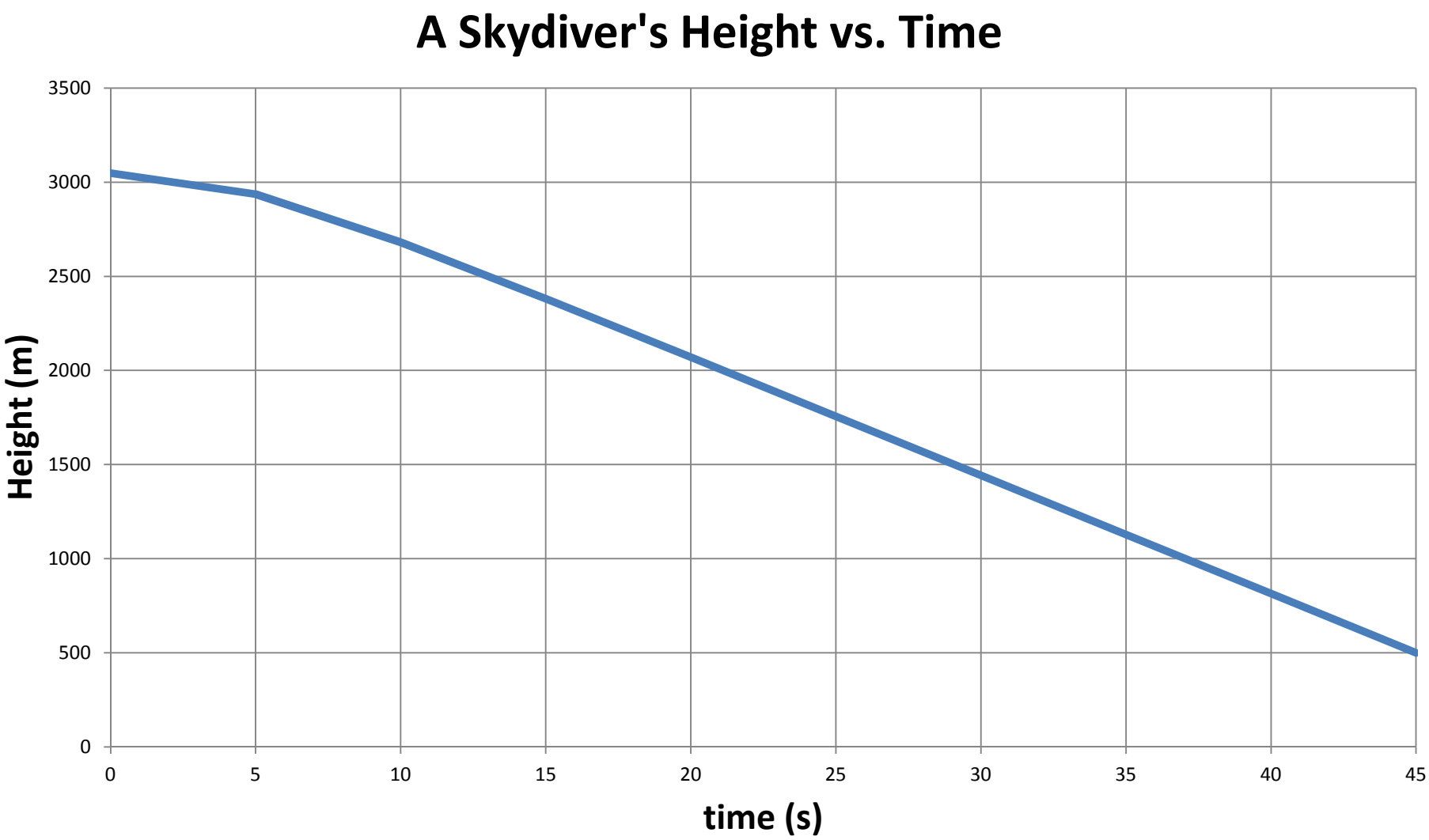


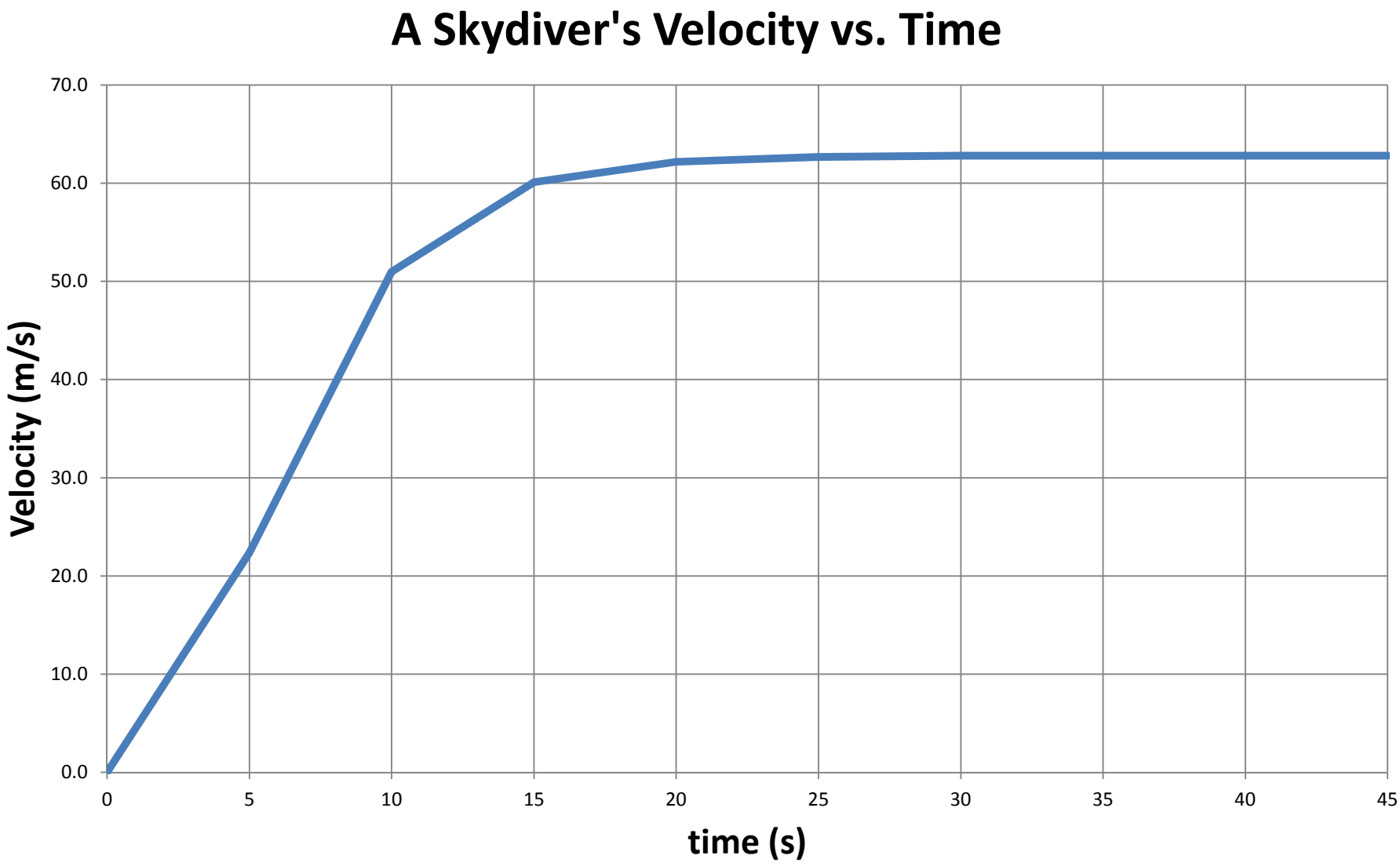
drag force

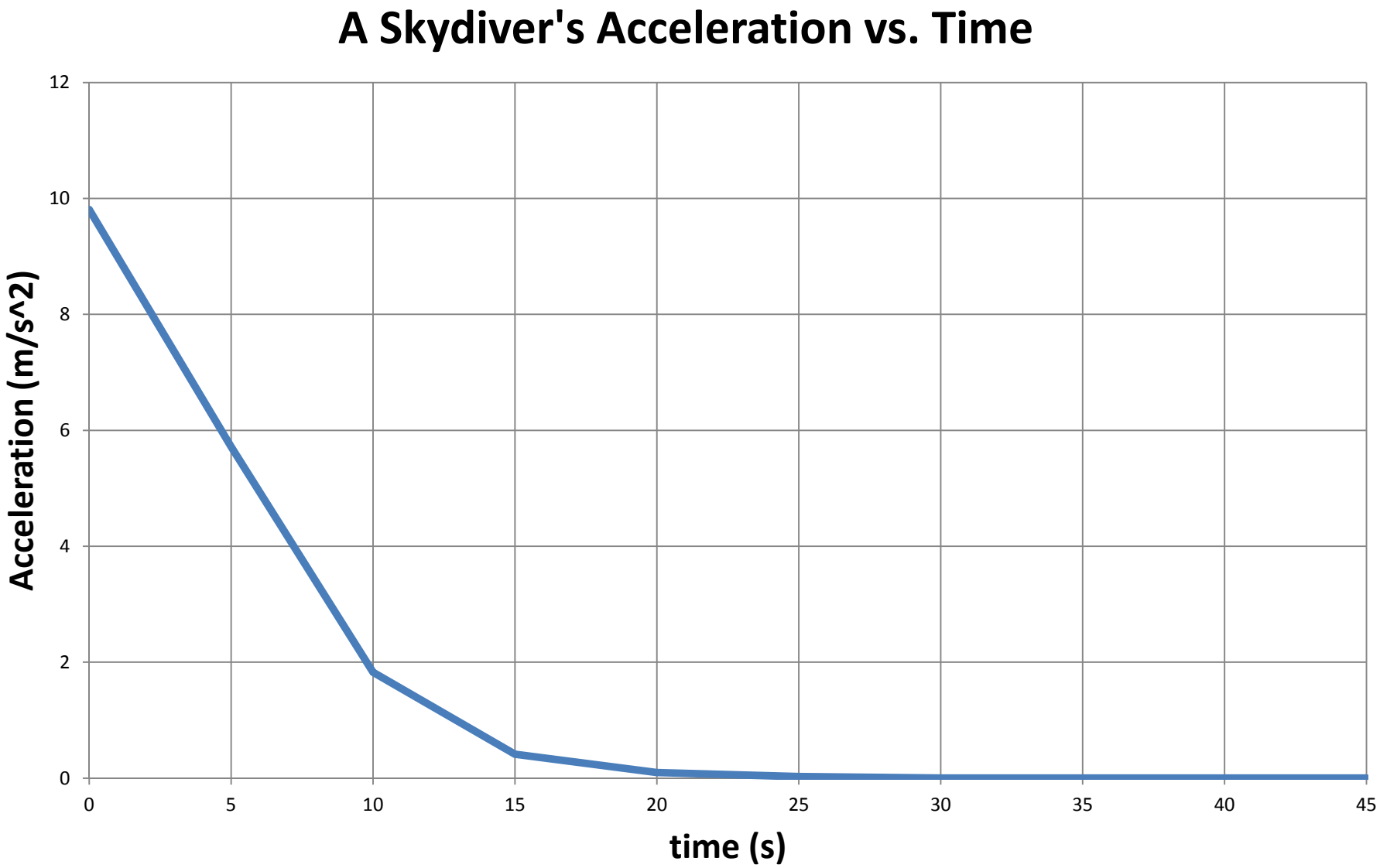
gravity

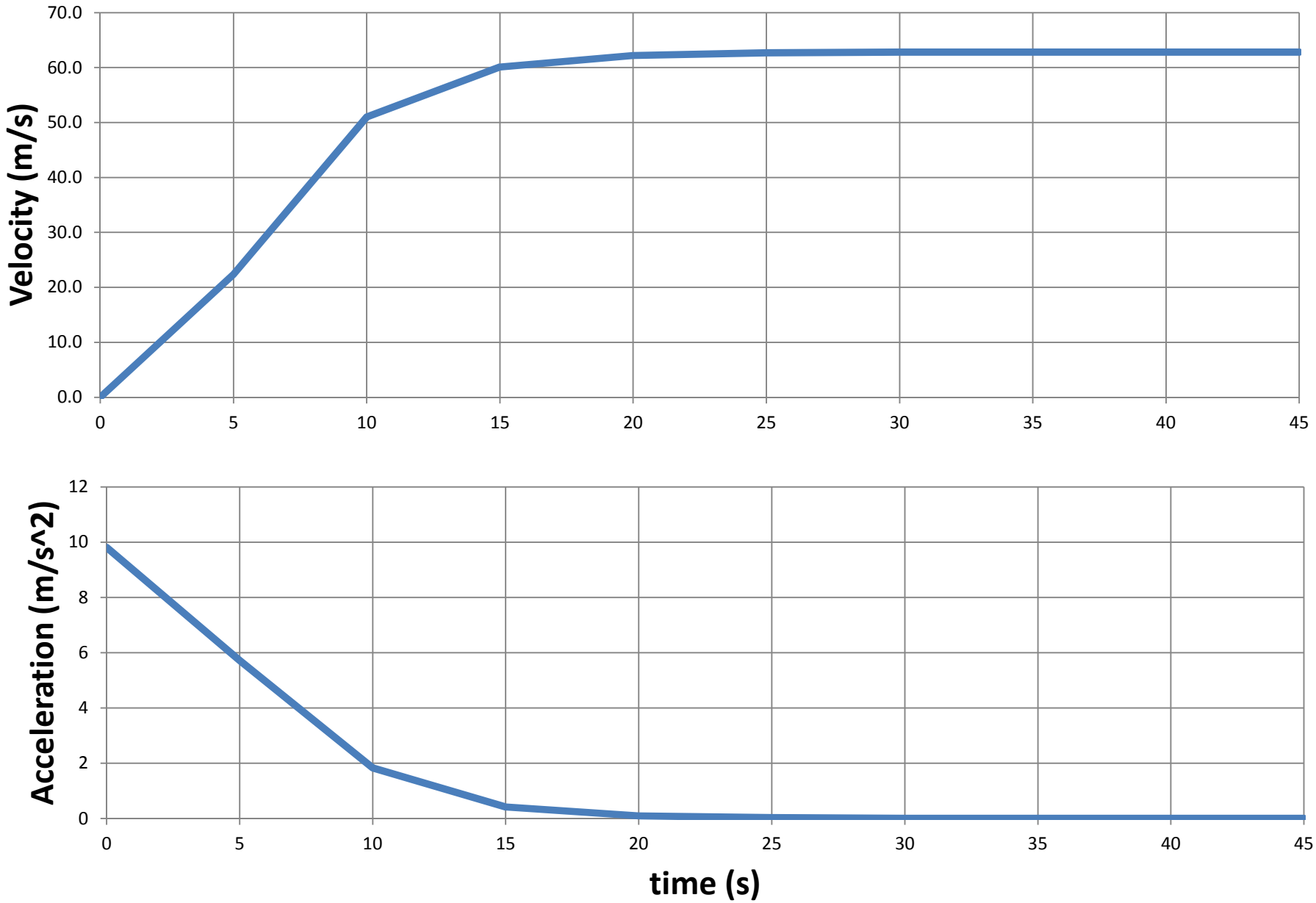
drag force

gravity


A Skydiver's Height vs. Time
Height (m)
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
45
time (s)


A Skydiver's Velocity vs. Time
Velocity (m/s)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
5
10
15
20
25
30
35
40
45
time (s)


A Skydiver's Acceleration vs. Time
Acceleration (m/s^2)
12
10
8
6
4
2
0
0
5
10
15
20
25
30
35
40
45
time (s)


Velocity (m/s)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
5
10
15
20
25
30
35
40
45
Acceleration (m/s^2)
12
10
8
6
4
2
0
0
5
10
15
20
25
30
35
40
45
time (s)

drag force

gravity

drag force

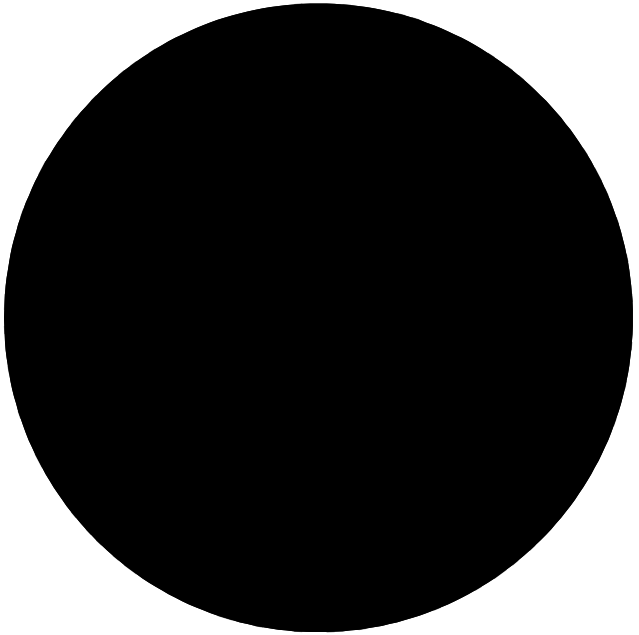
gravity

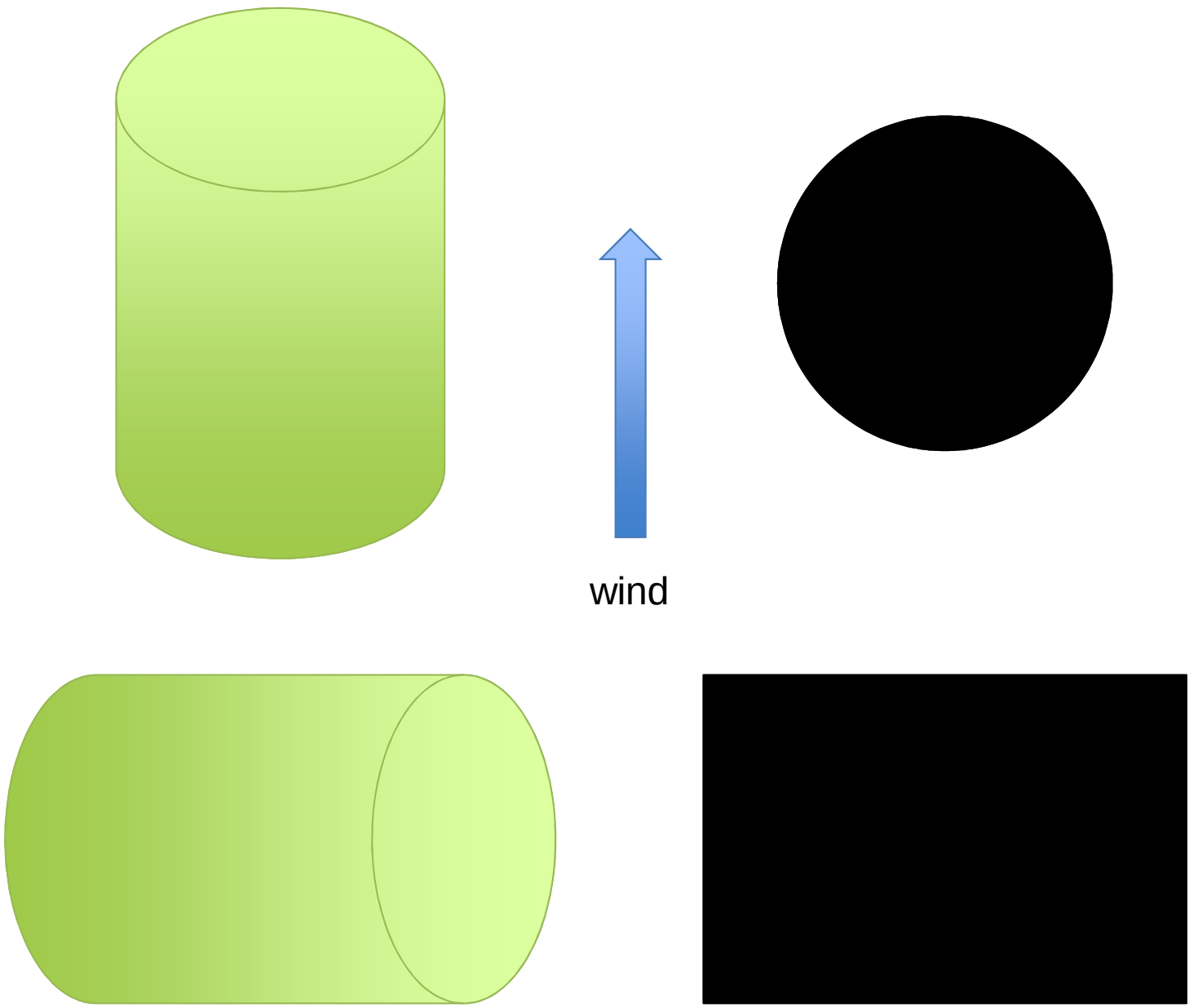
$$F_W - F_D = ma$$

At terminal velocity: $F_W - F_D = 0$

$$F_W = F_D$$


A larger
frontal area
decreases
your **velocity**.




wind

How fast
does the air have
to move
to support
your weight ?

Engineers and scientists use mathematics to ***quantify*** physical principles
…because…
we want to be able to ***predict*** what's going to happen.

What factors contribute to your terminal velocity?

- Mass
- Gravity
- Surface Area
- Drag
- Air Density

Mass

$$v = \frac{m}{\qquad\qquad\qquad\qquad}$$

Gravity

$$v = \frac{mg}{}$$

Frontal Area

$$v = \frac{mg}{A_f}$$

Drag

$$v = \frac{mg}{A_f C_D}$$

Air Density

$$v = \frac{mg}{A_f C_D \rho}$$

The experiment plan: predict your terminal velocity

$$v = \sqrt{\frac{mg}{A_f C_D \rho}}$$

Experimental Activity

- Measure yourself to find your frontal area.
- Go flying!
- During your flight, we'll record your terminal velocity
- After your flight, use your measurements to predict what your terminal velocity *should* be.
- Compare your *predicted* velocity with your *actual* velocity. How close did you get?