

3.3 Freely Falling Objects

STANDARDS

3.1 I can interpret and analyze the motion of an object in free fall.



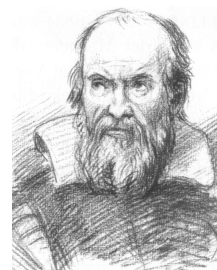
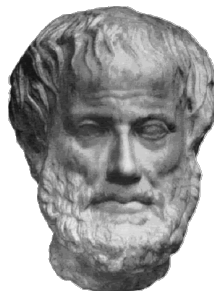
MECHANICS

- $v_x = v_{x0} + a_x t$
- $x = x_0 + v_{x0} t + \frac{1}{2} a_x t^2$
- $v_x^2 = v_{x0}^2 + 2 a_x (x - x_0)$
- $\bar{a} =$
- $|\vec{F}_j| \leq$
- $a_c =$
- $\vec{p} =$
- $\Delta \vec{p} =$
- $K =$
- $\Delta E =$
- $a =$ acceleration
- $A =$
- $d =$
- $E =$
- $f =$
- $F =$
- $l =$
- $K =$
- $k =$
- $L =$
- $\ell =$
- $m =$
- $P =$
- $p =$
- $r =$
- $T =$
- $t =$ time
- $U =$
- $V =$
- $v =$ speed/velocity
- $W =$
- $x =$ position

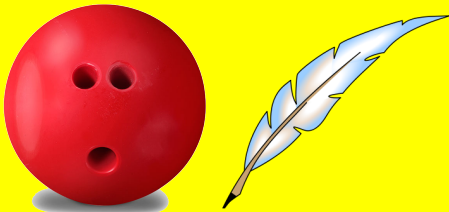
Free Fall is the motion of an object falling freely under the influence of gravity.



Aristotle vs. Galileo



Bowling Ball vs. Feather



18 ☹️

Same

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What up "g"?

g → is the acceleration due to gravity

g = 9.80 m/s²

Is "g" a constant value everywhere on Earth?



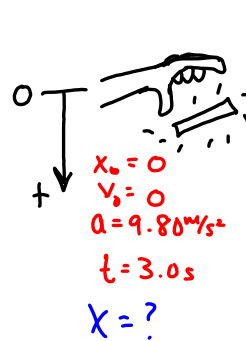
TABLE 2-5 Values of g at Different Locations on Earth (m/s^2)

Location	Latitude	g
North Pole	90° N	9.832
Oslo, Norway	60° N	9.819
Hong Kong	30° N	9.793
Quito, Ecuador	0°	9.780

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JOURNEY TO THE CENTER OF THE EARTH

1 2



$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

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

$$x = 44 \text{ m}$$

$$1 \text{ m} = 3.281 \text{ ft}$$

$$44 \text{ m} \times \frac{3.281 \text{ ft}}{1 \text{ m}} = 150 \text{ ft}$$

Equations

Equation
$v = v_i + g t$
$x = x_i + v_i t + \frac{1}{2} g t^2$
$v^2 = v_i^2 + 2 g \Delta x$





855 ft

How long will it take to get to the ground and how fast will you be moving?

$X_0 = 0$
 $V_0 = 0$
 $a = 9.80 \text{ m/s}^2$
 $X_f = 855 \text{ ft} = 261 \text{ m}$

$t = ?$
 $V_f = ?$

$X = X_0 + V_0 t + \frac{1}{2} a t^2$
 $2X = \frac{1}{2} g t^2 \cdot 2$
 $\sqrt{\frac{2x}{g}} = t = 7.30 \text{ s}$

~~$V = V_0 + at$~~
 $V^2 = V_0^2 + 2ax$
 $V = \sqrt{2gx_f}$
 $V = 71.5 \text{ m/s}$

PRACTICE

Unit 3 Practice Problems (10-13)

1.4 m

+ ↑

0

$$X = X_0 + V_0 t + \frac{1}{2} a t^2$$

$$0 = (1.4 \text{ m}) + \frac{1}{2} (-1.67 \text{ m/s}^2) t^2$$

$$\frac{-1.4}{\frac{1}{2}(-1.67)}$$