FREE FALL NOTES

Free Fall: when object is not touching any other objects.

An object is in free fall when the only force acting on it is the force of gravity.

There is NO air resistance.

g = acceleration due to gravity

On Earth $g = 9.8\ m/s^2$

OR $g = 10\ m/s^2$

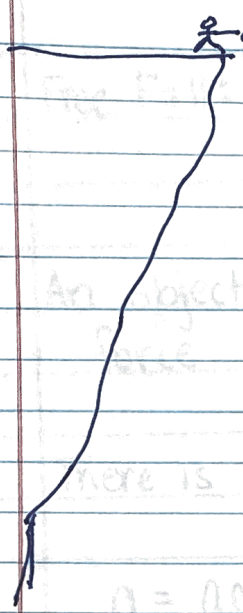
Free Fall Equations

$d = \frac{1}{2}gt^2$ or $d = v_i t + \frac{1}{2}gt^2$ or $t = \sqrt{\frac{2d}{g}}$

$v_f = v_i + gt$

$v_f^2 = v_i^2 + 2gd$ or $d = \frac{(v_f^2 - v_i^2)}{2g}$

Free Fall Notes



t	v	a
1s	10 m/s	10 m/s²
2s	20 m/s	10 m/s²
3s	30 m/s	10 m/s²
4s	40 m/s	10 m/s²
5s	50 m/s	10 m/s²

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Free Fall Notes

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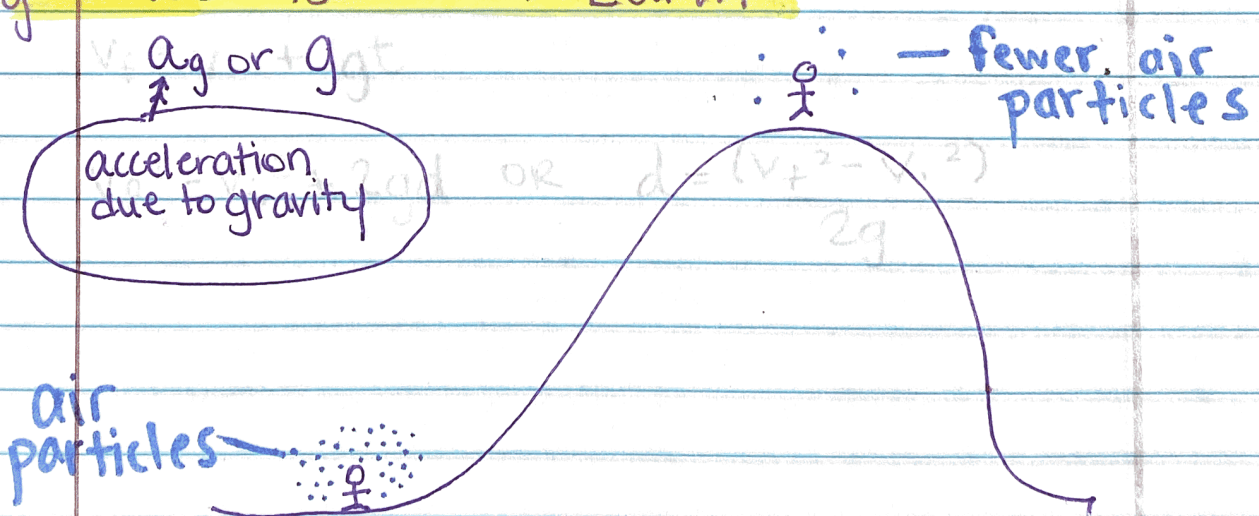
Free Fall Acceleration

$g = -9.81\ m/s^2$ – on Earth

a_g or g

acceleration due to gravity



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Mass vs **Weight**

how much matter have

mass x acceleration of gravity

$mg = m \times 9.81\ m/s^2$

mass = $110\ lbs \times \frac{1\ kg}{2.21\ lbs}$

mass = $50.4\ kg$

weight = mg

$= 50.4\ (9.81)$

$= 494.4\ N$

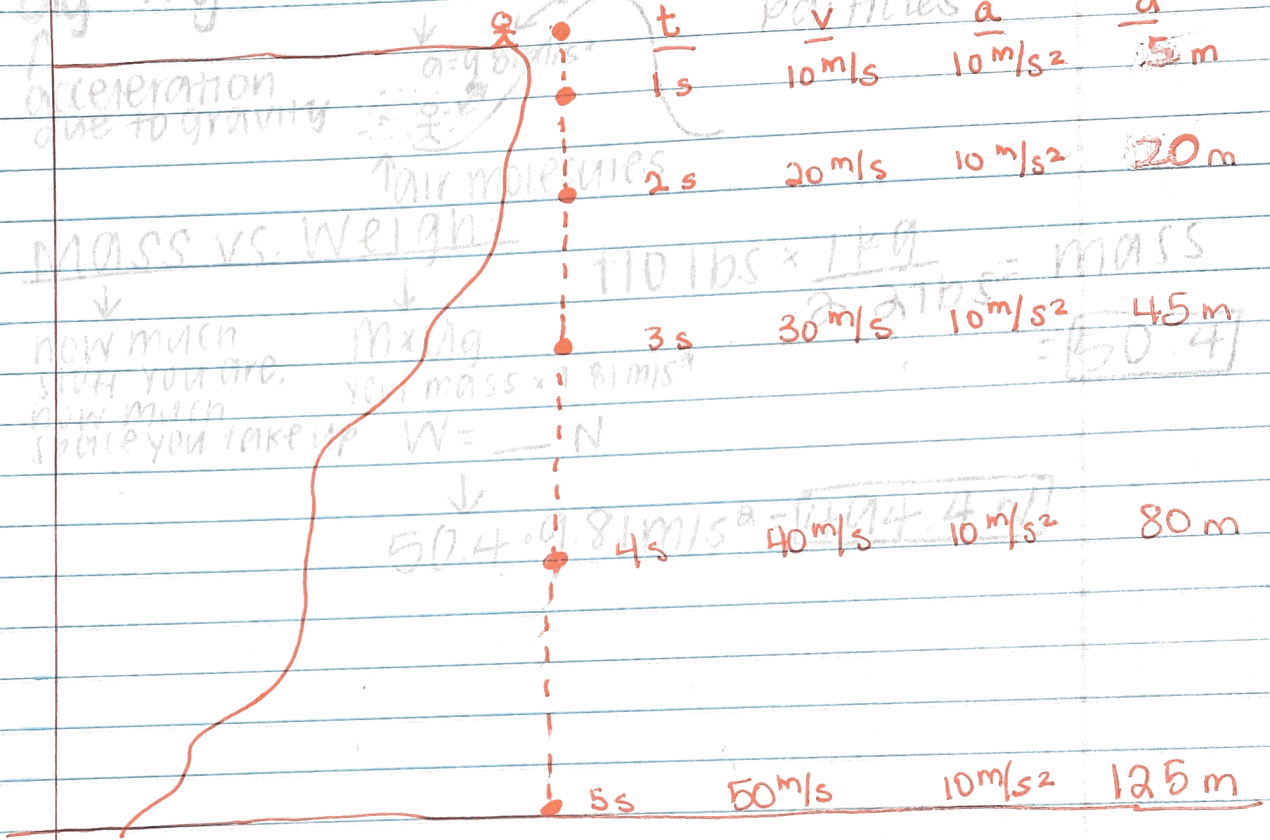
Free Fall Equations

$d = \frac{1}{2}gt^2$ OR $d = v_i t + \frac{1}{2}gt^2$ or $t = \sqrt{\left(\frac{2d}{g}\right)}$

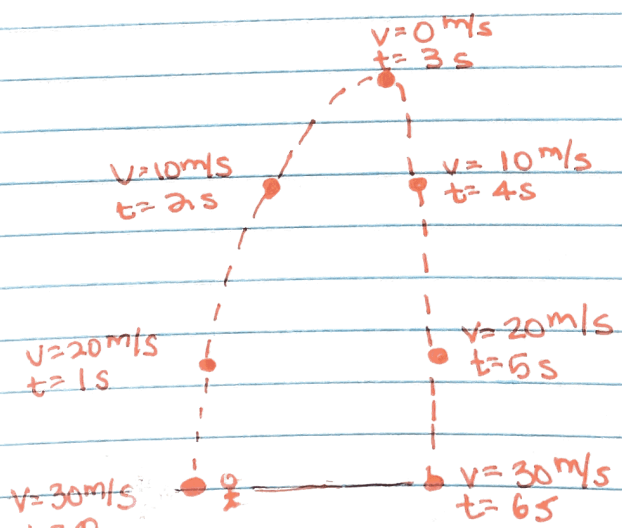
$v_f = v_i + gt$

$v_f^2 = v_i^2 + 2gd$ OR $d = \frac{(v_f^2 - v_i^2)}{2g}$

Free Fall Notes



t	v	a	d
1 s	10 m/s	10 m/s²	5 m
2 s	20 m/s	10 m/s²	20 m
3 s	30 m/s	10 m/s²	45 m
4 s	40 m/s	10 m/s²	80 m
5 s	50 m/s	10 m/s²	125 m



When object launched upward at a velocity, when it returns will be at same velocity.

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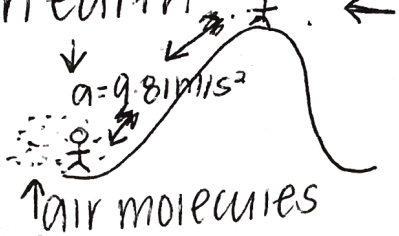
free fall acceleration

"acceleration of gravity"

- $9.81\ m/s^2$ > important #
  a_g or g *on earth



← fewer air particles

a_g ↑ acceleration due to gravity

↑ air molecules

mass vs. weight

↓ how much stuff you are, how much space you take up

↓ $m \times a_g$ (your mass × $9.81\ m/s^2$)

$W = \_\_ N$

$110\ lbs \times \frac{1\ kg}{2.2\ lbs} = mass$

$= \boxed{50.4}$

↓

$50.4 \cdot 9.81\ m/s^2 = \boxed{494.4\ N}$

FREE FALL PRACTICE PROBLEMS

1. King Kong carries Fay Wray up the 321-m-tall Empire State Building. At the top of the skyscraper, Fay Wray's shoe falls from her foot. How fast will the shoe be moving when it hits the ground? (HINT: $V_f^2=v_i^2+2gd$)

2. The Steamboat Geyser in Yellowstone National Park, Wyoming, is capable of shooting its hot water up from the ground with a speed of 48.0 m/s. How high can this geyser shoot? [HINT: $d= (v_f^2 - v_i^2) / 2g$]

3. A baby blue jay sits in a tall tree awaiting the arrival of its dinner. As the mother lands on the nest, she drops a worm toward the hungry chick's mouth, but the worm misses and falls from the nest to the ground in 1.5s. How high up is the nest? (HINT: $d= v_it + \frac{1}{2} gt^2$)

4. Billy, a mountain goat, is rock climbing on his favorite slope one sunny spring morning when a rock comes hurtling toward him from a ledge 40.0m above. Billy ducks and avoids injury. How fast is the rock traveling when it passes Billy?

5. Reverend Northwick climbs to the church belfry one morning to determine the height of the church. From an outside balcony he drops a book and observes that it takes 2.00s to strike the ground below. How high is the balcony of the church belfry?

6. How long is Tine, a ballerina, in the air when she leaps straight up with a speed of 1.8 m/s?

7. In order to open the clam it catches, a seagull will drop the clam repeatedly onto a hard surface from high in the air until the shell cracks. If a seagull flies to a height of 25m, how long will the clam take to fall?

8. At an amusement park, a popular ride know as "Free Fall" carries passengers up to a height of 33.5m and drops them to the ground inside a small cage. How fast are the passengers going at the bottom of this exhilarating journey?

9. A unique type of basketball is played on the planet Zarth. During the game, a player flies above the basket and drops the ball in from a height of 10m. If the ball takes 5.0s to fall, find the acceleration due to gravity on Zarth.

10. I drop a penny from the top of the tower at the front of Fort Collins High School and it takes 1.85s to hit the ground. Calculate the velocity in M/s after 1.10 seconds of freefall.

11. If I drop a watermelon from the top of one of the tower dorms as GSU, and it takes 3.34s to hit the ground, calculate how tall the building is in meters.

12. You are walking in Paris alongside the Eiffel Tower and suddenly a croissant smacks you in the head and knocks you to the ground. From your handy dandy tourist guidebook you find that the height of the Eiffel Tower is 300.5m. If you neglect air resistance, calculate how many second the croissant dropped before it tagged you on the head.

13. If you were to throw a large log over the edge of the Grand Canyon and it took 5.65s to hit the ground, calculate the velocity of the log at impact and the distance the log fell.