Themed: 10-01

g, reaction time/anticipation, graphical examples, definitions, NIFTY, <u>important</u> assumptions

What is “g”?

- g is the acceleration of gravity
- The value is -9.8 m/s^2 (you need to memorize this because it comes up SO MANY times!)
- Same symbol for magnitude of acceleration, so need to know context. Example:
    - Use 9.8 for scalar calculations, like energy or speed
    - Use -9.8 for vector calculations, like velocity or force

Reaction time

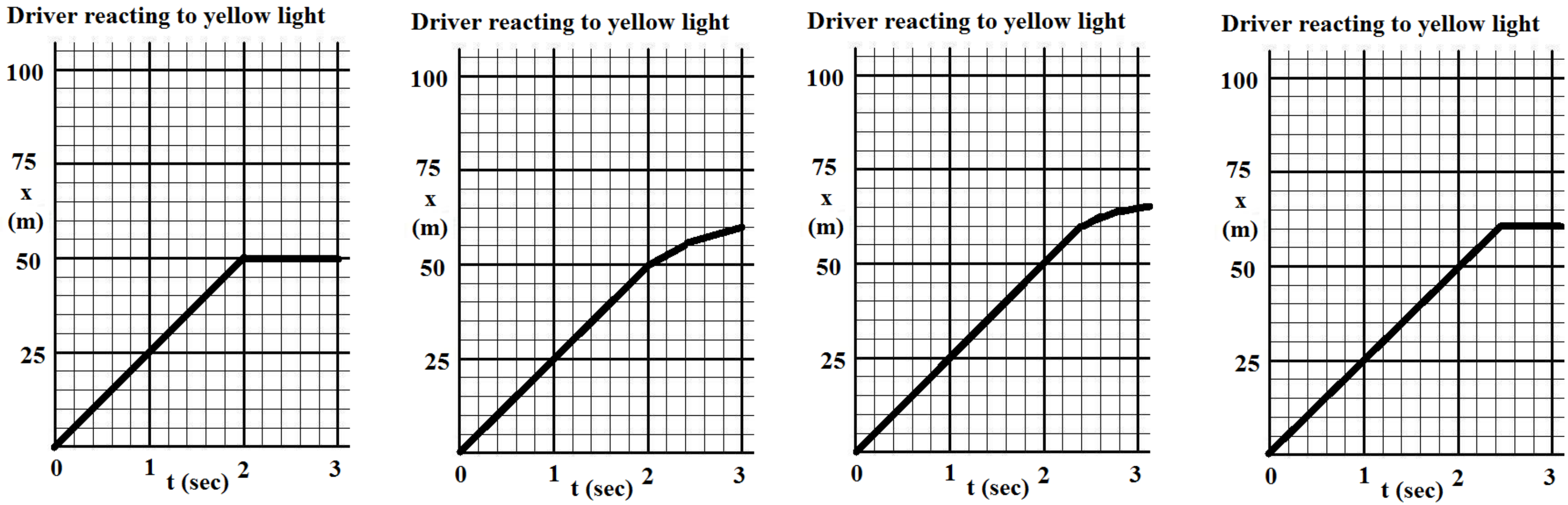
- It takes a minimum 80 ms (milliseconds) for the brain to process something it sees
- It takes another 35 ms for the body to begin moving after the brain processes, a total of 115 ms to press a button after a visual stimulus is given (about 1/10th of a second)
- Don’t need to know these numbers exactly, need to know concepts: real graphs, concepts

Anticipation

- There is no lag time with anticipation
- Example: a count down, 3, 2, 1, 0……
  - You have an expectation of when zero will be said based on a timed pattern – you don't react to hearing "zero", THEN processing the meaning of the sound THEN responding to it
- See the difference between anticipation and reaction time?

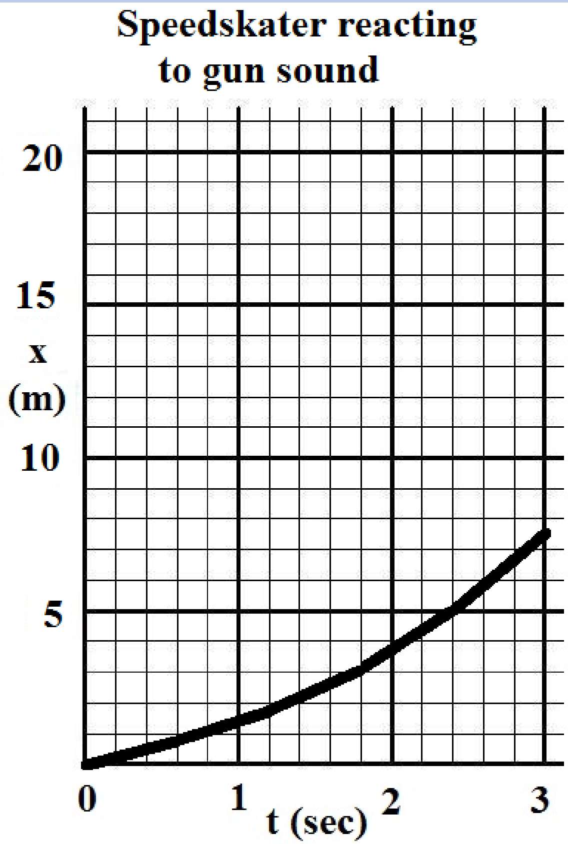
Graphical example

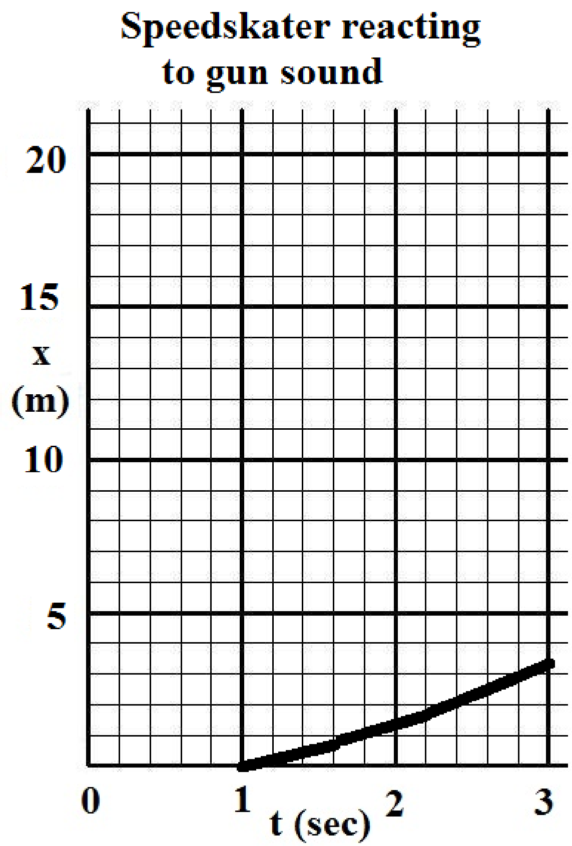
- Suppose you're driving in your car and see a yellow light and decide you must stop. Which plot is consistent with driving for 2.0 seconds, then the green light turns yellow (at 2.0 seconds)? How do you know?
- Do you stop instantly when brakes are applied, or is there a "braking distance"?
- Do any of these resemble a car hitting a brick wall rather than braking?

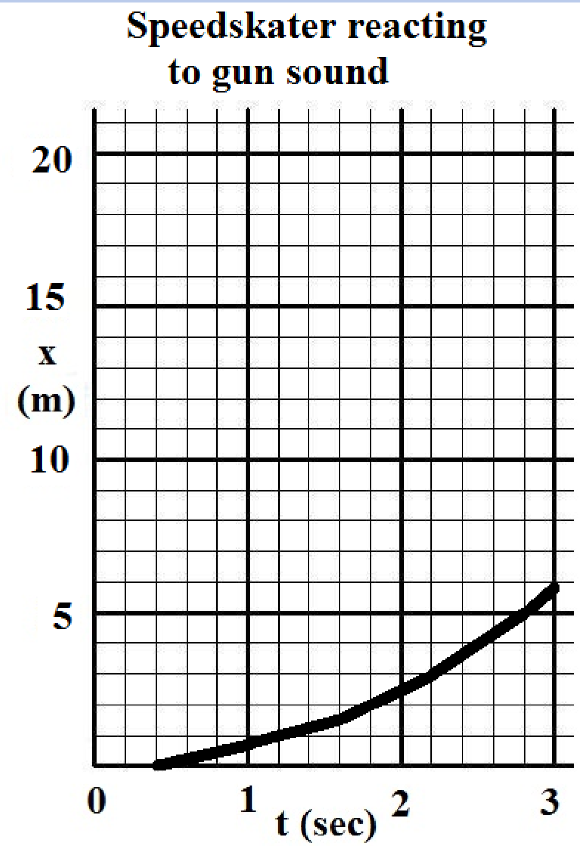


Graphical example

- Did yours look like any of these?
- Which is most realistic? Why?
- Could you do a velocity plot too? An acceleration plot?







Freefall definitions

Freefall – When the only force on a falling object is gravity (ideal case)

- assume no air resistance

Terminal Velocity – The steady-state speed a falling object reaches air resistance becomes as strong as gravity

Air resistance – force opposing a moving object by air molecules

Drag – air resistance

Hang time – The total time spent in the air, usually by someone jumping up: $t_H = t_{up} + t_{down}$

Up time – Half the hang time, the portion going up (t_{up})

Down time – Half the hang time, the portion going down (t_{down})

Symbols – g, a, **Δ**t, $v_{\mathbf{i}}$, $v_{\mathbf{f}}$ and **Δx** (acceleration of gravity on earth, acceleration in general, change in time, initial velocity or speed, final velocity or speed, distance or displacement (change in position)

Nifty equations of motion

- Systematic means of solving motion problems
- Eliminates searching for equations
- Still linear motion
  - Single direction is still called "X"
  - We'll have modified version for two-dimensional motion (next unit)
  - Next unit horizontal will be X and vertical will be Y
- Five variables:
  - 3 are knowns
  - 1 is an unknown
  - 1 variable is not part of problem: "sad face"
  - Sad face determines the equation to use

Equation	a	t	v_i	v_f	Δx
$\Delta x = \frac{(v_i + v_f)}{2} t$	☹	√	√	√	√
$v_f^2 = v_i^2 + 2a\Delta x$	√	☹	√	√	√
$\Delta x = v_i t + ½at^2$	√	√	√	☹	√
$vf = vi + at$	√	√	√	√	☹

t

Assumptions

Assumptions you need to know (write these in your notebook and commit them to memory!)

- g = -9.8 m/s^2 (you're on earth unless the problem specifically says differently)
- v_i = 0 for any object dropped (or, next unit thrown horizontally)
- symmetry: same time up as down, same **speed** up as down, same height up as down
- object tossed upward: v = 0 at highest point, acceleration **never** changes or "**stops**"
- easiest to use downward half + symmetry to find time airborne (half of hangtime)

Equation	a	*t*	v_i	v_f	Δx
$\Delta x = \frac{(v_i + v_f)}{2} t$	☹	√	√	√	√
$v_f^2 = v_i^2 + 2a\Delta x$	√	☹	√	√	√
$\Delta x = v_i t + ½at^2$	√	√	√	☹	√
vf = vi + at	√	√	√	√	☹

Time to try some!

- T-Bone takes up cliff diving. He steps off of a 10 m ledge and heads toward the blue ocean waters. How much time will he be in the air?
- Gillian jumps off of an 80 m tall moon crater in her spacesuit to the ground below. She impacts the lunar surface at 8.944 m/s. What is the acceleration due to gravity on the moon?

Equation	a	t	v_i	v_f	Δx
$\Delta x = \frac{(v_i + v_f)}{2} t$	☹	√	√	√	√
$v_f^2 = v_i^2 + 2a\Delta x$	√	☹	√	√	√
$\Delta x = v_i t + \frac{1}{2}at^2$	√	√	√	☹	√
$vf = vi + at$	√	√	√	√	☹