

# PHYSICS 1B03

## Mechanics and Waves

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# SI Units

Distance: metre [m]

Time: second [s]

Mass: kilogram [kg]

# Quick Quiz 1

How fast does the fastest man in the world run?

(A)  $10^{-2}$  m/s

(B)  $10^{-1}$  m/s

(C)  $10^0$  m/s

(D)  $10^1$  m/s

(E)  $10^2$  m/s

# Metric Prefixes

**TABLE 1.2** Common prefixes

Prefix	Power of 10	Abbreviation
mega-	$10^6$	M
kilo-	$10^3$	k
centi-	$10^{-2}$	c
milli-	$10^{-3}$	m
micro-	$10^{-6}$	$\mu$
nano-	$10^{-9}$	n

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## Quick Quiz 2

The density of water is  $1 \text{ g/cm}^3$ . A container that has a volume of  $10 \text{ m}^3$  could hold how many kilograms of water?

- (A)  $10^0 \text{ kg}$
- (B)  $10^1 \text{ kg}$
- (C)  $10^2 \text{ kg}$
- (D)  $10^3 \text{ kg}$
- (E)  $10^4 \text{ kg}$

# Proportionality

Mass is linearly proportional to density:

$$\text{mass} = \text{density} * \text{volume}$$

If you double the density of an object, while keeping its volume constant, its mass doubles

$$(2)^1 = 2$$

Linear proportionality



The area of a square is proportional to the  
SQUARE of the length of its sides:

$$\text{Area} = \text{side} * \text{side}$$

If you double the length of its sides, its area  
increases by a factor of FOUR

$$(2)^2 = 4$$



Proportional to the square


The volume of a square box is proportional to the CUBE of the length of its sides:

$$\text{Volume} = \text{side} * \text{side} * \text{side}$$

If you double the length of its sides, its area increases by a factor of EIGHT

$$(2)^3 = 8$$

Proportional to the cube



## Quick Quiz 3

A ball rolls off of the edge of a cliff. The distance that it has fallen is proportional to the square of the time that it has been falling. After 1 s it has fallen 5 m. How far has it fallen after 2 s?

- (A) 10 m
- (B) 20 m
- (C) 30 m
- (D) 40 m
- (E) 50 m

# Quick Quiz 4b

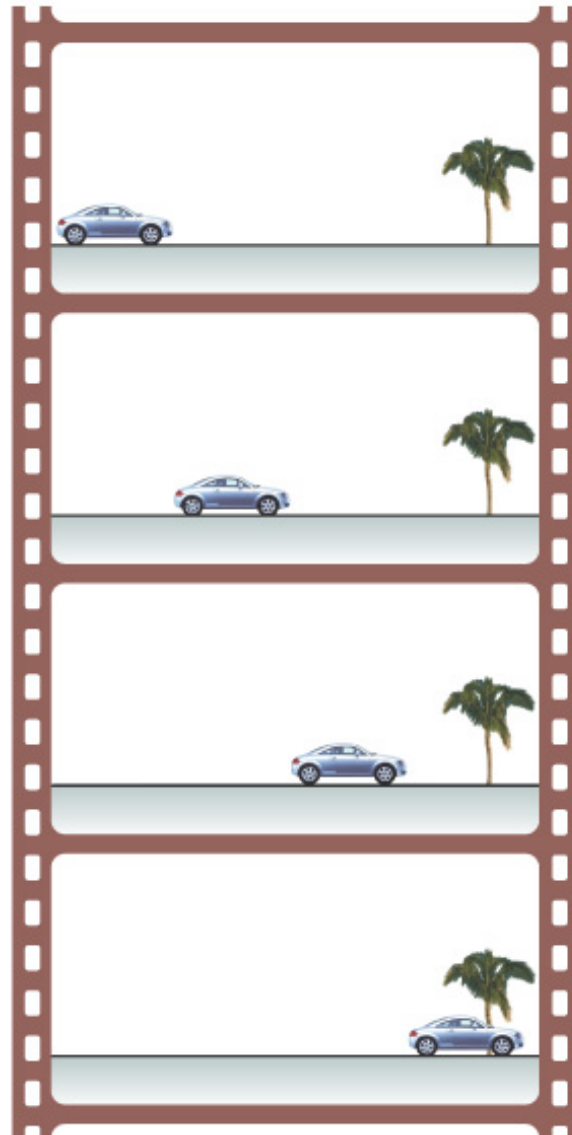
If a nasty villain were to bring the Earth to a dead stop, approximately how long would it take the Earth to hit the Sun?

- (A) 1 second
- (B) 1 hour
- (C) 1 day
- (D) 1 month
- (E) 1 year

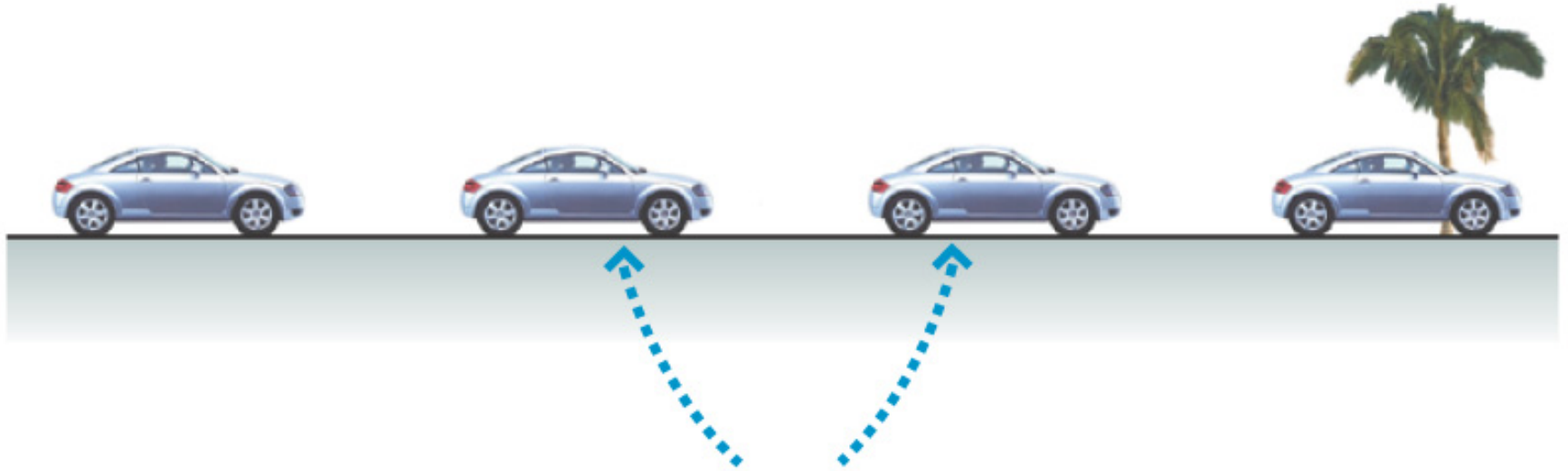
# Motion Diagrams

- Motion Diagrams help give information about position as a function of time
- The positions in a Motion Diagram are always shown at equal time intervals

# Like Movie Frames

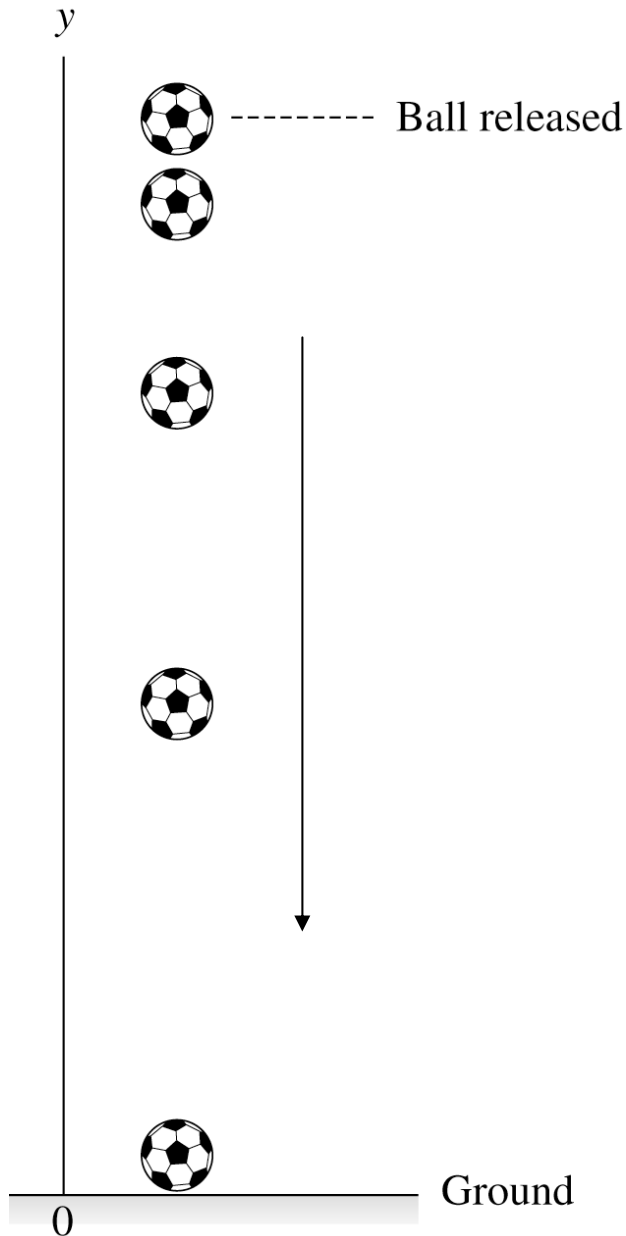


# But Overlaid



The same amount of time elapses  
between each image and the next.

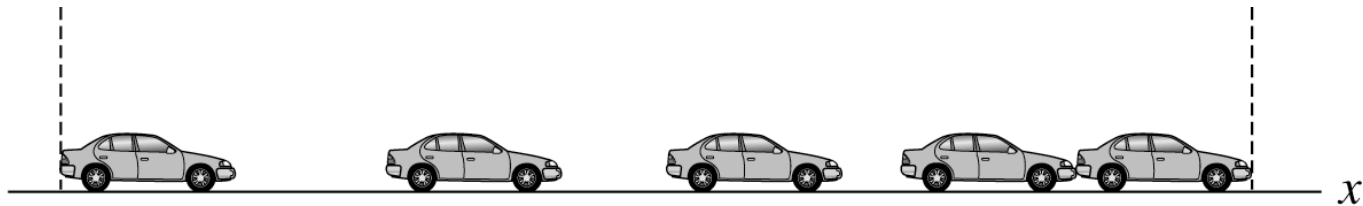
# Quick Quiz 4



This motion diagram shows the position of a ball at regular time intervals. Which of the following best describes the motion of this ball?

- (A) Falling at constant speed
- (B) Increasing its speed
- (C) Decreasing its speed
- (D) Need more information

# Quick Quiz 5



This motion diagram shows the position of a car at regular time intervals. Which of the following best describe the motion of this car?

- (A) The car is speeding up
- (B) The car is slowing down
- (C) The car is traveling at constant speed
- (D) Need more information