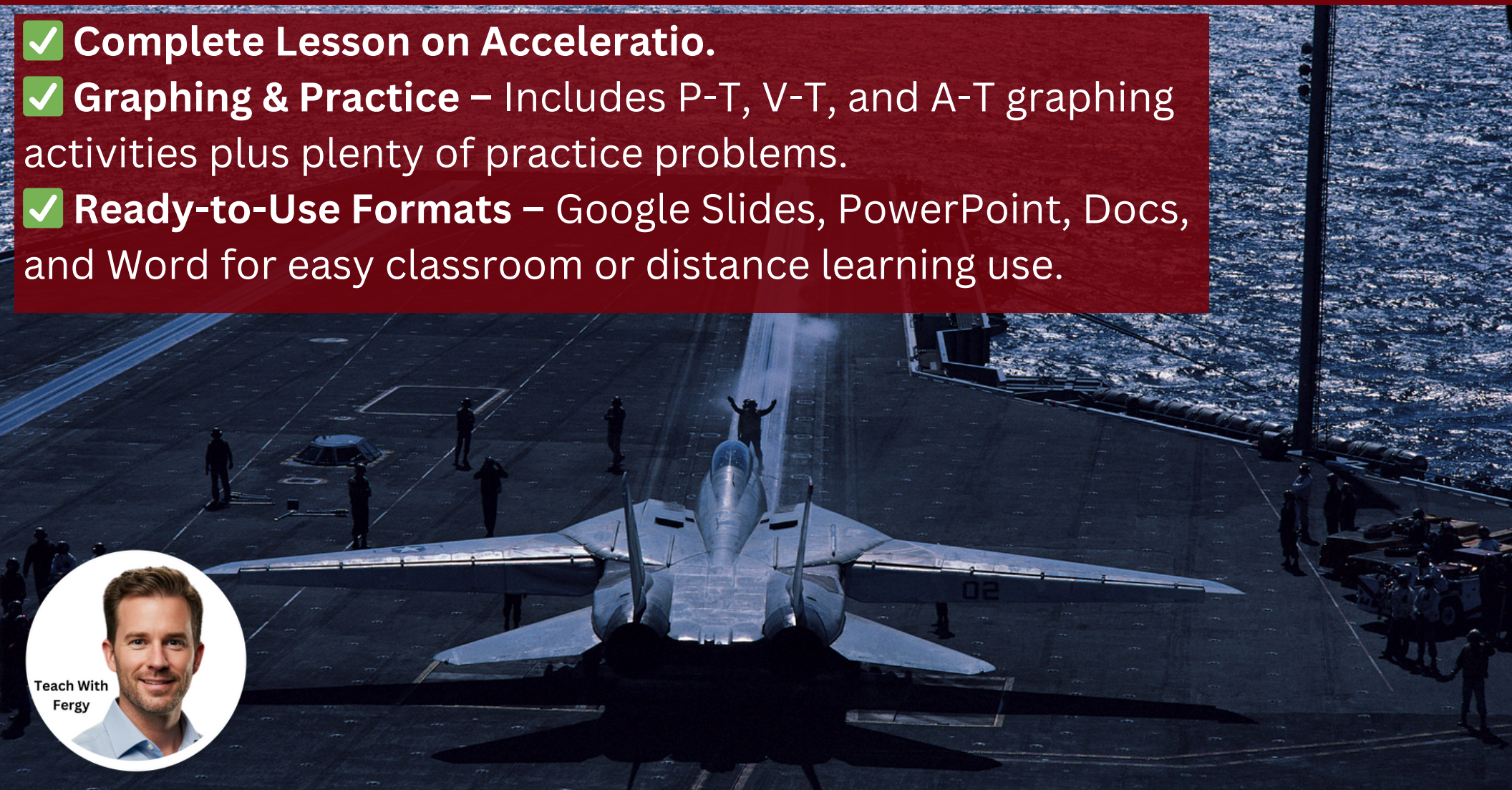


Acceleration

Lesson

High School Physics

- ✓ **Complete Lesson on Acceleration.**
- ✓ **Graphing & Practice** – Includes P-T, V-T, and A-T graphing activities plus plenty of practice problems.
- ✓ **Ready-to-Use Formats** – Google Slides, PowerPoint, Docs, and Word for easy classroom or distance learning use.



Your Lesson

- ✓ **Covers Key Concepts** – Covers speeding up, slowing down, uniform vs. nonuniform acceleration, and the Big 5 equations.
- ✓ **Complete Lesson Package** – Teacher and student PowerPoints, inquiry activities, embedded videos, and handout
- ✓ **Active Student Engagement** – Fill-in-the-blank student notes support focus and classroom discussion
- ✓ **Graphing & Practice** – Includes P-T, V-T, and A-T graphing activities plus plenty of practice problems.

Worksheet Activities

Uniform Acceleration Worksheet

1. An airplane accelerates down a runway at 3.20 m/s^2 for 32.8 s until it is finally on the ground. Determine the distance traveled before takeoff.
2. A car starts from rest and accelerates uniformly over a time of 5.21 seconds to a speed of 110 m/s . Determine the acceleration of the car.
3. Upton Chuck is riding the Giant Drop at Great America. If Upton free falls from a height of 91.5 m , how long does it take him to reach the ground? What will his final velocity be?
4. A racecar accelerates uniformly from 18.5 m/s to 46.1 m/s in 2.47 seconds . Determine the magnitude of the acceleration of the car and the distance traveled.
5. A feather is dropped on the moon from a height of 1.40 meters . The acceleration due to gravity on the moon is 1.67 m/s^2 . Determine the time for the feather to fall to the surface of the moon.
6. Rocket-powered sleds are used to test the human response to acceleration. If a sled is accelerated to a speed of 444 m/s in 1.83 seconds , then what is the acceleration and what is the distance that the sled travels?
7. A bike accelerates uniformly from rest to a speed of 7.10 m/s over a distance of 112 m . Determine the acceleration of the bike.
8. An engineer is designing the runway for an airport. Of the planes that will use the runway, the lowest acceleration rate is likely to be 3 m/s^2 . The takeoff speed for this plane is 65 m/s . Assuming this minimum acceleration, what is the minimum allowed length of the runway?
9. A car traveling at 22.4 m/s skids to a stop in 2.55 s . Determine the skidding distance of the car (assume uniform acceleration).
10. A kangaroo is capable of jumping to a height of 2.62 m . Determine the takeoff speed of the kangaroo.
11. If Michael Jordan has a vertical leap of 1.29 m , then what is his takeoff speed? How long does it take him to reach the peak? (Total time to move upwards to the peak and then return to the ground.)
12. A baseball is popped straight up into the air and has a hang-time of 6.25 s . Determine the height to which the ball rises before it reaches its peak. (Hint: the time to rise is one-half the total hang-time.)
13. The observation deck of tall skyscraper 370 m above the street. Determine the time required for a penny to free fall from the deck to the street below.
14. A bullet is moving at a speed of 367 m/s when it embeds into a lump of moist clay. The bullet penetrates for a distance of 0.0621 m . Determine the acceleration of the bullet while moving into the clay. (Assume a uniform acceleration.)
15. It was once recorded that a Jaguar left skid marks that were 290 m in length. Assuming that the Jaguar skidded to a stop with a constant acceleration of -3.90 m/s^2 , determine the speed of the Jaguar before it began to skid.

Answers:

- | | | | | |
|--|--|---|-------------------------|-------------------------|
| 1. 1720 m | 2. 8.10 m/s^2 [fwd] | 3. $v_i = 25.5 \text{ m/s}$ [down] | 4. 79.8 m | 5. $t = 1.29 \text{ s}$ |
| 6. $a = 243 \text{ m/s}^2$ [fwd], $d = 406 \text{ m}$ | 7. $a = 0.712 \text{ m/s}^2$ [fwd] | 8. 704 m | 9. $D = 28.6 \text{ m}$ | |
| 10. 7.17 m/s [up] | 11. $v_i = 5.03 \text{ m/s}$ [up] | 12. $d = 48.0 \text{ m}$ | | |
| 13. $t = 8.69 \text{ s}$ | 14. $a = 1.08 \times 10^6 \text{ m/s}^2$ [backwards] | 15. $v_i = 47.6 \text{ m/s}$ | | |
| 16. $a = 2.86 \text{ m/s}^2$ [fwd], $t = 30.8 \text{ s}$ | 17. 15.8 m/s^2 [fwd] | 18. $v_i = 42.3 \text{ m/s}$, $v_f = 94.4 \text{ mi/hr}$ | | |

Uniform Acceleration Worksheet 2

The 5 acceleration equations can be used to solve free fall/vertical acceleration problems. Instead of objects traveling east/west/north/south, they travel up and down; it's up to the problem solver (you) to designate positive and negative values. Remember that a negative acceleration value can refer to the direction an object is traveling and/or whether it is slowing down.

Practice

1. A rally car accelerates from 10.0 m/s [N] to 58 m/s [N] in 8.0 seconds as it moves along a straight road. Given that the acceleration is constant, what is the acceleration of the car? (6.0 m/s^2 [N])
2. A bus traveling along a straight road accelerates at 2.0 m/s^2 [S], for 4.0 seconds , covering a distance of 44 meters . After the 4.0 seconds what velocity is the bus traveling at? (15 m/s [S])
3. A rowing boat crosses the finish line at 12 m/s [N] and carries on in a straight line. If it immediately decelerates at 4.0 m/s^2 [N] until it comes to rest, how far past the finish line will the rowing boat come to a stop? (18 m)
4. During the middle of an $8.0 \times 10^3 \text{ meter}$ race an athlete running at 6.8 m/s [W] constantly accelerates, along part of the straight, to 8.0 m/s [W] in order to get in a better position for the final lap. Given this took 2.0 seconds , what was the athlete's displacement in this time? (15 m [W])
5. A train leaves a station from rest and travels west along a straight track. If after 20.0 seconds the train is $5.0 \times 10^2 \text{ metres}$ from the station, what is the acceleration of the train? (2.5 m/s^2 [W])
6. A lift at the ground floor rises vertically from rest with constant acceleration of 0.60 m/s^2 [up]. If it passes the first floor at 1.8 m/s [up] how high is the first floor? (2.7 m)

Four Worksheets with Answer Keys to reinforce concepts.

Acceleration Units

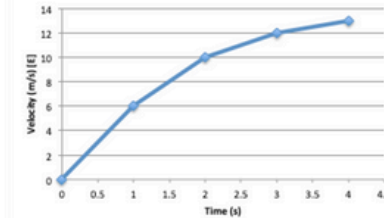
- What units do you end up with for acceleration?

$$a = \frac{\Delta v}{\Delta t} = \frac{\text{m/s}}{\text{s}} = \text{m/s}^2$$

- Acceleration is the change in velocity (m/s) per time interval (s) → m/s²

Uniform vs. Nonuniform Acceleration

- Uniform acceleration is motion that occurs when an object traveling in a straight line changes its speed uniformly with time
- Nonuniform acceleration is motion that doesn't travel in a straight line and/or doesn't change its speed uniformly



Acceleration Units

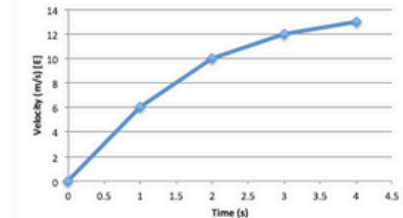
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- _____

Uniform vs. Nonuniform Acceleration

- Uniform acceleration is motion that _____
- Nonuniform acceleration is motion that doesn't travel in a straight line and/or doesn't change its speed uniformly



- Have your students complete the student version of the notes while you teach
- Student notes come mostly filled in so students can spend more time listening and less time copying notes.

Check Your Understanding

A car starting from rest and undergoing uniform acceleration reaches a velocity of 21.0 m/s [N] in 8.4 s. Find the average acceleration.

$$a = \frac{v_f - v_i}{\Delta t}$$



Check Your Understanding

A car starting from rest and undergoing uniform acceleration reaches a velocity of 21.0 m/s [N] in 8.4 s. Find the average acceleration.

$$a = \frac{v_f - v_i}{\Delta t}$$

Answer: $a = 2.5 \text{ m/s}^2 \text{ [N]}$

The uniform acceleration of $2.5 \text{ m/s}^2 \text{ [N]}$ means that the velocity of the motorbike increases by 2.5 m/s [N] every second.

Steam Power Catapult System on Aircraft Carriers



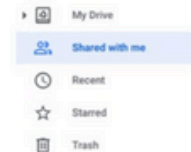
Aircraft carrier jets display some of the greatest accelerations you will see.

- Take-off: 0 km/h to 265 km/h in only 2.0 s
- Landing: 240 km/h $\rightarrow$ 0 km/h in 100 m

**Video and Practice Activities embedded
in directly into your lesson.**

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TWF

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