



PLTW Flight and Space Virtual Learning

**8th Grade/Size Effects on
Lift Problems**

May 15, 2020



8th Grade/Flight and Space
Lesson: May 15, 2020

Objective/Learning Target:
Students will learn about the effects of wingspan on weight capacity through research.

Warm-Ups:

Review the factors that affect lift of an airplane with this [Quizlet](#).

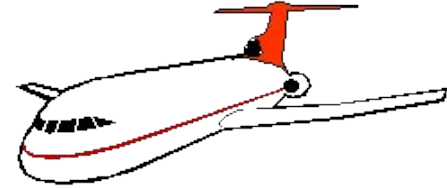
Lesson Introduction/Background Information:

In this lesson you will be examining the effect of wingspan on lift. You will see that more lift will allow more weight to be carried by the airplane. Answer the questions from the practice pages on [Cornell Notes](#) or notebook paper. Your research of the Boeing 747, 777, and the DC-8 and DC-10 jetliners will help you see the relationships between wingspan, lift, and weight.



Practice:

Open the slide called [Size Effects](#) (with text). Study the labeled diagrams and read the explanation of Size Effects.



1. What happens to lift when the surface area of an airplane's wings is increased?
2. Use this [Web Page](http://en.wikipedia.org/wiki/Boeing_747) (http://en.wikipedia.org/wiki/Boeing_747), or your favorite search engine, to find information about the Boeing 747. What is its wing area?
3. Refer to the above question. What is the Boeing 747's takeoff weight?
4. How many passengers can the Boeing 747 carry?
5. What is the ratio of the Boeing 747's takeoff weight to its wing area?
6. Now use this [Web Page](http://en.wikipedia.org/wiki/Boeing_777) (http://en.wikipedia.org/wiki/Boeing_777), or a search engine, to find information about the Boeing 777. What is its wing area?
7. What is the takeoff weight of the Boeing 777?
8. How many passengers can the Boeing 777 carry?

Practice:

9. What is the ratio of the Boeing 777's takeoff weight to its wing area?
10. Again, use [Wikipedia](http://en.wikipedia.org/wiki/DC-8) (<http://en.wikipedia.org/wiki/DC-8>), or a search engine to get information about the DC-8 jetliner. What is its wing area?
11. What is the DC-8's takeoff weight?
12. How many passengers can the DC-8 carry?
13. What is the ratio of the DC-8's takeoff weight to its wing area?
14. Find the DC-10 on [Wikipedia](http://en.wikipedia.org/wiki/DC-10) (<http://en.wikipedia.org/wiki/DC-10>), or use a search engine. What is its wing area?
15. What is the DC-10's takeoff weight?
16. How many passengers can the DC-10 carry?

Practice:

17. What is the ratio of the DC-10's takeoff weight to its wing area?
18. If both the Boeing 777 and the DC-10 weighed 130,000 kg, which airplane's wings would generate the most lift?
19. Which of the two planes in the previous question has a greater possible takeoff weight?
20. Which two of the four jet airplanes above have the closest takeoff weight to wing area ratios?
21. Explain the relationships among lift, takeoff weight, and wing area. You may want to read the slide called [Forces on an Airplane](#).
22. Do you see a relationship between the wingspan and passenger number?
23. Where are slats located and how do they affect an airplane's lift?
24. Where are the flaps located?

Self-Assessment:

In your notes reflect on the relationship between wing area and weight capacity. What would be some of the disadvantages of a very large wing area and weight capacity?

Extend Your Learning/Continued Practice:

Watch the take-off of a boeing 747 from the cockpit.

See airflow affects other vehicles like cars.

