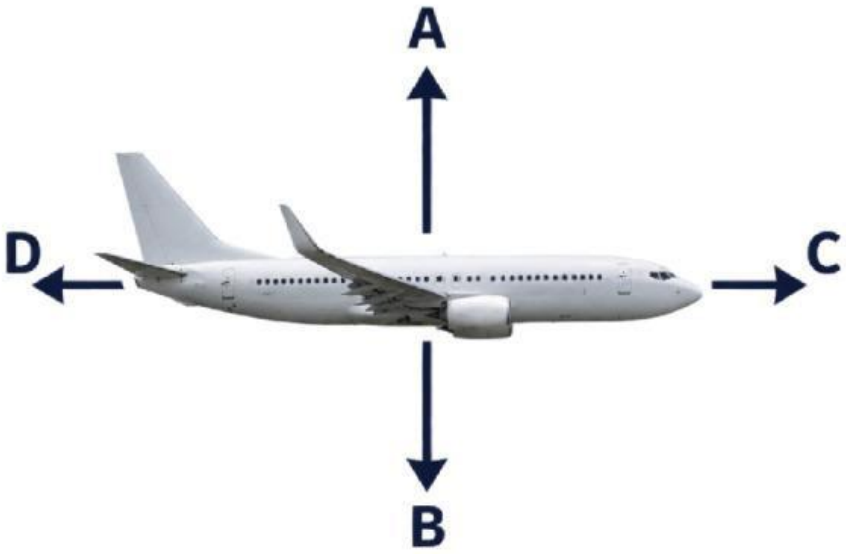
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Aerodynamics: How Aircraft Fly

Section 1: The Four Forces of Flight

An aircraft in flight experiences an invisible tug-of-war between two pairs of opposing forces.



1. Match each letter from the diagram to the correct force name:

Force A	Force B	Force C	Force D
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2. When an aircraft cruises at a steady altitude and constant speed, what is true about the four forces?

☐ A) Lift is greater than Weight, and Thrust is greater than Drag.

☐ B) Lift equals Weight, and Thrust equals Drag.

☐ C) Drag exceeds Thrust, while Lift is zero.

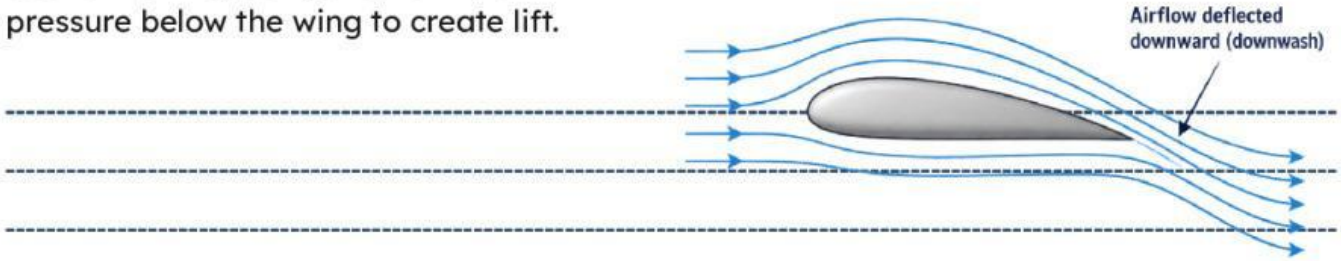
☐ D) Weight exceeds Lift so gravity can stabilise the wings.

3. What must happen to the forces for an aircraft to accelerate upwards and forwards at the same time?

Section 2: Wings and Engines

LIVEWORKSHEETS

4. A wing's curved cross-section is called an **aerofoil**. Explain how the air pressure above the wing compares to the air pressure below the wing to create lift.



5. According to Newton's Third Law, every action has an equal and opposite reaction. Complete this sentence:

The aerofoil pushes rushing air _____, which causes the air to push the wing _____.

6. How does a turbofan jet engine produce forward **thrust**?

- ☐ It blows air forward to push against oncoming clouds.
- ☐ It spins giant wheels that push against the runway.
- ☐ It forces large volumes of air backwards at high speed.
- ☐ It sucks all air out of the sky so the plane falls forward.

Section 3: Control Surfaces

7. Draw a line or write the correct letter to match each flight surface to the movement it controls:

Flight Surface	Main Function	Label Letter
Ailerons	Move in opposite directions to roll the aircraft into a turn	
Elevators	Located on the tail to control pitch (pointing nose up or down)	
Rudder	Located on the vertical tail fin to control yaw (pointing nose left or right)	
Slats & Flaps	Extend from the wing edges to create high lift at lower speeds	

8. Why do airliners retract their flaps and slats into a 'clean wing' when cruising at 900 km/h?

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Section 4: Flight Profile Application

9. Number the four stages of a typical flight in order from **1** (start of journey) to **4** (end of journey):

Flight Event	Order (1-4)
Engines throttle back as the plane begins a controlled descent toward the destination.	
Flaps extend and engines provide take-off thrust as the aircraft accelerates down the runway and climbs.	
Spoilers dump remaining lift on touchdown while reverse thrust and wheel brakes slow the aircraft.	
The aircraft reaches cruising altitude where lift equals weight and thrust equals drag.	

10. Think like an aeronautical engineer: If an aircraft is cruising smoothly and suddenly encounters strong air resistance that increases **drag**, what must the pilots do with the engine **thrust** to stop the plane from slowing down? Explain why.

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Answers

1. Force A: Lift; Force B: Weight (or Gravity); Force C: Thrust; Force D: Drag (or Air Resistance).

2. ☑ B) Lift equals Weight, and Thrust equals Drag.

3. Lift must be greater than Weight (to accelerate upward), and Thrust must be greater than Drag (to accelerate forward).

4. Air pressure above the wing is lower than the air pressure underneath the wing. This pressure difference produces an upward pushing force (lift).

5. The aerofoil pushes rushing air **downward (downwash)**, which causes the air to push the wing **upward**.

6. ☑ It forces large volumes of air backwards at high speed.

7. Matching order (top to bottom): All functions correspond directly to their named surface (Ailerons = roll, Elevators = pitch, Rudder = yaw, Slats & Flaps = high lift at low speeds).

8. At high cruising speeds (900 km/h), the wings already generate plenty of lift. Retracting flaps and slats minimises drag and saves fuel.

9. Order from top to bottom: **3** (Descent), **1** (Take-off), **4** (Touchdown), **2** (Cruise).

10. Pilots must increase engine thrust so that thrust once again balances the increased drag. If thrust equals drag, the aircraft maintains its steady forward speed.

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