

Name: _____

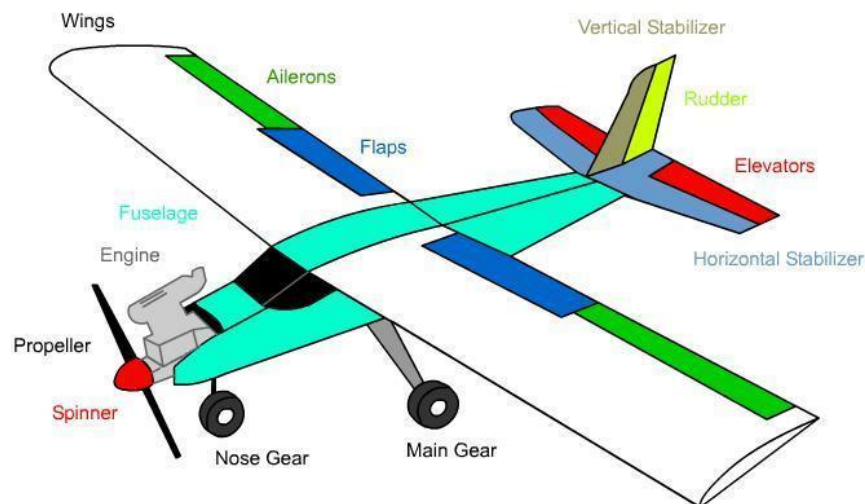
FLIGHT STUDY GUIDE

1. What is the difference between a glider and a powered flyer?
2. What 2 things affect the rate at which an object falls?
3. How does a parachute attempt to slow this rate?
4. Describe what happens to air molecules when heated. What does this air do? Describe what happens to air molecules when cooled. What does this air do?
5. How does a pilot control a hot air balloon? (up, down and direction)
6. What are 3 main parts of a hot air balloon?
7. Draw a simple airplane and label: **fuselage, main wing, horizontal stabilizer, vertical stabilizer**

8. Describe the following movements of a plane: **pitch, roll, yaw**
9. Explain which control surfaces are responsible for each movement above and how you would move them to control the aircraft.
10. How does a helicopter create **lift**? **thrust**? How does a jet achieve **thrust**?

Vocabulary

Elevators	Controls the pitch motion of the craft. Pitch means going up or down. When the elevators go up, the aircraft goes down.
Rudders	Controls the yaw motion. The yaw motion is the side to side movement of the nose of the craft.
Wing	Controls the lift of the plane. A plane needs wings to generate lift off the ground. The wings also keep the plane in the air.
Aileron	Controls the lateral balance by moving the aircraft left or right. When the right aileron goes up, the left one goes down. An aircraft can roll using the ailerons.
Motor	Controls the thrust to lift the plane into the sky. The motor sends the plane forward
Fuselage	The centermost piece of the aircraft that holds the cargo and passengers. Most aircrafts can hold up to 800 passengers and 250,000 pounds of cargo!
Propellers	Controls some of the thrust the plane needs to go forwards. Also controls pitch by tilting the propellers up or down.
Horizontal Stabilizer	Helps control pitch. Keeps the aircraft's equilibrium when flying up and down
Vertical Stabilizer	Helps control yaw by preventing lateral movements of the craft. Needed for complete control of the plane.



Answers

1. Gliders have wings but not means of propulsion; they can change their own direction with the same control surfaces as planes have. Powered flyers have an engine or rocket that allows them to create thrust and take off on their own.
2. Gravity and drag (wind resistance)
3. By having a large surface area that traps air, Parachutes slow the rate of falling by creating a large amount of drag.
4. As air molecules are heated, they gain energy and speed, causing them to vigorously collide with other air molecules as well as their container. This causes more space between the molecules (lower density). This is why hot air rises (**Hot air balloons**), the less dense hot air floats on the more dense cold air. When air is cooled, its molecules slow down and get closer together (contract). This makes cold air more dense and heavier than warm air.
5. The heater is used to control up and down. More heat means more lower density hot air inside the balloon and a gain in altitude. To go down, the heater is turned off and the “Trap” is opened at the top of the balloon, allowing some hot air to escape, causing the balloon to fall. Side to side direction is controlled by wind, so pick a calm day if you want to go hot air ballooning!!]
6. Basket, Balloon, Heater
7. See image of plane on page 3
8. Pitch: nose of the plane moving up and down, controlled by the elevators (Elevators up = nose up, elevators down = nose down)

Roll: Left or right banking of the plane during flight, controlled by ailerons. (Roll right: Right aileron up left aileron down) (Roll left: Left aileron up right aileron down)

Yaw: The nose of the plane moving left or right. (Rudder left = nose left) (Rudder right = nose right)

9. Control surfaces change air direction around the plane. Elevators, Ailerons, and the Rudder are the primary control surfaces on an aircraft. Large aircraft extend flaps during takeoff and landing. Flaps increase the surface area on the top of the wing, creating more lift (Bernoulli's Principle), and also increase the *angle of attack* of the wing, causing more lift. Flaps allow the plane to fly much slower during takeoff and landing

10. Helicopters create lift by spinning rotor blades that are shaped like wings. Forward thrust is created by tilting the helicopter forward (nose down), backward thrust is created by tilting the helicopter backward (nose up) Jets achieve thrust by controlling an explosion of hot gas. Fuel is burnt inside the jet engine, causing hot air to be forced out of the back of the engine (Thrust)