Name: _____
Date: _____

Physics Focused Closed Reading

Using the words in the bank below, fill in the blanks in the text with the appropriate word. You can use dictionaries and other resources to help you.

Word Bank

acceleration	airfoil	fuselage	thrust
aerodynamics	composites	Newton's third law	working fluid
aeronautics	drag	propulsion	

_____ is the study of the science of flight. This science is used when engineers are designing an airplane or other flying machine. To design a plane, engineers must understand four elements which are explained below.

_____ is the study of forces and the resulting motion of objects through the air. In simpler terms, it is the way air moves around things. This affects the motion of everything from a large jet to a model rocket to a kite to a pitcher's curveball. By studying the way air flows around a plane, engineers can define the shape of the plane. The wings, the tail, and the main body or _____ of the plane all affect the way the air will move around the plane.

The second element is _____, which means to push forward or drive an object forward. When talking specifically about the flight of an airplane, it is the study of how to design an engine that will provide the _____ that is needed for a plane to take off and fly through the air. On airplanes, this is usually generated through some application of _____, which says for every action, there is an equal and opposite reaction. When talking about planes, a gas, or_____, is accelerated by the engine, and the reaction to this _____ produces a force on the engine.

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The third element is the study of what materials are to be used on the plane and in the engine and how those materials make the plane strong enough to fly effectively. The choice of materials that are used to make the body, wings, tail and engine will affect the strength and stability of the plane. Many airplane materials are now made out of _____ , materials that are stronger than most metals and are lightweight.

In designing the structure of the airplane, the most important factor is the shape of an airplane's wings because that is what makes it able to fly. Airplanes' wings are curved on top and flatter on the bottom. That shape is called a/an _____ , and it makes air flow over the top faster than under the bottom. So, less air pressure is on top of the wing. This condition makes the wing, and the airplane it's attached to, move up. Using curves to change air pressure is a trick used on many aircraft. Helicopter rotor blades use this trick. Lift for kites also comes from a curved shape. Even sailboats use this concept. A boat's sail is like a wing. That's what makes the sailboat move.

When designing the structure, engineers also have to account for _____. This is a force that tries to slow something down. It makes it hard for an object to move. It is harder to walk or run through water than through air. That is because water causes more drag than air. The shape of an object also changes the amount of this force. Most round surfaces have less of this force than flat ones. Narrow surfaces usually have less of this force than wide ones. The more air that hits a surface, the more of this force it makes.

The final element is stability and control. This is the study of how to control the speed, direction, altitude and other conditions that affect how a plane flies. The engineers' design the controls that are needed in order to fly and instruments are provided for the pilot in the cockpit of the plane. The pilot uses these instruments to control the stability of the plane during flight.