

**C. TASK****PRINCIPLES OF FLIGHT****OBJECTIVE**

To determine that the applicant exhibit instructional knowledge of the elements of the principles of flight by describing:

**KEY ELEMENTS**

- Physical laws applicable to balloon flight
- Effects of changes in temperature and density altitude on maintaining equilibrium
- Effects of false left during takeoff, landing, and wind shear penetration

**SCHEDULE**

- Discuss objectives
- Review material (key elements)
- Development
- Conclusion

**EQUIPMENT**

- White board
- Markers
- FAR/AIM
- References
  - How to Fly A Balloon; Balloon Digest

**INSTRUCTOR ACTIONS**

- Discuss lesson objectives
- Present lecture
- Questions
- Homework

**STUDENT ACTIONS**

- Participate in discussion
- Take notes

**COMPLETION STANDARDS**

- Participate in discussion
- Take notes

**C. TASK****PRINCIPLES OF FLIGHT****PHYSICAL LAWS****DENSITY  
ALTITUDE**

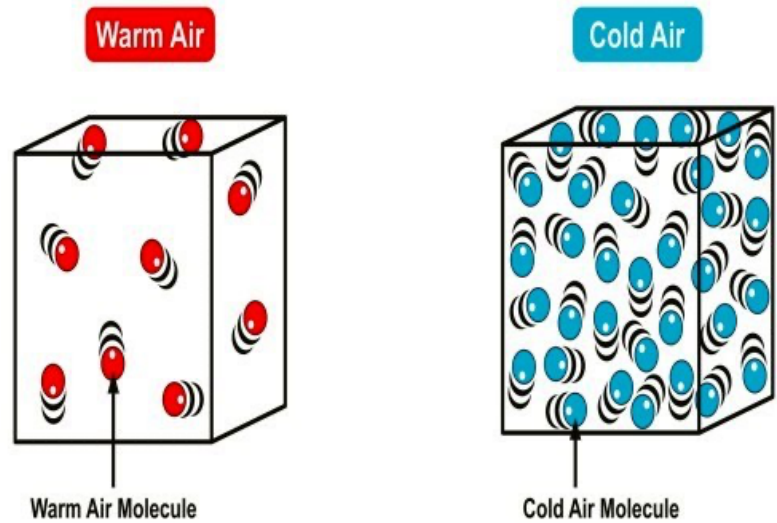
AIR - fluid

OBJECT - balloon

BUOYANCY - upward force of an object produced by the surrounding fluid

EQUILIBRIUM - The net upward buoyancy force is equal to the magnitude of the weight of fluid displaced by the object

AIR DENSITY -



HEATING - The air inside the balloon envelope is heated which causes the air to expand, making it less dense than the air outside the balloon

ALTITUDE - The internal temperature of the air in the envelope is raised or lowered to change altitude

**C. TASK****PRINCIPLES OF FLIGHT****EFFECTS OF  
FALSE LIFT****False lift****False heavy &  
wind shear****Diminished  
capacity & wind  
shear**

Three areas of focus warrant discussion:

- False lift
- False heavy (air flow under the lower portion of balloon, creating downward lift)
- Envelope distortion causing diminished capacity

**FALSE LIFT** - The lift created by air flow over the top is to be considered “false lift,” because it was not created by applying heat to the envelope.

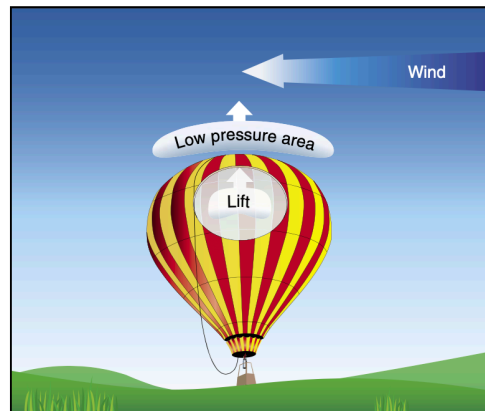


Figure 6-16. False lift dynamics.

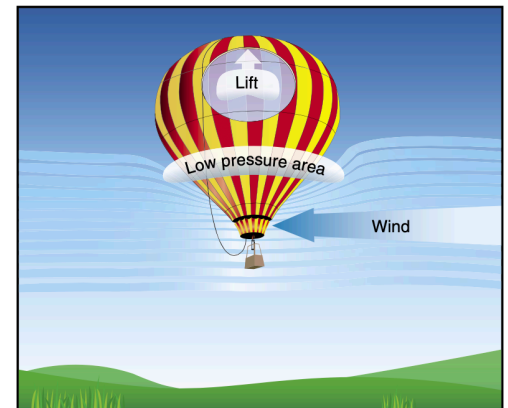


Figure 6-17. False heavy dynamics.

**FALSE HEAVY** (downward lift) - This phenomenon occurs when descending into a faster moving air mass or wind shear. The lower half of the balloon enters the shear and the surface of the balloon allows the air flow to generate lift. This lift is tangent to the surface of the balloon. Because it is below the equator, where the tangent line points in a downward direction, the lift has a downward component. This downward component of lift pulls the balloon down

Wind shear can increase the rate of descent by diminishing the capacity of the envelope.

For example, when descending, below is a low level wind shear with the air near the surface moving much faster or slower than the air mass in which the balloon is traveling. As the balloon enters the lower

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Wind shear can increase the rate of descent by diminishing the capacity of the envelope.

**EXAMPLE:** When descending, below is a low level wind shear with the air near the surface moving much faster or slower than the air mass in which the balloon is traveling. As the balloon enters the lower air mass, the side of the balloon is pushed in, decreasing the capacity of the envelope and pushing the air out the mouth.

**LARGE SPEED DIFFERENCE BETWEEN AIR MASSES**

The greater the false lift effect. The lift created by buoyancy is decreased and the balloon starts to descend. If this happens at a low altitude, and the pilot has not responded in a timely manner, this **may result in a hard landing**.

**DISHING**

This condition is very dangerous to the low level flight of a fully loaded balloon. It should be noted that as the envelope lowers into the slower wind and begins to distort and slow-up, the effective wind speed over the top begins to increase. Air moving over the top of an envelope produces false lift. Combined with diminished capacity, this again presents a hazardous condition which **may result in an extremely hard landing**.

**Signs of wind  
shear**

**SIGNS OF WIND SHEAR** roof for any movement in:

- Crown lines
- handling lines
- throat ropes
- skirt
- basket movement

**C. TASK****PRINCIPLES OF FLIGHT****EFFECTS OF  
FALSE LIFT  
(Continued)****Pilot action****TAKE ACTION****Continue to fly the balloon**

**during lift-off** - maintain a positive rate of climb until the false lift dissipates.

**during the landing** - be prepared for an acceleration in the descent  
- add heat to slow the descent

**MAINTAIN SITUATIONAL AWARENESS****WHEN WIND IS AROUND STAY ON THE GROUND****DON'T LET CREW PUSH BASKET UP AT ANY TIME**