Name:

Lab-Sect. no.:

Signature:

*Duration: 75 minutes*
Show all your work for full/partial credit!
Include the correct units in your final answers for full credit!
Unless otherwise stated, quote your results in SI units!
1.) *Multiple Choice* (18 pts.)

For each statement below, circle the correct answer (TRUE or FALSE, no reasoning required).

(a) Newton’s 3. Law of Motion implies that action and reaction force are always of the same magnitude.
   - TRUE
   - FALSE

(b) When a vertically moving projectile reaches its maximal height, its acceleration is zero.
   - TRUE
   - FALSE

(c) In uniform circular motion the speed of an object is constant and therefore no net force is acting on that object.
   - TRUE
   - FALSE

(d) The gravitational mass of an object is a vector quantity.
   - TRUE
   - FALSE

(e) If an object is at rest on an inclined plane, the normal force on that object is equal in magnitude to the weight force on that object.
   - TRUE
   - FALSE

(f) The kinetic friction force on an object is always directed opposite to the velocity of that object.
   - TRUE
   - FALSE
2.) *Projectile Motion*  
(18 pts.)
Person A (who is on the ground) wants to throw an object to person B (who is at the top of a 8m-high building) in such a way that the object reaches its maximal height when arriving at person B (see figure below). Person A throws the object with an initial speed of 14 m/s.

(a) At which angle with respect to the horizontal should person A aim the object? (*hint: consider the vertical component of the motion*)

(b) What is the flight time of the object?

(c) At what horizontal distance from the building should person A position himself?
3.) *Newton’s 2.Law*  
A load of 800 kg is attached to a helicopter via an ideal steel rope. Starting from rest, the helicopter is moving straight up at constant acceleration, reaching a vertical velocity of 6 m/s after 5 seconds (ignore friction forces).

(a) What is the acceleration of the load?
(b) Draw the free-body diagram including all forces on the load.
(c) What is the magnitude of the tension force in the steel rope?
4.) *Relative Velocity* 

An airplane is moving due East in still air at a speed of 520 mph relative to the ground. Suddenly, the plane encounters a wind with velocity of 65 m/s due South.

(a) What are the magnitude and direction (relative to due East) of the plane’s resultant velocity relative to the ground?

(b) How many miles has the plane been deflected to the South after being half an hour under the influence of the wind?

(1 m/s = 2.25 mph)
5.) *Circular Motion* 

The manager of a TV station wants to improve broadcasting to Europe and therefore put a new satellite into an orbit around Earth. He wants the satellite to revolve around the Earth three times per day.

(a) At what radius (distance from the center of the Earth) has the satellite to be set out?
(b) What is the speed and the centripetal acceleration of the satellite in its orbit?
6.) *Sliding on Inclined Plane* (16 pts.)

Starting from rest, a block (mass 2kg) is sliding down an inclined plane (height $h=25\text{ cm}$, inclination angle $\Theta=40^\circ$ with respect to the horizontal). The kinetic friction coefficient between block and plane surface is $\mu_k=0.25$.

(a) Draw a diagram including all forces on the block.
(b) What are the magnitudes of the normal and friction force on the block?
(c) What is the acceleration of the block?
(d) What is the speed of the block at the bottom of the plane?