(6 pts) 1. A small rock is thrown straight up into the air. It travels up to its maximum height and then returns to the point from which it was thrown. Air resistance can be neglected. As the rock travels downward from its maximum height, its acceleration is
(a) 9.8 m/s² downward
(b) 9.8 m/s² upward
(c) Zero

(6 pts) 2. A car moves in a straight line with constant acceleration. Starting from rest at \( t = 0 \) it travels 8.0 m in 4.0 s. What is the speed of the car at \( t = 4.0 \text{ s} \)?
(a) 1.0 m/s
(b) 2.0 m/s
(c) 4.0 m/s
(d) 32.0 m/s
(e) none of the above

(6 pts) 3. A small block with mass 2.0 kg slides down a frictionless ramp that is inclined at 53° above the horizontal. The acceleration of the block is
(a) zero
(b) 9.8 m/s²
(c) 5.9 m/s²
(d) 7.8 m/s²
(e) none of the above

(6 pts) 4. A 10 kg box is suspended from the lower end of a light rope. A person pulls upward on the upper end of the rope with a constant force and it is observed that the box accelerates downward with an acceleration of 2.00 m/s². What is the tension in the rope while the box is moving downward?
(a) 98 N
(b) 78 N
(c) 118 N
(d) none of the above
(6 pts) 5. A river flows due east. A boat travels with constant speed due north across the river from point A to point B. The speed of the boat relative to the water is 5.00 m/s. The river is 21.0 m wide and it takes the boat 7.00 s to travel from A to B. What is the speed of the current in the river (the speed of the water relative to the earth)?

(a) 8.00 m/s  
(b) 5.83 m/s  
(c) 4.00 m/s  
(d) 2.00 m/s  
(e) none of the above

On the following problems show all your work. Partial credit will be given, if earned. Write your answers in the blanks provided. All answers must include the correct plus or minus sign (if appropriate) and the correct units.

(16 pts) 6. A small rock is thrown straight up from the edge of the roof of a building. Air resistance can be neglected. The rock travels upward and then descends to the ground, missing the roof on the way back down. The maximum height that the rock reaches above the roof is 8.00 m. The rock reaches the ground 4.00 s after it was thrown. What is the height of the building? (That is, how far is the roof above the ground?)

Ans. _______
(16 pts) 7. A constant force $\vec{F}$ is applied to a box that is sliding on a horizontal surface. The force $\vec{F}$ has magnitude 40.0 N and is directed at 37° above the horizontal. The coefficient of kinetic friction that acts on the box equals 0.300. The mass of the box is 5.00 kg.

\[ F \]

\[ 5 \text{ kg} \]

\[ 37° \]

a) What is the magnitude of the friction force that acts on the box while the box is moving?

Ans. ________________

b) If the box starts from rest, how long does it take it to travel a distance of 6.0 m?

Ans. ________________
(18 pts) 8. A small rock is thrown from the roof of a building. The initial velocity of the rock has magnitude \( v_0 \) and is in a direction of 30° above the horizontal. The rock is in the air for 3.00 s and lands on the ground a horizontal distance of 36.0 m from the base of the building.

![Diagram of rock motion](image)

a) What is the initial speed of the rock?  
Ans. 

b) What is the height \( h \) of the building?  
Ans. 

c) What is the magnitude of the velocity of the rock just before it strikes the ground?  
Ans. 

(20 pts) 9. A box with mass 5.0 kg is pulled up a ramp by a constant force $F = 60.0\ N$ that is parallel to the ramp. The ramp is inclined at $37^\circ$ above the horizontal. The box starts from rest and after it has traveled a distance of 4.00 m parallel to the ramp its speed is 5.00 m/s.

(a) What is the acceleration of the box as it moves up the ramp?  
Ans. 

(b) What is the normal force that the ramp exerts on the box?  
Ans. 

(c) What is the coefficient of kinetic friction $\mu_k$ between the box and the ramp?  
Ans.