

※ 考生請注意：本試題不可使用計算機

1. A 5-kg ball is dropped from a height of $h = 35.0$ m. The wind is blowing and imparts a constant horizontal force of 5 N on the ball. (a) How long does it take for the ball to reach the ground? (b) With what Velocity does the ball hit the ground? (c) Show that the path of a ball is a straight line and find the value of falling distance and angle. (15%)

2. A mover is trying to slide a uniformly box of length L , height H and mass M across a floor. There is static friction with coefficient μ_s between the floor and the box. The mover exerts a horizontal force F at the upper edge of the box. If μ_s is large enough, the box will tip over before it slides. (a) Find an expression for the minimum value of the force F required for the box to tip. (b) Calculate the minimum value of μ_s required such that the box will tip before sliding begins. (15%)

3. Three identical boxes of mass 10 kg are stacked vertically inside an elevator. The elevator is pulled up the elevator shaft with a constant acceleration of 2.5 m/s^2 . (a) Draw and label a free-body-diagram for each box inside the elevator. (b) Apply Newton's 2nd law to each box. (c) Find the net resultant force on each box. (d) If the elevator cable breaks and it descends in free-fall, what are now the forces acting on the individual boxes? (20%)

4. What kind of physical quantities are described by using vectors? Give 3 examples (10%)

5. At night, when it is dark outside, and you are inside a brightly lit room, it is easy to see your reflection in a window. During the day, it isn't so easy. Explain why this is so. (10%)

6. A heat engine needs an input of 4000 J to produce 800 J of useful work. (a) How much waste heat is produced? (b) What is the efficiency of the engine? (10%)

7. Three resistors, with resistances of 20 k Ω , 30 k Ω , and 50 k Ω are connected in series to a 20V power supply. (a) Draw a circuit diagram for this circuit. (b) What is the total resistance? (c) What current flows in the circuit? (d) What current flows through the 30 k resistor? (e) What is the potential difference across the 30 k Ω resistor? (20%)