**CE 222 ENGINEERING MECHANICS II ( SPRING 2014 – 2015 )**
**Home Exercise I –Kinematics of Particles**
**(http://www2.ce.metu.edu.tr/~ce222)**

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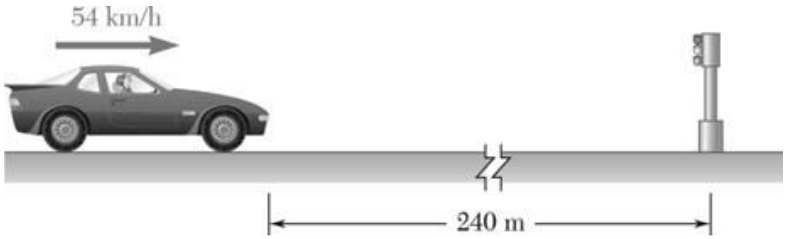
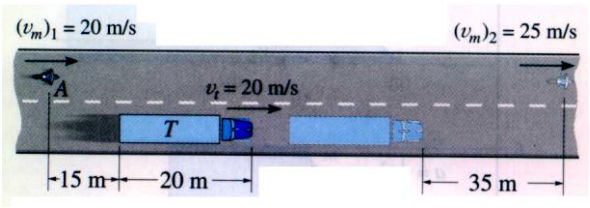
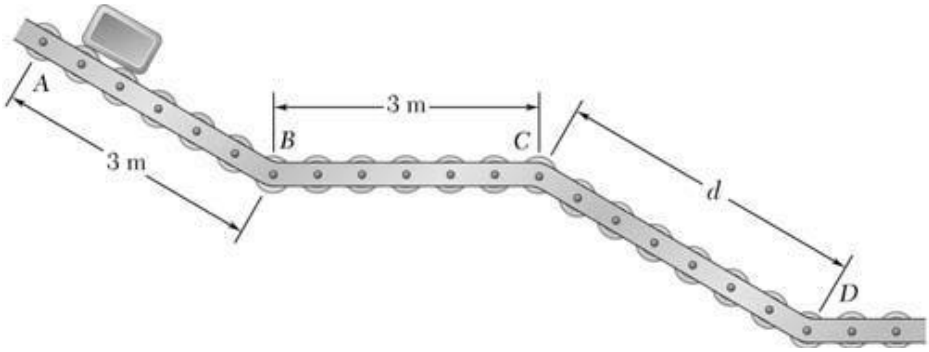
**1.** A motorist is traveling at 54 km/h when she observes that a traffic light 240 m ahead of her turns red. The traffic light is timed to stay red for 24 s. If the motorist wishes to pass the light without stopping just as it turns green again, determine:
**a)** the required uniform deceleration of the car,
**b)** the speed of the car as it passes the light.



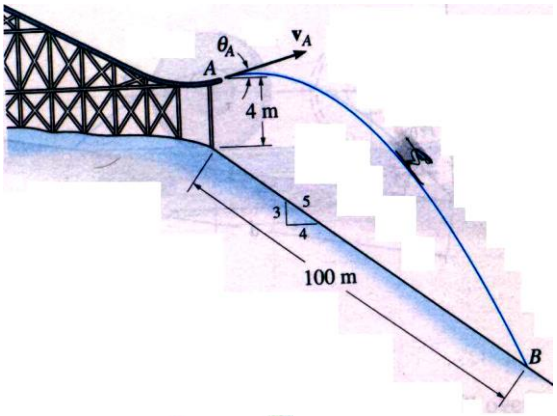

**2.** A motorcyclist at *A* is traveling at 20m/s when he wishes to pass the truck *T* which is traveling at a constant speed of 20 m/s. To do so the motorcyclist accelerates at 2 m/s$^2$ until reaching a maximum speed of 25m/s. If he then maintains this speed, determine the time needed for him to reach a point located 35m in front of the truck. Draw the *V-t* and *s-t* graphs for the motorcycle during this time.



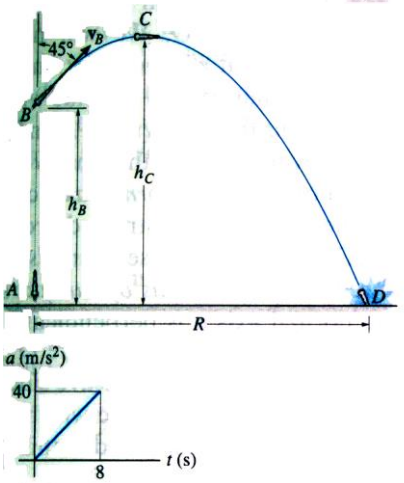

**3.** A small package is released from rest at *A* and moves along the skate wheel conveyor *ABCD*. The package has a uniform acceleration of 4.8m/s$^2$ as it moves down sections *AB* and *CD*, and its velocity is constant between *B* and *C*. If the velocity of the package at *D* is 7.2 m/s, determine:
**a)** the distance *d* between *C* and *D*,
**b)** the time required for the package to reach *D*.



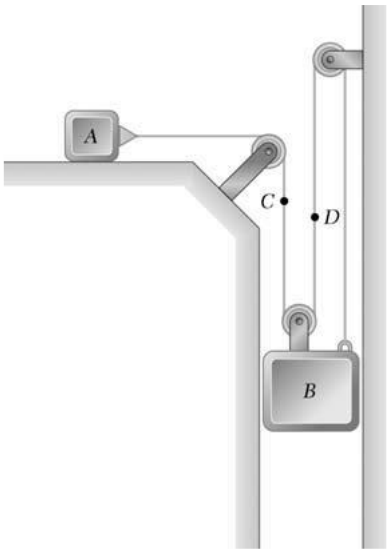
**4.** It is observed that the skier leaves the ramp *A* at an angle $\theta_A=25°$ with the horizontal. If he strikes the ground at *B*, determine his initial speed $V_A$ and the time of flight $t_{AB}$



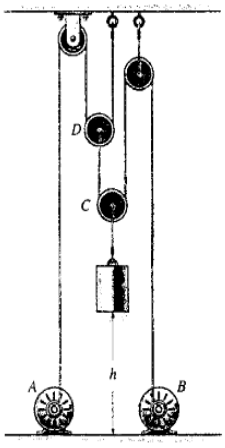

**5.** The missile at *A* takes off from rest and rises vertically to *B*, where its fuel runs out in 8 seconds. If the acceleration varies with time as shown, determine the missile's height $h_B$ and speed $V_B$. If by internal controls the missile is then suddenly pointed 45° as shown and allowed to travel in free flight, determine the maximum height attained, $h_C$, and the range *R* to where it crashes at *D*.



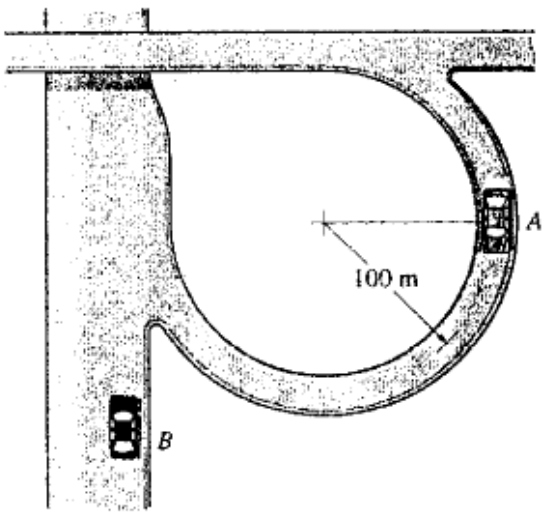

**6.** Slider block *A* moves to the left with a constant velocity of 6 m/s. Determine
**a)** the velocity of block *B*,
**b)** the velocity of portion *D* of the cable,
**c)** the relative velocity of portion *C* of the cable with respect to portion *D*.



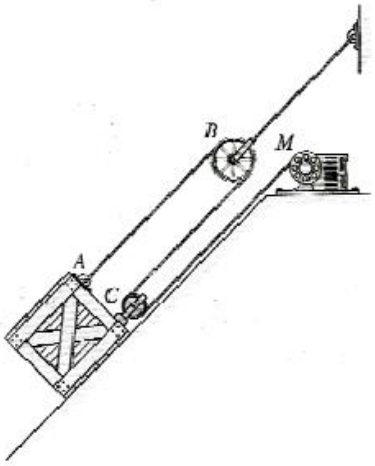

**7.** If motors A and B draw their attached cables with an acceleration of a=( 0.2 t ) $m/s^2$, where t is in seconds, determine the speed of the block when it reaches a height h = 4 m, starting from the rest. Also how much time does it take to reach this height?



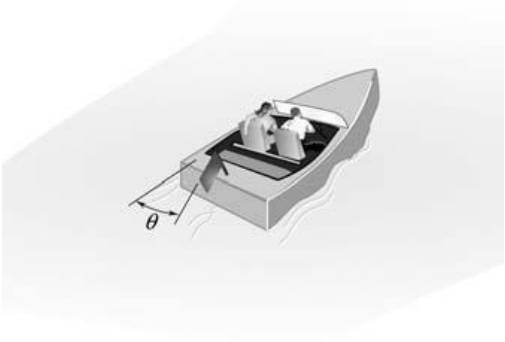
**8.** At the instant shown, the car A has a speed of 20 km/h, which is being increased at the rate of 300 km/h$^2$ as the car enters express way. At the same instant car B is decelerating at 250 km/h$^2$ while travelling forward at 100 km/h. Determine the velocity and acceleration of A with respect to B.




**9.** The crate is being lifted up the inclined plane using the motor M and the rope and pulley arrangement shown. Determine the speed at which the cable must be taken up by the motor in order to move the crate up the plane with a constant speed of 1.2 m/s.




**10.** When a small boat travels north at 5 km/h, a lag mounted on its stern forms an angle θ = 50° with the centerline of the boat as shown. A short time later, when the boat travels east at 20 km/h, angle θ is again 50°. Determine the speed and the direction of the wind.




**11.** A robot arm moves so that *P* travels in a circle about Point *B*, which is not moving. Knowing that *P* starts from rest, and its speed increases at a constant rate of 10 mm/s$^2$, determine

**a)** the magnitude of the acceleration when $t$ = 4 s,

**b)** the time for the magnitude of the acceleration to be 80 mm/s$^2$.