1) The 35N slender rod AB is released from rest when it is in the horizontal position so that it begins to rotate clockwise. A 10N ball is thrown at the rod with a velocity $v=15$m/s. The ball strikes the rod at C at the instant the rod is in the vertical position as shown. Determine the angular velocity of the rod and the velocity of the ball just after the impact. Take $e=0.7$ and $d=0.8$m. (30%)
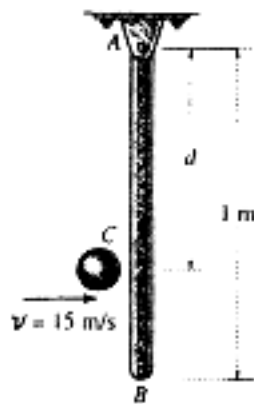

Fig 1.

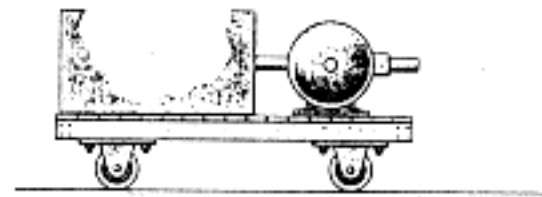Fig 2.

2) The cart has a mass M and is filled with water that has a mass m_o. If a pump ejects the water through a nozzle having a cross-sectional area A at a constant rate of v_o relative to the cart, determine the velocity of the cart as a function of time. No friction is encountered and the density of the water is ρ. (Hint: Derive the equation of motion for the following problem by using the principle of the impulse and momentum. Then, solve the problem.) (25 %)

3) IF the slider block C is fixed to the disk that has a constant counterclockwise angular velocity of 4 rad/s, determine the angular velocity and angular acceleration of the slotted arm AB at the instant shown. (25%)
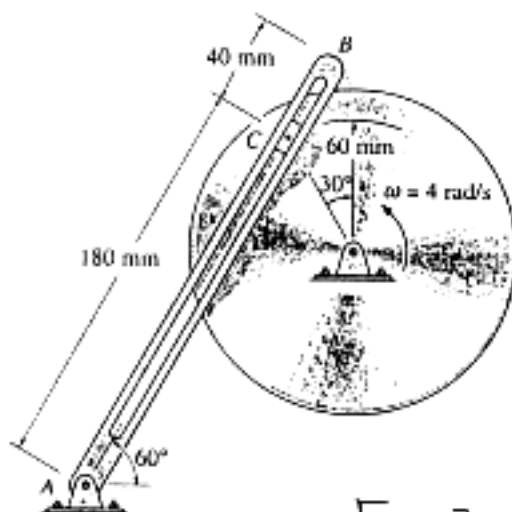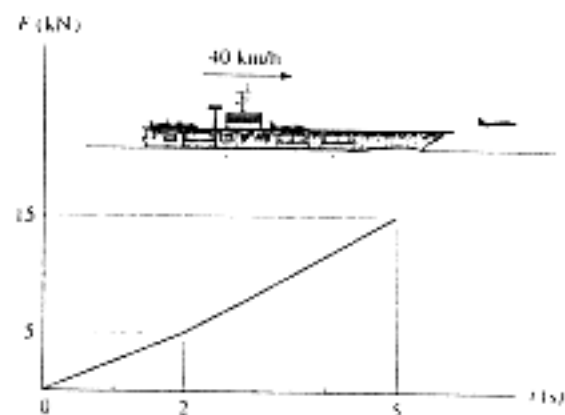

Fig. 3

Fig 4.

4) A jet plane having a mass of 7Mg takes off from an aircraft carrier such that the engine thrust varies as shown by the graph. If the carrier is traveling forward with a speed of 40Km/h, determine the plane's air speed after 5 s. (20%)