

※ 考生請注意：本試題 可 不可 使用計算機

1. (25%) A weight 10 kg is held at 90 degrees of abduction, as shown in Figure 1. The weight of the arm is 3 kg. The perpendicular distance from the glenohumeral (GH) joint to the center of the hand is 60 cm, and the distance to the center of gravity of the arm is 35 cm. Assume that the deltoid muscle is the only muscle acting to support the arm. Anatomical measurements have estimated that the perpendicular distance from the center of the deltoid muscle is 5 cm and that the deltoid muscle connects to the humerus at a point 9 cm distal to the GH joint.
- Write the three equations of static equilibrium, and hence
 - Calculate the deltoid muscle force and the joint reaction force.
 - How much is the magnitude of the joint reaction force reduced if the weight is dropped but the arm still remains at 90 degrees abduction?

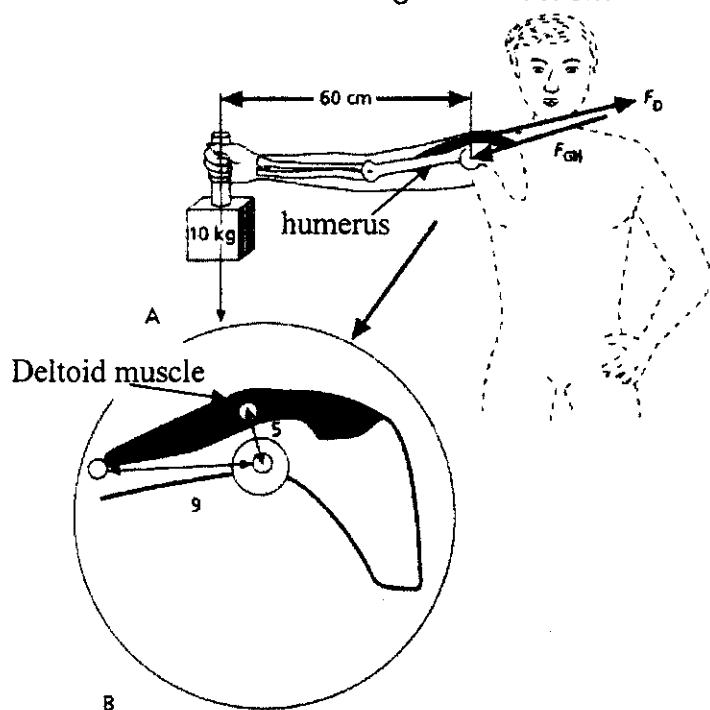


Fig. 1 Analysis of the shoulder joint

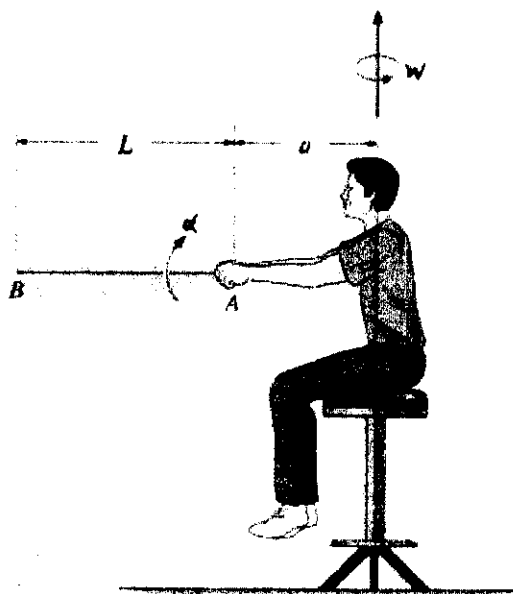


Fig. 2

- (20%) The man sits on a swivel chair which is rotating with constant angular velocity ω (Figure 2). He holds the uniform rod AB of weight W horizontal. He suddenly gives it an angular acceleration α measured relative to him, as shown. Determine the required force and moment components at the grip, A, necessary to do this. Establish axes at the rod's center of mass G , with $+z$ upward, and $+y$ directed along the axis of the rod towards A.
- (20%) Determine the moment of inertia of the cylinder with respect to the $a-a$ axis of the cylinder. The cylinder has a mass m . (Figure 3)
- (20%) The snowmobile of mass M with passenger is traveling down the hill at a constant speed v (Figure 4). Determine the resultant normal force and the resultant frictional force exerted on the tracks at the instant it reaches point A. Neglect the size of the snowmobile.

(背面仍有題目,請繼續作答)

系所組別： 醫學工程研究所甲組

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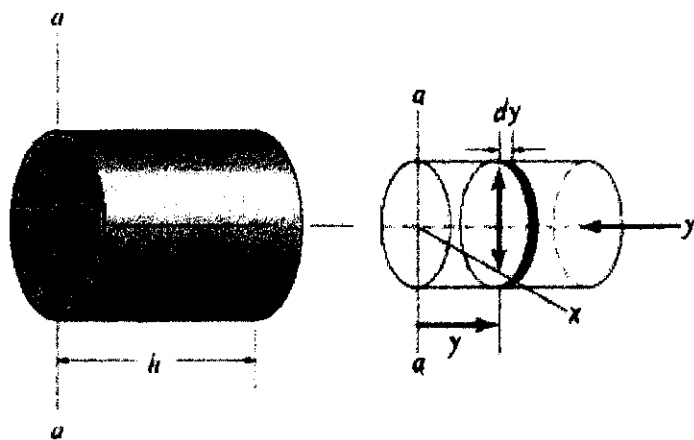


Fig. 3

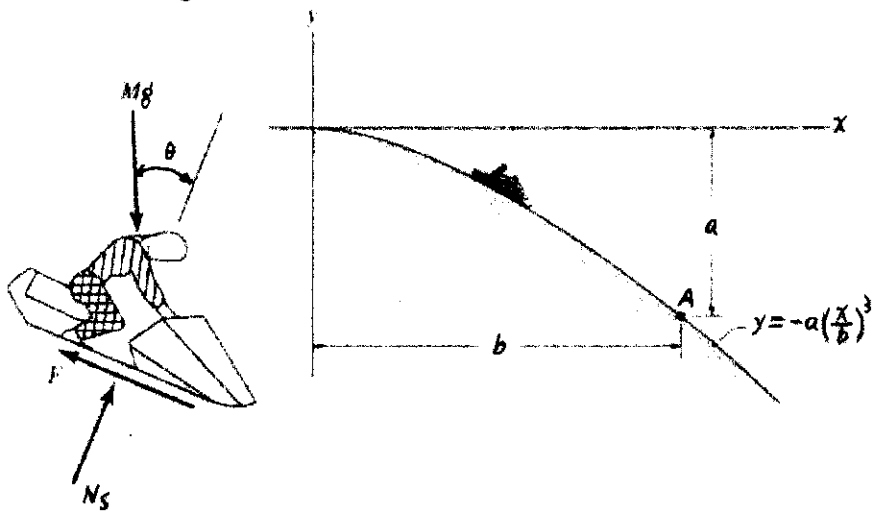


Fig. 4

5. (15%) Explain i) Principle of impulse and momentum; ii) Principle of work and energy.