科目：工程力學　　　　　　　　（※禁止使用計算機）

1. A homogeneous bar weights W and is placed against a smooth vertical wall at B (Figure 1). The coefficient of friction between the bar and the floor at A is μ_s and the length of the bar is L. Determine the minimum angle of θ at stable condition (10%). If the vertical wall is not smooth and the coefficient of friction between the bar and the wall at B is μ_s, determine the minimum angle of θ at stable condition (10%).
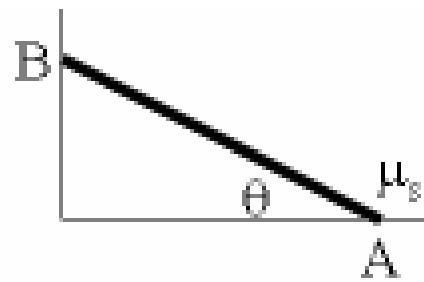

Fig. 1.

2. The pendulum bob shown in Fig. 2 weighs W (=mg). It is attached to the end of a light rigid rod whose length is L and mass is negligible. The pendulum is rotated from its initial vertical position through the angle θ. Let the pendulum be rotated until $\theta = 90°$ and released from rest. Determine the speed of the bob at the instant when $\theta = 0°$. Neglect friction of the pin A. (20%)
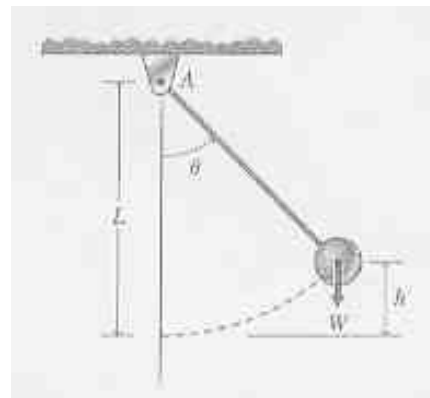

Fig. 2.

3. A particle with mass m at the end of string OA rests on a smooth cylindrical surface with radius r, as shown in Fig. 3. If the string is cut, the particle will slide down the surface and leave the surface at point B. Determine the position ϕ of B (i.e. express ϕ in terms of θ) and the velocity of particle at B. (20%)
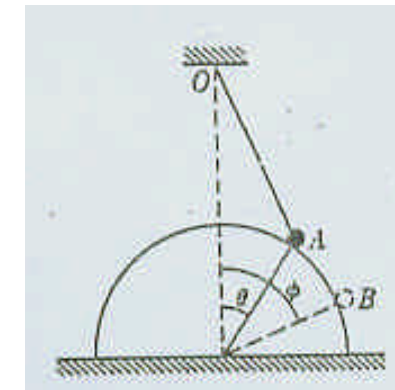

Fig. 3.

4. A simply supported wood beam AB with span length L = 3.5 m carries a uniform load of intensity q = 6.4 kN/m (Fig. 4). Calculate the maximum bending stress σ_{max} due to the load q if the beam has a rectangular cross section with width b = 140 mm and height h = 240 mm. (20%)
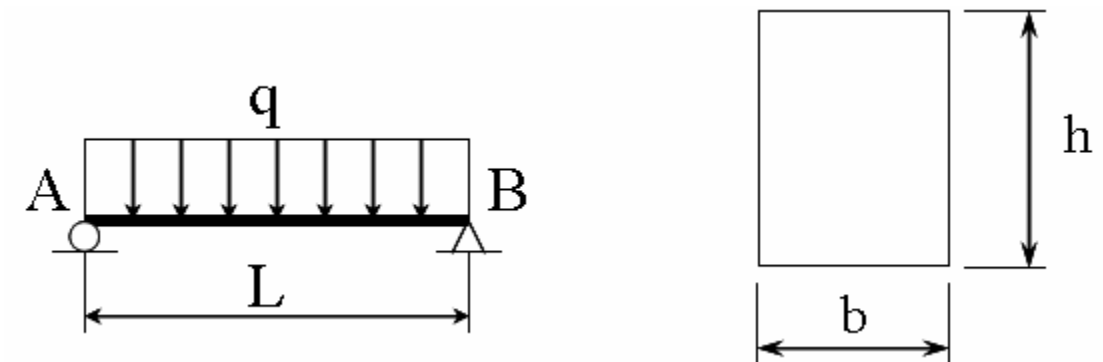

Fig. 4.

5. At a point on the surface of a pressurized cylinder, the material is subjected to biaxial stress as shown on the stress element of Fig. 5. Determine the principal stresses and the maximum shear stresses. (20%)
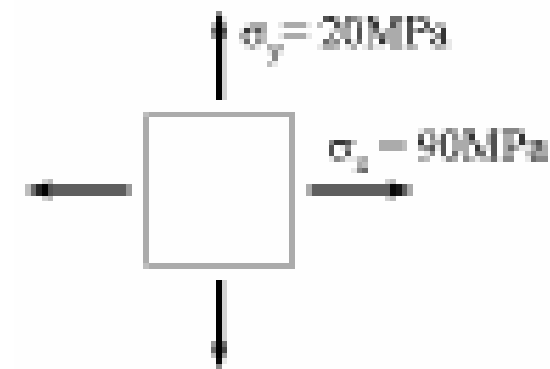

Fig. 5.