計算題
固力部份
1. (15%) 有一個無摩擦且質量可忽略的定滑輪掛了二個質量分別為 4 Kg 與 6 Kg 的方塊，
如右下圖所示。若二個方塊原為靜止狀態，且重力加速度常數 g=9.8 N/m²，試計算：
(1) 方塊 B 需要多少時間墜落至地面？ 5%
(2) 當方塊 B 墜落至地面瞬間，方塊 A 向上的速度為何？ 5%
(3) 方塊 A 最高可以向上移動多少公尺？ 5%

2. (20%) 有一重量均勻分佈的 10 Kgw 招牌懸吊於一剛性桿之下，如右下圖所示。剛性桿
與牆壁之間有插銷連接，且右端由一繩索支撐。若夾角 θ=30°，試計算繩索張力以及
插銷處牆壁對剛性桿在 x 與 y 方向的反力各為多少 N。剛性桿與繩索的重量不計，重力
加速度常數為 9.8 N/m²。
電學部份
3. (15%) A point charge $Q$ is located just above the center of the flat face of a hemisphere of radius $R$ as shown below. What is the electric flux (a) through the curved surface and (b) through the flat face.

![Diagram of a hemisphere with a point charge at its center](image)

4. (15%) A uniformly charged insulating rod of length $l$ is bent into the shape of a semicircle. The rod has a total charge $Q$. Find the magnitude and direction of the electric field at the center of the semicircle.

熱力部份
5. (20%) A person produces heat at a rate of 80 W. What is the temperature increase in one hour due to two people in an airtight room of volume 100 $m^3$ initially at 10°C and 10° Pa? Assume that all the heat is absorbed by the air. Take $C = 0.72$ $kJ/kg \cdot K$ and $M = 29$ g/mol.

6. (15%) A refrigerator with a coefficient of performance of 4.0 absorbs 100 $kJ$ from the freezer compartment. (a) How much work does this require? (b) How much heat is expelled to the surroundings?