

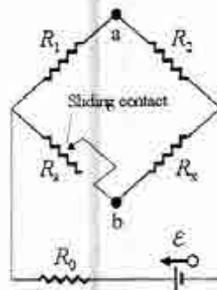
科目：普通物理 適用：應化系二

編號：342

考生注意：1. 依次序作答，只要標明題號，不必抄題。  
2. 答案必須寫在答案卷上，否則不予計分。  
3. 試題隨卷繳回。

本 試 題  
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- (20%) Please prove the total energy of a planet moving around the sun is  $E = -\frac{GMm}{r_1 + r_2}$ , where  $M, m$  are the mass of Sun and the planet, and  $r_1, r_2$  are the near and far points in the orbit of this planet.
- (20%) Fermat stated in 17th century that "the actual path from one point to another point which light travels is the one requires least time." Please prove the laws of reflection and refraction by using Fermat's principle.
- (20%) Please prove that the heat absorb during the constant pressure process equals the increase of enthalpy.
- (20%) As shown in the figure below,  $R_x$  is to be adjusted in value by moving the sliding contact across it until points  $a$  and  $b$  are brought to the same potential. Show that when this adjustment is made, the following relationship holds:  $R_x = R_3 (R_1 / R_2)$ . An unknown resistance ( $R_x$ ) can be measured in terms of a standard ( $R_x$ ) using this device, which is called a Wheatstone bridge.



- (20%) Using laws of momentum and energy conservation to prove a free electron can not absorb a photon completely in a single action. Note that  $E = m_0 c^2$  where  $E$  and  $m_0$  are the energy and mass of the free electron in the static reference system and  $P = h\nu/c$  where  $P, \nu$  and  $c$  is the momentum, frequency and velocity of light respectively.