1. (20 pts) A 85kg rider on a 15kg bicycle moves in a circular loop of 35m radius on a flat, horizontal pavement. Let the coefficient of static friction between the tires and the dry pavement be 0.500. Find the maximum speed of the bicycle before it starts to skid.

2. (20 pts) A rocket moving in vacuum space has a speed of 3.0×10^3 m/s relative to the Earth while turning on its engines. The exhaust is ejected at a speed of 5.0×10^3 m/s in the direction exactly opposite to the rocket's motion. Answer the following questions.

   (a) (10 pts) Give the rocket speed relative to the Earth once the mass is reduced to one half of its mass before ignition.

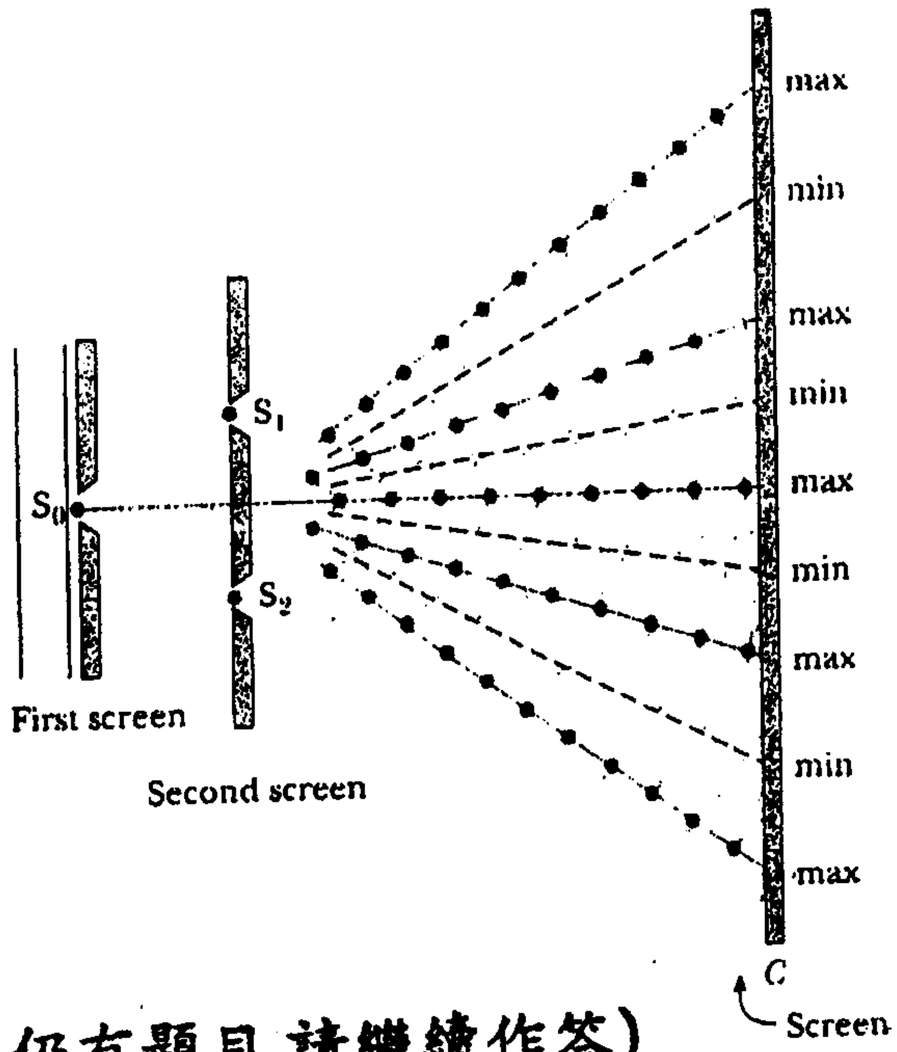
   (b) (10 pts) Let the rocket burn fuel at the rate of 50 kg/s. Give the thrust force.

3. (20 pts) The allowed energy levels for the electron in the hydrogen atom are $E_n = R_H(\frac{1}{n^2})$, where n = 1, 2, 3 ..., and $R_H = 1.0973732\times10^7 m^{-1}$. The electron makes a transition from n=2 energy state to the ground state of n=1. Give the wavelength and frequency of the emitted radiation.

4. (20 pts) A viewing screen (the C screen as shown in the figure below) is separated from the double-slit source by 1.2m. The distance between the two slits is 0.030mm. The second-order bright fringe is 4.5cm from the center line. Answer the following questions.

   (a) (10 pts) Determine the wavelength of the light.

   (b) (10 pts) Give the distance between adjacent bright fringes.



（背面仍有題目,請繼續作答）

5. (20 pts) Maxwell's equations, while supplemented by the Lorentz force equation $\vec{F} = q(\vec{E} + \vec{v} \times \vec{B})$ and the conservation of charge, describe a lot of electromagnetic phenomena we encounter. Collectively, Maxwell's equations consist of the following four equations:

Gauss' law for electricity	$\oint \vec{E} \cdot d\vec{A} = q_{enc} / \varepsilon_0$
Gauss' law for magnetism	$\oint \vec{B} \cdot d\vec{A} = 0$
Faraday's law	$\oint \vec{E} \cdot d\vec{s} = -d\Phi_B / dt$
Ampere-Maxwell law	$\oint \vec{B} \cdot d\vec{s} = \mu_0(\varepsilon_0 d\Phi_E / dt + i_{inc})$

Answer the following questions.

(a) (10 pts) In your opinion, is there anything that can be considered as the source of electric field? Briefly explain your answer.

(b) (10 pts) Is there anything that can be considered as the source of magnetic field? Explain your answer. Briefly explain your answer.