1. (15%) Wheel **A** of radius $r_A = 10\,\text{cm}$ is coupled by belt **B** to wheel of radius $r_C = 25\,\text{cm}$, shown in Fig.1. Wheel **A** increases it angular speed from rest at a uniform rate of $1.6\ rad/s^2$. Determine the time required for wheel **C** to reach a rotational speed of $100\ rev/\text{min}$, assuming the belt does not slip.
2. (15%) Two particles oscillate in simple harmonic motion along a common straight line segment of length L. Each particle has a period of 1.5 s but they differ in phase by $\pi/6$ rad. (a) How far apart are they (in terms of L) 0.5 s after the lagging particle leaves one end of the path ? (b) Are they then move in the same direction, toward each other, or away from each other ?
3. (15%) A brass rod is in thermal contact with a heat reservoir at $130^\circ$ C at one end and a heat reservoir at $24^\circ$ C at the other end. (a) Compute the total change in entropy arising from the conduction of 1200 cal of heat through the rod. (b) Does the entropy of the rod change in the process ?
4. (15%) Fig. 2 shows a spherical shell of charge of uniform volume charge density $\rho$. Calculate and plot E due to the shell for the distances **r** from the center of the shell ranging from zero to 30 cm. Assume that $\rho = 1.0\times10^{-6}\,C/m^3$, a=10 cm, and b=20 cm.
5. (10%) The two headlights of an approaching automobile are 1.4 m apart. At what (a) angular separation and (b) maximum distance will the eyes resolve them ? Assume that the pupil diameter is 5.0 mm, and use a wavelength of 550 nm. Also assume that diffraction effects alone limit the resolution.
6. (9%) Indicate three of the most important parameters of two interference waves for obtaining the largest contrast and most stable interference fringes ? Why ?
7. (5%) As shown in Fig. 3, where does the energy of the incident light go if the observer can watch nothing from T ? And what happens on the Michelson interferometer ?
8. 簡答題 (16%)
   (1) 爲何霧燈是黃色的？
   (2) 一架高速噴射飛機即將高　　飛過你的上方，如何在閉上眼睛後卻能有效地判斷飛機何時與你的距離最短？
   (3) 爲何一個有近視眼的人可以在水面下看得更遠？
   (4) 日光燈管管壁內層的白色介質作何用途？

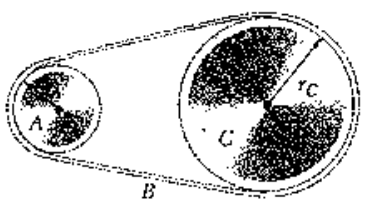

Fig. 1

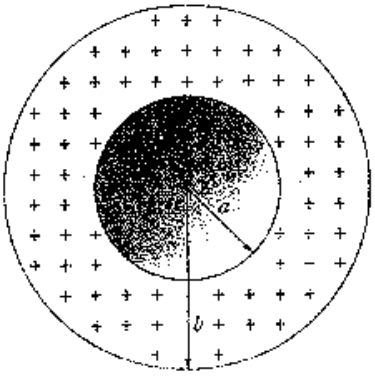

Fig. 2

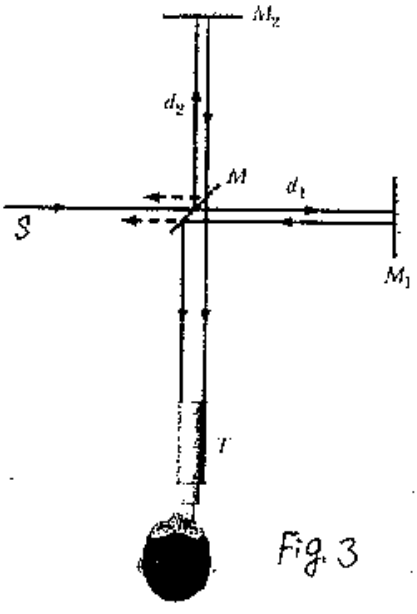

Fig. 3