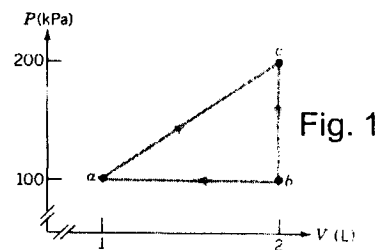


- (10 points) A thin rod of length L varies in its composition in such a manner that its linear mass density is $\lambda(x) = a + bx$, where x is the distance from one end. Locate the center of mass relative to $x = 0$.
- (15 points) A particle of mass M moves in the xy plane. Its coordinates as a function of time are given by $x(t) = A t^3$; $y(t) = B t^4 + C t^2$, where A , B , and C are constants. (a) Find its angular momentum about the origin. (b) What force acts on it?
- (10 points) A uniform disk of mass M and radius R oscillates about a horizontal axis at a distance of d from the center. What is the period of oscillation? The moment of inertia of the disk about a central axis is $MR^2 / 2$.

- (15 points) When a gas undergoes a process depicted as the straight line from a to c in Fig.1 the heat flow into the system is 200 J . (a) Find the work done from a to c . (b) If $U_a = 200 \text{ J}$, find U_c . (c) What is the work done by the gas when it return to a via b ? (d) What is the heat transfer in the process cba ?



- (10 points) A thin insulating rod of length L carries a uniformly distributed charge Q . Find the field strength at a point along its axis at a distance a from one end.

- (10 points) Consider the circuit shown in Fig. 2. Find: (a) the initial current through each resistor when the switch is closed; (b) the final steady-state current through each resistor.

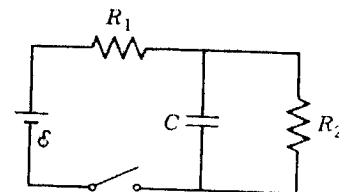


Fig. 2

- (15 points) A ring of radius R lies perpendicular to a uniform magnetic field that varies according to $B = B_0 \exp(-t)$. What is the induced electric field in the ring.
- (15 points) The total energy of a particle is four times its rest energy. Find (a) its kinetic energy; (b) its speed.