本試題是否可以使用計算機：　☑可使用　，　□不可使用　（請命題老師勾選）

1. A boat is cruising at a velocity v_o through a lake. If its engine is suddenly cut off, and the resisting force due to the water is proportional to its velocity. After time t, find (a) the velocity of the boat, (b) the distance that the boat traveled, and (c) the velocity of the boat in term of the distance traveled. (20%)

2. In a diatomic molecule, if the potential energy between the two atoms can be expressed as

$$U(r) = U_o \left[\left(\frac{r_o}{r} \right)^{12} - 2 \left(\frac{r_o}{r} \right)^{6} \right]$$, where r is the separation, U_o and r_o are constants. (a) Sketch the

form this potential as a function of distance r; (b) find the equilibrium distance between these two atoms; (c) sketch the form of the force as a function of distance r. （20%）

3. An ideal gas undergoes the cyclic process depicted in the figure 1. In the process abc, the system absorbs 6000 J of heat. The internal energy at a is $U_a = 1000$ J. (a) Determine U_c. The net heat absorbed during the complete cycle is 2000 J. For the process c to a find (b) the heat transfer and (c) the work done by the gas. (20%)
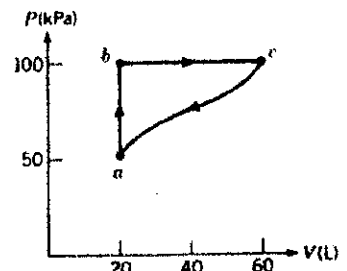
Fig 1

4. A metal sphere of radius R_1 carrying a charge $+Q_1$ is enclosed by a conducting spherical shell of radius R_2 that has a charge $-Q_2$ ($R_2 > R_1$). Find (a) the electric field for the regions $r > R_2$ and $R_1 < r < R_2$. If taking the electric potential at infinite as zero, find (b) the electric potential at $R_1 < r < R_2$. (20%)

5. A visible light has a wavelength of 500 nm. (a) What is the color of this light? (b) Find the frequency of the light. (c) Find the energy of the photon. If the light shines on a metal with a work function of 0.7 eV, find (c) the kinetic energy of the ejected electrons. $c = 3 \times 10^8$ m/s, $h = 6.626 \times 10^{-34}$ J s, 1 eV $= 1.602 \times 10^{-19}$ J (20%)