# 國立中央大學九十學年度碩士班研究生入學試題卷

所別：水文科學研究所　不分組　科目：普通物理　共 1 頁 第 1 頁

（每題 20 分;總分 100 分）

1. As shown in Figure 1, what horizontal force $F$ must be applied to the cart (mass $M$) so that the blocks (mass $m_1$ and $m_2$) remain stationary relative to the cart? Assume all surfaces, wheels, and pulley are frictionless.

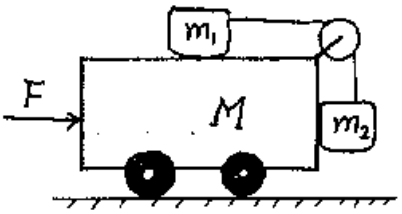



Figure 1.

2. A sinusoidal wave on a string is described by the equation

$$y = A\sin(kx - wt)$$

where $A$=0.51cm, $k$=3.1rad/cm and $w$=9.3rad/s. How far does a wave crest move in 10 seconds? Does the wave move in the positive or negative direction?

3. One mole of an ideal monatomic gas (at constant volume the molar specific heat $C_v = \frac{3}{2}R$) is taken through the cycle shown in Figure 3. The process A to B is a reversible isothermal expansion. (The universal gas constant $R$ = 8.315 J/mol K)
   (a) What is the net work done by the gas?
   (b) What is the (heat) energy added to the gas?
   (c) What is the (heat) energy expelled by the gas?
   (d) What is the efficiency of the cycle?

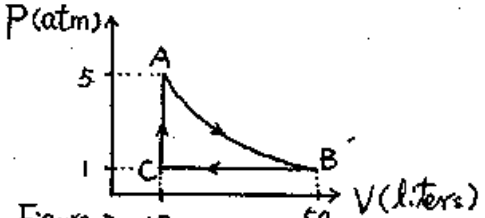
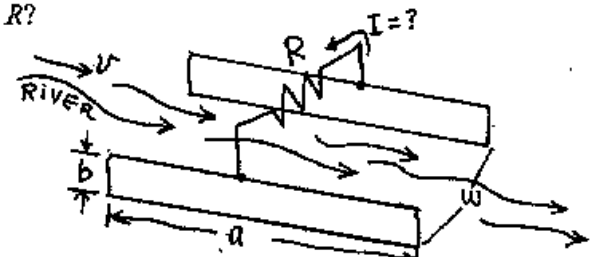



Figure 3.

4. Michael Faraday proposed that the following apparatus could be used to generate electric current from water flowing in the Thames River. Two conducting plates of lengths $a$ and widths $b$ are placed facing each other on opposite sides of the river, a distance $w$ apart, and immersed in water completely. Assume that the flow velocity of the river is $v$, the electric resistivity of the water is $\rho$ and the vertical component of the Earth's magnetic field is $B$. What is the current in the load resistor $R$?




5. As shown in the following figure, the current-carrying loop is formed of radial lines and segments of circles whose centers are at point P. Find the magnitude and direction of the magnetic field B at P.