大同大學 九十四 學年度 轉學考試 試題

考試科目：物理　　第 1 頁，共 1 頁

註：本次考試不可以參考自己的書籍及筆記；　不可以使用字典；　不可以使用計算器。

1. In fig.1, a ball has mass m is connected by means of two massless strings, each of length L, to a vertical, rotating rod. The strings are tied to the rod with separation 1.2L and are taut. If the speed of the ball is v, what are (a) the tension in the upper string and (b) the lower string?

2. In fig.2, block1 (mass=2.0 kg) is moving rightward at 10 m/s and block2 (mass=5.0 kg) is moving rightward at 3.0 m/s. The surface is frictionless, and a ideal spring with spring constant of 1120 N/m is fixed to block2. When the blocks collide, the compression of the spring is maximum at the instant the blocks have the same velocity. Find (a)the maximum compression and (b) the velocity of block1 and block2 after collision.

3. A sample of an ideal gas is taken through the cyclic process abca shown in fig.3; at point a, T=200K. (a) How many moles of gas are in the sample? What are (b) the temperature of the gas at point b and c, and (c) the net energy added to the gas as heat during the cycle? (R=8.31 J/mol·K)

4. In fig.4, a solid cylinder attached to a horizontal spring rolls without slipping along a horizontal surface. If the system is released from rest when the spring is stretched by x_o. Show that the cylinder's center of mass executes simple harmonic motion with period $T = 2\pi\sqrt{\frac{3M}{2k}}$

5. In Fig.5, a solid conducting sphere of radius a is concentric with a spherical conducting shell of inner radius b and outer radius c. The sphere has a net uniform charge q_1; the shell has a net charge $-q_2$. (a) What is the magnitude of the electric field E(r) versus radial distance r. (b) What is the net charge on the inner and outer surface of the shell?

6. A sinusoidal wave of wavelength 20cm is traveling along a string in the $-$x direction with speed 40cm/s. (a) What are the frequency and period? (b) The displacement of the particles of the string is maximum y_m=5.0cm at x=0 when t=0. If the wave is of the form $y(x,t) = y_m \sin(kx \pm \omega t + \phi)$, what are k, ω, ϕ, and the correct choice of sign in front of ω?

7. A long, rigid wire, lying along x axis, carries a current of 2.0A in the $+$x direction. A magnetic field B is present, given by $B=3.0\hat{i}+8.0x^2\hat{j}$, with x in meters and B in teslas. Find, in unit-vector notation, the force on the 2.0m segment of the conductor that lies between x=1.0m and x=3.0m.

Fig.1

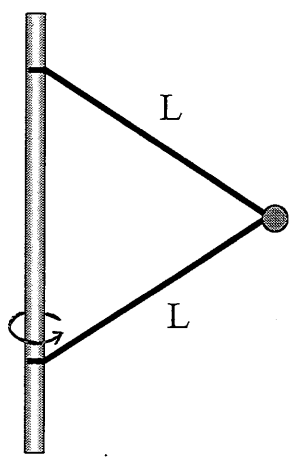

Fig.2

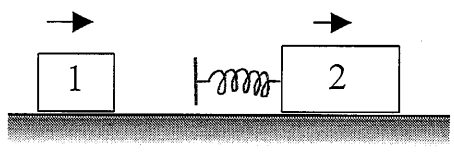

Fig.3

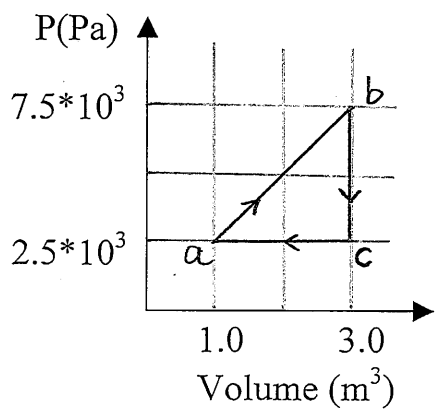

Fig.4

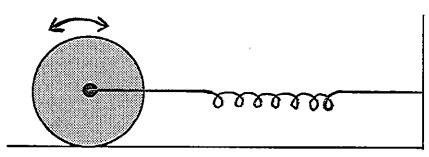
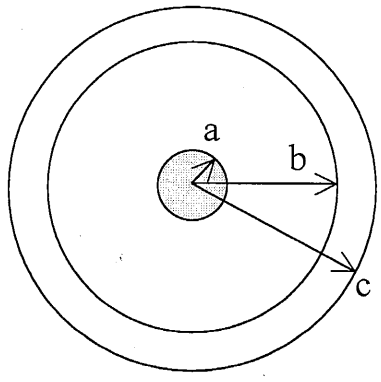
Fig.5