※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Fig 1. shows a tunnel in a uniform planet of mass M and radius R. (a) Show that the equation of motion for a particle moving along the tunnel is a simple harmonic oscillation (7%), and (b) find the period of the oscillation. (3%）
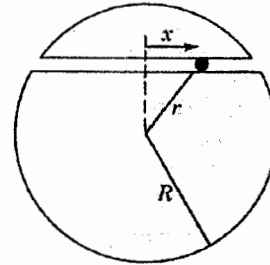


Fig.1

2. A particle encounters a position-dependent potential energy as shown in the figure to the right.
(a) Where the particle experiences no force when its total energy is $E_1$. (2%)
(b) Where the particle experiences an repulsive force when its total energy is $E_1$. (4%)
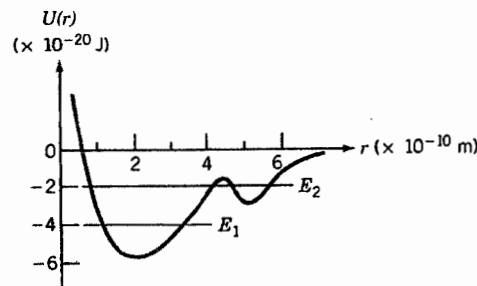(c) What is the maximum kinetic energy of the particle when its total energy is $E_2$ . (4%)



Fig2

3. A man of mass m runs at speed u along the tangent to a uniform disk-shaped platform of mass M and radius R, see Fig.3. The platform is initially at rest but can rotate freely about an axis through its center. (a) Show the moment of inertia of the uniform disk-shaped platform $I=(1/2)MR^2$. (6%) (b)Find the angular velocity of the platform after the man jumps on.(5%) (c) The man then walks to the center. Find the new angular velocity.(4%) Treat the man as a point particle.
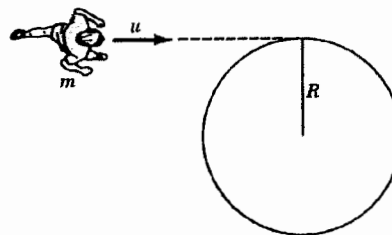


Fig.3

4. Two moles of an ideal diatomic gas are taken around the cycle of Fig.4. Find : (a)the heat absorbed or rejected in each segment（9%）; (b) the work done per cycle（3%）; (c)the efficiency（3%）. (The universal gas constant R=8.31 J/mol·K)



Fig.4

（背面仍有題目，請繼續作答）

系所組別：地球科學系甲、乙組

考試科目：普通物理　　　　　　　　　　　　　　　　　　考試日期：0223，節次：2
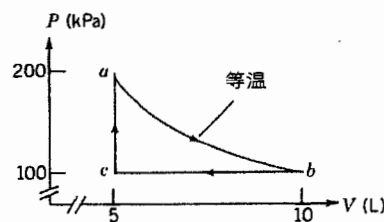
※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

5. A police car moves at 60m/s in the same direction as a truck that has a speed 30m/s. The police siren has a frequency of 1100Hz What is the frequency heard by the truck driver when the police car is (a) behind the truck, or (b) ahead of the truck? Take the speed of sound to be 340m/s. (10%)

6. Electrons are emitted from a thin, heated filament and collimated by two disks with holes (see Fig. 5). They initial velocity is $v_0 i$. They pass between two plates of length $l$ that produce a uniform field, $E = -E j$. As each electron strikes the screen, a tiny flash of light is emitted. Find: (a) its vertical position as it emerges from the plates(4%); (b) the angle at which it emerge from the plates(3%); (c) its final vertical displacement on the screen which is at distance L from the end of the plates.(3%).
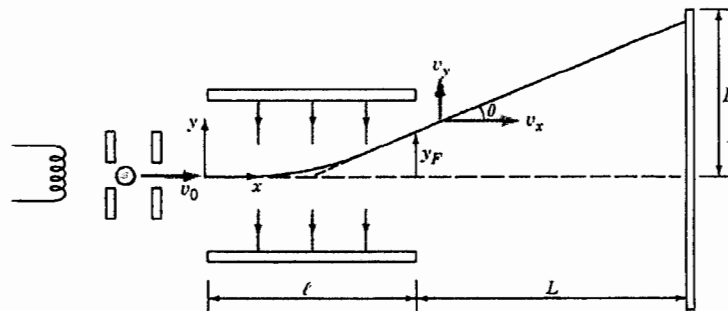


Fig. 5

7. In A. J. Dempster's mass spectrometer (as shown in Fig.6), two isotopes of an element with masses $m_1$ and $m_2$ are accelerated from rest by a potential difference $V_0$. They then enter a uniform field B normal to the magnetic field lines. What is the ratio of the radii of their paths?(10%)
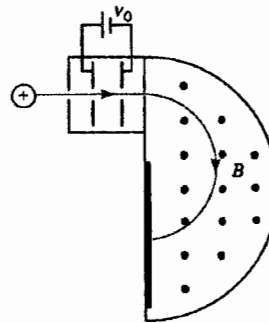


Fig. 6

8. A toroidal coil is tightly wound with $N$ turns and carries a current $I$. We assume that it has a rectangular cross section, as shown in Fig.7.
Find (a)the magnetic field strength within the toroid (8%), (b) the total energy within the toroid (8%), and (c) The self-inductance of the toroid (4%).
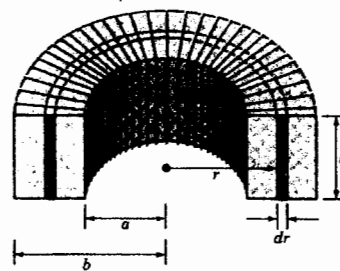


Fig. 7