國立中山大學九十四學年度轉學生招生考試試題

科目：微積分【物理系二年級、電機系二年級、材光系二年級、海工系二年級、機電系二年級、資管系二年級】

1. 求 $\lim_{x\to+\infty}\left[\sin\left(x+\frac{1}{x}\right)-\sin x\right]$

2. 求 $\lim_{x\to 0}\left(\frac{\sin x}{x}\right)^{1/x^2}$

3. 製作函數 $f(x)=\frac{x}{x^2+1}$ 之圖形.

4. 求 $\int \ln(x^2-1)\,dx$

5. 求 $\lim_{x\to+\infty}\left(\frac{1}{\sqrt{n^2}}+\frac{1}{\sqrt{n^2+n}}+\frac{1}{\sqrt{n^2+2n}}+\cdots+\frac{1}{\sqrt{n^2+(n-1)n}}\right)$

6. 求 $\int_{0^+}^{+\infty}\frac{dx}{(1+x)\sqrt{x}}$

7. 求橢圓體 $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ 之體積.

8. 求冪級數 $\sum_{n=1}^{\infty}\frac{(2x-3)^n}{2^n\sqrt{n}}$ 之收斂區間.

9. 求 $\iint_A x^2\,dA$，其中 A 為由 $xy=16$，$y=x$，$y=0$ 與 $x=8$ 在第一象限所圍區域.

10. 求 $\int_0^1\int_x^1\frac{\sin y}{y}\,dy\,dx$.

＊1－10題，每題十分.

94 學年度轉學生入學考試 普通物理試題

第一部分為選擇題，每題 6 分，共 60 分

1. An ideal gas is allowed to undergo a free expansion. If its initial volume is V_1 and its final volume is V_2, the change in entropy is
   (A) $nR \ln (V_2/V_1)$
   (B) $nRT \ln (V_2/V_1)$
   (C) $nk \ln (V_2/V_1)$
   (D) 0
   (E) $nR\, V_2/V_1$

2. The specific heat at constant pressure at 0°C of one mole of an ideal monatomic gas is
   (A) 0.5R
   (B) R
   (C) 1.5R
   (D) 2R
   (E) 2.5R

3. A uniform rod (length = 2.4 m) of negligible mass has a 1.0-kg point mass attached to one end and a 2.0-kg point mass attached to the other end. The rod is mounted to rotate freely about a horizontal axis that is perpendicular to the rod and that passes through a point 1.0 m from the 2.0-kg mass. The rod is released from rest when it is horizontal. What is the angular velocity of the rod at the instant the 2.0-kg mass passes through its low point?
   (A) 1.72 rad/s
   (B) 2.96 rad/s
   (C) 4.1 rad/s
   (D) 1.5 rad/s
   (E) 3.1 rad/s

4. A parallel-plate capacitor has a charge Q and plates of area A. What force acts on one plate to attract it toward the other plate?
   (A) $Q^2/\varepsilon_0 A$
   (B) $2Q^2/\varepsilon_0 A$
   (C) $Q^2/2\varepsilon_0 A$

(D) $Q^2/3\varepsilon_0 A$

(E) $3Q^2/\varepsilon_0 A$

5. A uniform rod (mass m = 1.0 kg and length L = 2.0 m) pivoted at one end oscillates in a vertical plane as shown below. The period of oscillation (in s) is approximately

(A) 4.0

(B) 2.3

(C) 3.2

(D) 1.6

(E) 2.0

6. The coil shown in the figure 2 has 3 turns, a cross-sectional area of 0.20 m^2, and a field (parallel to the axis of the coil) with a magnitude given by B = $(-4.0 + 3.0t^2)$ T, where t is in s. What is the potential difference, $V_A - V_C$, at t = 3.0 s?

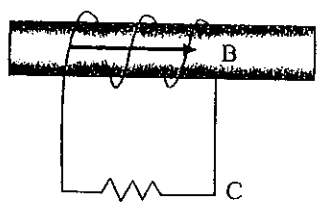

Fig. 2

(A) -10.8V

(B) +10.8V

(C) -3.6V

(D) +3.6V

(E) 24V

7. The magnetic field of a plane-polarized electromagnetic wave moving in the z-direction is given by $B = 1.2\times 10^{-6} \sin\left[2\pi\left(\frac{z}{240} - \frac{t\times 10^7}{8}\right)\right]$ in SI units. What is the speed of the EM wave?

(A) 100 m/s

(B) 1.2×10^6 m/s

(C) 2×10^7 m/s

(D) 2×10^8 m/s

(E) 3×10^8 m/s

8. When you look at a single slit diffraction pattern produced on a screen by light of a single wavelength, you see a bright central maximum and a number of maxima on either side, their intensity decreasing with distance from the central maximum. If the width of the slit is increased,

(A) the width of the central maximum decreases, but the other maxima do not change in position or width.

(B) the width of the central maximum increases, but the other maxima do not change in position or width.

(C) the pattern shrinks in size. (central maximum less wide; other maxima in closer to it)

(D) the pattern increases in size. (central maximum wider; other maxima farther from it)

(E) it does not affect the size of the pattern.

9. A stopping potential of 3.2 V is needed for radiation whose wavelength is 200 *nm*. What is the work function (in eV) of the material?

(A) 2.0

(B) 3.0

(C) 4.0

(D) 5.0

(E) 6.0

10. A particle of mass m= 0.10 kg and speed v_0 = 5.0 m/s collides and sticks to the end of a uniform solid cylinder of mass M = 1.0 kg and radius R = 20 cm. If the cylinder is initially at rest and is pivoted about a frictionless axle through its center, what is the final angular velocity (in rad/s) of the system after the collision?

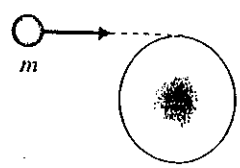

Fig. 3

(A) 5.0

(B) 2.47

(C) 6.1

(D) 4.16

(E) 10

第二部分為非選擇題，每題 10 分，共 40 分

1. A non-conducting sphere has mass m and radius a. A flat compact coil of wire with N turns is wrapped tightly around it, with each turn concentric with the sphere. As shown in Fig. 4, the sphere is placed on an inclined plane that slopes downward to the left, making an angle θ with the horizontal, so that the coil is parallel to the inclined plane. A uniform magnetic field B vertically upward exists in the region of the sphere. What current in the coil will enable the sphere to rest in equilibrium on the inclined plane? Please draw the force diagram in detail.

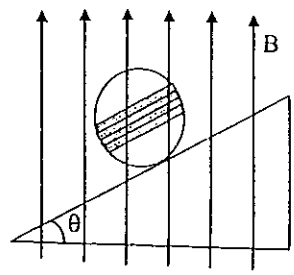

Fig. 4

2. A bullet of mass m is fired into a block of mass M initially at rest at the edge of a frictionless table of height h (Fig. 5). The bullet remains in the block, and after impact the block lands a distance d from the bottom of the table. Determine the initial speed of the bullet.

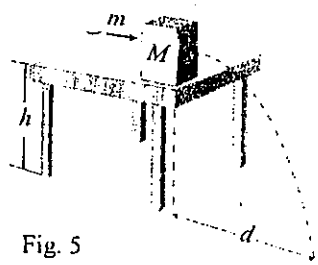

Fig. 5

3. A mole ideal monatomic gas is taken through the cycle shown in Figure 6. The process $A \rightarrow B$ is a reversible isothermal expansion. Calculate (a) the net work done by the gas, (b) the energy added to the gas by heat, (c) the energy exhausted from the gas by heat, and (d) the efficiency of the cycle.

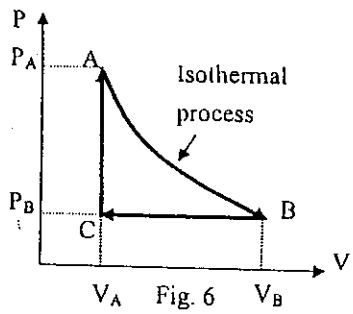

Fig. 6

4. Determine the magnetic field at a point P located a distance x from the corner of an infinitely long wire bent at a right angle, as shown in Figure 7. The wire carries a steady current I.

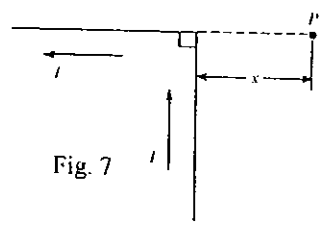

Fig. 7