銘傳大學八十八學年度管理科學研究所碩士班招生考試

（甲組）第一節

普通物理學 試題

NOTE:

A) An electronic calculation is **NOT** needed in this exam;

B) You can answer or solve the following problems in either Chinese or English.

1. Answer the following questions briefly, but precisely. (30%)
   (a) If the total force oil a system is zero, what physical quantity is conserved? If no torque on a system, then what is conserved?
   (b) With the same mass, write down the following in the order from the largest to the smallest volume: 0℃ ice, 100℃ steam, and 4℃ water.
   (c) Among the gravitational force, the strong interaction, and the electromagnetic force, Which strength is the strongest? which is the weakest?
   (d) After refraction, a beam of ordinary light can be separated into 7 visible colors. Which will bend more after refracting once, red light or blue light? Which one (blue or red) has longer wavelength? Which one has larger frequency?
   (e) An ordinary magnet has N and S poles. Can you make a magnet with only one pole, that is, only N or only S pole?
   (f) On the periodic table, the element He is the second lightest element. Its atomic number is 2, and its mass number 4. What particles, and how many for each, are there in a He atom?

2. The xy plane separates two media, air in the positive z side and some liquid in the negative z side. A beam of light hits on the xy plane on the point (0, 0, 0). Part of the light will travel into the liquid, and part will reflect.

(a) If the speed of light in the liquid is $3/\sqrt{\ } \times 10^8$ m/sec, what is the liquid's index of refraction? (6%)

(b) If the incident angle is 45°, what are the reflection angle and the refraction angle? (7%)

3. An object of mass M moves in a two-dimensional space under the potential of

V(x,y) = 1/2kx2 + Mgy, where k, g are constants. No other forces act on the object. At some moment, the object locates at (A, 0) with zero speed.

(a) If $\hat{i}$ and $\hat{j}$ are the unit vector in x and y axes, respectively, find the force acting on the object at any point in the two-dimensional space. (7%)
(b) Now the object is going up the y axis. What is the highest position it can arrive? (7%)
(c) The object is now moving on the x axis. Find its momentum at points (0, 0) and (A/2, 0) respectively. (7%)

4. Suppose charge Q is located at (-a, 0, 0) and charge -Q at (a, 0, 0), with a > 0. No other charge distributions nor sources of forces are found in the space.
(a) Find the electric field at any point on the z axis. (7%)
(b) What are the electric potentials for a unit charge at points (0, 0, 0) and (0, 0, a/2)? What is the work that you need to do in order to move the unit Charge from (0,0,0) to (0, 0, a/2)? (9%)
(c) At time t = 0, both charges are moving towards (0, 0, 0) with speed v. What is the direction of the magnetic field observed on the positive y axis? (5%)

5. Plot the following in the xy plane: (15%)
(a) y = the gravitational force between masses m and M, x = the distance between them;
(b) y = PV, x = T, where P, V, T are the pressure, the volume, and the temperature of a certain gas;
(c) Within a spring's elastic limit, y = the sprillg's extension length when it hangs a mass m vertically towards the ground, x = m.

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