系所別：太空科學研究所　科目：普通物理

1. The initial velocity of an object is 120 m/sec at 60 degrees above the horizontal. (a) Calculate the maximum vertical height that the object will reach (in meters). Just before reaching its maximum height its velocity is 70 m/sec. (b) What is the horizontal position at this time (in meters)? (10%)

2. A boy whirls a 0.4 kg stone at the end of a string in a vertical circle of a radius 1.2 meters. At its highest point (a) what is the minimum velocity required to keep the stone moving in the vertical circle? (b) What will be the tension in the string if it were moving at twice the speed determined in (a)? (10%)

3. During a mission to Mars, a spaceship traveling at 500 m/sec must increase its speed by 10 m/sec. The exhaust speed of rocket engine is 1200 m/sec relative to the ship. What fraction of the initial mass must be ejected as exhaust to accomplish this task? (10%)

4. A 1.6 meter stick is held vertically with one end resting on the floor and is allowed to fall over. Assume that the end on the floor does not slip. Determine the linear speed at which the other end hits the floor. (in meters/sec.) (10%)

5. A satellite is placed in orbit above the equator with its orbit in the same direction as the rotation of the earth. Fixed observers on opposite sides of the earth each see the satellite in the same location relative to themselves one each day. What is the radius of the orbit? (in earth radius) (10%)

6. A 3.0 meter long string is vibrating at a five loop standing wave consisting of two waves each of amplitude 1.0 cm. The wave speed is 100 m/sec. (a) Determine the frequency of the standing waves. (b) What is the displacement of the string at 0.3 meters and t = 1 millisecond. (in Hertz and centimeters). (10%)

7. A dipole consists of two opposite charges of magnitude 400 microcolumbs attached to the ends of light 2.0 cm rod. The dipole is initially lined up parallel to a 60000 N/C electric filed. (a) Determine the electric dipole moment. (b) Calculate the work required to rotate the dipole so that it makes an angle 60 degrees with the filed. (10%)

8. The active element in a Hall-Effect Gausmeter is a slab of semiconductor 1.0 millimeters thick, 12.0 millimeters wide, and 3.0 cm long. A current of 0.50 amps is lengthwise in the slab. The density of electron is $1.5 \times 10^{24}/m^3$. The instrument is rotated until a maximum voltage of 0.80 millivlots is measured across the strip. What is the magnetic filed? (in tesla) (10%)

9. An air conditioner is connected to a 120 volt 50 hertz power line. The motor is equivalent to a 20 ohm resistor and 25 millihenry inductor in series. Determine the power supplied to the motor. (10%)

10. The magnetic filed of the Earth in the Taiwan area is 50 microtesla north and 30 degrees below the horizontal. The radio antenna on an automobile is vertical and 1.10 meters long. If the automobile is moving east at 90 km/hr, what is the induced EMF in the antenna? (10%)