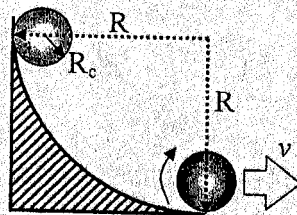
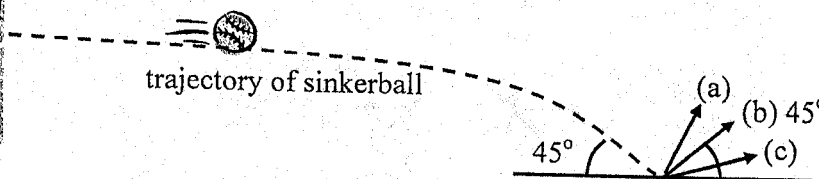


所別：光電科學研究所碩士班 一般生 科目：普通物理  
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1. The sound intensity at Niagara Falls is around  $10^{-4} \text{W/m}^2$ . The sound intensity of the lower limit of human audibility (standard reference intensity) is  $10^{-12} \text{W/m}^2$ . What is the sound level at Niagara Falls in dB? (5 %) The sound level of human speaking is around 60dB. How many speaking people do we need to make the noise with the same sound level as the Niagara Falls? (5 %)
2. The surface wave of earthquake is 3500m/s. The diameter of the earth is 12742km. What is the angular velocity of the surface wave of the earthquake? (10 %)
3. A solid cylinder of mass  $M$  and radius  $R_c$  starts from rest and rolls down a curved surface without slipping. The curvature of the surface is  $R$ .  $g$  is the acceleration due to gravity at the earth's surface. Find the speed of its center of mass,  $v$ , when the cylinder reaches the bottom. (10 %)



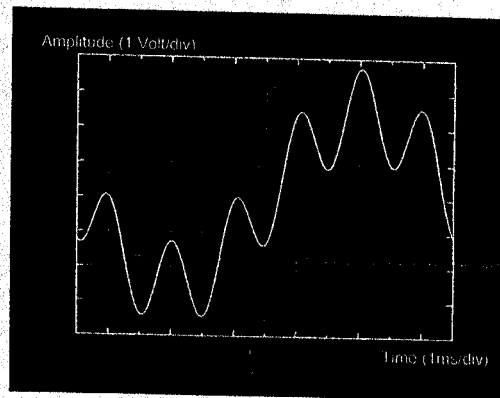
4. To prevent from the warming of the earth (global warming), we can send some satellites with huge mirrors to reflect a part of sunlight. Assuming that the satellites are traveling at an altitude of 200km above the surface of the earth with a speed of 7770m/s. The mean radius of the earth is  $6.37 \times 10^6 \text{m}$ . What is the magnitude of the acceleration of the satellites toward the earth? (10 %)
5. Chien-Ming Wang throws a sinker (variant of the straight fastball) which can fall down abruptly before the ball arrives the batter due the spin of the ball. The trajectory of the sinkerball is illustrated in the figure below. The incident angle to the ground is  $45^\circ$ . Which is the reflection angle of the ball: (a) larger than  $45^\circ$  (b)  $45^\circ$  (c) lower than  $45^\circ$ ? (10 %)



注意：背面有試題

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6. A series RLC circuit is included in a radio for the purpose of tuning to an FM station broadcasting at 104.9 MHz. Assume that the resistance in the circuit is 12 Ohms and the inductance is 2.3  $\mu$ H (microhenries), please select one from the following capacitance that best fits this application. State the reasons for your choice. (10%)  
 (a) 200 pF (b) 40 pF (c) 1 pF (d) 0.2 pF (e) 0.04 pF
7. The following figure shows the trace on the screen of an oscilloscope. This signal is synthesized from two oscillations, OSC1 and OSC2. Which is the most probable combination to produce the observed trace? Give your reasons. (10%)  
 (a) OSC1: 6.14V, 98Hz ; OSC2: 1.35V, 257Hz  
 (b) OSC1: 5V, 6Hz ; OSC2: 2V, 2Hz  
 (c) OSC1: 1.5V, 250Hz ; OSC2: 3V, 1500Hz  
 (d) OSC1: 2.5V 83 Hz ; OSC3: 1.25V, 500HZ  
 (e) None of the combinations can produce the observed trace.



8. X rays of wavelength  $\lambda=20$  pm are scattered from the electrons of a carbon target and the scattered rays are detected at  $60^\circ$  with respect to the incident beam. (a) What is the Compton shift and fractional energy loss of the scattered rays? (10%) If X-ray source is replaced by a green laser with wavelength of 532 nm, how does the result change with respect to the answer in (a)? (5%)
9. The following configuration can be used as a wavemeter. When mirror M2 is translated by a distance  $d$ , 81,305 interference fringes pass across PD1 and 100,000 fringes pass across PD2. It is known that the X laser is operated in visible. Determine the wavelength of the laser? (15%)

