南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

考试科目： 大学物理（上） **开课单位：** 物理系

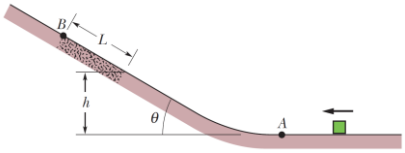
考试时长： 180 分钟 **考试方式：** 开 卷

题号	1	2	3	4	5	6	7	8	9	10
分值	10	10	10	10	10	10	10	10	10	10

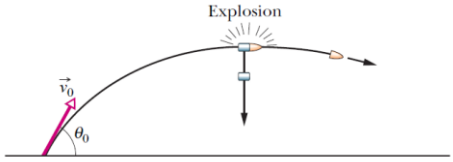
本试卷共（10）大题，满分（100）分.

Text Questions: (Please write down the detailed process.)

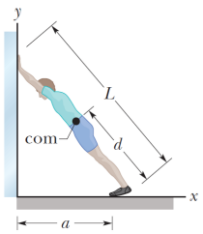
Q1. In Figure, a block slides along a path that is without friction until the block reaches the section of length L=0.75 m, which begins at height h=2.00 m on a ramp of angle θ=30°. In that section, the coefficient of kinetic friction is 0.40. If the block just can reach point B (where the friction ends), (a) what is the speed of the block passes through point A? (b) Then the block slides back from the point B, what is its speed of pass the point A again?



Q2. A shell is shot with an initial velocity $\vec{v}_0$ of 30 m/s, at an angle of $\theta_0 = 60^\circ$ with the horizontal. At the top of the trajectory, the shell explodes into two fragments of equal mass. One fragment, whose speed immediately after the explosion is zero, falls vertically. How far from the gun does the other fragment land, assuming that the terrain is level and that air drag is negligible?



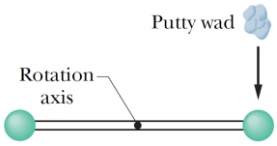
Q3. A climber leans out against a vertical ice wall that has negligible friction. Distance a is 0.90 m and distance L is 2.10 m. His center of mass is distance d =0.96 m from the feet–ground contact point. If he is on the verge of sliding, what is the coefficient of static friction between feet and ground?



Q4. Two 2.00 kg balls are attached to the ends of a thin rod of length 60.0 cm and negligible mass. The rod is free to rotate in a vertical plane without friction about a horizontal axis through its center. With the rod initially horizontal, a 50 g wad of wet putty(油灰) drops onto one of the balls, hitting it with a speed of 4.00 m/s and then sticking to it.

(a) What is the angular speed of the system just after the putty wad hits?

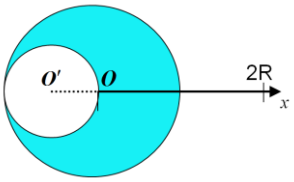
(b) What is the ratio of the kinetic energy of the system after the collision to that of the putty wad just before?



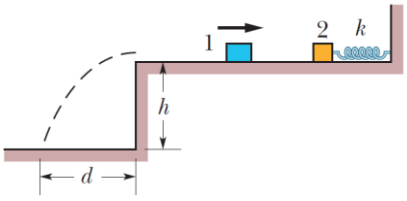
Q5. A spherical hollow inside a uniform lead sphere of radius R=6.00 cm, the surface of the hollow passes through the center of the sphere and "touches" the left side of the sphere. The mass of the sphere before hollowing was M=10.27 kg. What is the magnitude of the gravitational force due to the hollow sphere on a particle of mass m=0.40 kg.

(a) When the particle is located at a distance of 2R from the center of the hollow sphere (point O).

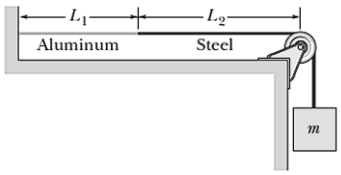
(b) When the particle is located at any point in the cavity of the sphere.



Q6. Figure shows block 1 of mass 0.50 kg sliding to the right over a frictionless elevated surface at a speed of 9.00 m/s. The block undergoes an elastic collision with stationary block 2, which is attached to a spring of spring constant 1200 N/m. (Assume that the spring does not affect the collision.) After the collision, block 2 oscillates in SHM with a period of 0.157 s, and block 1 slides off the opposite end of the elevated surface, landing a distance d from the base of that surface after falling height h =4.90 m. What is the value of d?



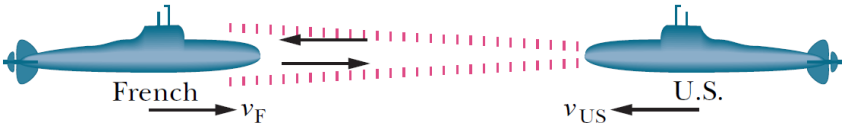
Q7. In figure, an aluminum wire, of length L_1 =60.0 cm, cross-sectional area 1.25×10^{-2} cm, and density 2.60 g/cm^3, is joined to a steel wire, of density 7.80 g/cm^3 and the same cross-sectional area. The compound wire, loaded with a block of mass m =10.0 kg, is arranged so that the distance L_2 from the joint to the supporting pulley is 86.6 cm. Transverse waves are set up on the wire by an external source of variable frequency, a node is located at the pulley, and another node is also located at the left boundary. Find the second lowest frequency that generates a standing wave having the joint as one of the nodes.



Q8. A French submarine and a U.S. submarine move toward each other during maneuvers in motionless water in the North Atlantic. The French sub moves at speed v_F =50.00 km/h, and the U.S. sub at v_{US}=75.00 km/h. The French sub sends out a sonar signal (sound wave in water) at 1.00×10^3 Hz. Sonar waves travel at 5470 km/h.

(a) What is the signal's frequency as detected by the U.S. sub?

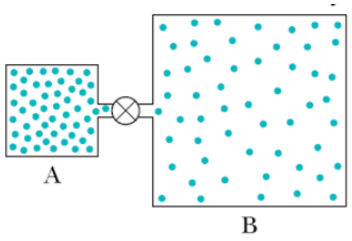
(b) What frequency is detected by the French sub in the signal reflected back to it by the U.S. sub?



Q9. Container A holds an ideal monatomic gas at a pressure of 7.5×10^5 Pa and a temperature of 300 K. It is connected by a thin tube (and a closed valve) to container B, with three times the volume of A. Container B holds the same ideal gas at a pressure of 1.0×10^5 Pa and a temperature of 400 K. The valve is opened to allow the pressure to equalize, but the temperature of each container is maintained.

(a) What then is the pressure?

(b) If the volume V_A= 1 m^3, what is the energy transferred as heat to the container during this process?



Q10. Figure shows a reversible cycle through which 1.00 mol of a monatomic ideal gas is taken. Volume V_c =8.00V_b. Process *bc* is an adiabatic expansion, with p_b = 10.0 atm and V_b=1.0×10^{-3} m^3. For the cycle, find:

(a) The energy added to the gas as heat.

(b) The energy leaving the gas as heat.