※ 考生請注意：本試題 ☑可 □不可 使用計算機

1. (10%) A block of mass m is placed on a wedge of a mass M that is on a horizontal table (Fig.1). All surfaces are frictionless. Find the acceleration of the wedge. (Note: a' is the block's acceleration relative to the wedge.)
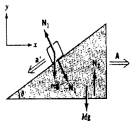

Fig.1

2. (10%) Consider the potential energy function in Fig. 2. (1) Sketch the corresponding force F_r versus r graph. (5%) (2) What are the turning points if the total energy of the particle is E_1 or E_2? (3%)　(3) What is the maximum kinetic energy of the particle when its total energy is E_2. (2%)
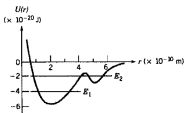

Fig2

3. (10%) A disk of mass M and radius R that rolls without slipping down an incline (Fig.3). (1) Find the linear acceleration of the CM. (7%) (2) Which is the minimum coefficient of friction required for the sphere to roll without slipping. (3%)
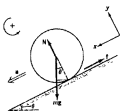

Fig.3

4. (10%) A hot liquid is contained within a spherical shell of inner radius r_a and outer radius r_b. Find the rate of heat transfer due to conduction. Here, Ta and Tb are the temperatures at the inner and outer surface respectively.

5. (10%) Find the work W, the change of internal energy ΔU, and the heat Q of an ideal gas when its state is changes isothermally from (P_1, V_1) to (P_2, V_2).

6. (10%) A copper ball of mass 2.0kg and specific heat C=390J/kg・K is at a temperature T_1=90℃. The ball is thrown into a large lake at T_2=20℃, which stay constant. Find the change in entropy of (1) the ball and (2) the lake.

（背面仍有題目,請繼續作答）

系所組別：地球科學系甲、乙組
考試科目：普通物理　　　　　　　　　　　　　　　　　　　考試日期：0306，節次：2

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7. (10%) Two capacitors, $C_1=10\,\mu$ F and $C_2=6\,\mu$ F, are initially in parallel with a 12V battery, as in Fig. 4a. They are disconnected and then reconnected as shown in Fig. 4b. Note carefully the numbering on the plates. Find the charges, potential difference, and energies stored (1) in the initial state and (2) in the final state.
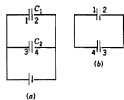
Fig. 4

8. (10%) A coaxial cable consists of an inner wire of radius a that carries a current I upward, and an outer cylindrical conductor of radius b that carries the same current downward, see Fig. 5. Find the self-inductance of a coaxial cable of length L. Ignore the magnetic flux within the inner wire.
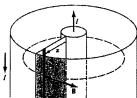
Fig. 5

9. (10%) A straight wire lines along a body diagonal of an imaginary cube of side a=30 cm, and carries a current of 2.0 Ampere (Fig.6). Find the force on it due to a uniform field B=0.5j T
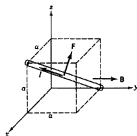
Fig. 6

10. (10%) Use the Ampere-Maxwell law to find the magnetic field between the circular plates of a parallel-plate capacitor that is charging with Q (Fig. 7). The radius of the plates is R. Ignore the fringing field. Find the magnetic field at (1) r< R; (6%) (2) r>R. (4%)
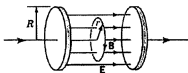
Fig. 7