

# 淡江大學九十一學年度碩士班招生考試試題

系別：物理系

科目：古典物理

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1. Two oppositely charged conducting plates, having equal quantities of charge per unit area, are separated by a dielectric  $d$  thick of dielectric constant  $k$ . The resultant electric field intensity in the dielectric is  $E$ . Compute

- (a) the free charge per unit area on the conducting plates,
- (b) the induced charge per unit area on the surfaces of dielectric, and
- (c) the capacitance of the capacitor

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2. Two long cylinders (radii  $a$  and  $b$ ) are separated by material of conductivity  $\sigma$  (see Fig.1). If they are maintained by a potential difference  $V$ . What current flows from one to the other in a length  $L$ .

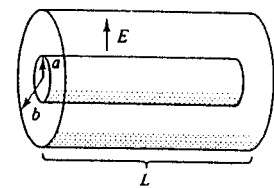


Fig.1

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3. A body A with mass  $m$  on a frictionless table is attached to a hanging body B with mass  $m$  by a cord (length  $\ell$ ) through a hole in the table (Fig.2). The body A is given an initial velocity of magnitude  $v_0$  when its radius is  $a$ . Let  $r$  be the instantaneous rotating radius of the body A while  $\theta$  is the instantaneous rotating angle  $\theta$ . The body A must spin and the body B hangs down freely.

- (a) Set up the Lagrangian of the system.
- (b) Write down the Lagrange's equation of motion for the body A in terms of  $r$  and  $\theta$ .
- (c) Find the instantaneous angular velocity  $\dot{\theta}$  of body A at any position in terms of  $a$ ,  $v_0$  and  $r$ .
- (d) Find the speed of body A at any position in terms of  $a$ ,  $v_0$  and  $r$ .

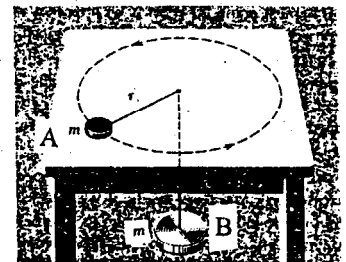


Fig.2

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4. The heat absorbed by a mole of ideal gas in a quasi-static process in which its temperature  $T$  changes by  $dT$  and its volume  $V$  by  $dV$  is given by

$$dQ = c_v dT + PdV$$

where  $c_v$  is its constant molar specific heat at constant volume and  $P$  is its pressure,  $PV = RT$ . Find an expression for the change of entropy  $S$  of the gas in quasi-static which takes it from initial values of temperature  $T_i$  and volume  $V_i$  to

the final values of  $T_f$  and  $V_f$

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5. Light strikes a flat piece of glass at an incident angle of  $60^\circ$  as in Fig3. If the index of the refraction of the glass is  $n$ .

- (a) Show that the direction of the beam is unchanged by passing through a plane piece of glass, and
- (b) show that this is true for any index of refraction  $n$  of the glass

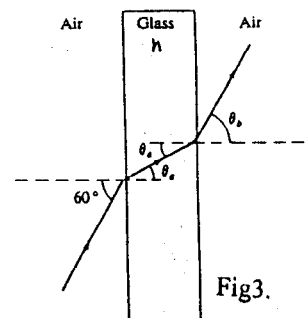


Fig3.