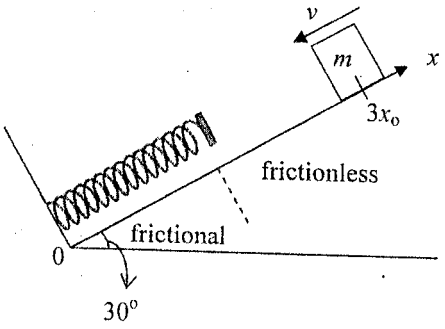
所別：生物物理研究所碩士班 科目：普通物理

(1) (15%) A force $F(x)$ acts on a particle that moves along an x axis. The potential energy associated with force $F(x)$ is given by $U(x) = ax^2 - bx$. Plot $F(x)$ for the range $0<x<5$ m.

(2) (20%) A block of mass m slides along a plane inclined of angle 30° with speed v at $x=3x_0$. It then runs into and compresses a spring of spring constant k, until the object stops momentarily. Its path to the initially relaxed spring is frictionless, but as it compresses the spring, a kinetic frictional force from the plane acts on the block. Assume the spring is massless and its relaxed length is x_0.

(a) (10%) What is the speed of the block just as it touches the spring?

(b) (10%) When the block stops, the spring is compressed by distance d. Find the coefficient of kinetic friction of the frictional surface.



(3) (10%) A thin film suspended in air is 0.41×10^{-6}m thick and illuminated with white light that is incident perpendicularly on its surface. The index of refraction of the film is 1.5. At what wavelengths will visible light reflected from the two surfaces of the film undergo fully constructive interference?

(4) (20%) Suppose n moles of an ideal gas undergoes a reversible isothermal expansion from volume V volume $2V$ at temperature T. Find

(a) (5%) the work done by the gas and

(b) (10%) the entropy change of the gas.

(c) (5%) If the expansion is reversible and adiabatic instead of isothermal, what is the entropy change of the gas?

(5) (20%) Write down the Maxwell's four fundamental equations of electromagnetism and describe their physics.

注意：背面有試題

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(6) (15%) Two large non-conducting sheets are arranged to be parallel and close (separated by a distance *d*). One sheet has a uniform positive charge with surface charge density σ_+ and the other sheet has a uniform negative charge with surface charge density σ_-. Assume $\sigma_+ > \sigma_-$,

(a) (10%) what are the electric fields (magnitudes and directions) in regions A, B, and C, respectively?

(b) (5%) What is the electric potential difference between the two plates?