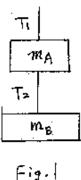
年度碩士地

太空科學研究所 不分组 科国: 普通物理

1. Two blocks with masses $m_A = 0.2kg$ and $m_B = 0.3kg$ hang one under the other, as shown in Fig. 1. Find the tensions in the (massless) ropes in the following situations: (a) The blocks are at rest; (b) they move upward at 10 m/s; (c) they accelerate upward at $2 m/s^2$. $(g = 9.8 m/s^2)$

2. A projectile of mass 0.25kg moving at 24m/s collides with and sticks to a 1.75-kg block that is connected to a spring for which k = 40 N/m, as in Fig.2, The block is initially on a frictionless part of a horizontal surface but starts to slide on a rough section immediately after the collision. If the maximum compression of the spring is 0.5m, what is the force of friction on the block?







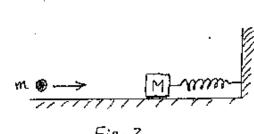


Fig. 2

3. A cylinder with a piston contains 0.2kg of water at 100°C. What is the change in internal energy of the water when it is converted to steam at 100°C at a constant pressure of 1 atm? The density of water is $\rho_w = 10^3 \, kg/m^3$ and that of steam is $\rho_s = 0.6 \, kg/m^3$. The latent heat of vaporization of water is $L_o = 2.26 \times 10^6 \ J/kg ... 1 \ atm = 1.01 \times 10^5 \ N/m^2$.



- 4. A metal sphere of radius R_1 has a charge Q_1 . It is enclosed by a conducting spherical shell of radius R_2 that has a charge $-Q_2$; see Fig.4. Determine: (a) the potential V_1 of the inner sphere; (b) the potential V_2 of the outer sphere.
- 5. For the circuit in Fig.5 find: (a) the initial current through each resistor when the switch is closed; (b) the final steady-state current through each resistor; (c) the final energy stored in the capacitor.



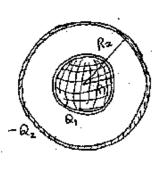


Fig.4

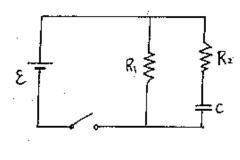


Fig.5

- An ideal infinite solenoid has n turns per unit length and carries a current I. Find its magnetic field. (Hint: apply Ampere's law).
- 7. Explain: (a) Heisenberg uncertainty principle, (b) The de Broglie wavelength of a particle; (c) Maxwell's theorem of the equipartition of energy. (d) The postulates of the Bohr model of hydrogen atom.