

須列出計算過程

1. (20%) A bullet with mass of 30 gm strikes a ballistic pendulum whose target block has a mass of 2 kg. The block is observed to rise a distance of 5 cm.

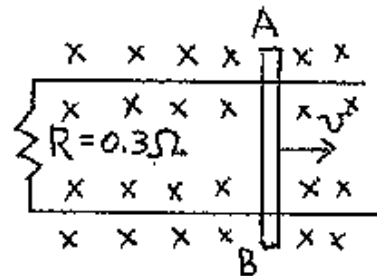
- (a) What is the speed of the bullet when it strikes the block ?
- (b) How much kinetic energy of the bullet is transformed into heat in the collision?

2. (20%) v_0 is the speed for a circular orbiting satellite at a distance r_0 from the center of the earth. If a satellite is fired off horizontally from the same point r_0 , but with an initial speed $1.2 v_0$. Use conservation of energy and angular momentum to find (a) the maximum distance from the center of the earth attained by the satellite and (b) its speed when it reached this maximum distance.

3. (20%) A charge Q is uniformly spread around a ring of radius R .

- (a) Find the potential function along the central axis of the ring.
- (b) Use the result of (a) to find the electric field strength along the central axis. (c) Where and what is the largest value of (b) ?

4. (20%) A metal rod of length 20 cm moves at a constant speed 4 m/s on a rails of no resistance that terminate in a resistor $R = 0.3 \Omega$ as shown in the right hand figure.



A uniform magnetic field $B = 0.5 \text{ T}$ is normal to the plane of the rail. Find (a) the value and direction of the current in the rod,

- (b) the mechanical power needed to keep the rod moving at the constant speed,
- and (c) the electric power dissipated in the resistor.

5. (20%) One D - D fusion reaction releases 4.03 Mev. If the number ratio of deuterium to hydrogen is 1 / 6500 in sea water, what is the fusion energy available in one cubic meter (about 1000 kg) of sea water ?

constants for your reference:

Avogadro's number $6.02 \times 10^{23} / \text{mol}$

$e = 1.602 \times 10^{19} \text{ C}$

參考用