

高級組 Senior

計算題 Problem for calculation 80%

1. 均勻細棒的質量 $M=1\text{ kg}$, 長 $L=1\text{ m}$, 以其一端點 A 垂直懸掛, 只作平面擺動, 今有一質點, 質量 $m=10\text{ g}$, 以速度 $v=100\text{ m/s}$, 在擺動平面, 垂直地入射到靜止的棒, 且保持在入射點與棒一起運動, 入射點與端點 A 相距 75 cm . 求棒的最大偏轉角 θ 的表示式及數值. Uniform thin rod (mass $M=1\text{ kg}$, Length $L=1\text{ m}$) is hanged at one end A to swing in a 2D motion. If a mass point $m=10\text{ g}$ with speed $v=100\text{ m/s}$ in the swing plane hits and sticks to the rod at rest. The distance between point A and hitting point is 75 cm . To find the expression and the value of the maximum deflected angle θ of the rod after hit.
2. 求理想大氣溫度 T 的隨高度 y 的變化率 dT/dy . To find the change rate dT/dy of temperature T with height y for an ideal atmosphere.
3. 在介電常數 ϵ 的介質中, 存在有均勻電場 E_0 , 現在介質內形成一半徑 R 的球形空腔, 求腔內電場 E_R . Inside a material with dielectric constant ϵ has an uniform electric field E_0 , if now a spherical cavity with radius R is formed within the material, to find the electric field E_R in the cavity.
4. 質點 m_1 以速度 v_1 入射某靜止質點, 合成質點 M , 然後分裂成質點 m_2 和 m_3 , 但總質量 $M > m_2 + m_3$, 其中 m_2 以速度 v_2 垂直於 v_1 射出, 而 m_3 以速度 v_3 及相對於 v_1 成角度 ϕ 射出, 不考量相對論, 求 v_2 , v_3 及 ϕ . A mass m_1 with v_1 hits another mass at rest to form a mass point M and then to split into masses m_2 and m_3 , but the total mass $M > m_2 + m_3$, in where m_2 with v_2 flies vertically to v_1 , but m_3 with speed v_3 flies away with angle ϕ relatively to v_1 . Not considering the relativity effect. To find v_2 , v_3 and ϕ .
5. 波長 0.296 nm 的 X 光投射到晶體上, 產生第一極大的 X 光束與入射 X 光束, 成角度 31.7° , 求晶體原子的距離. If the incident X ray with wavelength 0.296 nm irradiates on a crystal, and generates the first maximum X ray beam forming angle 31.7° to the incident X ray. To find the atomic distance between two atom planes of crystal.

簡答題 Brief answer 20% 超長字數可被扣分

1. 如何測量引力波? How do we measure the gravity wave?
2. 什麼是費米子? What is the Fermion?
3. 列出一種核融合的反應式. Give a reaction equation of fusion.
4. 為什麼電磁感應定律有一負號? Why has the induction law a negative sign?
5. 什麼是狹義相對論的 2 個條件? What are the 2 conditions of special relativity?
6. 估計雷射光的頻寬. Estimate the frequency broaden of laser?
7. 為什麼要用能帶理論才可以解釋半導體? 可舉例說明. Why can only the theory of energy band explain the semiconductor? You may use an example to do.
8. 為什麼大恆星燃燒完(可用氫)會爆炸? Why will the big star explore if using up the available hydrogen?
9. 為什麼在靜電場中, 金屬內的電場是零? In static electric field, why the field is zero inside a metal?
10. 什麼是熱電效應? What is the thermoelectric effect?