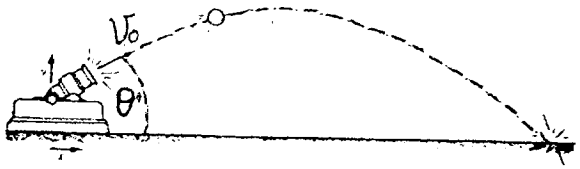
中國文化大學 101 學年度暑假轉學招生考試

系組：物理學系三年級　　日期節次：7 月 24 日第 2 節 10:50-12:10

科目： 力學

01-3-2



1.A projectile is launched with initial speed v_0 at an angle θ with respect to the horizontal。 Find (a)the position vector at any time， (b)the time to reach the highest point， (c)the maximum height reached， (d)the time of flight back to earth and (e)the range。(20%)

2.If the position of a particle is given by

$\bar{r} = (t^3 + 2t)\hat{i} + 3e^{-2t}\hat{j} + 2\sin 5t\hat{k}$， find (a) $\frac{d\bar{r}}{dt}$ and (b) $\frac{d^2\bar{r}}{dt^2}$。(20%)

3.Show that the force field $\bar{F}$ defined by $\bar{F} = (y^2z^3 - 6xz^2)\hat{i} + 2xyz^3\hat{j} + (3xy^2z^2 - 6x^2z)\hat{k}$ is a conservative force field。(15%)

4. Let (r,θ) represent the polar coordinates describing the position of a particle。If $\hat{r}$ is a unit vector in the direction of the radial part and $\hat{\theta}$ is a unit vector in the direction of the angular part。 Show that (a) $\hat{r} = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$， $\hat{\theta} = -\sin\theta\,\hat{i} + \cos\theta\,\hat{j}$ and (b) $\hat{i} = \cos\theta\,\hat{r} - \sin\theta\,\hat{\theta}$， $\hat{j} = \sin\theta\,\hat{r} + \cos\theta\,\hat{\theta}$。(20%)

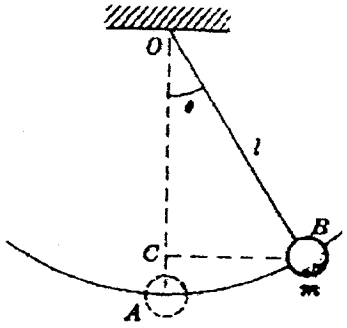


Figure-1

5. As shown in figure-1， consider the case of a simple pendulum(length ℓ， mass m) moving in a uniform gravitational field。 Using Lagrangian formalism to find the equation of motion in polar coordinate (r,θ)。(25%)