

1. 何謂產品或設計的「規格」？規格的設定對整個設計程序有何重要性？在設定規格時常利用 Quality Function Deployment (QFD)的方法，試簡述這個方法的目的、步驟、和精神。(10%)
2. 四連桿機構(four-bar linkage)在機構設計上有何重要性？繪一簡圖描述四連桿機構中各連桿名稱，並舉兩個四連桿機構應用實例，說明其運動方式。(10%)
3. 省油車設計大賽在國內舉辦多年，國內大專學生記錄每公升汽油可跑大約四百公里，國際的省油車記錄則已接近每公升汽油跑三千公里。汽油的能量密度每公升大約是 32 百萬焦耳，也就是每公升汽油蘊藏了 32 百萬焦耳的能量，國內省油車比賽規定駕駛人體重至少要六十五公斤。請自行假設一些合理參數（如車重、摩擦係數、風阻係數、引擎熱功轉換效率等等），估算在定速行駛時，每公升汽油最多可以跑多少公里。(10%)
4. 閱讀以下問題，試利用圖形、文字、數學符號、式子等等，以最詳細方式，描述你解答此問題之思維過程，以及你對此問題最後的答案。(10%)

#### Monk on the Mountain

One morning, exactly at sunrise, a Buddhist monk began to climb a tall mountain. The narrow path, no more than a foot or two wide, spiraled around the mountain to a glittering temple at the summit.

The monk ascended the path at varying rates of speed, stopping many times along the way to rest and to eat the dried fruit he carried with him. He reached the temple shortly before sunset. After several days of fasting and meditation, he began his journey back along the same path, starting at sunrise and again walking at variable speeds with many pauses along the way. His average speed descending was, of course, greater than his average climbing speed.

Prove that there is a single spot along the path the monk will occupy on both trips at precisely the same time of day.

5. 「水火箭」是最近頗為流行的科學遊戲。2000 年四月十五日聯合晚報記者陳香蘭對於一項國小學生水火箭製作競賽有如下報導：

「 拿起兩個空寶特瓶，一個空瓶從底部切掉，再把另外一個寶特瓶下方的塑膠底部除去，兩個寶特瓶套在一起，再用厚紙板替寶特瓶設計一個支撐火箭的底座，火箭就成型了，小朋友替火箭裝上七分滿的水，放在發射器上，再以打氣筒在寶特瓶打滿氣，用力一拉開關，火箭就衝上天了。」

根據這段報導，撰寫一份簡略的水火箭設計報告，內容必須包括設計原理、設計圖、操作順序，以及所有你認為必要的項目。(10%)