一、簡答題（25%）
1. 植物缺水時，細胞內哪些物質將累積以適應逆境？(3%)
2. 試述 CO₂、光線和水分三者如何調控氣孔的開閉運動？(6%)
3. 植物體內哪些礦物是屬於不可移動的（immobile），所以缺乏此元素時，病
  症常出現在幼葉？請列出四種。(4%)
4. 試述如何取得韌皮部的汁液（phloem sap）？(3%)
5. 如何決定水耕液中某一元素的最適濃度範圍（adequate zone）？(4%)
6. 原生質膜（plasma membrane）上，哪些物質的進出細胞需要透過
  H⁺-ATPase 所產生的伴隨運輸（cotransport）？(5%)

二、Write down the net equation of light reaction of photosynthesis in which
H₂O, ADP, NADP⁺, and photons are involved. And state whether the
Far-red light of 700 nm (~170 kJ mol⁻¹) is sufficient to make ATP (~30 kJ
mol⁻¹). (7%)

三、In what chemical form(s) and where is energy put into the Calvin cycle and
what is the enzyme catalyzing the first reaction? You must outline the
three stages of the cycle, including the key products. [You must use
diagram to describe.] (8%)

四、Describe the plant mitochondrial electron transport system starting from
the reduced molecules going to the final electron acceptor. Be sure to
include all major complexes, their functions, and all major transfer
molecules. [You must use diagram to describe.] (10%)
五、請解釋 ethylene 之生合成路徑，並說明環境因子和其他調控素如何影響 ethylene 在植物體之生合成量。(15%)

六、請說明下列生理現象與調控素之關係：
1. Cell elongation 與 auxin (Acid growth hypothesis) (5%)
2. Root:shoot ratio under drought stress 與 ABA (5%)

七、請說明生長(growth)、分化(differentiation)和發育(development)三個名詞的意義。(9%)

八、描述膨脹(turgor pressure)在植物細胞生長中扮演的角色。(6%)

九、說明光敏素(phytochrome)之光化學性質及光敏素如何促使植物適應光條件之變化？(10%)