Country: _____	Student Code: _____

19th INTERNATIONAL BIOLOGY OLYMPIAD

13th – 20th July, 2008

Mumbai, INDIA

PRACTICAL TEST 1
實作一
PLANT ANATOMY AND PHYSIOLOGY
植物解剖及生理
Total Points: 47

Duration: 60 minutes

Dear Participants,

- In this test, you have been given the following two tasks: 本實作包括兩部分

  Task 1: Study of factors affecting the activity of stomata (33 points)

  第一部分: 探討影響氣孔活動的因子 (33 分)

  Task 2: Study of plant anatomy and its correlation with the habitat

  (14 points) 第二部分: 探討解剖構造及其相對應的棲地環境

- **You have to write down your results and answers in the ANSWER SHEET. Answers written in the Question Paper will not be evaluated.**

  把答案寫在答案紙上，寫在試卷上的答案將不計分

- Please make sure that you have received all the materials and equipment listed for each task. In case any of these items is missing, please raise the yellow card.

請檢查確定每部分所有列出的材料及器材，**如有缺失，請舉起黃色卡片**

- At the end of the test, put the Answer Sheet and Question Paper in the envelope. The supervisor will collect this envelope.

在本實作結束時，將答案紙及試卷放入信封中，監考人員將來收此信封

Good Luck!!

Country: _____

Country Code: _____

First Name: _____

Middle Name: _____

Family Name: _____

Student Code: _____

Task 1 (33 points)

Study of factors affecting the activity of stomata

第一部分: 探討影響氣孔活動的因子 (33 分)

You should try and complete this task in 30 minutes.

請在 30 分內完成本部分

Materials and equipment 材料及器材	Quantity 數量
1. Specimens labeled 1 to 8 (in red capped vials)	8
分別標示 1-8 的標本 (在紅蓋的瓶中)	
2. Compound binocular microscope 光學顯微鏡	1
3. Glass microslides 載玻片	8
4. Box of coverslips 蓋玻片	1
5. Watchglass 錶玻璃	1
6. Forceps 鑷子	1
7. Brush 毛刷	1
8. Wash bottle containing distilled water 裝有蒸餾水的洗瓶	1
9. Permanent marker pen 油性筆	1
10. Tissue paper roll 吸水衛生紙	1
11. Container for washing and discard 裝廢水及垃圾用的容器	1

Introduction

Stomata are specialized microscopic structures found in all vascular plants. These microscopic pores allow exchange of gases between the environment and the plant cells. Stomata are also the sites from where water evaporates from the plant. Various environmental factors such as temperature, humidity and light intensity can affect the opening or closing of the stomata.

氣孔是所有維管束植物具有的微細構造，作爲植物細胞與環境進行氣體交換的途徑，氣孔也會使植物散失水分。多種環境因子如溫度、濕度及光強度等可影響氣孔的開閉。

Q. 1.1. (3 points) Some statements about stomata are given below. Indicate whether the statements are true or false by putting a tick mark (√) **in the appropriate boxes in Q. 1.1. in the Answer Sheet.**

判斷下列有關氣孔的敘述之**真僞**，並**在答案紙的對應空格上打鉤(√)**

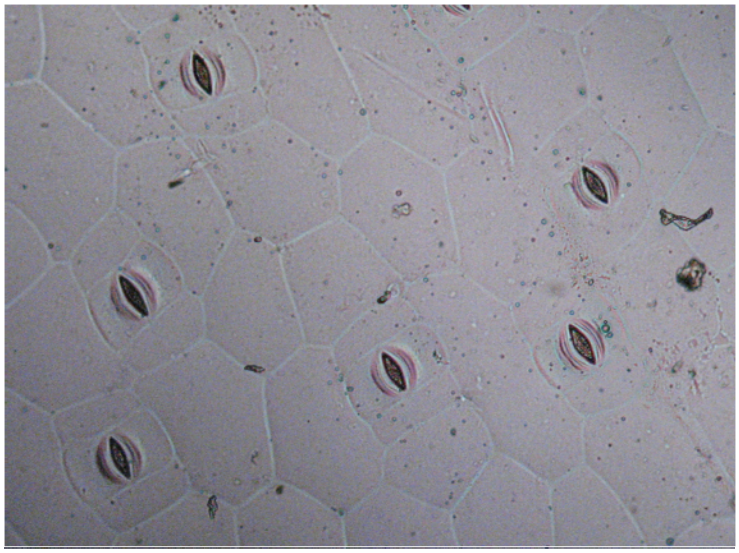
	Statement 敘述	True 真	False 僞
a.	Guard cells are the only epidermal cells that contain chloroplasts. 保衛細胞是唯一具有葉綠體的表皮細胞		
b.	The Stomatal Index of any plant species is the ratio of number of stomata in a given area of the leaf to the total number of stomata and other epidermal cells in that same area. 任何一種植物的氣孔指數(Stomatal Index)是在特定葉面積下之氣孔數目與相同面積下之氣孔及其他表皮細胞總數的比值		
c.	Stomata are characteristic of angiosperms alone. 氣孔是被子植物才有的特徵		
d.	Larger the stomatal pore, greater is the rate of transpiration per unit area of the pore. 氣孔愈大，該氣孔之單位面積的蒸散作用速率愈大		
e.	The Stomatal Index is always constant for a given species. 每個物種的氣孔指數總是固定的		
f.	A plant with stomata only on the upper surface of its leaves is most likely to be a submerged hydrophyte. 氣孔只出現在上表皮的植物很可能是沉水性的水生植物		

Stomata can be observed by taking an epidermal peel of a leaf. Alternatively, An imprint of the stomata can be obtained, without damaging the leaf tissue, as follows:
氣孔可藉由直接從葉片上撕下的表皮來觀察；或者也用印模法來觀察，而不傷到葉組織。方法如下：

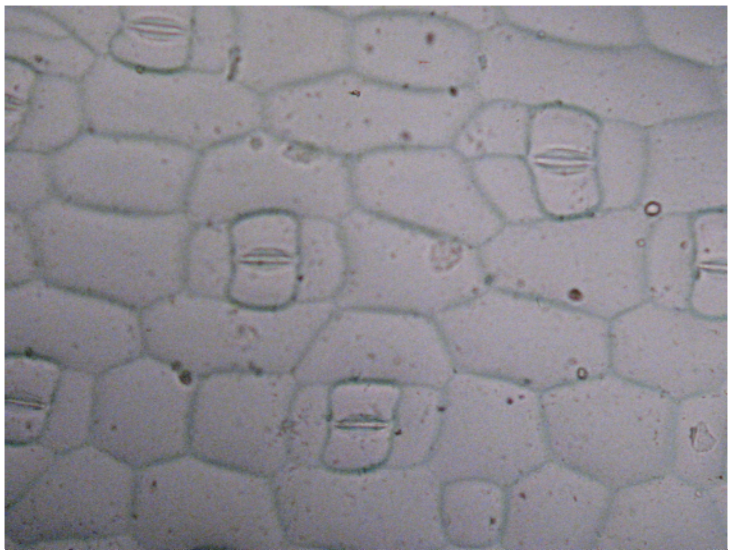
A thin coat of transparent colourless nail polish is applied on the leaf surface. The coat is allowed to dry and peeled off using a pair of forceps. This imprint is placed on a microslide with a drop of water, a coverslip is placed on it and it is observed under the microscope.
在葉表面塗上一層透明的指甲油，待乾後，將之以鑷子取下，將此印模放在有一滴水的載玻片上，蓋上蓋玻片，並以顯微鏡觀察。

Open and closed stomata can be easily distinguished from these imprints. Representative microscopic images of the imprints are given below.
這些印模可清楚觀察到打開或關閉的氣孔，其顯微影像如下所示。

OPEN stomata: (10X)
打開的氣孔



CLOSED stomata: (10X)
關閉的氣孔



In this task, you will study the effect of various factors on the opening and closing of the stomata. These experiments are conducted by immersing leaves in solutions of different chemicals under specified conditions.

在此部分，你將探討影響氣孔開閉的不同因子。這些實驗操作是在特定狀況下，將葉片浸泡於含有不同化學物質之溶液中。

Q. 1.2. (0.5 point) The best choice for such an experiment would be:

操作這樣的實驗，最好是選下列何種植物？

a. a mesophyte 中生植物

b. a hydrophyte 水生植物

c. a xerophyte 旱生植物

d. a halophyte 鹽生植物

Put a tick mark (√) in the appropriate box **in Q. 1.2. in the Answer Sheet.**

在答案紙上的適當空格中打鉤

a.	b.	c.	d.

Q. 1.3. (2 points) In one such experiment, a solution of pH 4.0 containing 100 mM K^+ and 0.1 mM Ca^{++} is required. Choose the correct way to prepare this solution from the following options and calculate the amount of KCl and volume of 10mM $CaCl_2$ solution you have to add.

在一實驗中，pH 值 4.0 的溶液須含有 100 mM K^+及 0.1 mM Ca^{++}，從下列選項中選出正確的配製步驟，並計算出應加入多少量的 KCl 及 10mM $CaCl_2$ 溶液？

Atomic mass of K is 39.1 and of Cl is 35.5.

K 的分子量是 39.1；Cl 的分子量是 35.5

a. Dissolve **X** g of KCl in 40 ml citrate buffer of pH 4.0, add **Y** ml of 10 mM $CaCl_2$, and make up the volume to 50 ml.

   將 **X** g 的 KCl 溶於 pH 值 4.0 的檸檬酸緩衝液中，加入 **Y** ml 的 10 mM $CaCl_2$，再使總體積爲 50 ml

b. Dissolve **X** g of KCl in 40 ml distilled water. Add **Y** ml of 10 mM $CaCl_2$ to 5 ml distilled water. Mix both the solutions and adjust the pH to 4.0 with HCl. Make up the volume to 50 ml.

   將 **X** g 的 KCl 溶於 40 ml 蒸餾水中；將 **Y** ml 的 10 mM $CaCl_2$ 於 5 ml 蒸餾水中；將兩種溶液混合，並以鹽酸調整 pH 值至 4.0，再使總體積爲 50 ml

c. Dissolve **X** g of KCl in 40 ml distilled water. To this, add **Y** ml of 10 mM $CaCl_2$. Make up the volume to 50ml. Adjust the pH to 4.0 with HCl.

   將 **X** g 的 KCl 溶於 40 ml 蒸餾水中，加入 **Y** ml 的 10 mM $CaCl_2$，使總體積爲 50 ml，再以鹽酸調整 pH 值至 4.0

Put a tick mark (√) in the appropriate box and give the correct answer for X and Y **in**

Q. 1.3. in the Answer Sheet. 在答案紙上的適當空格中打鉤，並填入正確的 X, Y 值

a.	b.	c.

X = _____ g KCl

Y = _____ml 10mM $CaCl_2$

Experiment

In order to study the effect of various factors on stomata, leaves of a plant were treated in eight different ways. The imprints obtained after each of these treatments (1 to 8 given below) are provided in red-capped vials labeled 1 to 8, respectively.

爲了探討影響氣孔開閉的不同因子，葉片以下列八種不同方式處理。經此八種處理（敘述如下）後的葉片所製成的印模分別放置於標示 1-8 的紅蓋瓶中。

Please note that these treatments have also been described in the following table for your convenience.

注意：爲方便比較，也將這些處理作成表格呈現於下頁中

Treatment 1: Leaves were immersed in a solution containing 100 mM KCl, 0.1 mM $CaCl_2$, pH 7.0 and kept in light for 2 h.

處理 1：葉片浸於含有 100 mM KCl, 0.1 mM $CaCl_2$, pH 值 7.0 之溶液中，照光 2 小時

Treatment 2: Leaves were immersed in a solution containing 10 mM KCl, 0.1 mM $CaCl_2$, pH 7.0 and kept in dark for 2 h.

處理 2：葉片浸於含有 10 mM KCl, 0.1 mM $CaCl_2$, pH 值 7.0 之溶液中，黑暗中 2 小時

Treatment 3: Leaves were immersed in a solution containing 0.5 M mannitol, 100 mM KCl, 0.1 mM $CaCl_2$, pH 7.0 and kept in light for 2 h.

處理 3：葉片浸於含有 0.5 M 甘露醇,100 mM KCl, 0.1 mM $CaCl_2$, pH 值 7.0 之溶液中，照光 2 小時

Treatment 4: Leaves were immersed in a solution containing 10 mM KCl, 0.1 mM $CaCl_2$, pH 4.0 and kept in dark for 2 h.

處理 4：葉片浸於含有 10 mM KCl, 0.1 mM $CaCl_2$, pH 值 4.0 之溶液中，黑暗中 2 小時

Treatment 5: Leaves were immersed in solution containing 10 mM KCl, 0.1 mM $CaCl_2$, pH 7.0 containing an Unknown Chemical and kept in dark for 2 h.

處理 5：葉片浸於含有 10 mM KCl, 0.1 mM $CaCl_2$, pH 值 7.0 及未知化學物質之溶液中，黑暗中 2 小時

Treatment 6: Leaves were immersed in a solution containing 100 mM KCl, 0.1 mM $CaCl_2$, pH 4.0 and kept in light for 2 h.

處理 6：葉片浸於含有 100 mM KCl, 0.1 mM $CaCl_2$, pH 值 4.0 之溶液中，照光 2 小時

Treatment 7: Leaves were immersed in a solution containing 100 mM KCl, 0.1 mM $CaCl_2$, 10 μM abscisic acid, pH 7.0 and kept in light for 2 h.

處理 7：葉片浸於含有 100 mM KCl, 0.1 mM $CaCl_2$, 10 μM 離層酸, pH 值 7.0 之溶液中，照光 2 小時

Treatment 8: Leaves were immersed in a solution containing 100 mM KCl, 0.1 mM $CaCl_2$, 10 μM abscisic acid, pH 4.0 and kept in light for 2 h.

處理 8：葉片浸於含有 100 mM KCl, 0.1 mM $CaCl_2$, 10 μM 離層酸, pH 值 4.0 之溶液中，照光 2 小時

Treatment **處理**	**KCl**	**$CaCl_2$**	**pH**	**Light**	**Abscisic Acid** 離層酸	**Mannitol** 甘露醇	**Unknown Chemical** 未知化學物質
1	100mM	0.1mM	7.0	2 h Light	-	-	-
2	10mM	0.1mM	7.0	2 h Dark	-	-	-
3	100mM	0.1mM	7.0	2 h Light	-	0.5 M	-
4	10mM	0.1mM	4.0	2 h Dark	-	-	-
5	10mM	0.1mM	7.0	2 h Dark	-	-	Yes
6	100mM	0.1mM	4.0	2 h Light	-	-	-
7	100mM	0.1mM	7.0	2 h Light	10μM	-	-
8	100mM	0.1mM	4.0	2 h Light	10μM	-	-

Q. 1.4. (8 points): Observation of the imprints 印模的觀察

(i) Pick up the imprint gently from the container using a brush. You may need to gently swirl the vial in order to locate the imprint.

以毛刷自紅蓋瓶中小心地取出印模，你可能需輕搖瓶子，以便找到透明的印模

(ii) Place the imprint in a drop of water on a glass microslide.

將印模放在載玻璃片上的一滴水中

(iii) Place a coverslip and observe under the 10X objective of the microscope. **Note that you will be observing unstained specimens. Hence, make appropriate adjustments in the microscope.**

蓋上蓋玻片，並在 10 倍物鏡下觀察。**注意：印模未染色，故須調整顯微鏡，以利觀察**

(iv) Note down the observations **in Table 1.4. in the Answer Sheet**. You need to count at least 20 stomata per imprint.

在答案紙上的表 **1.4** 中，記錄你的觀察結果。每種印模你至少須數 20 個氣孔

Table 1.4.

Treatment 處理	Total number of stomata counted 氣孔總數目	Number of open stomata 打開的氣孔數目	Number of closed stomata 關閉的氣孔數目
1			
2			
3			
4			
5			
6			
7			
8			

Interpretations 結果解釋

Q. 1.5. (10 points)

Based on the results obtained from the given set of experiments, answer the questions **Q. 1.5.A to Q. 1.5.D in the Answer Sheet**. Fill in the blanks with the appropriate serial numbers from the options given below. Use all options but only once each. 根據每組實驗的結果，在答案紙上回答 **Q. 1.5.A to Q. 1.5.D**，在空格中填入下列適當選項的代表數字，每個選項只用一次！

A. The factor/s that clearly lead to stomatal closure is/are: _____

可明確導致氣孔關閉的因子是

B. The factor/s that clearly lead to stomatal opening is/are: _____

可明確導致氣孔打開的因子是

C. The factor/s that clearly have no effect on stomatal opening/closing is/are:

_____

對氣孔開閉沒有明確影響的因子是

D. The factor/s whose effect cannot be clearly established in this experiment is/are:

_____

在此實驗無法確定其作用的因子是

Options: 選項

1. Light alone 光照下
2. Darkness alone 黑暗下
3. Acidic pH 酸性環境
4. Mannitol 甘露糖醇
5. Unknown Chemical 未知化學物質
6. 10mM KCl alone
7. 100mM KCl alone
8. $CaCl_2$
9. Abscisic acid alone 離層酸
10. Abscisic acid and acidic pH 離層酸及酸性環境

Q. 1.6. (2.5 points) The correct explanation for the observations in Treatments 7 and 8 is: 處理 7 及 8 觀察結果的正確解釋是

a. Acidification of guard cells leads to opening of K^+ channels of the plasma membrane. This results in entry of K^+ and water molecules to the guard cells.
保衛細胞的酸化導致膜上的鉀離子通道打開，結果使鉀離子及水分子進入保衛細胞中

b. As the pKa of abscisic acid is close to 5.0, most of the molecules remain undissociated at pH 4.0. This hastens their entry into the guard cells.
因離層酸的 pKa 接近 5.0，大部分的分子在 pH 4.0 下呈未溶解狀態，此加速離層酸進入保衛細胞中

c. No effect was observed in either treatment because there was no water stress.
兩處理沒有觀察到任何作用，這是因爲沒有缺水逆境

d. Abscisic acid is a strong acid and works best at highly acidic pH.
離層酸是一種強酸，且在強酸環境中效果最好

Put a tick mark (√) in the appropriate box **in Q. 1.6. in the Answer Sheet**
在答案紙上的適當空格中打鉤

a.	b.	c.	d.

Q. 1.7. (2.5 points) Which of the following correctly explains the effect of mannitol on the stomatal aperture?下列何者是甘露醇對氣孔開閉作用的正確解釋？

a. Mannitol is a highly hydrophilic substance and restricts the entry of water molecules into the guard cells.

   因甘露醇的親水性高，限制了水分子進入保衛細胞中

b. High concentration of mannitol in the extracellular fluid forces K^+, Cl^- and Ca^{++} to enter the guard cells. This leads to entry of water molecules into the cells as well.

   細胞外的甘露醇濃度高，迫使 K^+, Cl^- and Ca^{++}進入保衛細胞中，導致水也隨之進入細胞中

c. Entry of mannitol into guard cells increases their solute potential leading to uptake of water.

   甘露醇進入保衛細胞中，使溶質化學勢升高，導致水的吸收

d. High solute concentration of mannitol results in withdrawal of water from guard cells. 甘露醇的溶質濃度高，結果造成水從保衛細胞釋出

e. Entry of mannitol in the guard cells is counter-balanced by the efflux of K^+ and Ca^{++} leading to the withdrawal of water from the guard cells.

   甘露醇進入保衛細胞，可被 K^+ 及 Ca^{++}的釋出以反方向平衡作用，導致水從保衛細胞釋出

Put a tick mark (√) in the appropriate box **in Q. 1.7. in the Answer Sheet**

在答案紙上的適當空格中打鉤

a.	b.	c.	d.	e.

Q. 1.8. (2.5 points) You have already observed the effect of the Unknown Chemical on stomata (Treatment 5. Leaves were immersed in solution containing 10 mM KCl, 0.1 mM $CaCl_2$, pH 7.0 containing an Unknown Chemical and kept in dark for 2 h.).

你已觀察了未知化學物質對氣孔的影響（也就是處理 5：葉片浸於含有 10 mM KCl, 0.1 mM $CaCl_2$, pH 值 7.0 及未知化學物質之溶液中，黑暗中 2 小時）

These results suggest that the chemical could be useful for:

這些結果暗示此物質可被利用爲

a. weed control by increasing the rate of respiration.

藉由增高呼吸作用來控制雜草

b. keeping plant cuttings fresh over long periods by preventing water loss.

藉由避免水散失以使切下的植物枝條長期保鮮

c. weed control by acting as a wilting toxin.

作用類似一種凋萎毒物來控制雜草

d. increasing crop yield in arid lands by increasing rate of photosynthesis.

藉由提高光合作用速率以增加在乾燥土地上的農作產量

e. increasing plant growth by reducing photorespiration.

藉由降低光呼吸作用速率以增加植物生長

Put a tick mark (√) in the appropriate box **in Q. 1.8 in the Answer Sheet.**

在答案紙上的適當空格中打鉤

a.	b.	c.	d.	e.

Q. 1.9. (2 points) In this task, you studied the effect of various factors on the opening and closing of the stomatal aperture. Similar experiments were performed by scientists and they discovered that light activates zeaxanthin molecules, present in the guard cells, which in turn, activate an ATP-powered proton pump of the guard cell membrane. With this background information and the observations made by you in this task, you have to arrange the sequence of events involved in the response of stomata to light. Fill in the correct options against each step **in Q. 1.9. in the Answer Sheet**.

在此部分，你已看過不同因子對氣孔開閉的影響。科學家操作過類似的實驗，發現光照可活化保衛細胞中的玉米黃素(zeaxanthin)，進而活化一個在保衛細胞膜上需 ATP 的質子幫浦。根據此背景資料及你在此部分所觀察到的結果，有關氣孔對光的反應機制步驟之順序如下。在答案紙上將正確選項的數字填入下列步驟中。

Mechanism: 機制

Step I: _____1_____

Step II: _____2_____

Step III: _____

Step IV: ____6_____

Step V: _____

Step VI: _____

Step VII: _____

Options: 選項

1) Activation of zeaxanthin by light 玉米黃素被光活化
2) Activation of ATP-powered proton pump 活化需 ATP 的質子幫浦
3) Closing of the stomata 氣孔關閉
4) Influx of K^+ K^+ 進入細胞
5) Efflux of K^+ K^+ 自細胞釋出
6) Change in membrane potential 膜電位改變
7) Efflux of Ca^{++} Ca^{++} 自細胞釋出
8) Efflux of protons 質子自細胞釋出
9) Influx of water molecules 水分子進入細胞
10) Efflux of water molecules 水分子自細胞釋出
11) Opening of the stomata 氣孔打開

Task 2 (14 points)

Study of plant anatomy and its correlation with the habitat

第二部分: 探討解剖構造及其相對應的棲地環境

You should try and complete this task in 30 minutes.

請儘可能在 30 分內完成此部分

Materials and equipment 材料與器材		**Quantity 數量**
1. Fresh plant specimens 植物新鮮材料		
(i) Leaf in a Petri dish (labeled X)	在培養皿中的葉（標示 X）	1
(ii) Stem in a Petri dish (labeled Y)	在培養皿中的莖（標示 Y）	1
2. Compound binocular microscope	雙眼顯微鏡	1
3. Razor blades	刀片	2
4. Glass microslides	載玻片	2
5. Box of coverslips	蓋玻片	1
6. Watchglasses	錶玻璃	3
7. Safranin staining solution (labeled S)	Safranin 染劑（標示 S）	1
8. Brush	毛刷	1

Introduction

Plants growing in different habitats exhibit various adaptations. These adaptations can be studied macroscopically as well as microscopically and correlated to their habitats.

生長在不同棲地的植物呈現不同的適應。這些適應可在巨觀及微觀的層次上來研究，並與其棲地相關連。

In this task, you will study the anatomy of the given specimens using the following method. Both specimens X and Y belong to the same plant.

在本部分中，你將利用以下方法來研究所提供材料的解剖，材料 X 及 Y 是來自同一植物

Method 方法

1. Take thin transverse sections of the leaf specimen X.

   對葉（材料 X）作橫切之徒手切片

2. Stain with Safranin staining solution for about 30 to 60 seconds.

   加染劑染色約 30-60 秒

3. Wash the section with distilled water and mount on a clean glass microslide in a drop of water. 以蒸餾水洗切片，再將切片置於載玻片的水滴上

4. Place a coverslip and observe under 10X objective of the microscope.

   蓋上蓋玻片，並在 10 倍物鏡下觀察

5. Repeat Steps 1- 4 for the stem specimen Y.

   對莖（材料 Y）重複步驟 1- 4

Observations on the leaf specimen X: 葉（材料 X）的觀察

Observe the leaf section and answer **Questions Q. 2.1. and Q. 2.2.**

觀察葉的橫切並回答 **Q. 2.1. and Q. 2.2.**

Q. 2.1. (4 points) Choose the appropriate letters from the Dichotomous Keys 1 and 2 given in **Annexure 2.1.** and fill in **Q. 2.1.I. and Q. 2.1.II. in the Answer Sheet.**

從附錄 **2.1** 所提供的兩個檢索表中，選擇適當的英文字母，填在答案紙的 **Q. 2.1.I. and Q. 2.1.II.**中

Note: Schematic representations of some of the plant structures are given in **Annexure 2.2.** for your reference.

注意：附錄 **2.2.**提供一些植物構造的手繪示意圖可供你參考

I. Trichomes 毛茸 ☐

II. Stomata 氣孔 ☐

Q. 2.2. (4 points) Based on your observations on the leaf section, put a tick mark (√) in the appropriate boxes **in Q. 2.2. in the Answer Sheet**. 根據你所作的葉片橫切，在答案紙上適當空格打鉤

	Present 有	Absent 無
1. Cuticle 角質層	☐	☐
2. Sclerenchyma 厚壁組織	☐	☐
3. Collenchyma 厚角組織	☐	☐
4. Aerenchyma 通氣組織	☐	☐
5. Water storage tissue 儲水組織	☐	☐
6. Glands: 腺體		
a. Oil gland 油腺體	☐	☐
b. Salt gland 鹽腺體	☐	☐
c. Digestive gland 消化腺體	☐	☐

Observations on the stem specimen Y:

Observe the stem section and put a tick mark (√) in the appropriate boxes in **Q. 2.3. in the Answer Sheet**.

觀察莖的橫切並在答案紙上 **Q. 2. 3.**適當空格打鉤

Q. 2.3. (3.5 points)

	Present 有	Absent 無
1. Cuticle 角質層	☐	☐
2. Sclerenchyma 厚壁組織	☐	☐
3. Collenchyma 厚角組織	☐	☐
4. Aerenchyma 通氣組織	☐	☐
5. Water storage tissue 儲水組織	☐	☐
6. Vascular bundle:維管束	Open 開放式	Closed 封閉式
	☐	☐
	Collateral 單韌	Bicollateral 雙韌
	☐	☐

Q. 2.4. (2.5 points) Based on your observations of specimens X and Y, identify the type of plant to which they belong.

根據你對材料 X and Y 的觀察，判斷這植物是屬於哪一類？

a. Mesophyte 中生植物

b. Succulent xerophyte 多肉旱生植物

c. Submerged hydrophyte 沉水性水生植物

d. Floating hydrophyte 浮水性水生植物

e. Insectivorous mesophyte 食蟲性的中生植物

f. Parasitic mesophyte 寄生性的中生植物

g. Halophyte 鹽生植物

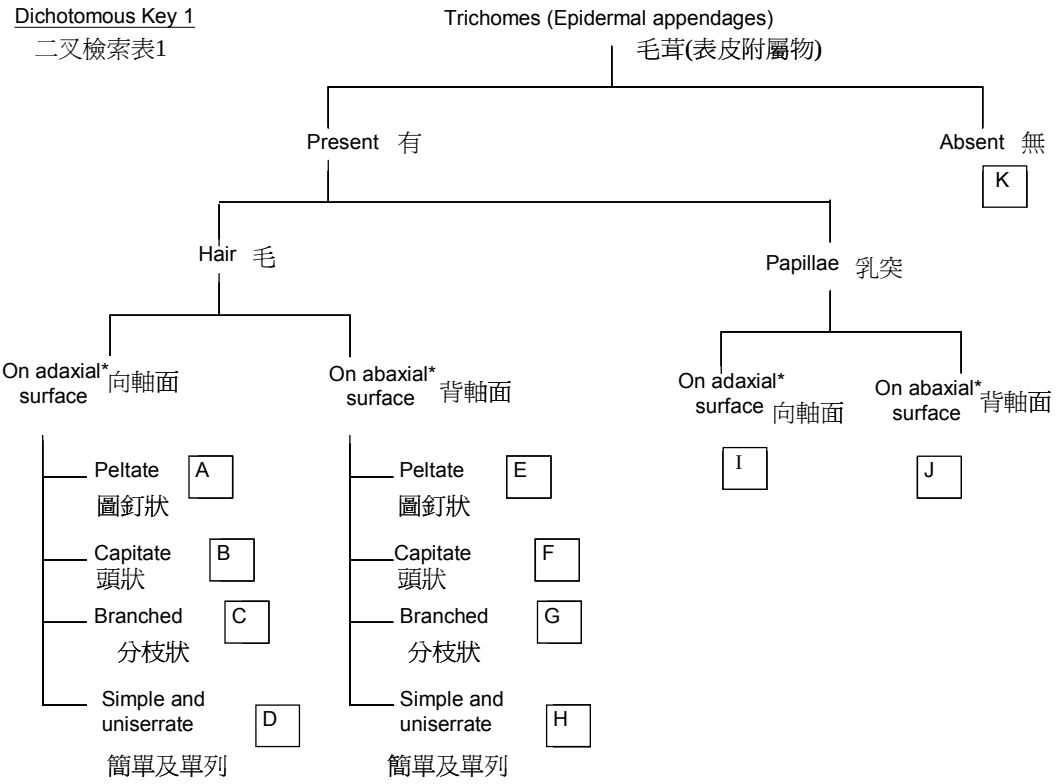
h. Freshwater hygrophyte 淡水濕生植物

Put a tick mark (√) in the appropriate box in **Q. 2.4. in the Answer Sheet.**

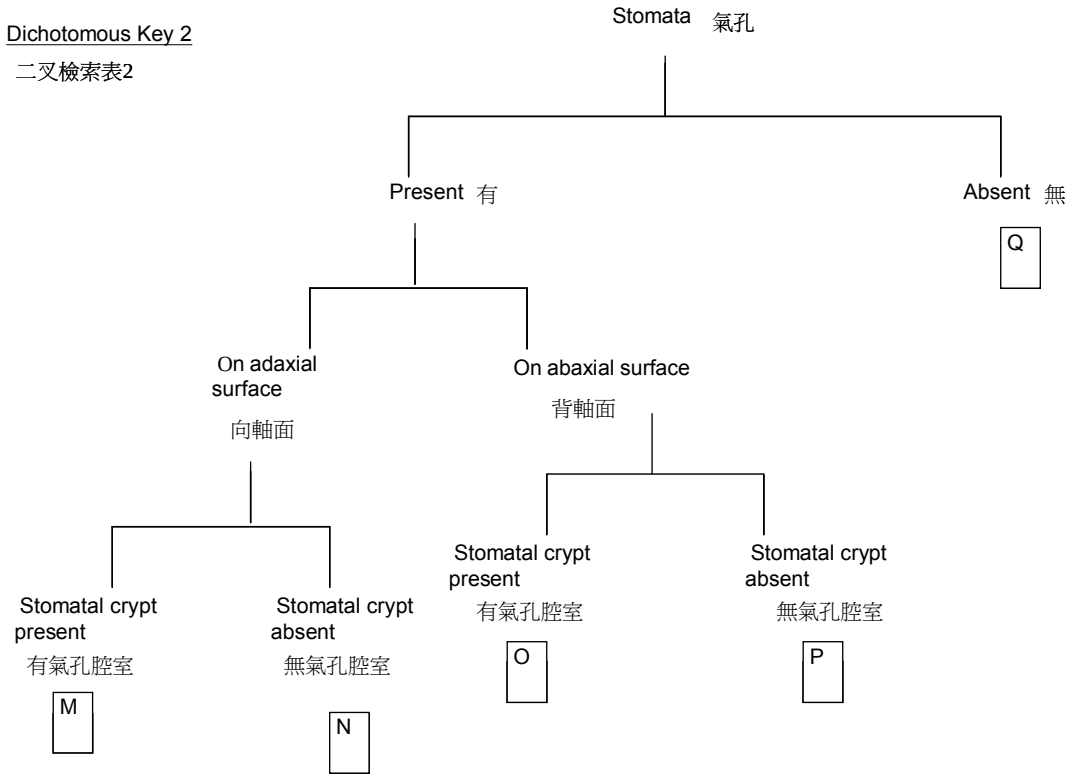
(In this question, the correct interpretation will be given points if it is consistent with your observations.) 在答案紙上 **Q. 2.4** 適當空格打鉤（在此問題中，若你的答案與標準解答不同，但你的觀察是一致的，則正確的解釋也會給分）

a.	b.	c.	d.	e.	f.	g.	h.

ANNEXURE 2.1 附錄 2.1



*NOTE：Adaxial: facing the stem; abaxial: facing away from the stem
*注意：向軸面：向莖的一面；背軸面：背向莖的一面



ANNEXURE 2.2. 附錄 2.2.

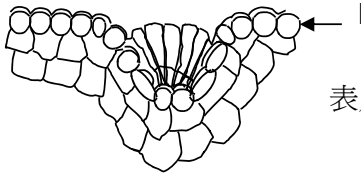


Figure 1: Salt Gland 鹽腺體

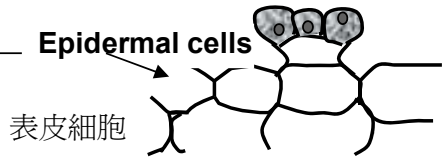


Figure 2: Digestive Gland
消化腺體

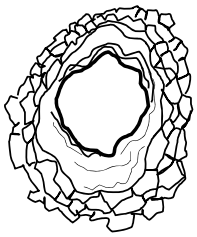


Figure 3: Oil Gland
油腺體

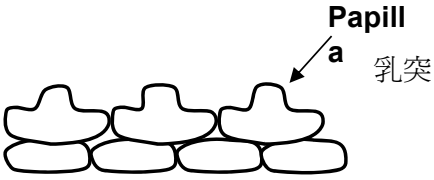


Figure 4: Papillose Epidermis
乳突狀表皮

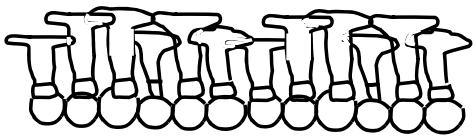


Figure 5: Peltate Hair
圖釘狀毛

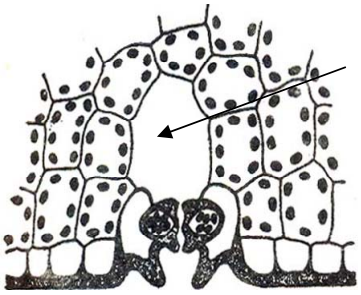


Figure 6: Sunken Stoma
下陷型氣孔

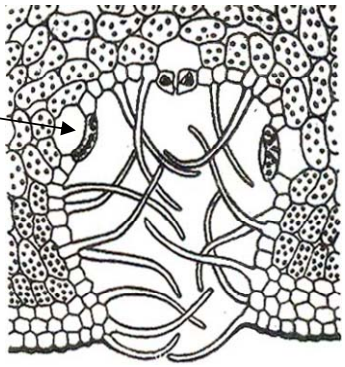


Figure 7: Stomatal Crypt 氣孔腔室

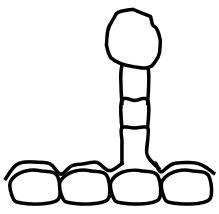


Figure 8: Capitate Hair
頭狀毛

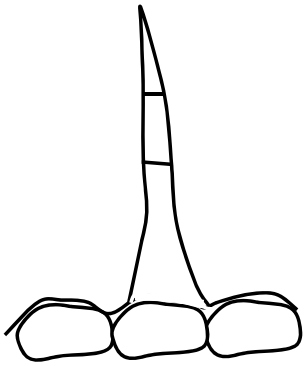


Figure 9: Uniserrate Trichome
單列毛

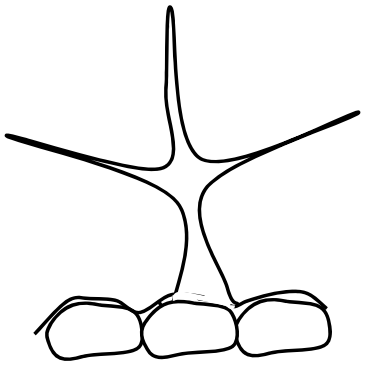


Figure 10: Branched Trichome
分枝狀毛

**********END OF PRACTICAL TEST 1**********