

## 示例及評語

### 前言

以下示例取材自樣本試卷一乙部的第 7、9、和 12 題。選取這三題，皆因它們涵蓋本科考試範圍內不同的重要評核目標。這些試題的答卷樣本可作為不同水平學生所達致的學習成果的例證。在本光碟內，示例先按試題分組，每組由第 5 級順序排列至第 1 級。各試題的相關答案刊於資料冊內的頁號，亦清楚列出，方便讀者參閱。

### 卷一乙部 第 7 題（相關答案見於資料冊第 96 頁）

本題旨在測驗考生對遺傳學概念的理解，分析相關資料並作出推論的能力。同時，題目亦評核考生在選取有關知識並將它們應用於不熟悉情境，以及具邏輯地表達觀點的能力。

示例一：第五級示例及評語

7. 陳先生和陳太太誕下一對孿生兒——安兒和珍兒。下表列出這對孿生兒的某些性狀：

性狀	安兒	珍兒
身體質量（6歲時）	20 kg	21 kg
色覺	正常	正常
血型	O 型	AB 型
智商	110	105

- (a) 指出她們屬於哪一種的孿生兒。解釋如何得出你的答案。（3分）

異卵雙生。因為兩者血型不同。

- (b) 已知決定血型的抗原的等位基因是  $I^A$ 、 $I^B$  和  $i$ ，指出陳先生和陳太太的基因型。（2分）

$I^A i$  及  $I^B i$ 。

- (c) 等位基因  $I^A$  編碼着某種酶，該酶負責製造紅血細胞表面的抗原 A。概述等位基因  $I^A$  表達而導致形成此酶的過程。（6分）

等位基因 A 於細胞核內進行轉錄作用，形成帶有該酶密碼子的 mRNA。mRNA 經過核孔進入細胞質，並在多核糖體上進行轉譯作用。mRNA 上的密碼子透過互補基制吸引擁有特定反密碼子的 tRNA-氨基酸複合物，而兩個複合物的氨基酸間互相形成肽鍵，如此類推，最終形成一條肽鏈，並經多重摺疊屈曲，形成該酶。

評語

考生能夠將遺傳學的概念應用到試題所述的情境中，表現優異；對蛋白質合成的過程，亦有透徹的認識和理解。考生能運用準確的科學辭彙，並用邏輯和有條理的方法，有效地傳達意念。

示例二：第四級示例及評語

7. 陳先生和陳太太誕下一對孿生兒——安兒和珍兒。下表列出這對孿生兒的某些性狀：

性狀	安兒	珍兒
身體質量 (6 歲時)	20 kg	21 kg
色覺	正常	正常
血型	O 型	AB 型
智商	110	105

- (a) 指出她們屬於哪一種的孿生兒。解釋如何得出你的答案。(3 分)

異卵相胎，因為從它們的血型可能看出其基因存在着差異，而因為血型是不連續變異，由基因控制的。而同卵相胎的基因不會存在着差異，所以她們是異卵相胎。

- (b) 已知決定血型的抗原的等位基因是  $I^A$ 、 $I^B$  和  $i$ ，指出陳先生和陳太太的基因型。(2 分)

陳先生為  $I^A i$ ，陳太太為  $I^B i$ ，或陳先生為  $I^B i$ ，陳太太為  $I^A i$

- (c) 等位基因  $I^A$  編碼着某種酶，該酶負責製造紅血細胞表面的抗原 A。概述等位基因  $I^A$  表達而導致形成此酶的過程。(6 分)

基因  $I^A$  會在 mRNA 縮合酶的作用下解旋形成模板吸引自由的核糖核苷酸在互補鹼基對上，並在 mRNA 縮合酶的作用下形成 mRNA，mRNA 會在細胞中的核糖體的協助下，吸引自由的 tRNA-氨基酸複會物到互補鹼基對上，在適當的酶的作用下氨基酸會縮合形成  $I^A$  編碼的多肽鏈，多肽鏈在基份之內的氫鍵作用下摺疊捲曲成立體結構，形成  $I^A$  所編碼的酶。

評語

考生對有關遺傳學的概念有充分的認識和理解，並能夠將這些概念應用到試題所述的情境中。考生能夠概述蛋白質合成的整體過程，但遺漏了一些細節。除偶有不適當的辭彙和文句外，考生能用邏輯和有條理的方法，有效地傳達意念。

示例三：第三級示例及評語

7. 陳先生和陳太太誕下一對孿生兒——安兒和珍兒。下表列出這對孿生兒的某些性狀：

性狀	安兒	珍兒
身體質量（6歲時）	20 kg	21 kg
色覺	正常	正常
血型	O 型	AB 型
智商	110	105

- (a) 指出她們屬於哪一種的孿生兒。解釋如何得出你的答案。（3 分）

她們屬異卵雙胎，因為她們的血型不相同。安兒是 O 型，珍兒是 AB 型。

- (b) 已知決定血型的抗原的等位基因是  $I^A$ 、 $I^B$  和  $i$ ，指出陳先生和陳太太的基因型。（2 分）

陳先生的基因型： $I^A I^B$

陳太太的基因型： $I^A I^B i$

- (c) 等位基因  $I^A$  編碼着某種酶，該酶負責製造紅血細胞表面的抗原 A。概述等位基因  $I^A$  表達而導致形成此酶的過程。（6 分）

首先  $I^A$  的編碼的 DNA 雙鏈裂開，經傳錄作用合成 mRNA 鏈，mRNA 鏈釋出細胞核後，由 tRNA 及氨基酸合成的氨基酸-tRNA 複合物進行轉譯作用，氨基酸之間會形成肽鍵，形成多肽鏈。多肽鏈經折疊後便形成此酶。

評語

考生對遺傳學的概念有一定的認識和理解，並能將相關的概念應用到試題所述的情境中。考生能以清晰的文句和科學辭彙概述蛋白質合成的過程，但遺漏了一些細節，及夾雜一些謬誤。

示例四：第二級示例及評語

7. 陳先生和陳太太誕下一對孿生兒——安兒和珍兒。下表列出這對孿生兒的某些性狀：

性狀	安兒	珍兒
身體質量（6歲時）	20 kg	21 kg
色覺	正常	正常
血型	O 型	AB 型
智商	110	105

- (a) 指出她們屬於哪一種的孿生兒。解釋如何得出你的答案。（3 分）

異卵孿生。  
因她們的血型不相同。

- (b) 已知決定血型的抗原的等位基因是  $I^A$ 、 $I^B$  和  $i$ ，指出陳先生和陳太太的基因型。（2 分）

陳先生： $I^A i$   
陳太太： $I^B i$

- (c) 等位基因  $I^A$  編碼着某種酶，該酶負責製造紅血細胞表面的抗原 A。概述等位基因  $I^A$  表達而導致形成此酶的過程。（6 分）

$I^A$  經轉錄和轉譯作用，可形成一特定的氨基酸，而  
那些特定的氨基酸會形成蛋白質，蛋白質則合成酶。  
在轉錄作用當中會有 mRNA 形成，mRNA 帶有密碼子，  
在轉譯作用中，mRNA 與 tRNA 結合，形成氨基酸。

評語

考生對遺傳學的概念有基礎的認識，亦具有基礎的能力將相關的概念應用到試題所述的情境中。考生對蛋白質合成的過程有基礎的理解，但他們在描述有關過程時遺漏了一些關鍵的細節，有些意念亦因夾雜有謬誤之處而未能正確表達。整體而言，考生在以文字傳達意念時，達到基礎的水平。

示例五：第一級示例及評語

7. 陳先生和陳太太誕下一對孿生兒——安兒和珍兒。下表列出這對孿生兒的某些性狀：

性狀	安兒	珍兒
身體質量（6歲時）	20 kg	21 kg
色覺	正常	正常
血型	O 型	AB 型
智商	110	105

- (a) 指出她們屬於哪一種的孿生兒。解釋如何得出你的答案。（3分）

異卵雙胎。

因為她們的血型不同，所以是有不同量精子與卵子結合而成，染色體不同，所以血型也不同，而血液中的抗原也不同。

- (b) 已知決定血型的抗原的等位基因是  $I^A$ 、 $I^B$  和  $i$ ，指出陳先生和陳太太的基因型。（2分）

陳生： $I^A$ ；陳太： $i$ 。

- (c) 等位基因  $I^A$  編碼着某種酶，該酶負責製造紅血細胞表面的抗原 A。概述等位基因  $I^A$  表達而導致形成此酶的過程。（6分）

基因  $I^A$  ~~令紅血細胞產生抗原~~，令蛋白質按其特性  
 列  
 核糖 mRNA

評語

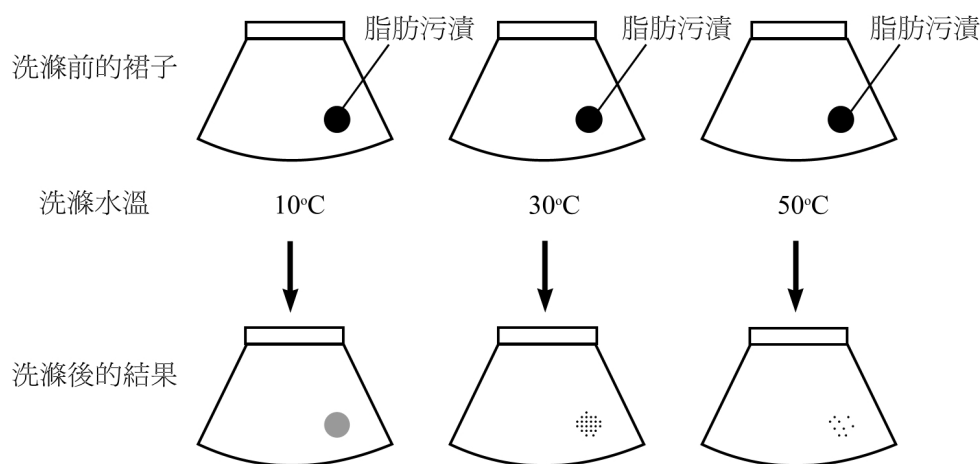
考生對遺傳學的概念有初階的認識，但對蛋白質合成的過程所知甚少，運用遺傳學概念的能力亦只達最低水平。

卷一乙部 第9題 (相關答案見於資料冊第97頁)

本題旨在測驗考生對酶活性知識的應用來解釋生物洗衣粉的工作原理，同時亦評核考生就分析某科學探究的結果來作出結論，以及為預設的難題設計一個探究活動來解難的能力。考生需要具邏輯和有系統地表達其觀點。

示例六：第五級示例及評語

9. 酶在日常生活中的其中一項應用可見於生物洗衣粉。為了研究生物洗衣粉的效能，把三條相同及染有相同脂肪污漬的裙子，用相同濃度的洗衣粉溶液，在不同水溫下洗滌。這項研究及其結果概述如下：



(N.B. 在以上三個溫度重複這項研究，但不使用洗衣粉。三條裙子上的脂肪污漬保持不變。)

- (a) 試解釋為什麼生物洗衣粉能清除脂肪污漬。(3分)

生物洗衣粉中含有酶類，能將不溶于水脂肪分解成溶于水的甘油及脂肪酸，這些甘油和脂肪酸能順利地被水沖走而清除脂肪污漬。

- (b) 從研究的結果可得出什麼結論？(1分)

在10°C至50°C間，溫度上升，脂肪酶的活性愈高，即洗衣粉的清洗效能愈高。

- (c) 一名學生質疑生物洗衣粉是否較普通（非生物）洗衣粉更有效清除脂肪污漬。若你是該名學生，描述你如何進行一項研究以找出哪種洗衣粉更為有效。（5 分）

以兩個桶中加入相同溫度的水，並保持水溫不變；  
在兩布料上滴上相同體積的油漬；  
將兩桶中，每個桶加入相同質量的非生物洗衣粉及生物  
洗衣粉。分別取出兩樣布料的布料，比較布料上油  
漬的體積面積大小；面積較小者代表該洗衣劑  
更為有效。  
重複在數個相同溫度下以相同的裝置進行實驗，  
觀察在溫度不同下兩洗衣粉的相對活性是否有異。

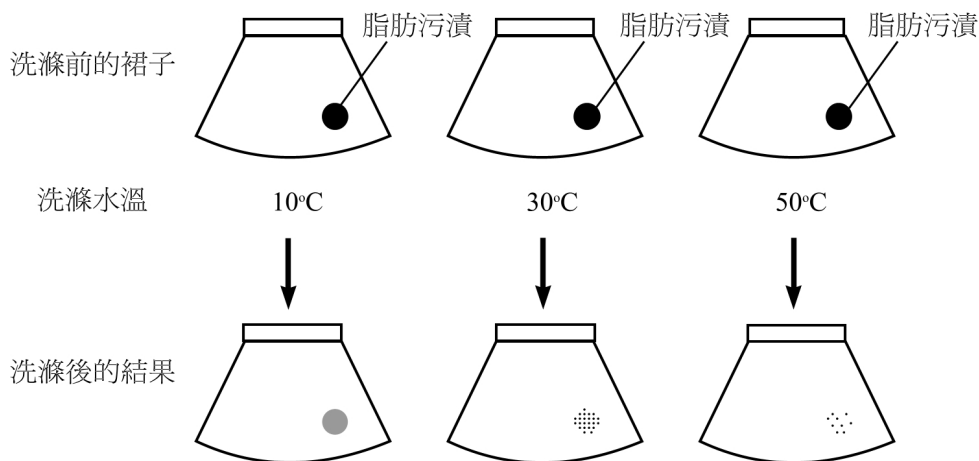
#### 評語

考生能運用有關酶活性的概念以解釋生物洗衣粉的工作原理，並能設計探究活動以解決特定的問題，且表現卓越。考生能詳細描述探究活動，包括需要調控的變項、應量度的變項及針對問題來詮釋結果的方法。整體而言，考生能運用準確的科學辭彙，並用邏輯和有條理的方法來傳達意念。



示例七：第四級示例及評語

9. 酶在日常生活中的其中一項應用可見於生物洗衣粉。爲了研究生物洗衣粉的效能，把三條相同及染有相同脂肪污漬的裙子，用相同濃度的洗衣粉溶液，在不同水溫下洗滌。這項研究及其結果概述如下：



(N.B. 在以上三個溫度重複這項研究，但不使用洗衣粉。三條裙子上的脂肪污漬保持不變。)

- (a) 試解釋爲什麼生物洗衣粉能清除脂肪污漬。(3分)

脂肪 催化分解

因為生物洗衣粉內含有酶，這種酶能將脂肪分解成甘油及脂肪酸，在脂肪從衣物上清除。

- (b) 從研究的結果可得出什麼結論？(1分)

生物洗衣粉中 脂肪酶的最適溫度是 50°C。

- (c) 一名學生質疑生物洗衣粉是否較普通（非生物）洗衣粉更有效清除脂肪污漬。若你是該名學生，描述你如何進行一項研究以找出哪種洗衣粉更為有效。  
(5 分)

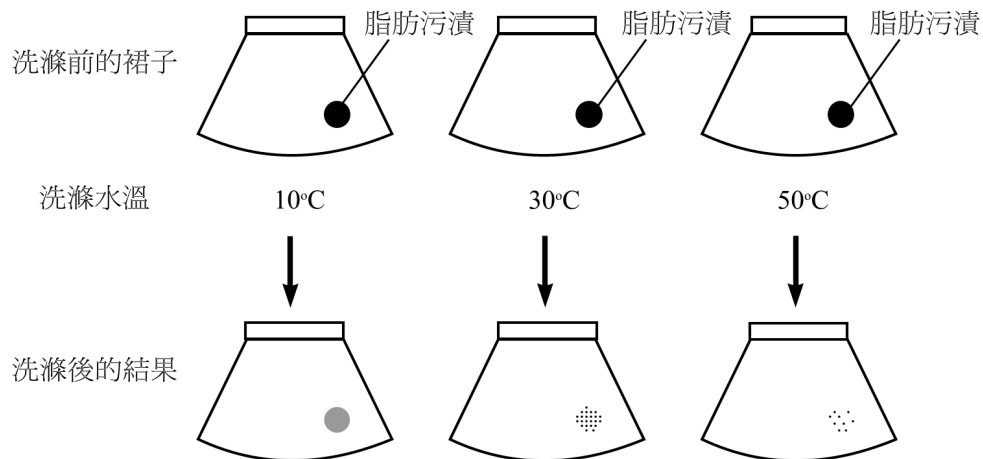
~~將普通洗衣粉~~ 把三條相似及染有相同脂肪污漬的裙子，用相同濃度的普通洗衣粉溶液，在分別為  $10^{\circ}\text{C}$ 、 $30^{\circ}\text{C}$  及  $50^{\circ}\text{C}$  的水溫下洗滌，~~與~~ 在相同溫度下的前述以生物洗衣粉洗滌的裙子比較，污漬越少的洗衣粉較有效。

#### 評語

考生有能力運用有關酶活性的概念以解釋生物洗衣粉的工作原理及設計科學探究。考生掌握調控變項的概念，但未能清晰表達量度結果的方法。整體而言，考生能運用適當的科學辭彙來傳達意念。

示例八：第三級示例及評語

9. 酶在日常生活中的其中一項應用可見於生物洗衣粉。爲了研究生物洗衣粉的效能，把三條相同及染有相同脂肪污漬的裙子，用相同濃度的洗衣粉溶液，在不同水溫下洗滌。這項研究及其結果概述如下：



(N.B. 在以上三個溫度重複這項研究，但不使用洗衣粉。三條裙子上的脂肪污漬保持不變。)

- (a) 試解釋爲什麼生物洗衣粉能清除脂肪污漬。 (3 分)

因为生物洗衣粉中含有酶，而該種酶可分解脂肪为  
甘油和脂肪酸，故能清除脂肪污漬。

- (b) 從研究的結果可得出什麼結論？ (1 分)

洗衣粉中的酶在 50°C 時較在 30°C 和 10°C 時更能有效  
分解脂肪。

- (c) 一名學生質疑生物洗衣粉是否較普通（非生物）洗衣粉更有效清除脂肪污漬。若你是該名學生，描述你如何進行一項研究以找出哪種洗衣粉更為有效。  
(5 分)

我會進行 2 組實驗，而 2 組實驗均在 50°C 時進行。

實驗 I: 把染有脂肪污漬的裙子，用生物洗衣粉溶液中洗滌。

實驗 II: 把染有與實驗 I 相同脂肪污漬的裙子，用與實驗 I 相同濃度的普通洗衣粉溶液中洗滌。

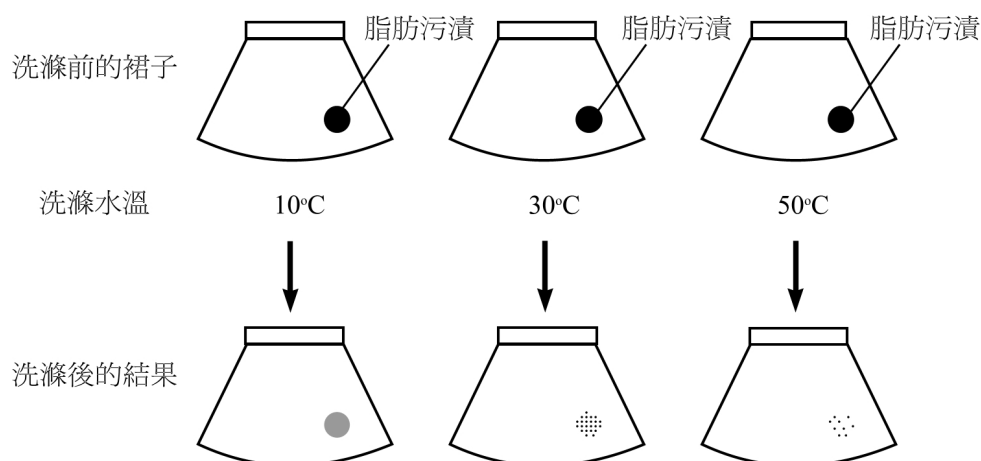
洗滌後，比較 2 條裙子的污漬。

#### 評語

考生有一定能力運用有關酶活性的概念以解釋生物洗衣粉的工作原理。在設計科學探究時，考生明瞭需要調控某些變項，但沒有清晰描述量度結果的方法。整體而言，考生能以一些科學辭彙清晰地傳達意念。

示例九：第二級示例及評語

9. 酶在日常生活中的其中一項應用可見於生物洗衣粉。爲了研究生物洗衣粉的效能，把三條相同及染有相同脂肪污漬的裙子，用相同濃度的洗衣粉溶液，在不同水溫下洗滌。這項研究及其結果概述如下：



(N.B. 在以上三個溫度重複這項研究，但不使用洗衣粉。三條裙子上的脂肪污漬保持不變。)

- (a) 試解釋爲什麼生物洗衣粉能清除脂肪污漬。(3 分)

生物洗衣粉內含有一種酶能催化脂肪  
 分解，洗滌時該酶<sup>的活性部位</sup>以鎖鑰原理或誘導  
 契合假說與脂肪(受質)結合，將脂肪轉化  
 成另一種可溶於水物質，從而將其分解。

- (b) 從研究的結果可得出什麼結論？(1 分)

最適溫度高於 50°C 度，而溫度越低，酶  
 催化脂肪分解效率越低。

- (c) 一名學生質疑生物洗衣粉是否較普通（非生物）洗衣粉更有效清除脂肪污漬。若你是該名學生，描述你如何進行一項研究以找出哪種洗衣粉更為有效。  
(5 分)

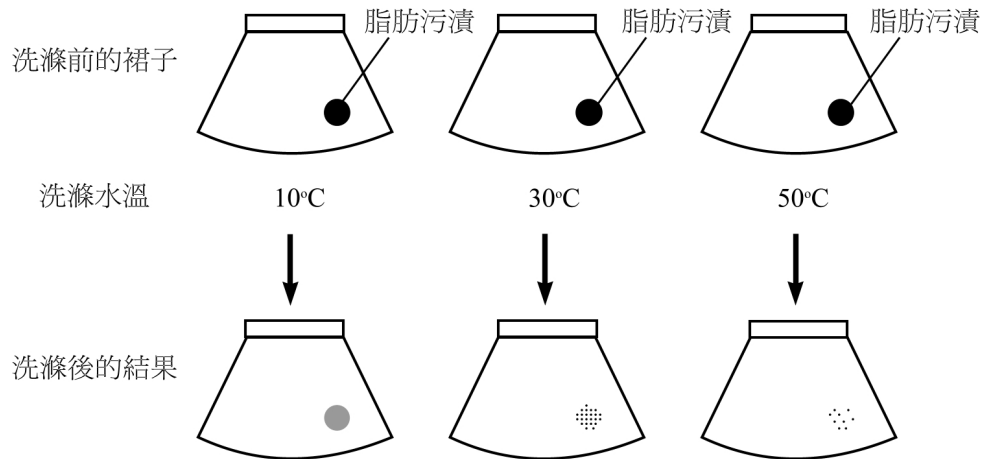
取相同脂肪污漬的  
羣情衣服襪子，分成兩組，~~在~~在 50°C 時  
以非生物洗衣粉及生物洗衣粉，~~另一組是 50°C~~  
時洗滌襪子，洗滌後比較其污漬清潔  
程度。—— 裝好裝置，在 60°C 用非生物洗衣粉  
洗滌襪子。

#### 評語

考生對有關酶活性及酶應用於生物洗衣粉的概念，具有基礎的理解。考生對需要調控變項有些少理解，但沒有提及量度結果的方法。整體而言，考生在以文字傳達意念時，達到基礎的水平。

示例十：第一級示例及評語

9. 酶在日常生活中的其中一項應用可見於生物洗衣粉。爲了研究生物洗衣粉的效能，把三條相同及染有相同脂肪污漬的裙子，用相同濃度的洗衣粉溶液，在不同水溫下洗滌。這項研究及其結果概述如下：



(N.B. 在以上三個溫度重複這項研究，但不使用洗衣粉。三條裙子上的脂肪污漬保持不變。)

- (a) 試解釋爲什麼生物洗衣粉能清除脂肪污漬。(3 分)

因為洗衣粉含有酶，能與脂肪酶，能與衣物上的脂肪污漬起反應，令到脂肪污漬被分解，從而脫離衣物。

- (b) 從研究的結果可得出什麼結論？(1 分)

酶與洗衣粉的去污效能會受到<sup>水的</sup>溫度影響。

- (c) 一名學生質疑生物洗衣粉是否較普通（非生物）洗衣粉更有效清除脂肪污漬。若你是該名學生，描述你如何進行一項研究以找出哪種洗衣粉更為有效。  
(5 分)

進行相同的實驗，但這次不是利用生物洗衣粉，而是利用普通洗衣粉，其他條件不變，即如左圖的條件，水溫就有  $10^{\circ}\text{C}$ ， $30^{\circ}\text{C}$ ， $50^{\circ}\text{C}$ ，洗完衣服後，比較不同溫度的水洗越後的衣服的油漬，再與之前利用生物洗衣粉洗後的衣服作比較，比較在相同條件下，哪種洗衣服的油漬能力較高，再作結論。

#### 評語

考生對酶活性及設計科學探究的原理，有初階的理解。考生在傳達意念方面，含糊不清，明顯欠缺科學的精確度。



**卷一乙部 第 12 題（相關答案見於資料冊第 99 頁）**

本題旨在測驗考生對植物獲取和合併重要元素（這題以氫和氮為例）以合成蛋白質的認識和理解，並評核考生在選取和綜合有關知識來回應問題的能力。考生需要具邏輯和有系統地組織及表達其觀點。

示例十一：第五級示例及評語

12. 氮和氮是蛋白質的必需成分。比較非豆科植物從環境獲取這兩種元素的過程的異同；並描述在葉肉細胞中，它們如何被合併一起，形成蛋白質。

(11分)

非豆科植物攝取該兩種元素均是由泥土中吸收的，而且均是由根部吸收的，同樣是以吸收含氮元素的 $\text{O}$ 化合物再進行同化的。

而不同處則吸收 $\text{O}$ 時，是靠吸收泥土中的水，而吸收氮是靠吸收泥土中的 $\text{O}$ ；而吸收氮時是根毛藉滲透作用吸水的，而吸收 $\text{O}$ 則是靠主動運輸及擴散作用。

葉肉細胞中氮以水形式存在，氮以 $\text{NH}_4^+$ 形式存在。葉肉細胞中的葉綠體進行光合作用，在光磷酸化反應中，葉綠素 $\text{a}$ 激發出高能電子提供能量將 $\text{H}_2\text{O}$ 光解為 $\text{H}$ 和 $\text{O}$ ，而 $\text{H}$ 由 $\text{NADP}$ 載上成為 $\text{NADPH}$ 。然後 $\text{NADPH}$ 在葉綠體基質中參與固碳反應， $\text{H}$ 作為還原劑與 $\text{C}_3$ 的羧基中間產物磷酸甘油酸結合，並將其還原為磷酸丙糖，部分磷酸丙糖會繼續進行卡爾文循環，轉為磷酸核酮糖，再轉為二磷酸核酮糖，再加入 $\text{CO}_2$ 成為 $\text{C}_3$ 的羧基甘油酸，而它可經糖酵解成為乙酰輔酶 $\text{A}$ ，最後進入克雷伯氏循環形成 $\alpha$ -酮基戊二酸，此時含氮的 $\text{NH}_4^+$ 會加入形成 $\alpha$ -氨基戊二酸， $\alpha$ -氨基戊二酸而脫水縮合變為 $\alpha$ -氨基酸。

a): 在葉綠體的類囊體膜上，

評語

考生對氮和氮合併以形成蛋白質所涉及的概念，有廣泛的認識和深入的理解。考生能以準確的科學辭彙，具邏輯及有條理地將有關概念綜合及有效地傳達。

示例十二：第四級示例及評語

12. 氮和氮是蛋白質的必需成分。比較非豆科植物從環境獲取這兩種元素的過程的異同；並描述在葉肉細胞中，它們如何被合併一起，形成蛋白質。  
(11分)

非豆科植物獲取氮和氮的元素的途徑同樣是源自根部的  
泥土中所吸收，不過這兩種元素的來源成分並不相同。

非豆科植物要利用根部與泥土的水勢差，令水進入根部經  
蒸騰作用沿木質部運送至葉肉細胞的葉綠體之中。進行光反應  
時會用水作為反應物，將水作光解反應變為氮元素氧元素，這便是  
植物獲取氮的途徑。

比較植物<sup>要</sup>獲取氮的時候，非豆科植物的根部內皮層會進行  
主動運輸將礦物鹽泵入中柱木質部之中溶於水並集體流體  
至各葉肉細胞之中，這令內皮層的行動令泥土中的礦物鹽濃度  
較根部高，於是泥土的礦物鹽便會經擴散作用進入根部細  
胞之中，當中的礦物鹽會包括硝酸鹽，即氮元素的來源。由此  
比較到獲取氮和氮的元素時，植物所進行的反應皆會有所不同，  
而它們兩者亦分別來自水和硝酸鹽，之後當它們進入葉肉網  
胞中，便會開始進行合成植物所需蛋白質的步驟。

氮和氮被吸收進植物中後，氮會被硝酸鹽分離出氮元素吸  
引形成<sup>\*</sup>胺基，然後當胺基與葉肉細胞中的羧酸分子<sup>結合</sup>時便會形  
成氨基酸，當附有不同<sup>脫</sup>烷基的氨基酸不斷縮合，漸漸便會  
形成一條多肽鏈，從而最終形成蛋白質。

評語

考生對植物獲取氮和氮，以及將氮合併以形成蛋白質的過程，有充分的認識和理解；惟對氮合併至碳骨架所涉及的光合作用和克雷伯氏循環的關鍵步驟，則付諸闕如。整體而言，考生能運用適當的科學辭彙和合乎邏輯地傳達意念。

示例十三：第三級示例及評語

12. 氫和氮是蛋白質的必需成分。比較非豆科植物從環境獲取這兩種元素的過程的異同；並描述在葉肉細胞中，它們如何被合併一起，形成蛋白質。(11分)

非豆科植物獲取H是透過其進行光合作用時，光反應期間，水會被光分解為氫和氧，氫會與NADP結合而形成NADPH<sub>2</sub>，而氧則釋放於大氣。

而至於氮的獲取則是透過植物根部從泥土中吸收硝酸鹽，從而獲取氮。

兩個過程的相異之處在於獲取氮不需耗能而獲取氫時，根部靠主動運輸吸收硝酸鹽，要耗能的。在獲取時，即光反應期間，是有能量產生，使ADP與磷酸結合形成ATP分子；但獲取氮的過程則沒有ATP分子形成。

兩個過程的相同之處在於氫的來源(H<sub>2</sub>O)和氮的來源(硝酸鹽)，都是植物根部從泥土吸收。

在葉肉細胞當中，當光反應進行之後，產生的NADPH<sub>2</sub>會應用於暗反應當中，二磷酸核酮糖會與CO<sub>2</sub>和水反應形成磷酸甘油酸，磷酸甘油酸經過會轉化為磷酸甘油酸，期間會令NADPH<sub>2</sub>變回NADP。在暗反應中形成的磷酸甘油酸會進入糖酵解作用，應用

前呼吸作用中，在克魯伯氏循環中的羧酸，可與葉  
片內的  $\text{NH}_3$  結合，形成蛋白質。

#### 評語

考生對植物獲取氫和氮，以及將它們合併以形成蛋白質的過程，有一定的理解；惟答案夾雜一些不相關的細節。整體而言，考生能以清晰的文句及科學辭彙傳達意念。

示例十四：第二級示例及評語

12. 氮和氧是蛋白質的必需成分。比較非豆科植物從環境獲取這兩種元素的過程的異同；並描述在葉肉細胞中，它們如何被合併一起，形成蛋白質。

(11分)

非豆科植物從環境~~獲~~獲取氮的途徑<sup>是</sup>以~~是~~透過有根吸收水分子而獲取氮的，而氮的獲取途徑是透過吸收泥土的硝酸鹽而獲取的。水分子在被根部吸收到葉片時，葉片的葉肉細胞進行光合作用，在光反應時分解水分子，而氧原子便由NADP接收生成NADPH 來供與往應用。~~而氮~~

蛋白質是在葉肉細胞內附在粗糙內質網上~~的核糖體內合成~~的，由核細胞核內~~的~~ mRNA 在核糖體內~~附於大次單位上~~，而有两个密碼子附於大次單位上，~~第一個~~密碼子吸引其~~與其~~互補的 tRNA-氨基酸複合物到大次單位上，~~第二~~第二個密碼子吸引一個與其~~與其~~互補的 tRNA-氨基酸複合物到大次單位上，兩個氨基酸之間以肽鍵連接，此時第一個 tRNA 被釋出，再吸引其~~與其~~反密碼子~~與其~~互補的氨基酸，形成 tRNA-氨基酸複合物。而核糖體不斷沿 mRNA 移動，直至到~~到~~表示終結的密碼子，氨基酸間以肽鍵連接形成一條多肽，多肽間以~~以~~氫鍵連接成~~成~~蛋白質。

評語

考生對植物獲取氮和氧的過程，有基礎的認識，但沒有提及這兩種元素合併為蛋白質所涉及的過程。考生未能理解題意，且描述了與本題無關的蛋白質合成所涉及的轉譯作用。考生仍能傳達意念，惟答案夾雜了無關重要的詳細資料。

示例十五：第一級示例及評語

12. 氮和氮是蛋白質的必需成分。比較非豆科植物從環境獲取這兩種元素的過程的異同；並描述在葉肉細胞中，它們如何被合併一起，形成蛋白質。  
(11分)

非豆科植物中氮是由光合作用中光反應將水水解成氫原子及氧氣時獲得。及用電

氮由泥土中硝化細菌將空氣中的氮氣轉化成硝酸鹽，或直接将動植物分解後所得的硝酸鹽、銨離子經擴散作用及主動運輸吸收到植株中。

兩種元素被運送到葉肉細胞後，在光合作用中的克魯伯氏循環中經以輔酶A合成氨基酸。

葉肉細胞的細胞核中DNA鏈經轉錄作用形成mRNA，mRNA釋出到細胞質，由tRNA將mRNA進行轉譯作用。

評語

考生對試題相關的概念有初階的認識，以文字傳達意念方面，亦展現初階水平。

## EXEMPLARS AND COMMENTS

### Introduction

The exemplars below are taken from Questions 7, 9 and 12 of Sample Paper 1 Section B. These questions have been selected as they address different important assessment objectives in the examination. Samples of student performance in these questions provide evidence of the learning outcomes achieved by candidates at different levels. In this CD, exemplars from Level 5 to Level 1 of the same question have been put together. Page references for the suggested answers of the respective questions in the Information Booklet are provided.

### Paper 1 Section B Question 7 (refer to p.107 of the Booklet for the suggested answer)

This question tests candidates' understanding of the concepts used in genetics and their ability to analyse the information provided to make a deduction. Their abilities to select relevant knowledge and apply it to an unfamiliar situation and to communicate ideas logically are also assessed.

#### Sample 1: Level 5 exemplar and comments

7. Mr and Mrs Chan gave birth to a pair of twins, Anne and Jane. The table below lists some characters shown by the twins:

Character	Anne	Jane
Body mass (at the age of 6)	20 kg	21 kg
Colour vision	normal	normal
Blood group	O	AB
IQ	110	105

- (a) State the type of twins they belong to. Explain how you arrive at your answer. (3 marks)

They are non-identical twins. It is because their blood types are different which indicates they have 2 different genotype & that means they came from two different fertilized eggs having 2 genotypes.

- (b) Given that the alleles for the antigens that determine blood groups are  $I^A$ ,  $I^B$  and  $i$ , state the genotypes of Mr and Mrs Chan. (2 marks)

Mr. Chan :  $I^A i / I^B i$       Mrs. Chan :  $I^A i / I^B i$



- (c) Allele  $I^A$  codes for an enzyme responsible for forming antigen A on the surface of red blood cells. Outline the processes in which allele  $I^A$  is expressed to form this enzyme. (6 marks)

The DNA strands at which allele  $I^A$  locates unwind itself by breaking hydrogen bond between bases. Then, one of the DNA strands act as a template for forming mRNA by complementary base pairing. The mRNA then leave the nucleus & reaches ribosome carrying with it codons. The tRNA with one end of anti-codons which fits the codons in complementary base pairing & the other end an amino acid attached, then follow the specific sequence of mRNA & amino acids are arranged in specific sequence & join together forming the enzyme.

#### Comments

The candidate displays excellent ability to apply the concepts of genetics to the given context and shows very good knowledge and understanding of the process of protein synthesis. The ideas are effectively communicated in a logical and coherent way with an accurate use of scientific terminology.

**Sample 2: Level 4 exemplar and comments**

7. Mr and Mrs Chan gave birth to a pair of twins, Anne and Jane. The table below lists some characters shown by the twins:

Character	Anne	Jane
Body mass (at the age of 6)	20 kg	21 kg
Colour vision	normal	normal
Blood group	O	AB
IQ	110	105

- (a) State the type of twins they belong to. Explain how you arrive at your answer. (3 marks)

They are non-identical twins. Anne's blood group is O while <sup>that of</sup> Jane is AB. For identical twins, they must have the same blood group ~~as~~ as they have totally identical genes from the same zygote. Yet, there is a discrepancy in their blood groups, showing that they must be non-identical twins.

- (b) Given that the alleles for the antigens that determine blood groups are  $I^A$ ,  $I^B$  and  $i$ , state the genotypes of Mr and Mrs Chan. (2 marks)

Genotype of Mr. and Mrs Chan are  $I^A i$  and  $I^B i$ .

- (c) Allele  $I^A$  codes for an enzyme responsible for forming antigen A on the surface of red blood cells. Outline the processes in which allele  $I^A$  is expressed to form this enzyme. (6 marks)

Allele  $I^A$  exists in free uncoiled DNA in resting stage. Its two <sup>specific</sup> strands of DNA disintegrate and complementary <sup>specific</sup> pairs of bases along the portion of the allele occurs. A <sup>specific</sup> mRNA is formed by RNA polymerase. After that, the mRNA <sup>which codes for the synthesis of the enzyme</sup> travels through nuclear pores to the cytoplasm. It approaches and joins a ribosome. tRNA activated with amino acids enter the ribosome. The mRNA molecule consists of triplet codes which by complementary base pairing, joins with tRNA-complex. The amino acids form peptide bonds to form a polypeptide for the enzyme molecule.

**Comments**

The candidate shows sound knowledge and understanding of concepts related to genetics and has the competence to apply these concepts to the given context. A general outline of the process of protein synthesis is presented but a few details are left out. The ideas are communicated logically and coherently, though inappropriate use of terminology and expressions is detected in a few instances.

**Sample 3: Level 3 exemplar and comments**

7. Mr and Mrs Chan gave birth to a pair of twins, Anne and Jane. The table below lists some characters shown by the twins:

Character	Anne	Jane
Body mass (at the age of 6)	20 kg	21 kg
Colour vision	normal	normal
Blood group	O	AB
IQ	110	105

- (a) State the type of twins they belong to. Explain how you arrive at your answer. (3 marks)

Non-identical twins.

The blood group of them is different.

- (b) Given that the alleles for the antigens that determine blood groups are  $I^A$ ,  $I^B$  and  $i$ , state the genotypes of Mr and Mrs Chan. (2 marks)

One of them is  $I^A i$ , and one of them is  $I^B i$ .

- (c) Allele  $I^A$  codes for an enzyme responsible for forming antigen A on the surface of red blood cells. Outline the processes in which allele  $I^A$  is expressed to form this enzyme. (6 marks)

When a repressor don't bind to the gene, the DNA sequence that consist of Allele  $I^A$  start to unwind, and two strands are separated. The free nucleotides start to bind to the template by homologous pairing. So, transcription is finished and mRNA is formed. After that, tRNA bind to specific amino acid by ATP. And then the complex bind to the mRNA in translation. As a result, peptide bonds are formed between amino acids + enzyme is formed.

**Comments**

The candidate shows general knowledge and understanding of the concepts in genetics and is able to apply the relevant concepts to the given context. A general outline of the process of protein synthesis is presented clearly with the use of scientific terminology, but some details are left out and some misconceptions are apparent.

**Sample 4: Level 2 exemplar and comments**

7. Mr and Mrs Chan gave birth to a pair of twins, Anne and Jane. The table below lists some characters shown by the twins:

Character	Anne	Jane
Body mass (at the age of 6)	20 kg	21 kg
Colour vision	normal	normal
Blood group	O	AB
IQ	110	105

- (a) State the type of twins they belong to. Explain how you arrive at your answer. (3 marks)

Non-identical twins. They have different blood group but ~~identical~~  
Identical twins must have same blood type due to same DNA.

- (b) Given that the alleles for the antigens that determine blood groups are  $I^A$ ,  $I^B$  and  $i$ , state the genotypes of Mr and Mrs Chan. (2 marks)

$I^A i$ ,  $I^B i$

- (c) Allele  $I^A$  codes for an enzyme responsible for forming antigen A on the surface of red blood cells. Outline the processes in which allele  $I^A$  is expressed to form this enzyme. (6 marks)

The DNA is copied at first. The mRNA replicate the gene of allele  $I^A$  from one strand of DNA as template. The mRNA then bind with tRNA and ribosome. The tRNA transcript the mRNA genetic message and into amino acid information. Corresponding amino acid bind with the binding site of tRNA in ribosome. The ribosome chain up the amino acid into protein of enzyme.

**Comments**

The candidate shows basic knowledge of the concepts in genetics and the ability to apply the relevant concepts to the given context. The candidate demonstrates basic understanding of the process of protein synthesis, leaving out some essential details in the description. Ideas presented are also marred by misconceptions. On the whole, the ideas are presented at a basic level of written communication.

**Sample 5: Level 1 exemplar and comments**

7. Mr and Mrs Chan gave birth to a pair of twins, Anne and Jane. The table below lists some characters shown by the twins:

Character	Anne	Jane
Body mass (at the age of 6)	20 kg	21 kg
Colour vision	normal	normal
Blood group	O	AB
IQ	110	105

- (a) State the type of twins they belong to. Explain how you arrive at your answer. (3 marks)

They are non-identical (fraternal) twins. Because they belongs to different blood group while blood group is controlled by genes.

- (b) Given that the alleles for the antigens that determine blood groups are  $I^A$ ,  $I^B$  and  $i$ , state the genotypes of Mr and Mrs Chan. (2 marks)

$ii$  and  $I^A I^B$

- (c) Allele  $I^A$  codes for an enzyme responsible for forming antigen A on the surface of red blood cells. Outline the processes in which allele  $I^A$  is expressed to form this enzyme. (6 marks)

The double strands of the DNA untied and the gene with allele  $I^A$  is copied to form a complementary mRNA, by which tRNA transport the necessary amino acids to the gene. The mRNA codes for the formation of the enzyme at the surface of ribosomes, which the synthesized enzyme as transported through the rER to the Golgi apparatus. Inside the Golgi apparatus, the enzyme is chemically modified into inactive forms and packed into vesicles, which is then budded off as vesicles and carried to the cell membrane for synthesis of antigen.

**Comments**

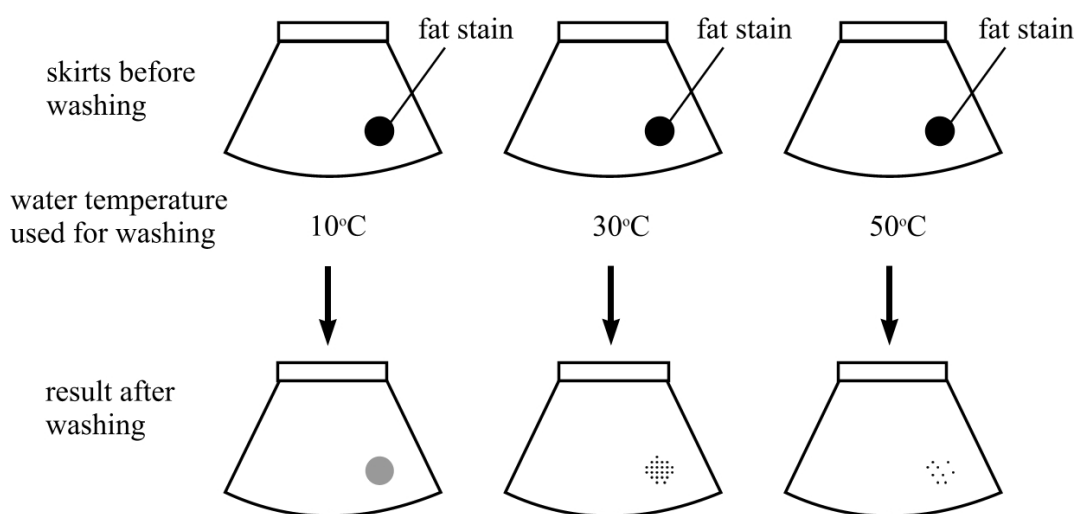
The candidate shows elementary knowledge of the concepts in genetics and fails to apply these concepts to deduce the genotypes. He/she shows elementary understanding of the process of protein synthesis, and his/her answer is marred by misconceptions and irrelevant information.

**Paper 1 Section B Question 9 (refer to p. 108 of the Booklet for the suggested answer)**

This question tests candidates' abilities to apply their knowledge of enzyme activity to explain the working principle of biological washing powders. Their ability to analyse the results of a scientific investigation in order to draw a valid conclusion and to design an investigation to solve a given problem are also assessed. Candidates are required to communicate their ideas logically and systematically.

**Sample 6: Level 5 exemplar and comments**

9. One of the applications of enzymes in everyday life is found in biological washing powders. To study the effectiveness of a biological washing powder, three identical skirts with identical fat stains were washed with the washing powder solutions of the same concentration but at different water temperatures. The investigation and its results are outlined below:



(N.B. The investigation was repeated at the three temperatures, but no washing powder was used. The fat stains on all three skirts remained unchanged.)

- (a) Suggest an explanation why the fat stain can be removed by using the biological washing powder. (3 marks)

Biological washing powder contains lipase, which can digest fat into fatty acids and glycerols. The fatty acid and glycerols are soluble in water, thus the fats are removed from skirts.

- (b) What conclusion can be drawn from the results of this investigation? (1 mark)

The higher the temperature, the more effective the washing powder in removing the stains.

- (c) A student queried whether or not biological washing powder is more effective than ordinary (non-biological) washing powder in removing fat stains. If you were the student, describe how you would carry out an investigation to find out which washing powder is more effective.

(5 marks)

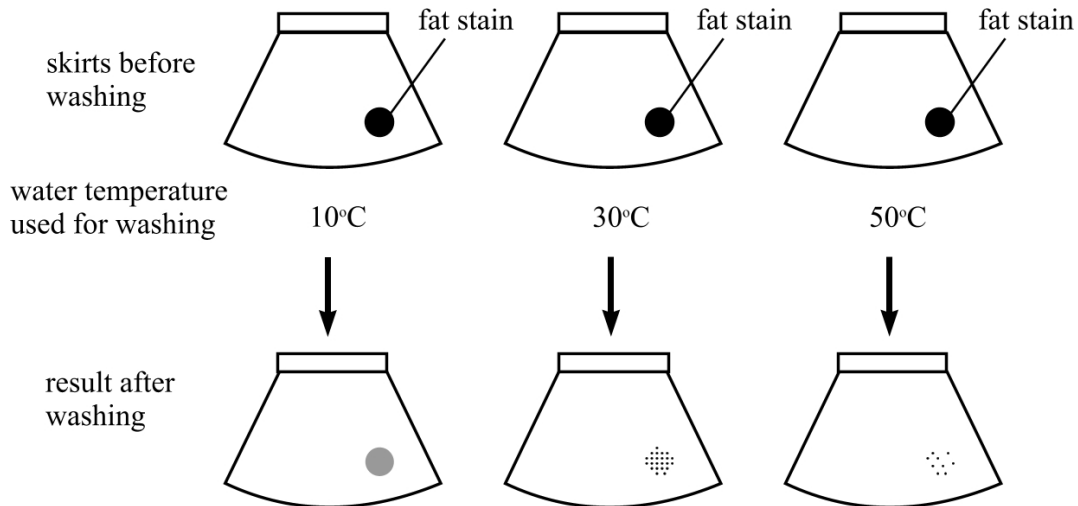
2 similar skirts with identical stains are washed with the two different washing powder solutions of the same ~~con~~ concentration at the same temperature. After a fixed time, the skirts were removed from the washing powder solutions. Measure the area of the translucent spot after drying. The smaller the area the translucent spot is, the more effective is the washing powder.

#### Comments

The candidate shows high ability in applying relevant concepts of enzyme activity to explain the working principle of biological washing powders and in designing an investigation to solve a given problem. The description of the investigation is comprehensive, covering the variables to be controlled, the variable to be measured and the way of interpreting the results in relation to the problem posed. On the whole, the ideas are presented in a logical and coherent manner with an accurate use of scientific terminology.

**Sample 7: Level 4 exemplar and comments**

9. One of the applications of enzymes in everyday life is found in biological washing powders. To study the effectiveness of a biological washing powder, three identical skirts with identical fat stains were washed with the washing powder solutions of the same concentration but at different water temperatures. The investigation and its results are outlined below:



(N.B. The investigation was repeated at the three temperatures, but no washing powder was used. The fat stains on all three skirts remained unchanged.)

- (a) Suggest an explanation why the fat stain can be removed by using the biological washing powder. (3 marks)

The ~~bit~~ biological washing powder contains lipases which digest fat stain into a soluble form of glycerol and fatty acids, therefore can be washed away by water.

- (b) What conclusion can be drawn from the results of this investigation? (1 mark)

The effectiveness of the washing powder increases when temperature is increased from 10°C to 50°C.



- (c) A student queried whether or not biological washing powder is more effective than ordinary (non-biological) washing powder in removing fat stains. If you were the student, describe how you would carry out an investigation to find out which washing powder is more effective.

(5 marks)

Two similar shirts with identical fat stains were washed at the same water temperature for the same period of time, one using biological washing powder solution while the other using ordinary biological washing powder solution.

The solutions should have the same concentration. <sup>Compare</sup> ~~Investigate~~ <sub>three</sub> the fat stain after washing, the sample with which less stain remains is more effective in removing fat stains.

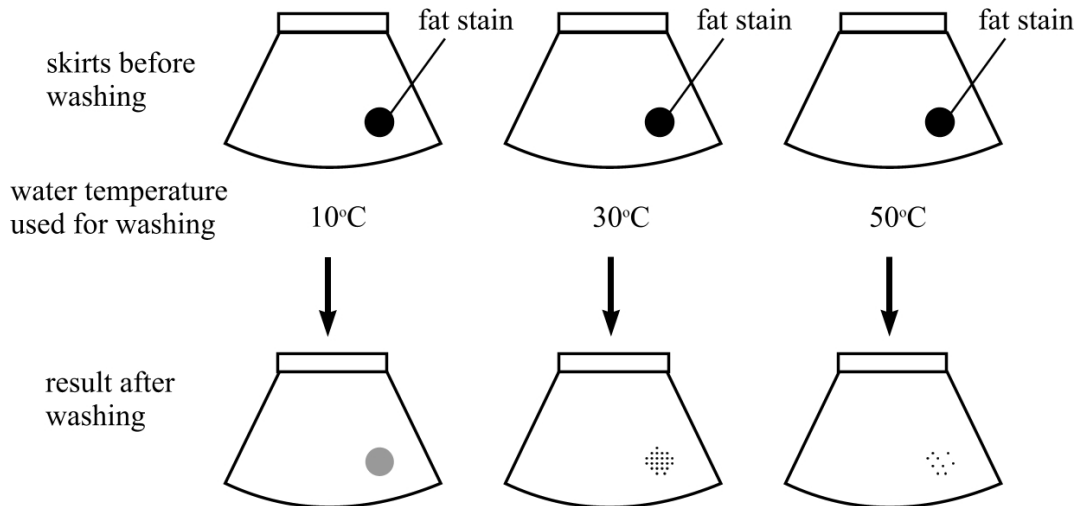
(A control should be done with a similar shirt with identical fat stains and washed with using any washing powder.)

#### Comments

The candidate shows competence in using the concepts of enzyme activity to explain the working principle of biological washing powders and in designing a scientific investigation. The candidate has an idea of controlling variables, but the way of measuring the results is not clearly presented. On the whole, the ideas are presented with the use of appropriate scientific terminology.

**Sample 8: Level 3 exemplar and comments**

9. One of the applications of enzymes in everyday life is found in biological washing powders. To study the effectiveness of a biological washing powder, three identical skirts with identical fat stains were washed with the washing powder solutions of the same concentration but at different water temperatures. The investigation and its results are outlined below:



(N.B. The investigation was repeated at the three temperatures, but no washing powder was used. The fat stains on all three skirts remained unchanged.)

- (a) Suggest an explanation why the fat stain can be removed by using the biological washing powder. (3 marks)

Biological washing powder contains enzymes  
e.g. lipase, which is able to digest fats into  
soluble materials which can dissolve in  
water, thus removing the fat stain.

- (b) What conclusion can be drawn from the results of this investigation? (1 mark)

Temperature affects the effectiveness of  
biological washing powder. A higher temperature  
leads to greater effectiveness.

- (c) A student queried whether or not biological washing powder is more effective than ordinary (non-biological) washing powder in removing fat stains. If you were the student, describe how you would carry out an investigation to find out which washing powder is more effective.

(5 marks)

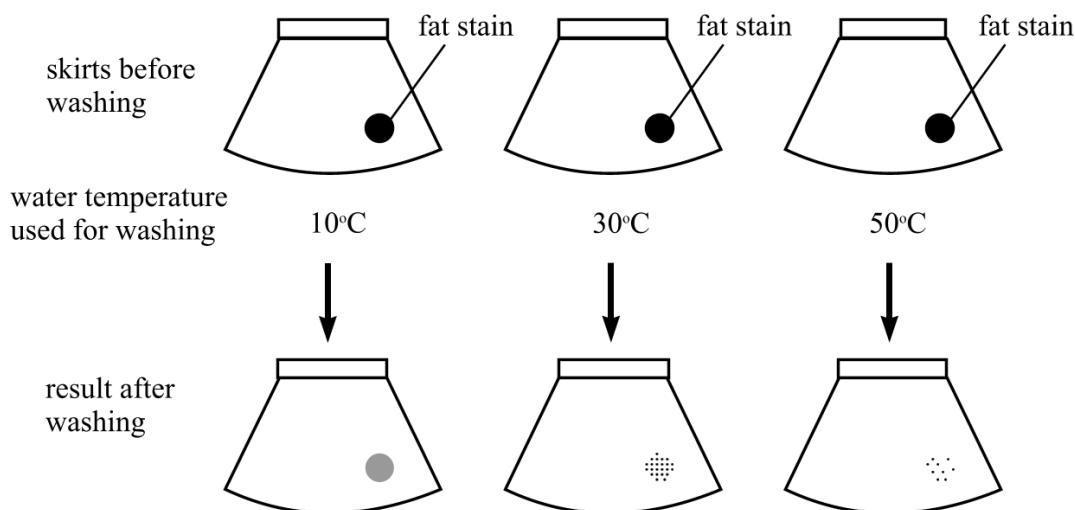
Prepare two similar skirts with identical fat stains. ~~One of them is washed with biological washing powder.~~ Prepare a biological washing powder solution and an ordinary washing powder solution. They should be of the same concentration and same water temperature. One skirt is washed with biological washing powder solution. The other is washed with ordinary washing powder solution for the same time. Compare the result after washing to determine which washing powder is more effective.

#### Comments

The candidate shows a general ability to apply the concepts of enzyme activity to explain the working principle of biological washing powders. In the design of a scientific investigation, the candidate understands the need to control some variables but he/she does not mention clearly the method of measuring the results. On the whole, the ideas are clearly presented with the use of some scientific terminology.

**Sample 9: Level 2 exemplar and comments**

9. One of the applications of enzymes in everyday life is found in biological washing powders. To study the effectiveness of a biological washing powder, three identical skirts with identical fat stains were washed with the washing powder solutions of the same concentration but at different water temperatures. The investigation and its results are outlined below:



(N.B. The investigation was repeated at the three temperatures, but no washing powder was used. The fat stains on all three skirts remained unchanged.)

- (a) Suggest an explanation why the fat stain can be removed by using the biological washing powder. (3 marks)

The enzyme molecules in the biological washing powder combine with the substrate molecules (fat molecules) to form enzyme-substrate complex. But after some time, the substrate molecules will become products which are totally different from the substrate in structure. But the enzyme molecules remain unchanged. For fat, the products can be fatty acids which are colorless. ∴ The fat stain can't be seen anymore.

- (b) What conclusion can be drawn from the results of this investigation? (1 mark)

The enzyme in the biological washing powder works more effectively at higher temperature.

- (c) A student queried whether or not biological washing powder is more effective than ordinary (non-biological) washing powder in removing fat stains. If you were the student, describe how you would carry out an investigation to find out which washing powder is more effective.

(5 marks)

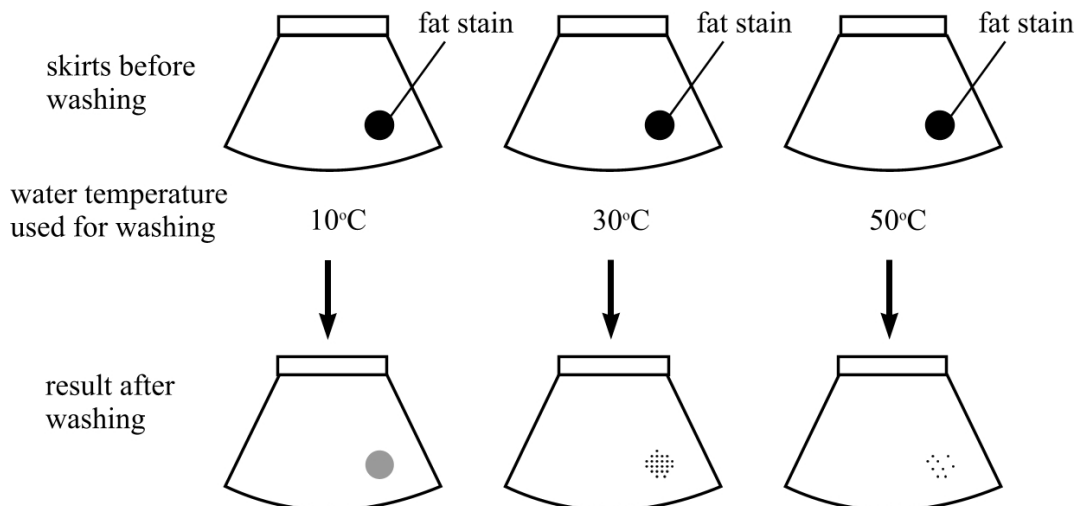
Repeat the ~~the~~ experiment above at the same temperatures (i.e.  $10^{\circ}\text{C}$ ,  $30^{\circ}\text{C}$  and  $50^{\circ}\text{C}$ ) but using ordinary washing powder. The concentration of ordinary washing powder must be the same as that of the biological ones. Besides, the time of washing should also be the same and fat stains should be identical too. After that, compare the results of using biological washing powders and non-biological powders at  $10^{\circ}\text{C}$ ,  $30^{\circ}\text{C}$  and  $50^{\circ}\text{C}$ . (The results of using biological at  $10^{\circ}\text{C}$  and using ordinary at  $10^{\circ}\text{C}$ )

#### Comments

The candidate demonstrates basic understanding of enzyme activity and the application of enzymes in biological washing powders. The candidate has some idea of controlling variables but leaves out the way of measuring the results. On the whole, the ideas are presented at a basic level of written communication.

**Sample 10: Level 1 exemplar and comments**

9. One of the applications of enzymes in everyday life is found in biological washing powders. To study the effectiveness of a biological washing powder, three identical skirts with identical fat stains were washed with the washing powder solutions of the same concentration but at different water temperatures. The investigation and its results are outlined below:



(N.B. The investigation was repeated at the three temperatures, but no washing powder was used. The fat stains on all three skirts remained unchanged.)

- (a) Suggest an explanation why the fat stain can be removed by using the biological washing powder. (3 marks)

The biological washing powder contain enzymes <sup>which</sup> specced for the fat molecules  
 The enzyme can convert the insoluble fat molecules into other  
 soluble molecules. therefore, the fat stain can be removed by water.

- (b) What conclusion can be drawn from the results of this investigation? (1 mark)

The rate of activity of enzyme increase with the temperature increase

- (c) A student queried whether or not biological washing powder is more effective than ordinary (non-biological) washing powder in removing fat stains. If you were the student, describe how you would carry out an investigation to find out which washing powder is more effective. (5 marks)

Repeat the experiment but using ordinary washing powder. Compare  
 the results after washing by the two different washing powder.

**Comments**

The candidate shows elementary understanding of enzyme activity and the principles underpinning the design of scientific investigations. The ideas are vaguely presented, with an obvious lack of scientific precision.

**Paper 1 Section B Question 12 (refer to p. 110 of the Booklet for the suggested answer)**

This question tests candidates' knowledge and understanding of the acquisition and incorporation of essential elements — hydrogen and nitrogen in this case — by plants to synthesize protein. Candidates' abilities to select and integrate relevant knowledge to address the given problem are assessed. Candidates are required to organize and present their ideas logically and systematically.

**Sample 11: Level 5 exemplar and comments**

12. Hydrogen and nitrogen are essential components of proteins. Compare and contrast the processes by which non-leguminous plants acquire these two elements from the environment and describe how they can be incorporated together to form proteins in mesophyll cells. (11 marks)

The source of hydrogen is water in the soil.  
Water enters the root by osmosis and transport along xylem <sup>by mass flow</sup> to the mesophyll cell. (The source of nitrogen is Nitrate ion in soil.) the nitrate ions uptake by active transport through root hair cells and to the xylem by mass flow too.  
The uptake of water require no energy while uptake of  $\text{NO}_3^-$  require energy.

Water is break down into  $\text{H}^+$  and  $\text{OH}^-$  by light.  
Nitrates is break down by enzyme

In chloroplast in mesophyll cells, water is first photolysis into  $\text{H}^+$  and  $\text{OH}^-$ , the  $\text{H}^+$  is accept by NADP to form NADPH. the carbon dioxide is combine with RuBP to form a 6C-compound the 6C compound form two PGA the PGA is reduced to triose by NADPH, triose phosphate. In cytoplasm, the glucose convert to hexose phosphate, and then two triose phosphate then to pyruvate. then pyruvate is oxidise to acetyl coA, the acetyl coA enter krebs cycle in mitochondria <sup>in mesophyll cells</sup> to combine with a 4C-compound to form

6C-compound, the 6C-compound is convert to 5C-compound and 4C compound by decarboxylation. the 4C, 5C-compound is combine with the Nitrogen element of nitrate ion, to form amino acid. the amino acid is transaminated, to other amino acid and form protein by polymerization in mesophyll cell.

#### Comments

The candidate shows extensive knowledge and understanding of the acquisition and incorporation of hydrogen and nitrogen to form proteins. The concepts are well integrated and effectively communicated in a logical and coherent manner with an accurate use of scientific terminology.



**Sample 12: Level 4 exemplar and comments**

12. Hydrogen and nitrogen are essential components of proteins. Compare and contrast the processes by which non-leguminous plants acquire these two elements from the environment and describe how they can be incorporated together to form proteins in mesophyll cells. (11 marks)

For non-leguminous plants, hydrogen is obtained from water while nitrogen is obtained from ~~nitrite, nitra~~ nitrates and ammonium ions dissolved in soil water. Both absorption use water as a medium and both are absorbed through roots.

However, hydrogen in water is obtained by osmosis while nitrogen in ions ~~are~~ is obtained by active transport because of the low concentration of nitrogen-containing ions. Absorption of nitrogen requires energy while that of hydrogen does not.

By photosynthesis, ~~triose phosphate~~ <sup>in the mesophyll cells.</sup> sugar is formed. The sugar is converted into pyruvic acid and later Acetyl CoA and then enter the Krebs' ~~cycle~~ cycle. The intermediates of Krebs' cycle, which contain hydrogen and nitrogen, formed amino acids. The amino acids then combine together to form protein.

**Comments**

The candidate shows sound knowledge and understanding of the acquisition of hydrogen and nitrogen in plants. The importance of photosynthesis and the Krebs cycle in providing the carbon skeleton of amino acids is mentioned though details are not adequately illustrated. The ideas are communicated in a concise and coherent manner with an appropriate use of scientific terminology.

Sample 13: Level 3 exemplar and comments

12. Hydrogen and nitrogen are essential components of proteins. Compare and contrast the processes by which non-leguminous plants acquire these two elements from the environment and describe how they can be incorporated together to form proteins in mesophyll cells. (11 marks)

Both hydrogen and nitrogen are absorbed ~~at~~<sup>by</sup> the root in the soil.

~~However, hydrogen is absorbed in the form of water or  $\text{NH}_4\text{Cl}$  by osmosis.~~

Both hydrogen and nitrogen can be absorbed by root in the form of ~~it~~ ammonium chloride. However, hydrogen is mainly absorbed in the form of ~~the~~ water and nitrogen is absorbed in the form of nitrate ion.

The plants absorb water ~~at~~ by osmosis due to the water potential gradient between the soil and the root cells. However, the plants absorb nitrate and ammonium chloride by active transport, which is energy-consuming.

Both the hydrogen and nitrogen elements ~~are~~ are transported to the plant cells for protein synthesis.

In mesophyll cells, the hydrogen and nitrogen ~~are~~ ~~react~~ react ~~with~~ with some ~~are~~ intermediate in the Kreb's cycle of respiration. ~~to form amino acid.~~

And then, some other element, such as phosphate ~~or~~ or sulphur may be added. So that,

amino acids are produced.

The amino acids join together to form protein. In transition between mRNA and tRNA. Peptide bonds are formed between the amino acids and specific proteins are synthesised by the structural protein and functional protein, such as some enzyme for respiration are produced.

#### Comments

The candidate shows general knowledge and understanding of the acquisition of hydrogen and nitrogen in plants. However, the candidate fails to give the details of the processes by which hydrogen and nitrogen are incorporated to form amino acids. Minor misconceptions and irrelevant material are evident. On the whole, the ideas are clearly presented with the use of scientific terminology.

**Sample 14: Level 2 exemplar and comments**

12. Hydrogen and nitrogen are essential components of proteins. Compare and contrast the processes by which non-leguminous plants acquire these two elements from the environment and describe how they can be incorporated together to form proteins in mesophyll cells. (11 marks)

Proteins are produced by hydrolysis of amino acids and amino acids are produced by amination and transamination. Amino acids are composed of carboxyl group and amino group, which contain hydrogen and nitrogen respectively.

For hydrogen, it is absorbed <sup>absorbing</sup> from water by the root of non-leguminous plants. Similarly, nitrogen is absorbed from nitrate ions dissolved in water by the root of non-leguminous plants. However, in order to use the hydrogen to form proteins, hydrogen need to be converted into pyruvate by photosynthesis first. And then the pyruvate enter the Krebs's cycle and to form the carboxyl group of amino acids. And nitrate ions are just directly converted into amino group of amino acids.

We can say that when hydrogen and nitrogen are absorbed from the environment, there are more steps for hydrogen to be converted into protein than nitrogen.

**Comments**

The candidate shows basic knowledge and understanding of the required concepts. Concepts presented are confused and misconceptions on the Calvin cycle and protein synthesis are evident. On the whole, the candidate is able to present his/her ideas, though the range of scientific terms used is limited.

**Sample 15: Level 1 exemplar and comments**

12. Hydrogen and nitrogen are essential components of proteins. Compare and contrast the processes by which non-leguminous plants acquire these two elements from the environment and describe how they can be incorporated together to form proteins in mesophyll cells. (11 marks)

The non-leguminous plants ~~acquire~~ acquire these two elements from air. Nitrogen converts to nitrate by lightning and ~~dissolve~~ dissolve in the soil which can then be obtained by plants. Hydrogen can be obtained from water in soil by mass flow. Nitrogen ~~can~~ also <sup>can</sup> be obtained from inorganic fertilizers.

~~In meso~~ mesophyll cells,

Photosynthesis is carrying at mesophyll cell, during the ~~light~~ Calvin cycle, 3-carbon substances are produced for ~~the~~ synthesis of others ~~nutre~~ nutrients. The 3-carbon substances then carry out a process which is the ~~conversion~~ conversion of glycolysis. Adding nitrogen, ~~carbon~~ pyruvate pyruvate acid and ~~to~~ hydrogen together to form protein in mesophyll cells.

**Comments**

The candidate shows an elementary knowledge of the concepts. The ideas presented are muddled and are marred by errors.