18th INTERNATIONAL BIOLOGY OLYMPIAD
JULY 15 - 22, 2007

THEORY EXAMINATION # 2 理論試題二

Total marks : 53.5 總分：53.5 分

Time allowed: 120 minutes 總時間：120 分鐘

WRITE YOUR 4-DIGIT STUDENT NUMBER IN THE BOX BELOW 請將 4 碼學生代碼寫於下列欄位中

STUDENT CODE **學生代碼**	

GENERAL INSTRUCTIONS 指引

Check that you have the correct examination paper and an answer sheet.
檢查你的題目卷與答案卷是否完整
BE SURE TO RECORD ALL YOUR ANSWERS ON THE ANSWER SHEET
確實將所有答案劃記於答案卷上
WHEN YOU HAVE FINISHED THE EXAM, PLACE YOUR ANSWER SHEET INSIDE YOUR QUESTION PAPER AND HAND BOTH TO THE INVIGILATOR BEFORE LEAVING THE EXAM ROOM.
當你完成考試後，將答案卷置於試卷內，離開教室前將二者均交給監試人員
REMEMBER TO WRITE YOUR 4-DIGIT STUDENT CODE ON THE FRONT PAGE OF THE QUESTION PAPER.
記得務將 4 碼學生代碼寫於題目卷的首頁
Read each question carefully before attempting it.
仔細閱讀後再作答

IMPORTANT

- Use the answer sheet provided to record your answers.
- **Ensure that your name and student code is PRINTED in the top margin of the front page of the answer sheet.** The markers will enter this information in the correct places on the reverse side of the answer sheet.

請注意你的名字及學生代碼是否**正寫**（或**已列印**）在答案卷的首頁上邊。閱卷者將會將此資料填入答案卷的反頁。

- Use only the HB pencil provided to mark the answer sheet. **Completely fill in the circle.**

只能以大會提供的 HB 鉛筆作答。**將圈選之答案塗黑，如下所示：**

	A	B	C	D	E
This is the correct way:	o	•	o	o	o

- **DO NOT USE AN X OR ANY OTHER SYMBOL TO MARK YOUR ANSWER.**

請勿用 X 號或其他任何符號劃記

- If you want to change your answer, use the eraser to completely erase your incorrect response and fill in the new circle you require.

若要修改答案，請用橡皮將原有答案擦去，再圈選你要的答案

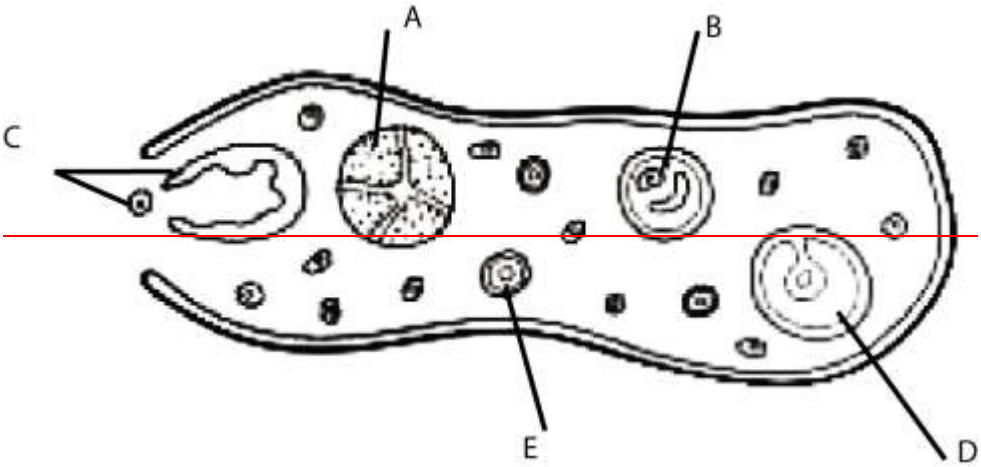
- There is only one correct answer to each question.

每一題只有一個答案

- Each question is worth one mark Marks will not be deducted for incorrect answers.

若劃記多個選項，即使其中包含正確答案亦不計分

~~Question 1. The diagram below shows a section through a mammalian ovary.~~
~~下圖為哺乳類卵巢的切面圖~~



~~Which one of the following is the correct sequence of the development of the structures indicated by the letters A to E?~~
~~請選出正確的發育過程~~

~~A. A, C, D, B, E~~
~~B. A, B, D, C, E~~
~~C. C, B, D, A, E~~
~~D. D, B, C, A, E~~
~~E. E, B, D, C, A~~

Question 2. Oogenesis differs substantially from spermatogenesis. Which of the following statements concerning oogenesis is **INCORRECT**?

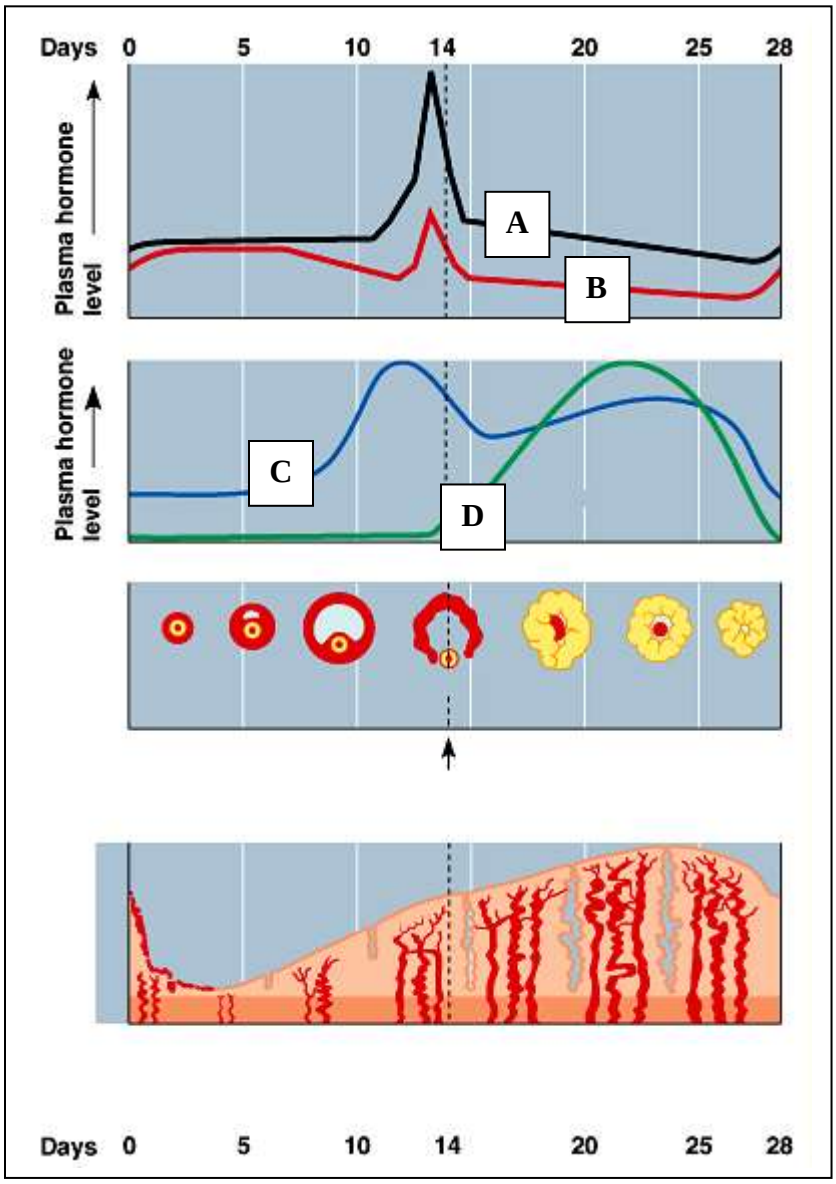
A. Cytokinesis is unequal during the meiotic divisions
B. The sequence from secondary oocyte to ovum is interrupted by a relatively long rest period
C. The first meiotic division is not completed unless the egg is reactivated by a hormone
D. A mature ovum has not completed its second meiotic division
E. The number of potential gametes is, by and large, established at birth

卵子生成與精子生成實質上是有所差異，有關的卵子生成的敘述下列何者 **錯誤**

A. 細胞質分裂在減數分裂過程中是不平均的
B. 從次級卵母細胞到形成卵前會經過一段很長的靜止期
C. 當卵子受到荷爾蒙刺激後，第一次減數分裂才會完全完成
D. 排出之成熟卵子尚未完成第二減數分裂
E. 出生後，卵子的數目即已確定

Questions 3 – 7. **Examine the figure below**:
仔細檢視下圖，並回答下列問題

Hormone Levels during the Human Female Reproductive Cycle
人類女性生殖周期激素表現量圖



Question 3. Which of the following correctly lists the hormones in order from A to D?

A. estrogen, progesterone, LH, FSH
B. estrogen, FSH, progesterone, LH
C. LH,FSH, progesterone, estrogen
D. LH, estrogen, FSH, progesterone
E. LH, FSH, estrogen, progesterone

請依序列出自 A 到 D 的激素名稱

A. 動情素、黃體素、促黃體激素(LH)、促濾泡激素(FSH)
B. 動情素、促濾泡激素(FSH)、黃體素、促黃體激素(LH)
C. 促黃體激素(LH)、促濾泡激素(FSH)、黃體素、動情素
D. 促黃體激素(LH)、動情素、促濾泡激素(FSH)、黃體素
E. 促黃體激素(LH)、促濾泡激素(FSH)、動情素、黃體素

Question 4. Which of the following statements is **INCORRECT**?

A. An increase in hormone B causes a decrease in hormones C and D
B. A steep rise in hormone C stimulates the production of hormones A and B.
C. A low level of hormone C inhibits the production of hormones A and B.
D. A high level of hormones C and D inhibits the secretion of hormones A and B

下列敘述何者 **錯誤** ?

A. 激素 B 上升，會導致激素 C 與激素 D 下降
B. 激素 C 的快速上升，會刺激激素 A 與激素 B 的生成
C. 低量的激素 C，會抑制激素 A 與激素 B 的生成
D. 高量的激素 C 與激素 D，會抑制激素 A 與激素 B 的分泌

Question 5. Ovulation is triggered by a peak in the hormone whose level is shown by the

排卵作用是受到下列何種激素分泌達到高峰所觸發

A. Line A
B. Line B
C. Line C
D. Line D

Question 6. Hormones A and B are secreted by the

A. uterine wall
B. ovary
C. hypothalamus
D. anterior pituitary

激素 A 與激素 B 是由下列何者所分泌

A. 子宮壁
B. 卵巢
C. 下視丘
D. 腦下腺前葉

~~Question 7. Hormones C and D are secreted by the~~

~~A. uterine wall~~
~~B. ovary~~
~~C. hypothalamus~~
~~D. anterior pituitary~~

~~激素 C 與激素 D 是由下列何者所分泌~~

~~A. 子宮壁~~
~~B. 卵巢~~
~~C. 下視丘~~
~~D. 腦下腺前葉~~

Question 8. ~~It is assumed that plants replace their very thin roots (<2mm) several times per year resulting in a high amount of dead plant material in the soil.~~ One hypothesis predicts that most of the CO_2 produced in the soil originates from microorganisms feeding on dead plant material. To which trophic level do these microorganisms belong?

一假說預測：土壤中所產生的 CO_2，大多都是由土壤微生物分解植物遺骸所產生。這些微生物的營養階層為何？

A. . Primary producers 初級生產者
B. Secondary producers 次級生產者
C. Decomposers 分解者
D. First order consumers 初級消費者
E. Second order consumers 次級消費者

Question 9. Joan and Claude (neither have cystic fibrosis) come to you seeking genetic counseling. Claude was married before, and he and his first wife had a child with cystic fibrosis, a ~~homozygous~~ autosomal recessive condition. A brother of Joan's died of cystic fibrosis and Joan has never been tested for the gene. If they marry, what is the probability that Joan and Claude will have a son that **WILL NOT** be a carrier for, nor have cystic fibrosis?

Joan 與 Clauda（兩人均無囊狀纖維腫；囊狀纖維腫屬體染色體隱性遺傳）去做遺傳諮詢，Clauda 曾經結過婚，育有一子（囊狀纖維腫患者）。Joan 的兄弟有一人死於囊狀纖維腫，而 Joan 從未檢測過該基因。如果 Joan 與 Clauda 結婚，而生下一個男嬰，該男嬰 <u>不會</u> 成為帶原者或具有囊狀纖維腫的機率為何？

A. 1/12
B. 1/8
C. 1/6
D. 1/4
E. 1/2

Question 10. Chromosomal crossing over occurs in which of the following stages of cell division?

A. Prophase of mitosis.
B. Metaphase of mitosis.
C. Prophase I of meiosis.
D. Metaphase II of meiosis.
E. Telophase I of meiosis.

染色體互換是發生於下列細胞分裂的何種階段

A. 有絲分裂前期
B. 有絲分裂中期
C. 第一減數分裂前期
D. 第二減數分裂中期
E. 第一減數分裂末期

Question 11. A man whose blood group is Type A has two boys. The plasma of one of the boys agglutinates the red cells of his father, but the plasma from the other son does not. Which ~~combination of the following~~ statement.is incorrect?
一個血型為 A 的男子有兩個兒子，其中一個兒子的血清會凝集父親的紅血球，另一個不會。下列敘述何者 **錯誤** ？

A. The father must be heterozygous for the A blood type allele.
B. The mother of the son that agglutinates his father's blood can be type AB.
C. The boy that agglutinates could have type O blood.
D. The mother of the son that agglutinates must possess a type O allele.
E. The boy that doesn´t cause agglutination can be type AB.

A. 父親一定是 A 型的異型合子
B. 血清會凝集父親紅血球的兒子，其母親可能是 AB 型
C. 會凝集父親紅血球的兒子其血型可能是 O 型
D. 凝集父親紅血球的兒子，其母親一定是 O 型
E. 血清不凝集父親紅血球的兒子是 AB 型

Question 12. In peas, the allele for smooth seed coat (S) is dominant to wrinkled (s), Tall plant (T) is dominant to short (t) and yellow coloured seed (Y) is dominant to green (y).
A plant with the genotype SsTtyy was test crossed and 145 progeny survived to maturity.
Approximately how many of these progeny are expected to be tall plants with green wrinkled seeds?
豆子的種皮平滑(S) 對皺褶(s)為顯性，高莖(T) 對矮莖(t)為顯性，種子黃色(Y) 對綠色(y)為顯性。
一株基因型為 SsTtyy 的植物試交後，有 145 株子代長為成體，預期其中約有多少子代為有高莖、綠色皺褶種子的植物？

A. 9
B. 18
C. 36
D. 72

~~Question 13. B chromosomes are additional chromosomes possessed by some, but not all, individuals in a population. Which combination of statements is correct?~~

~~I. They occur only in plants.~~
~~II. While they are common in plants, they occur also in fungi, insects and animals.~~
~~III. They arise from normal chromosomes by fragmentation.~~
~~IV. They are normal, but short, chromosomes..~~
~~V. In plants they are associated with reduced viability.~~

~~B 染色體為在一族群中某些但非全部個體所具有的額外染色體，下列敘述何者正確？~~

~~I. 只發生在植物~~
~~II. 在植物中常見，也發生部份在真菌、昆蟲及動物~~
~~III. 是由正常染色體斷裂而來~~
~~IV. 它們是正常、但比較短的染色體~~
~~V. 在植物中它們與存活力有關~~

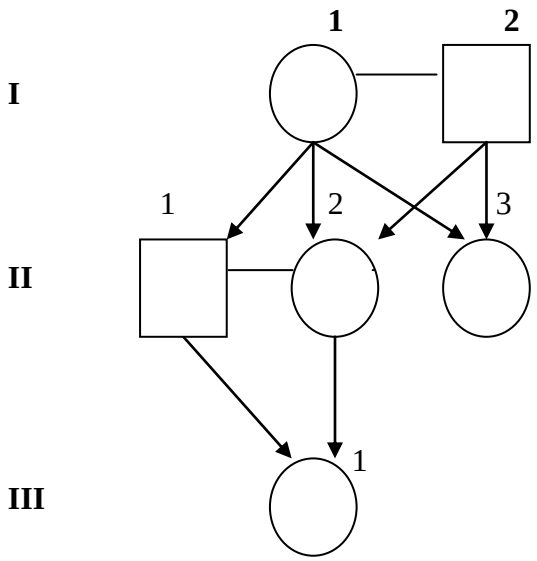
~~A. I, III and V~~
~~B. I, IV and V~~
~~C. II, III and V~~
~~D. II, IV and V~~

Question 14. Often the frequency of a particular deleterious allele is very different in neighbouring populations. For example, the frequency of the allele causing cystic fibrosis is 0.02 in Population A and 0.006 in Population B. Such a difference in allele frequencies between two close populations is probably the result of
特別有害的對偶基因在相鄰的族群中出現的頻度常有很大不同，例如：囊狀纖維腫在族群 A 的頻度為 0.02，在族群 B 的頻度為 0.006，這兩族群對偶基因的不同是下列何者的結果？

A. The occurrence of the founder effect in an earlier generation
B. More effective repair of DNA damage caused by mutation
C. Selective advantage of the allele in one population but not the other
D. Recurring migration between the populations
E. Non-random mating.

A. 較早期世代中發生的先驅者效應
B. 更有效的修補因突變引起之 DNA 損害
C. 對一族群是對偶基因的選擇利益，而非另一族群
D. 族群間的來回遷移
E. 非隨機的配對

Question 15. The coefficient of relatedness is a theoretical value determined by the number of alleles that would be the same between two organisms. ~~Thus, since a parent gives half its genes to an offspring, the parent and offspring would have a coefficient of relatedness of 0.5.~~
The diagram below shows the relationships between honey bees. What is the coefficient of relatedness between II-2 and II-3; and between II-2 and III-1?
親源關係係數是指兩種生物間，具有相同對偶基因數目的一個理論值。
下圖顯示蜜蜂之間的親源關係，在 II-2 與 II-3 間及 II-2 與 III-1 間親源關係係數為何？



ANSWER	Between II-2 and II-3	Between II-2 and III-1
A.	0.50	0.50
B.	0.75	0.50
C.	0.75	1.00
D.	0.25	1.00
E.	0.50	0.75

Question 16. Collenchyma and sclerenchyma are plant support tissues. Which combination of the following statements correctly differentiates these two types of plant tissue?

I. Collenchyma occurs only in Dicotyledons; sclerenchyma is an elastic tissue that is found in both Monocotyledons and Dicotyledons.
II. Collenchyma cells are developed during growth; sclerenchyma cells generally occur in organs that have concluded their longitudinal growth.
III. Collenchyma and sclerenchyma may arise from the same cell type.
IV. Collenchyma cells have primary walls only while sclerenchyma cells have secondary walls.
V. Collenchyma originates from the protoderm; sclerenchyma is formed by the procambium.

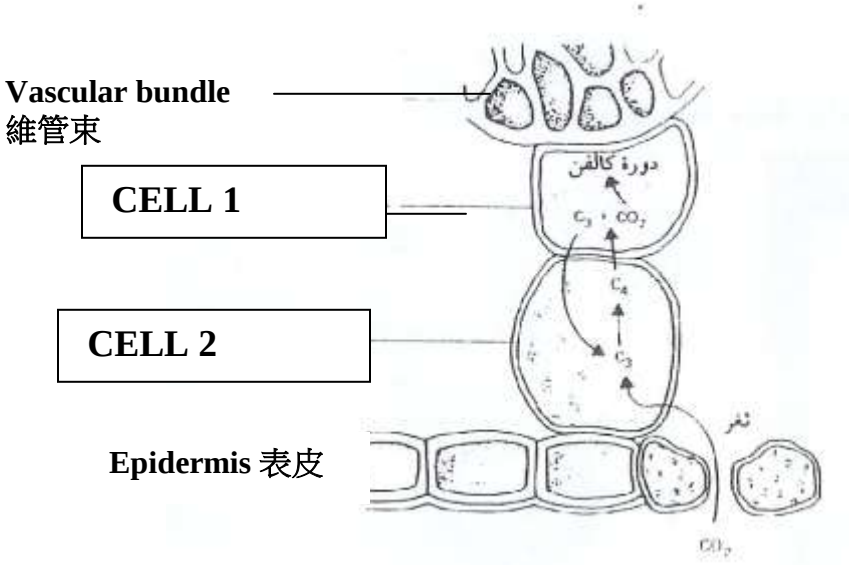
厚角組織及厚壁組織為植物的支持組織。下列哪一個敘述組合可較正確地區分此兩種組織？

I. 厚角組織僅見於雙子葉植物；厚壁組織有彈性且於單子葉植物及雙子葉植物皆可見。
II. 厚角細胞在快速生長的部位中發生；厚壁細胞則通常於延長生長後才逐漸形成。
III. 厚角組織及厚壁組織可源自相同細胞類型的生長而來。
IV. 厚角細胞僅具初生細胞壁；厚壁細胞則有次生細胞壁。
V. 厚角細胞源自原始皮層；厚壁細胞則源自原始形成層。

A. I, II, III.
B. II, III, IV
C. II, IV, V
D. IV, V

Question 17. The following figure shows the carbon fixation reactions during photosynthesis in a typical C4 plant :

下圖為典型 C4 植物光合作用中的固碳反應



Which of the following answers indicate the dominant carbon fixation enzyme in each of the two cells?

下列何者正確顯示出上圖兩種細胞中佔優勢的固碳酵素？

Answer	Cell 1	Cell 2
A.	Malate dehydrogenase 蘋果酸脫氫酶	Sucrose synthase 蔗糖合成酶
B.	PEPCase (PEP carboxylase)	Rubisco
C	Rubisco	PEPCase (PEP carboxylase)
D.	Aspartate aminotransferase 天冬氨酸轉氨酶	Malate dehydrogenase 蘋果酸脫氫酶
E.	Malic enzyme 蘋果酸酶	Pyruvate dehydrogenase 丙酮酸脫氫

Question 18. Suppose that an illuminated suspension of *Chlorella* (a photosynthetic alga) was actively carrying out photosynthesis when the light was suddenly switched off. How would the levels of 3-phosphoglycerate and ribulose 1,5-bisphosphate change during the next minute?

人工光照下的 *Chlorella*（一種可行光合作用的藻類）懸浮液，在切斷光源後，光合作用即停止，接下來一分鐘內，3-磷酸甘油酸及 1,5-雙磷酸核酮糖將有何變化？

A. The concentration of 3-phosphoglycerate would increase and that of ribulose 1,5-bisphoshate would increase.
B. The concentration of 3-phosphoglycerate would increase; the concentration of ribulose 1,5-bisphoshate would decrease.
C. The concentration of 3-phosphoglycerate would decrease; the concentration of ribulose 1,5-bisphoshate would increase.
D. The concentration of 3-phosphoglycerate would decrease; the concentration of ribulose 1,5-bisphoshate would decrease.
E. The concentration of 3-phosphoglycerate would remain the same; the concentration of ribulose 1,5-bisphoshate would decrease.

A. 3-磷酸甘油酸及 1,5-雙磷酸核酮糖(RuBP)的濃度增加
B. 3-磷酸甘油酸的濃度增加，但 1,5-雙磷酸核酮糖(RuBP)的濃度降低
C. 3-磷酸甘油酸的濃度降低，但 1,5-雙磷酸核酮糖(RuBP)的濃度增加
D. 3-磷酸甘油酸的濃度降低，但 1,5-雙磷酸核酮糖(RuBP)的濃度降低
E. 3-磷酸甘油酸的濃度維持不變，但 1,5-雙磷酸核酮糖(RuBP)的濃度降低

Question 19. Which of the following statements shows the difference between the reaction sites of photosystem I and II ?

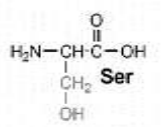
下列何者顯示光合系統I 及 II在反應位置上的差異？

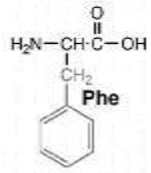
A. Chlorophyll *a* is only found in photosystem I; chlorophyll *b* is found in photosystem II.
B. Each preferentially absorbs slightly different wavelengths of light.
C One is located in the thylakoid membrane; the other occurs in the stroma.
D. Only photosystem I is found in the thylakoid membranes.
E. None of these statements are correct.

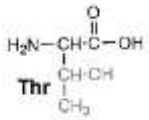
A. 葉綠素 a 僅見於光合系統 I；葉綠素 b 見於光合系統 II
B. 所吸收的光波長各有不同
C. 一個位於葉綠囊的膜上，另一個則出現在基質
D. 只有光合系統 I 出現在葉綠囊膜上
E. 以上皆非

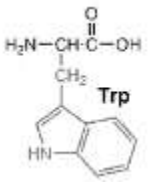
Question 20. You are a biotechnologist designing novel eukaryotic enzymes that are regulated by phosphorylation. Which amino acid residues shown below would you most likely use at the regulatory site?

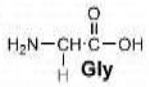
你是個生物技術專家，欲設計一適於真核細胞內之可受磷酸化反應調節的新酵素，下列哪個氨基酸可能位於該調節位置？

I. 

II. 

III. 

IV 

V. 

A. I, III
B.. I, IV
C. I, II, III
D. II, IV, V
E. III, IV, V

Question 21. A biologist has discovered two new species of micro-organisms. Micro-organism A was isolated from a hot spring whereas micro-organism B was obtained from a tropical forest. DNA was isolated from both organisms and an analysis of the melting profile of each DNA sample was carried out. The melting temperature ™ was 80 ℃ for DNA from micro-organism A, and 70 ℃ for DNA from micro-organism B.

Which statement best describes the reason for this difference in values?

某生物學家發現兩個微生物新種 A, B，A 種是從溫泉中分離出來；B 種是從熱帶森林中取得。A 種 DNA 的熔點(TM)為 80 ℃；而 B 種為 70 ℃。

下列何者敘述最適於解釋此溫度差異？

A. DNA of micro-organism A has higher A+T content
B. DNA of micro-organism A has higher G+A content
C. DNA of micro-organism A has higher G+C content
D. DNA of micro-organism A has higher T+G content
E. DNA of micro-organism A has a higher proportion of TGA codons

A. A 種的 DNA 有較高的 A+T
B. A 種的 DNA 有較高的 G+A
C. A 種的 DNA 有較高的 G+C
D. A 種的 DNA 有較高的 T+G
E. A 種的 DNA 有較高比例的 TGA 密碼子

~~Question 22. Which of the following cofactors is not redox active?~~
~~下列哪個輔因子不兼具氧化還原活性~~
~~Coenzyme A　輔酶 A　Flavin coenzyme 黃素輔酶 NADH Vitamin C　維生素 C~~

~~A. I~~
~~B. II~~
~~C. III~~
~~D. IV~~
~~E. I, III~~

Questions 23-24. **Two cells have the following characteristics:**
兩種細胞的特徵比較如下，回答第 23-24 兩題

Characteristic 特徵	**Cell I**	**Cell II**
Cell wall 細胞壁	Present 有	Present 有
Ribosomes 核糖體	Present 有	Present 有
Nucleus 細胞核	Absent 無	Present 有
Ability to photosynthesize 可行光合作用	Present 有	Absent 無
Cell respiration 細胞呼吸	Present 有	Present 有

Question 23. From the characteristics presented in the table, which statement is correct?
根據上表所示的特徵,判斷，下列敘述何者正確？

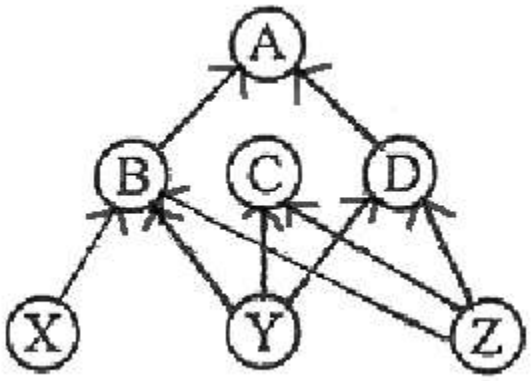
A. Cell I is more complex in its organization than cell II
B. Cell I is a prokaryote
C. Cells with all characteristics of cell II appeared earlier in the fossil record than cells with all characteristics of cell I
D. Cell II does not have a cell membrane
E. Both groups of cells are from fungi

A. Cell I 在構造上較 Cell II 複雜
B. Cell I 是一種原核生物
C. 化石記錄中，具有所有 Cell II 特徵的細胞出現的時間較早
D. Cell II 缺乏細胞膜
E. 真菌具有這兩群細胞的特性

Question 24. Cell II is a

A. plant cell 植物細胞
B. eubacterium 細菌
C. archaebacterium 古細菌
D. animal cell 動物細胞
E. cyanobacterium 藍綠菌

Question 25. Suppose Species B disappears from an ecosystem in which the interrelationship among the component species can be described by the food web below.
下圖為某生態系的食物網，假設物種 B 由此生態系消失，對此生態系的影響為何？



Which of the following consequences of its elimination will result?:

A. Species X loses its only prey.
B. Species A loses its only prey.
C. Species D benefits because it is most distant from Species B.
D. Species C benefits because the competition between species B and species C is reduced.
E. The disappearance of species B has no effect on species C or species D.

A.物種 X 失去它僅有的食物
B.物種 A 失去它僅有的食物
C.物種 D 受益，因為它與 B 的關係最遠
D.物種 C 受益，因物種 B 與 C 之間的競爭降低
E.物種 B 的消失，不影響物種 C 或物種 D

~~Question 26. You have been asked by an international organization to initiate a biodiversity conservation project on a tropical island off the south coast of Java, and far from any large continental land. For this purpose, you must identify from three islands the island that has the highest number of species.~~
~~The following information is provided:~~
~~在爪哇南岸一個遠離大陸的熱帶海島上，國際保育組織請你進行一項保育計劃，要達到此項目標，你必須從三個小島中找出當中具有最高物種多樣性的島嶼。~~
~~下表為此三島的資料：~~

~~Island Name~~	~~Size/Area~~	~~Distance from Java~~
~~Boa~~	~~418 km^2~~	~~220 km~~
~~Ibo~~	~~500 km^2~~	~~800 km~~
~~Bio~~	~~420 km^2~~	~~450 km~~

~~Which of the following statements describes your decision?~~
~~下列敘述何者正確？~~
~~A. . Bio Island~~

~~B. Boa Island~~
~~C. Ibo Island~~
~~D. Either Boa Island or Bio Island~~
~~E. Insufficient information is provided to allow you to make a decision.~~

Question 27. Marine bony fishes have much lower internal osmotic concentration than the seawater around them. Which of the following statements DOES NOT EXPLAIN the osmotic regulation of marine bony fishes:
海洋硬骨魚的滲透壓比海水低很多，下列敘述與海洋硬骨魚的滲透壓調節 **無關** ？

A. They lose water by osmosis and gain salt by diffusion
B. They drink seawater
C. They actively absorb sodium chloride across gills
D. They absorb sodium chloride from stomach
E. They absorb water from stomach

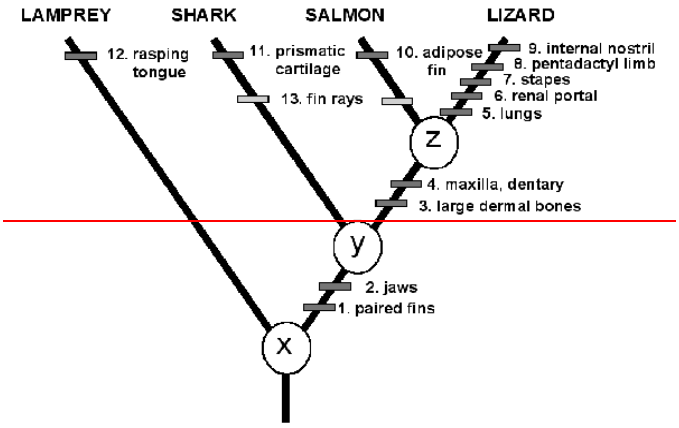
A.它們藉滲透作用喪失水分並藉擴散獲得鹽分
B.它們喝海水
C.它們由鰓主動的吸收氯化鈉
D.它們由胃吸收氯化鈉
E.它們由胃吸收水

~~Question 28. The best description of the relationships between fundamental niches (FN) and realized niches (RN) of two competing species A and B that coexist is:~~
~~二個競爭種 A、B 共同存在時，其理想的生態地位(fundamental niche,FN)與實際的生態地位(realized niche, RN)的關係，以下列何公式最能表達？~~

~~A. $FN_A = RN_A$; $FN_B = RN_B$~~
~~B. $FN_A > RN_A$; $FN_B = RN_B$~~
~~C. $FN_A < RN_A$; $FN_B < RN_B$~~
~~D. $FN_A > RN_A$; $FN_B > RN_B$~~
~~E. $FN_A = RN_A$; $FN_B > RN_B$~~

~~Question 29. Use the information given in Figures 1 and 2 to answer this question.~~
~~以圖 1 及圖 2 的資訊，回答下列問題~~

盲鰻　　鯊魚　　鮭魚　　蜥蜴



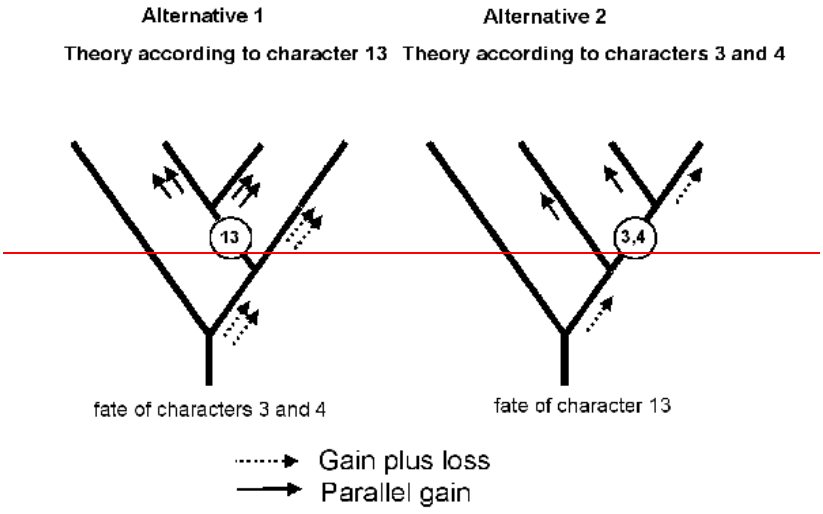
（1.成對的鰭、2.頷、3.大的硬骨、4.大頷及齒骨、5.肺、6.腎門脈、7.鐙骨、8.五趾肢、9.內鼻孔、10.脂鰭、11.稜形軟骨、12.齒舌）

Figure 1. An example of a phylogeny showing characters by which taxa are recognised. Characters 1 – 4 are synapomorphies, 5 – 12 are autapomorphies and 13 is an attribute seen in the salmon and the shark.

圖 1.物種系統數字分布圖例：1～4 為祖徵、5～12 為衍徵、13 為鮭魚及鯊魚身上的特徵

第一種可能　　第二種可能

根據特徵 13 所繪的分支圖　　根據特徵 3 及 4 所繪的分支圖



特徵 3 及 4 的命運　　特徵 13 的命運

Figure 2. Two possible ways to organize the data from Figure 1.

圖 2.　　整合圖 1 資訊所得的二種可能的路徑

Which of the following statements best describes the information presented in Figures 1 and 2?

下列敘述何者最能代表圖 1 與圖 2 所表示的訊息

A. Alternative 2 shows more parsimony than does Alternative 1.
B. The Lamprey and the Lizard are the oldest because they have the longest line.
C. The four groups shown in Figure 1 are equally related because they are all at the same horizontal level.
D. X, Y and Z are characteristics common to all groups.
E. The Lamprey is more closely related to the Shark than to the Salmon or the Lizard.

~~A.第 2 種可能比第 1 種可能的路徑節約(parsimony)~~
~~B.盲鰻及蜥蜴出現最早，因為他們的線最長~~
~~C.圖 1 所示的四群因為它們都在同一水平，所以它們的親緣關係相等。~~
~~D.X、Y、Z 是此 4 群共有的特徵~~
~~E. 盲鰻與鯊魚的親緣關係，較與鮭魚或蜥蜴近~~

Question 30 . A woman visits her doctor after noticing several changes in her body over a period of 6 (six) months. She has noticed weight loss, intolerance to temperature variations, irregular menstrual cycles, insomnia, and general weakness. Based on these symptoms, you would expect the doctor to test her for:
在發現過去 6 個月間，其身體產生變化後，一婦女去看醫生。她的體重降低、對環境溫度變化的耐受性下降、月經週期不規則、失眠、虛弱。基於這些症狀，你認為醫生應該對她進行何種疾病的檢測？

A. Diabetes mellitus 糖尿病
B. Hyperactive Thyroid(Grave's disease) 甲狀腺機能亢進（突眼性甲狀腺腫）
C. Underactive Thyroid(Hashimoto's disease) 甲狀腺機能退化（橋本氏甲狀腺腫）
D. hypoglycemia 低血糖症

Question 31. Endocrine glands ~~that compose the endocrine system~~
下列有關內分泌腺的敘述，何者正確？

A. Produce hormones that are only secreted into the digestive tract
B. Release most hormones into the bloodstream
C. Release hormones that generally act as rapidly as nerve impulses ~~are transmitted~~
D. Are present only in ~~human~~ vertebrates

A.分泌之激素只分泌進消化道
B.激素通常釋放進入血液循環中
C.激素的分泌與神經衝動的傳導一樣快
D.只有脊椎動物有

Question 32. Long corolla length in tobacco is inherited as a recessive monogenic characteristic. If in a natural population 49% of the plants have a long corolla, what is the probability that the result of test crossing a random selected plant with a short corolla from this population in F_1 will have uniform progeny?
煙草的長花冠為一隱性的單基因性狀。若一自然族群中，49％的植株為長花冠，則與該族群內之短花冠植株進行試交的 F1 子代皆呈相同性狀(表型一致)的機率為何？

A. 100%
B. 50%
C. 30%
D. 18%
E. 0%

Question 33. From an evolutionary viewpoint, which of the five following individuals is the most fit?

從演化的觀點來看，下列 5 個個體中何者之適應性最強？

A. A child who does not become infected with any of the usual childhood diseases, such as measles or chicken pox.
B. A woman of 40 with seven adult offspring
C. A woman of 80 who has one adult offspring
D. A 100-year old man with no offspring
E. A childless man who can run a mile in less than five minutes

A.一個不會感染任何一般之孩童疾病（如麻疹或水痘）的小孩
B.有 7 個成年後代的 40 歲婦女
C.有一個成年後代的 80 歲婦女
D.沒有後代的百歲老人
E.可以在 5 分鐘內跑一公里的無後代之人

Question 34. A study of a grass population growing in an area of irregular rainfall found that plants with alleles for curled leaves reproduced better in dry years, whereas plants with alleles for flat leaves reproduced better in wet years. Curled and flat leaves are controlled by different alleles at the same gene locus.
This situation tends to
在降雨不定的區域研究某一禾草族群，結果發現具有捲葉對偶基因的個體可在乾旱年有較佳的生殖力；而在多雨年則是平坦葉的個體生殖較佳。捲葉及平坦葉是由相同基因位置上的不同對偶基因控制，則此情況易導致禾草族群發生何種現象？

A. cause genetic drift in the grass population
B. cause gene flow in the grass population
C. lead to directional selection in the grass population
D. preserve variability in the grass population
E. lead to uniformity in the grass population

A. 基因漂變
B. 基因流
C. 有方向性的天擇
D. 保留族群的遺傳變異
E. 一致性

Question 35. The cohesion-tension (C-T) theory of sap ascent states that in plants sap is transported against gravity by bulk flow through the xylem vessels or chains of tracheids. Which of the following statements correctly describes the main factors affecting this bulk flow?
內聚力-張力原理（cohesion-tension theory）說明植物水分抗地心引力沿著木質部導管或假導管而上升的現象，下列敘述何者可適當解釋影響此水流的因素？

A. Hydrogen bonds within the water, hydrogen bonding to the hydrophilic walls of the xylem cells, and the gradient of solute potential (ψ_s).
B. The gradient of the pressure potential (ψ_p), and solute concentration
C. The gradient of water potential (ψ), hydrogen bonds within the water and solute concentration.
D. Hydrogen bonds within the water, hydrogen bonding to the hydrophilic walls of the xylem cells, and the gradient of pressure potential (ψ_p).

A.水的氫鍵、氫鍵連結於木質部細胞的親水性內壁、溶質水勢梯度(ψ_s)
B.壓力水勢梯度(ψ_p)、溶質濃度
C.水勢梯度(ψ)、水的氫鍵、溶質濃度
D. 水的氫鍵、氫鍵連結於木質部細胞的親水性內壁、壓力水勢梯度(ψ_p)

Questions 36 - 38. **Plants maintain most IAA (an auxin) in conjugated forms, which complicates IAA quantification.**
植物將多數的 **IAA** 以共軛型式存在，造成在 IAA 計量上的複雜性。回答第 36-38 題。

~~Question 36. These forms can exist in forms such as~~

~~A. IAA-amino acid conjugates IAA-氨基酸共軛~~

~~B. IAA-hydrolase conjugates IAA-水解酶共軛~~

~~C. IAA-glycerol conjugates IAA-甘油共軛~~

~~D. IAA-peroxide conjugates IAA-過氧化物共軛~~

Question 37. These forms can exist in forms such as IAA-amino acid conjugates. Before analysis in order to measure total IAA in a particular tissue, these conjugates must be
為了能從某特定組織中測得 IAA 總量，在分析之前需進行何種處理？

A. dehydrated 脫水
B. dehydrogenized 脫氫
C. hydrolyzed 水化
D synthesized 合成

Question 38. Therefore free IAA, thought to be the active form of the hormone, is measured
承上題，游離的活化態 IAA 可以何種型式被測得？

A. in the same sample without enzymes 取相同材料來測，不加酵素
B. in the same sample with enzymes 取相同材料來測，但添加酵素
C. in a parallel sample without enzymes 取與本實驗平行的另一組材料來測，不加酵素
D. in a parallel sample with enzymes 取與本實驗平行的另一組材料來測，但添加酵素

Question 39. You find a mutant bacterium that synthesizes lactose-digesting enzymes whether or not lactose is present. Which of the following statements or combination of statements might explain this?

I. The operator has mutated such that it is no longer recognised by the repressor.
II. The gene that codes for the repressor has mutated and the repressor is no longer effective.
III. The gene or genes that code for the lactose-digesting enzymes have mutated.

有一種突變的細菌可合成乳糖分解酶，藉此可判別乳糖是否存在。下列敘述組合，何者可能造成此現象？

I. 因操作子產生突變，故不能被抑制子所辨識。
II. 因抑制子的密碼發生突變，故抑制子不再有作用
III. 乳糖分解酶的密碼發生突變

A. only I
B. only II
C. only I, II
D. only I, III
E. I, II, III

Question 40. What mechanism is responsible for the acidification of the lysosome?

A. A lysosome fuses with acidic vesicle derived from Golgi aparatus
B A pump transports protons from the cytosol into the lysosome
C. A pump transports protons from the lysosomal lumen to the cytosol
D. A lysosome fuses with acidic endocytosed material
E. A pump transports OH^- ions from the cytosol to the lysosomal lumen

有關溶體的酸化機轉 (acidifaction) 的描述，何者正確？

A. 溶體會與來自高基氏體的酸性小泡結合
B. 質子幫浦將氫離子自細胞質運送到溶體中
C. 質子幫浦將氫離子自溶體運送到細胞質中
D. 溶體會與酸性的胞飲物質結合
E. 會有質子幫浦將氫氧離子 (OH^-) 自細胞質運送到溶體中

Question 41. Active transport is defined as the transport of an ion or other compound across the cell membrane requiring ATP as an immediate energy source. Which of the following is an example of active transport?

~~主動運輸是指細胞會利用 ATP 做為能量，將離子或物質穿過細胞膜的運輸方式。~~下列有關主動運輸的描述，何者正確？

A. K^+ through a voltage-gated K^+ channel
B. Ca^{2+} through a voltage-gated ion channel
C. Na^+ through ligand-gated ion channel
D. 3 Na^+ in exchange for 2 K^+ across the plasmalemma
E. All of the above

A. K^+ 通過 K^+ 電壓敏感閘式離子通道
B. Ca^{2+} 通過電壓敏感閘式離子通道
C. Na^+ 通過配體閘式離子通道
D. 3 個 Na^+ 進入細胞膜，同時有 2 個 K^+ 離開細胞膜
E. 以上皆是

Question 42. The transport of glucose into the mammalian red blood cell is accomplished by
葡萄糖分子如何運送進入哺乳類的紅血球

A. simple diffusion through the phospholipid bilayer
B. a Na^+ - K^+ ATPase
C. esterifying the glucose to phosphatidate
D. first converting glucose into lactose
E. facilitated diffusion through a glucose transporter

A. 簡單擴散通過雙層磷脂質
B. Na^+ - K^+ 泵
C. 將葡萄糖酯化變成磷脂質
D. 先將葡萄糖轉化成為乳糖
E. 經由葡萄糖運輸蛋白進行便利性擴散

Question 43. Isopods ~~(*Porcellio* sp.)~~ are one of the few crustacean groups that have successfully invaded terrestrial habitats. Which of these statements is **INCORRECT**?
等足目為少數能成功生活於陸地上的甲殼類動物。下列相關敘述，何者 **錯誤**？

A. They live in dry conditions.
B. They must live in moist conditions.
C. Their abdominal appendages bear gills.
D. They do not have an efficient cuticular covering to conserve water.
A. 等足目能生活於乾旱的環境中
B. 等足目必須生活於潮濕的環境中
C. 等足目腹肢具有裸鰓
D. 等足目不具有效的幾丁質覆蓋以保存水分

~~Question 44. Hormones are essential to maintaining homeostasis mainly because~~
~~A. they catalyze specific chemical reactions in brain cells.~~
~~B. the body requires them for digesting food.~~
~~C. they cause specific responses in specific targets.~~
~~D. they act faster than nerve impulses.~~

~~下列何者是激素維持生物體恆定的主因~~
~~A. 能在大腦細胞中催化特定反應~~
~~B. 身體需要他們消化食物~~
~~C. 能作用在特定的地方引發特定的反應~~
~~D. 能加速神經傳導~~

~~Question 45. Compared to nerve impulses, hormones are generally~~
~~A. released more slowly and have longer lasting effects.~~
~~B. released faster and have longer lasting effects.~~
~~C. release more slowly and have effects of a shorter duration.~~
~~D. released faster and have effects of shorter duration.~~

~~與神經傳導比較，有關激素釋放的描述何者正確~~
~~A. 釋放較慢，反應維持時效較長~~
~~B. 釋放較快，反應維持時效較長~~
~~C. 釋放較慢，反應維持時效較短~~
~~D. 釋放較快，反應維持時效較短~~

Question 46. Someone who has suffered damage to the pancreas might

A. have difficulty maintaining normal cortisol levels
B. have abnormal blood calcium levels
C. have periods of very low energy.
D. experience fluctuating blood pressure

當胰臟受損時，患者會出現下列何種現象

A. 較難維持正常皮質醇濃度
B. 不正常的血鈣濃度
C. 低活動力
D. 血壓會起伏不定

Question 47. The hypothalamus

A. sends nerve impulses and also makes hormones.
B. directly stimulates the adrenal gland to produce glucocorticoids
C. belongs to both the nervous and circulatory systems.
D. regulates circadian rhythms in vertebrates

有關下視丘的敘述，下列何者正確

A. 送出神經衝動與合成激素
B. 直接刺激腎上腺產生葡萄糖皮質素
C. 兼具神經與循環系統的功能
D. 調節脊椎動物的生理週期

Questions 48 - 49. **Ten grams of plant material were homogenized in 50 ml buffer and the homogenate was centrifuged. Protein from 10 ml of the supernatant was precipitated by addition of ammonium sulphate and the protein precipitated was collected by centrifugation and re-suspended in 1 ml of buffer. The re-suspended protein was diluted 10 times for protein determination.**

10 克的植物被均質化在 50 ml 的緩衝液中，再經過離心。將 10 ml 上清液中的蛋白質以硫酸銨沉澱，經過離心後，將沉澱物回溶於 1 ml 的緩衝液。此回溶後的蛋白質稀釋 10 倍後，進行蛋白質濃度測定。

~~Question 48. The amount of protein in 1 ml of the diluted sample was 0.4 mg. What is the total amount of protein recovered from 10 ml of the supernatant?~~
~~1 ml 的稀釋檢體蛋白質濃度為 0.4 mg。請問 10 ml 的上清液蛋白質總量為何？~~

~~A. 2 mg~~
~~B. 4 mg~~
~~C. 6 mg~~
~~D. 8 mg~~

Question 49. The amount of protein in 1 ml of the diluted sample was 0.4 mg. What is the amount of protein extracted from 100 g tissue?
此稀釋十倍後的 1 ml 檢體的蛋白質濃度為 0.4 mg，試問從 100 g 的植物組織中所萃取出的蛋白質總量為何？

A. 0.2 g
B. 0.4 g
C. 0.6 g
D. 0.8 g

Question 50. Prion diseases are characterized by:

A cellular DNA damage.
B. misfolded proteins that are much more soluble than the regular form of the protein.
C. a misfolded protein that is prone to aggregation and is very stable.
D. abnormal enzyme activity.
E. protein chaperones in cells.

有關普恩蛋白 (prion) 所造成疾病的敘述，何者正確？

A 細胞 DNA 受損
B. 因為蛋白質摺疊錯誤，造成該蛋白溶解度增加
C. 因為蛋白質摺疊錯誤，造成該蛋白容易聚集而穩定
D. 酵素活性異常
E. 蛋白質結合於細胞中

Question 51. Why are some proteinases synthesized as inactive precursors known as zymogens (proenzyme)?

A. Because they don't degrade a cell's starch supply.
B. Zymogens have a higher degree of substrate specificity than most enzymes.
C. Zymogen synthesis ensures that proteinase activity is kept to a minimum inside the cell where they are synthesised.
D. Zymogens are better at interconverting energy than regular enzymes.
E. Zymogens are more resistant to protein denaturation than the regular proteinase.

有關蛋白質酶原（蛋白質酶的不活化前驅物）的敘述，何者正確

A. 需要澱粉的提供
B. 較其他酵素有較高的受質特異性
C. 確保蛋白質酶的活性能被保留
D. 能量轉換的效果較佳
E. 較不容易變性

~~Question 52. Negative feedback is a process that~~

~~A. always reduces the amount of a hormone present in the blood.~~
~~B. keeps conditions near their normal state.~~
~~C. lowers the body temperature below normal.~~
~~D. none of the above are correct.~~

~~有關負回饋的敘述，何者正確~~

~~A. 只能減低血中激素含量~~
~~B. 保持正常的生理狀態~~
~~C. 降低體溫~~
~~D. 以上皆非~~

Question 53. What is the role of the "second messenger" in hormone action?

A. it signals a cell to secrete a hormone.
B. it informs a gland as to whether its hormones are having an effect.
C. it relays a hormone's message inside a target cell.
D. it carries a hormone while it is in the blood.

有關激素刺激產生『第二信息者』的敘述，何者正確

A. 讓細胞分泌激素
B. 告訴腺體激素已經作用完畢
C. 將激素的信息帶進細胞內
D. 在血液中攜帶激素

~~Question 54. It takes much longer for sex hormones and other steroids to produce their effect that it takes nonsteroid hormones. Why?~~

~~A. Steroids are bigger, slower moving molecules.~~
~~B. Steroids usually must be carried longer distances by the blood.~~
~~C. Steroids generally cause target cells to make new proteins, which take time.~~
~~D. Steroids relay their message via a second messenger.~~

~~性腺激素與類固醇作用影響時間較非類固醇激素來的持久，下列敘述何者正確~~

~~A. 類固醇為一種較大移動較緩慢的分子~~
~~B. 類固醇通常需要有較長的血液運送距離~~
~~C. 類固醇會讓目標細胞產生新的蛋白質，所以較慢~~
~~D. 類固醇會以第二信息者的方式傳遞激素訊息~~

Questions 55 – 57. To test the origin of CO_2 available in the soil, two experiments were conducted on trees in a *Pinus* forest.
為測試土壤中 CO_2 的來源，以松樹林中松樹個體來進行兩個實驗。請回答 55-57 題。

Question 55. In the first experiment, a 20 cm-wide strip of bark around the stem was removed from trees mid-way between the ground and the lowest branch.
Which of the following statements correctly describes the effect of this treatment on the trees?
第一個實驗：在植物在樹幹中段上（由地表部分至最低的枝條之間的一半高度處），做 20 cm 寬的樹皮環剝。

下列有關此實驗的作用之敘述何者正確？

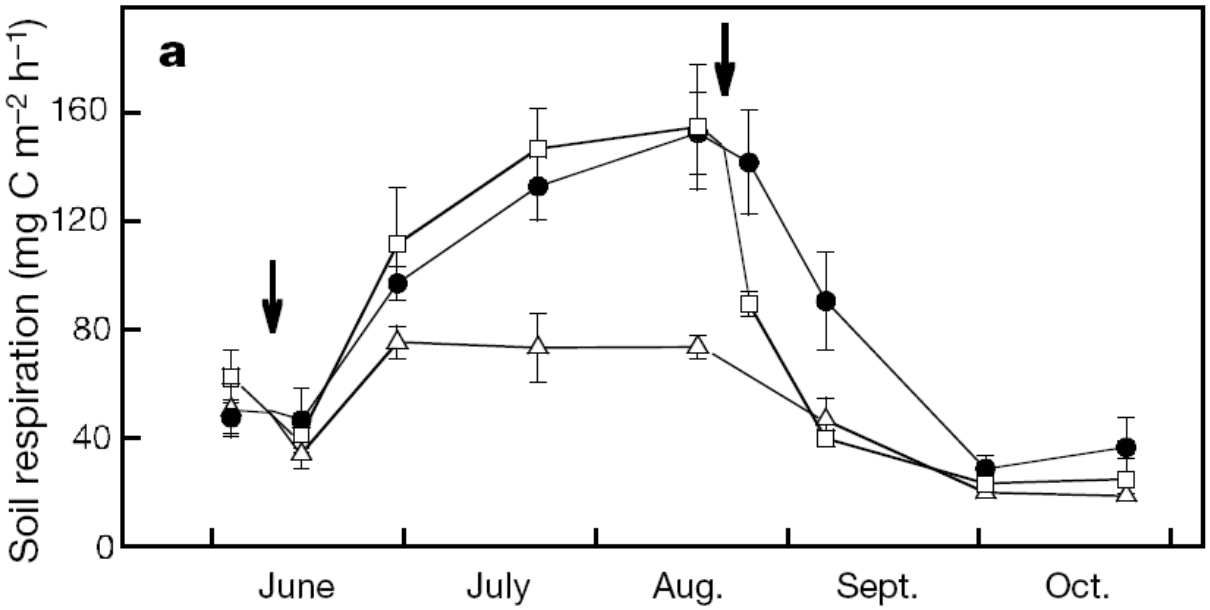
A. Transpiration will cease. As a result, the tree will lose all its needles.
B. Transport of auxin in the xylem is prevented. This will cause increased auxin concentration in the roots and root growth will be stimulated.
C. Phloem transport is prevented causing the roots to become deficient in nitrogen.
D. Transport of sugars to the roots ceases and the roots will die.
E. Transport of potassium and calcium from the roots to the needles will cease.

A. 蒸散作用停止，故此松樹的針葉會全部掉落。
B. 在木質部中，植物生長素的傳送中斷，造成根部中的植物生長素的增加，而刺激根的生長。
C. 韌皮部的傳送中斷，使根部呈缺氮狀態。
D. 糖傳送到根的路徑中斷，根死亡。
E. 從根往葉上傳的鉀與鈣將中斷。

Question 56. In the second experiment, the amount of CO_2 released from the soil at the base of trees was measured on several days during the growing period. The bark-removal experiment was repeated on a total of 9 trees, three trees per teament. In the first treatment, the bark was removed in early June (white triangles); in the second treatment, the bark was removed in late August (white squares); the third treament was the control treatment where the bark was not removed (black circles).

The data from this experiment is shown in the following graph. The black arrows indicate the time of bark removal.

在第二個實驗中，持續數天監測生長中的松樹，其基部土壤中釋放之 CO_2 含量，利用 9 棵樹進行環剝實驗，分 3 組，3 棵為一組處理；第一組處理：樹皮在 6 月初移除（下圖白色三角形）；第二組處理：樹皮在 8 月底移除（下圖白色正方形）；第三組處理為控制組；樹皮不被移除（下圖黑色圓圈）。下圖為此實驗所得之數據結果，黑色箭頭表示樹皮被移除的時間。



Which combination of the following statements best describe the results of this experiment?

I. The variability of the different treatments overlap and any effect of bark removal is due to chance.
II. The production of CO_2 in the soil shows seasonal variation.
III. Bark removal in June had a much smaller effect on the total CO_2 production in the soil during the whole season than bark removal in August.
IV. The decrease in the CO_2 production in the soil in the treatments where bark was removed cannot be explained by seasonal variations alone.
IV. The production of CO_2 in the soil is always smaller for trees with bark removed than for undamaged trees.

下列有關此實驗的敘述，何種組合是正確的？

I. 不同處理的變異有重疊，樹皮環剝的結果不可預期。
II. 土壤中 CO_2 的產生顯示季節性變化。
III. 對土壤中 CO_2 的總產量而言，在 6 月環剝樹皮比 8 月環剝樹皮所產生的影響要小得多。
IV. 樹皮環剝的不同處理所造成的土壤中 CO_2 的產量降低，不能僅以季節變化來解釋。
V. 樹皮環剝處理後的土壤中 CO_2 產量通常較未處理的對照組低。

A. Only I, II and V
B. Only I , II and IV
C. Only II, IV and V
D. Only II, III and IV
E. Only I, III and V

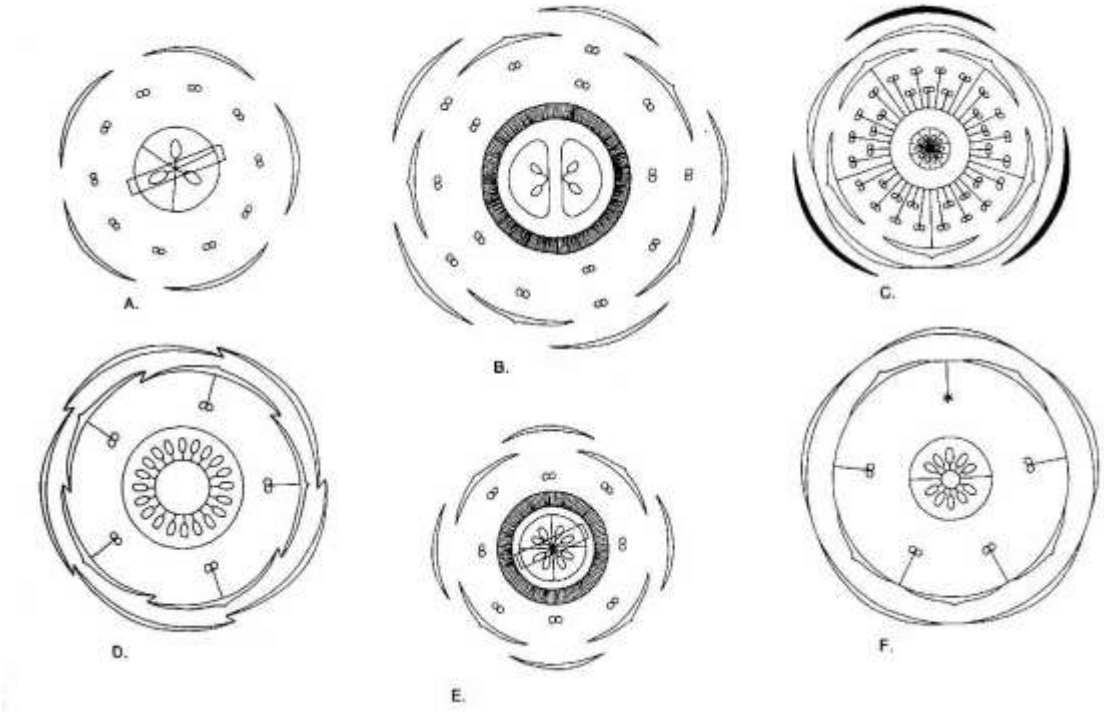
Question 57. Which of the following statements is a valid conclusion for the results of the second experiment?

下列何者敘述為第二個實驗的合理結論？

A. Most CO_2 produced in the soil is due to the decomposition of dead roots.
B. Most CO_2 produced in the soil is due to cellular respiration of root cells.
C. The amount of CO_2 produced in the soil is not influenced by photosynthesis.
D. When most of the roots die, the production of CO_2 in the soil is greatest.
E. The amount of CO_2 produced in the soil depends on the soil temperature.

A. 大部分土壤中的 CO_2 是由死亡的根之分解所產生。
B. 大部分土壤中的 CO_2 是由於根細胞的呼吸作用所產生。
C. 土壤中的 CO_2 量不受光合作用影響。
D. 當大部分的根死亡，土壤中的 CO_2 量最高。
E. 土壤中的 CO_2 量仰賴於土壤溫度。

Questions 58 - 59. **Below are six floral diagrams, labelled A to F.**
下圖為 A~F 六種植物的花式圖，回答 58～59 題



~~Question 58. From the following, choose the combination in which the floral diagram is associated with the correct family.~~

~~下列為花式圖字母代碼與其對應的科名，何者正確？~~

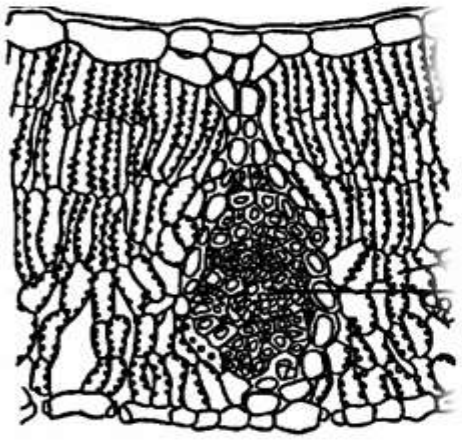
~~A. A = Brassicaceae 十字花科~~
~~B. B = Fabaceae 豆科~~
~~C. C = Liliaceae 百合科~~
~~D. D = Malvaceae 錦葵科~~
~~E. E = Rosaceae 薔薇科~~

Question 59. In which floral diagram do the all the floral characteristics listed below occur?
哪一個花式圖同時具有以下三種特徵？

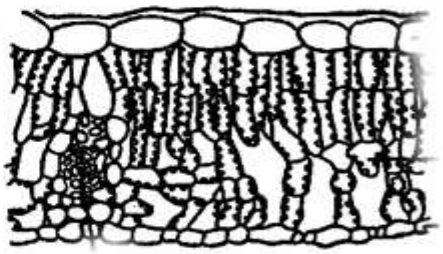
- Zygomorphic flower, fused sepals 兩側對稱，萼片癒合
- Axile placentation. 中軸胎座
- Epipetalous stamen 雄蕊著生在花瓣上

A. B
B. C
C. D
D. E
E. F

Question 60. Students made cross-sections of leaves collected from two different oak trees. When they examined the sections under a microscope, they were surprised to see that the leaves were different.
The following diagrams show cross-sections of leaves from Oak tree 1 and Oak tree 2.
學生收集兩株不同的橡樹進行葉的橫切，在顯微鏡下觀察其差異。
下列為橡樹 1 及橡樹 2 的葉子橫切：



1



2

Which of the following statements best explains the difference in leaf structure that the students observed?
下列有關造成此二葉片構造上差異的敘述，何者 正確？

A. Oak tree 1 grows in a swampy area; Oak tree 2 grows in sandy soil.
B. Oak tree 1 is a young tree; Oak tree 2 is a mature tree.
C. Oak tree 1 grows in fertile soil; Oak tree 2 grows in poor soil.
D. Oak tree 1 is exposed to sun for most of the day; Oak tree 2 grows in a shaded area.
E. Oak tree 1 is infected by fungi, which induced the cell proliferation; Oak tree 2 was not infected.

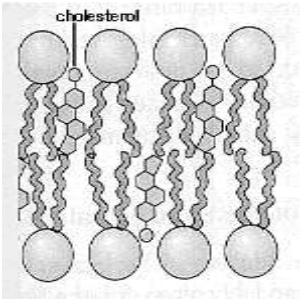
A. 橡樹 1 生長在沼澤，橡樹 2 生長在沙質土壤
B. 橡樹 1 是幼樹，橡樹 2 是成樹
C. 橡樹 1 生長在肥沃的土壤中，橡樹 2 生長在貧脊的土壤中
D. 橡樹 1 生長在向陽處，橡樹 2 生長在陰暗處
E. 橡樹 1 受到真菌感染而產生細胞的增生，橡樹 2 則未受到真菌感染

Question 61. Cloning of a new DNA fragment into a circular plasmid/vector always requires:
在選殖新的 DNA 片段插入環狀的質體 / 載體中，下列何者為 **必要** 條件：

A. Complementary base pairing
B. DNA ligase activity
C. The presence of the same restriction site in the insert and the vector
D. Selectable markers and autonomous replicating sequences
E. All of the above

A. 互補的鹼基
B. DNA 接合酶活性
C. 新的 DNA 片段與載體內有限制酶切位
D. 可供篩選的標記與可複製的序列
E. 以上皆是

Question 62. Below is a diagram representing cholesterol in the lipid bilayer.
下圖為存在於脂雙層中膽固醇的圖形



Cholesterol mixes with phospholipids in a cell membrane because cholesterol molecules are:
有關膽固醇分子能與磷脂質一起混合形成細胞膜的原因是：

A. amphipathic 雙性分子
B. steroid derivatives 類固醇衍生物
C. entirely hydrophobic 完全厭水性
D. phospholipids derivatives 磷脂質衍生物
E. bound with glycoproteins 與醣蛋白結合

Question 63. Which of the following molecules can diffuse through the lipid bilayer without using a channel/transporter?
下列何種分子能藉由擴散作用直接進出脂雙層，並不需要藉由通道蛋白或載體蛋白？

I.. O_2 氧氣
II. glucose 葡萄糖
III. steroid hormones 固醇類激素
IV. K^+
V. amino acids 胺基酸

A. I, III
B. I, IV
C. II, III, V
D. II, III, IV, V
E. All of the above.

Question 64. What is the net charge of aspartic acid when the pH of the solution in which it is prepared is the same as its pI value? Note the three pKa values of aspartic acid are as follows: -COOH pKa = 2.1; $-NH_3^+$ pKa = 9.8; R group pKa = 3.9
當溶液的 pH 值與天冬胺酸的 pI 值相同時，請問此時天冬胺酸的淨電荷為何？天冬氨酸的三個 pKa 值分別為，-COOH pKa = 2.1; $-NH_3^+$ pKa = 9.8; R group pKa = 3.9

A. one net positive charge 正一價
B. two net positive charges 正二價
C. one net negative charge 負一價
D. two net negative charges 負二價
E. no net charge 無電荷

Question 65. A quantitative amino acid analysis reveals that bovine serum albumin (BSA) contains 0.58% tryptophan residues by weight. The molecular mass of the tryptophan molecules is 204 daltons. The molecular mass of bovine serum albumin is known to be approximately 66000 daltons. What number of tryptophan residues is present in each BSA molecule?
氨基酸定量分析顯示，按重量比，胎牛血清白蛋白(BSA)含有0.58%的色胺酸，色胺酸的分子量為204。若BSA的分子量約為66000，問一個BSA分子中有幾個色胺酸殘基？

A. 2
B. 3
C. 4
D. 5
E. 6

Question 66. What essential function does gastrulation perform for the developing embryo?
原腸胚形成過程對發育中胚胎的主要功能為何？

A. ~~It gives form to the embryo~~. It results in the dorsal-ventral axis formation.
B. It gives rise directly to ~~basic tissue types~~ the germ layers of the embryo.
C. It gives rise to neural crest cells.
D. It gives rise directly to endocrine cells.
E. It gives rise directly to the trophectoderm.
A. ~~形成胚胎~~.造成背腹軸的形成
B. 直接形成胚胎的胚層~~各種基本組織~~
C. 形成神經嵴
D. 直接形成內分泌細胞
E. 直接形成營養外胚層細胞

Question 67. Which of the following is not true about the lymphatic system?
下列有關淋巴系統的敘述何者 **錯誤** ？

A. It helps maintain the volume and protein concentration of the blood.
B. It helps defend the body against infection.
C. It transports fats from digestive tract to circulatory system.
D. Lymph composition is similar to that of interstitial fluid.
E. Lymph drains directly into the excretory system.
A. 它幫助維持血液的體積及蛋白質濃度
B. 它幫助身體抵抗感染
C. 它將脂肪由消化系統輸送到循環系統
D. 淋巴液的組成與腸液相似
E. 淋巴液能直接排放到排泄系統

Question 68. The most direct consequence on amphibian development upon removal of the grey crescent would be:

去除灰月區對兩生類發生最直接的結果是：

A. Inability to develop from the 2-cell stage to the 4-cell stage.
B. Inability to develop form the 4-cell stage to the 8-cell stage.
C. Inability to form a blastocoel.
D. Inability to form dorsal structures.
E. Inability to form ventral structures.

A. 不能由 2 細胞期發育成 4 細胞期
B. 不能由 4 細胞期發育成 8 細胞期
C. 不能形成囊胚腔
D. 不能形成背部的構造

- THE END -