《生物》試題評析

曾正老師試題評析

一、各類命題最高之幾個部分：
1.演化、生態學：17 題。
2.分子生物學：15 題。
3.遺傳工程：4 題。
4.發生遺傳學：5 題。
其他零星命題：1～3 題。

二、超過生物教本題目，一共出現了 7 題，生物題庫班即講授了 4 題。

三、上課講義、練習卷、考前猜題，第三次模考皆有命中。

四、如往常，考前有人散佈不考 Campbell 生物教本，事實證明，試題大部分可由 Campbell 找到芳踪。

五、本班優秀同學可拿到 80 分以上；中等程度亦有 70 分。

六、往後建議：
1.對修習過分子生物學、生化同學有利。
2.上題庫班多學課外補充。
3.死背口訣，不必弄懂的學習方式，勢必淘汰。
4.一定要理解，自然可記憶。

七、爭議試題：
1.第 31 題有誤：MPF 在 M 期到達高峰，選項(B)錯誤，答案應改爲(B)。
可參考 Campbell (7E) p.230。
2.第 66 題有誤：
(A) genomic library 不需運用 reverse transcriptase.
(B) genomic library 含有 intron sequences
故選項(A) (B)皆錯。
可參考① Genetics by Brooker 3E(2009)—偉明出版 (P.497)
② Principles of Genetics by Simmons 4E (2006)
—偉明出版 (P.430～431)

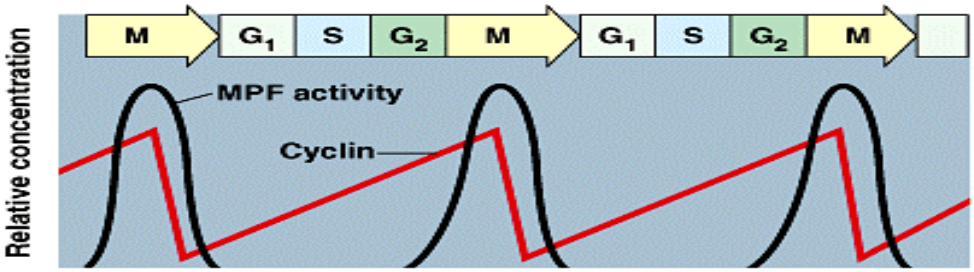
楊老師試題評析

一、此份試題比去年難，除了以 campbell 爲出題藍本之外，另外還有許多其它書本的題目。
二、許多觀念講義雖有提到，但是經題目的一番變化，若只有死背答案則會吃大虧。
三、仍有考古題，及與講義完全相同的題目：如第 7 題、第 47 題、第 5 題…
四、遺傳考 4 題，分生 22 題，佔 33%，比去年多（去年 21%）（前年 30%）
五、動物生理考 13 題，佔 18%，比去年少（去年 30%）（前年 2 6%）
六、分類、演化考 12 題，佔 20%，比去年多（去年 4%）
七、植物學考 4 題，佔 6%，比去年少（去年 10%）
八、生態學考 9 題，佔 11%，比去年多（去年 4%）
九、能量學去年幾乎沒有考，今年考 3 題，佔 3%
十、其它如細胞生化及基本概論佔 10%
十一、整體而言，題目比去年平均但在寫的過程中，會覺得分生題目很多，其原因是因爲分生出的比較難（正規課本上面並非都有寫），如第 28、30 題，32 題也出的很細節（當然講義上還是有）
十二、有部分題目雖然生物學有提及但所提的內容未深入，因此看起來題目似乎簡單，但是下筆卻又很困難，如第 58 題、第 62 題及第 74 題。
十三、許多題目是綜合性的應用題，所以題目算是很活。
十四、爭議試題有二：

1.試題一：

(C)31. MPF is a cyclin-Cdk complex that was discovered first in Xenopus egg. Its activity fluctuates during cell cycle. Which of the following is NOT its characteristic?
(A) Fluctuationof the cyclin concentration is the same as MPF activity.
(B) The peak of the MPF activity is G2 phase.
(C) The peak of the MPF activity is M phase.
(D) The breakdown of the MPF occurs abruptly during M phase.
(E) The activity of the MPF promotes mitosis by phosphorylating various proteins.

根據Campbell 7th第 230 頁



(a) Fluctuation of MPF activity and cyclin during the cell cycle

Figure 12.16 Molecular control of the cell cycle at the G_2 checkpoint. The steps of the cell cycle are timed by rhythmic fluctuations in the activity of cyclin – dependent kinases (Cdks). Here we focus on a cyclin – Cdk complex called MPF, which acts at the G_2 checkpoint as a go – ahead signal, triggering the events of mitosis.

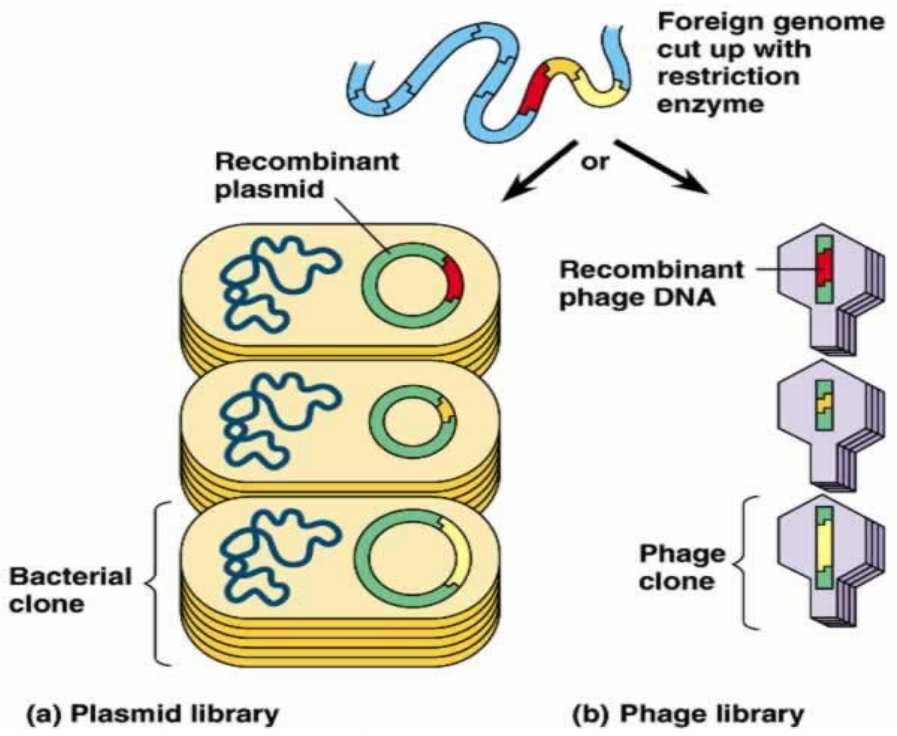
『論證』

可由上圖看出：
①MPF 在 M 期突然被崩解②MPF 的活性波峰也是在 M 期，故（D）及（C）選項都是正確的，此題是選錯誤的，故此題無解。

2.試題二：

(E) 66.Which one FALSELY describes a genomic library?

(A) A genomic library must be performed with a restriction enzyme, a DNA ligase, and a reverse transcriptase.
(B) A genomic library contains only coding sequences.
(C) Plasmids can be used the cloning vector for making genomic libraries.
(D) A genomic library is a "shotgun" approach-no single gene is targeted for cloning.
(E) None of the above.



根據 Campbell 7th 第 389 頁

Figure 20.6 Genomic libraries. A genomic library is a collection of many bacterial or phage clones, each containing copies of a particular DNA segment from a foreign genome. In a complete genomic library, the foreign DNA segments cover the entire genome of an organism. (a) Shown are three of the thousands of "books" in a plasmid library. Each "book" is a clone of bacterial cells, each containing copies of a particular foreign genome fragment (pink, yellow, black segments) in its recombinant plasmid. (b) The same three foreign genome segments are shown in three "books" of a phage library.

『論證』

由上敘述可知
①genomic library 是有可能含 intron（符合 B 選項的應該是 cDNA）
②genomic library 不需經反轉錄（符合 A 選項的應該是 cDNA）
故此題答案應該是（A）和（B）

《生物》命中事實

曾正老師講義命中事實

題號	回數	頁數	說　　明
1	第 18 回	P62	族群中個體之間吸引交配及生殖差異的結果(本例之公雞與母雞)稱爲性擇。
2	第 18 回	P275	東方人過度開發作爲食物，以致大量捕捉導致鯨及鯊之數量下降。
3	第 18 回	P299	生理生態學家:研究生物運用生理及解剖的機制以處理物理及化學環境的變動的科學家。
4	第 18 回	P62	雄性亦可與雌性進行交配，以增加遺傳變異。
5	第 18 回	P197	藉由某些區塊個體的交換以使得空間隔離的區塊的次族群,得以存活稱爲 metapopulation
6	第 12 回	P246	胰泌素受胃的內含物(HCl)刺激而分泌
7	第 6 回	P199	肝門靜脈中的葡萄糖量會入肝而處理後其濃度達到最低
8	第 7 回	P206	魚鰓的血流與水的流向平行相反(爲了增加交換梯度)稱爲逆流交換
9	第 9 回	P190	體內受精的子代數通常少，但會受到母體極佳的保護
10	第 8 回	P153	肌肉收縮最易受Ca^{2+}濃度下降所影響，其餘各項均與Ca^{2+}無關
11	第 18 回	P149	運用演化樹的每個分支點代表來自一共有祖先的分歧,每個分支是一個個別的子代路線
12	第 18 回	P295	運用標準取樣技術(考慮樣品取樣值)否則誤差極大
13	第 18 回	P253	化石燃料燃燒是碳循環之碳的主要來源
14	第 18 回	P227	Soil depths 減少不屬於消長在生態系中的變化
15	第 5 回	P273	核基因組高度重覆的序列有 Satellite DNA 及 Alu elements
16	第 5 回	P114	Spliceosome 突變故無法進行 primary transcript 的 intron 移除
17	第 17 回	P107	homeotic genes 突變致使動植物形態發生變化造成巨演化(本例植物的葉取代花)
18	第 9 回	P44	Adenylyl cyclase 將 ATP 轉變成 cAMP；而 phosphodiesterase 將 cAMP 轉變成 AMP
19	第 16 回	P86	BAC (攜帶 10 萬～50 萬 bps) ＜YAC (攜帶 100 萬 bps)
20	第 5 回	P172	tRNA 與質中胺基酸結合，則 tRNA 稱 charged tRNA，故此不在核中進行
21	第 5 回	P266,268	所有細胞中的染色質皆存在 Heterochromatin-gene off 以及 euchromatin-gene on 之狀態
22	第 5 回	P237	Trp 作爲 corepressor 與 repressor 於是 repressor 活化
23	第 2 回	P128,129	膜主要脂計有磷脂、糖脂及膽固醇
24	第 3 回	P52	NADH立即進入電子傳遞鏈以獲得H^{+}濃度梯度的建立
25	第 5 回	P185	Ubiquitination 是當不用 protein 降解才需要進行
26	第 16 回	P19	質體作爲載體的條件中不需要 coding sequence 的標籤
27	第 5 回	P315	表觀遺傳學導致在不同的世代中不同的對偶基因的表現
28			Tandem MS 或稱爲 MS/MS 可用於多肽的短序列的定序
29	第 17 回	P61,63	含有 homeobox 的基因，亦可稱爲 Hox gene (特別在 animal)
30	第 5 回	P188	一邊轉評一邊將合成出的蛋白質進入 Er lumen 稱爲共同轉運轉譯

31	第 3 回	P204,205	MPF 在 M 期到達高峰，本題答案應修改爲(B)錯誤。 可參考 Campbell (7E) p.230
32	第 5 回		真核生物 DNA 聚合酶 γ 進行粒線體複製
33	第 5 回	P174,180	核糖體小次單位與 mRNA 結合→胺基醯 tRNA 結合至 A 位→胺基酸與肽鏈形成肽鍵→tRNA 易位至 P 位→tRNA 離開 P 位
34	第 13 回	P68-P69	轉座子真核亦有；稱爲剪貼轉座，在演化上賦與個體之特殊表現，幾乎可在 DNA 上移動。
35	第 5 回	P385	C-onco 是正常的細胞基因，與細胞正常與分裂有關
36	第 16 回	P63	DNA 移動的速率與大小，電荷，膠濃度，鹼基改變有關
37	第 16 回	P125	蛋白組困難處有蛋白質數目超過基因數目;不同細胞其蛋白質有所不同，蛋白質的結構及化學性質多樣，無法單由數量及溶解度來研究蛋白質
38	第 18 回	P63-67	內在隔離機制,又稱爲合子形成前的隔離
39	第 1 回	P31-32	AB 同門，故其結構同源程度最差
40	第 13 回	P232	真菌會使植物感染而影響農作產量
41	第 10 回	P121	肌肉爲中胚層衍生；神經系統爲外胚層衍生；肝、肺爲內胚層衍生
42	第 18 回	P280	運用原核生物以解決受汙染的環境稱爲 bioremediation
43	第 18 回	P259	N 可供植物合成蛋白質及核酸
44	第 15 回	P140	微量養分可作爲植物酵素催化的輔因子
45	第 15 回	P257	植物面臨過冷環境會增加膜流體性來因應
46	第 12 回	P279	Fat 吸收發生在小腸
47	第 6 回	P67	血漿蛋白質不進行O_2運輸
48	第 7 回	P26-27	補體可以涉及抗體；但大部份屬於非特異性防衛，造成病原體膜破裂(穿孔)
49	第 9 回	P110-112	Melatonin 除了與色素形成有關外，另與生物節律、生殖亦有關
50	第 5 回	P213-215	上述是因鹼基加入而導致閱讀框架發生改變的錯義突變
51	第 19 回	P6-7	有體腔動物具有由中胚層完全內襯的體腔
52	第 12 回	P52	基底膜與覆膜的接觸導致柯氏器毛細胞引發聲音的訊息轉導
53	第 11 回	P157	增加突觸後，神經膜對 Ach 的反應而使 SNS 受到興奮
54	第 18 回	P163-165	Uniform distribution—aggressive interaction
55			Protein 層級分析不同 DNA 分析來得精準，且樣品需要量小，重覆性高且無害
56	第 18 回	P248	藻床、珊瑚礁之淨初級生產最高
57	第 18 回	P49-53	由一極端往一極端的方向演化稱爲 directional selection
58	第 16 回	P126	BLAST 程式是排列 DNA 序列的最佳方式
59	第 5 回	P228	DNAP. Endonuclease 及 ligase 涉及 TT dimmer 修復，而 photolyase 的修復僅在可見光(特別是藍光)下即可
60	第 5 回	P93	RNAPⅢ負責 tRNA 及 5S-rRNA 的合成
61	第 5 回	P363	MiRNA 單股時與 target mRNA 雜合才發揮其作用
62	第 1 回	P136	上述四種化合物不含 carboxylic acid group
63	第 3 回	P258-265	減數分裂中的 Recombination 及 Reassortment 皆會促進多樣性
64	第 13 回	P144	陰道滴蟲屬於副體蟲，具有修飾的粒線體
65	第 2 回	P243-245	酵素反應速率與溫度、PH、受質濃度皆有關
66	第 16 回	P48	本題有誤，cDNA library 才僅有 coding sequence
67	第 18 回	P17	本題爲 conrergent evolution
68	第 13 回	P37-38	古細菌可至 100℃以上，高鹽環境下存活，與真核生物較接近，不含

			肽聚糖
69	第 13 回	P30-31	Proteobacteria：G^-；Chlamydias：intracellular parasites endotoxins：G^-；Cyanobacteria：photosynthesis
70	第 13 回	P230	地衣運用 soredia 進行無性生殖方式
71	第 13 回	P233	外部菌根形成根外部的鞘：內部菌根佔多數(85～90% plant species)
72	第 15 回	P186-195	生長素無法進行光周期偵測
73	第 15 回	P266	對於真菌攻擊，植物會分泌 Phytoalexin
74	第 7 回	P111-112	抗體重排理論涉及 Ab 多樣性形成，包括 (1)V 及 J 片段任意接合 (2)DNA 片段任意移除 (3) 鹼基改變
75	第 18 回	P26-29	f (bb)＝0.04⇨ b＝0.2

楊老師講義命中事實

題號	回數	頁數	題號	回數	頁數
1	總複習 1	演化 I P4→ 第 4 分支 → 第 4 小分支	39	總複習 1	演化 2 分類概念性的應用題
2	第 13 回	P55→13	40	總複習 1	植物學 概念性的應用題
3	第 13 回	基本觀念活用題	41	總複習 1	胚胎學 生理 P2→ 第 5 分支
4	總複習 1	生理學 P82→ 第 1→5 分支	42	總複習 1	生態學 P30→ 第 5 分支 →1
5	總複習 1	生態學 P10 次族群一筆記 去年後醫也考過	43	總複習 1	生態學 P24→ 第 1 分支 →5
6	總複習 1	生理學 P10→第 4→2→1 分支	44	總複習 1	植物學 P16→ 第 2 分支
7	第 6 回	P90→ 上面牛刀小試 11 題完全一樣	45	總複習 1	植物學 P27→ 第 3 分支
8	總複習 1	生理學 P14→ 第 4 分支 → 第 1 小分支	46	綜合性	生理學 P10→第 3 分支
9	第 8 回	P217→ 第 10 行完全命中	47	總複習 1	生理學 P25→第 2 分支→2 私醫曾考過
10	總複習 1	生理學 P49；過去曾考過，當血鈣低時 會造成肌肉痙攣	48	總複習 1	生理學 P27 免疫綜合性應用考題
11	總複習 1	演化 I P9→ 第 2 分支 → 第 2 小分支	49	補充講義 1	生理學（內分泌） P75→第 8 分支→1
12	總複習 1	生態學 P11→ 第 1→3 分支 須思考，概念性考題	50	綜合性	分生（突變） P31→第 4 分支→1
13	第 13 回	P304→ 第 3 行	51	總複習 1	動物學 P24→第 1 分支→3
14	總複習 1	生態學	52	總複習 1	生理學（特殊感覺）

		P19→3→3→ 第 1 小分支 活用題			P69→第 1 分支→4
15	總複習 1	分生 P43→ 第 3→4→1→2 分支	53	總複習 1	生理（神經） P51→第 2 分支→2
16	總複習 1	分生 P33→ 第 2 分支 → 第 3 小分支	54	總複習 1	生態學（族群） P11→第 1 分支→4
17		分生 突變應用考題	55	總複習 1	分生 應用性考題
18	總複習 1	生理學 P79→ 第 4→1→2 小分支	56	總複習 1	生態學（生態系） P22→第 2 分支→7→4
19	總複習 1	分生（遺傳工程） P49→ 第 2→2→4 分支	57	總複習 1	演化 1 P4→第 5 分支→4
20	總複習 1	分生 P32 基本觀念題	58	總複習 1	分子生物學 時勢應用題
21	總複習 1	遺傳 P18 → 第 1 分支 → 第 1 小分支	59	總複習 1	分子生物學 P30→第 3 分支→3→2
22	總複習 1	分生 P39→ 第 3→2 分支	60	總複習 1	分子生物學 P33→第 1 分支→1→2→3
23	總複習 1	細胞學 P9→ 第 2 分支	61	總複習 1	分子生物學 P33→第 3 分支→2→5→2
24	總複習 1	能量學 P14→ 第 4 分支	62	總複習 1	基礎生化 應用題
25	總複習 1	遺傳分生 P46→ 第 7→2→2 小分支	63	總複習 2	遺傳學 P21→第 3 分支
26	總複習 1	分生 P49→4→1→2 小分支	64	總複習 1	演化 2（分類） P18→第 2 分支
27	總複習 1	分生 P46→ 第 1 分支 3 小分支	65	總複習 2	能量學（酵素） P13→第 2 分支→3→2
29	總複習 1	分生 第 5 分支	66	第 7 回	分子生物學（遺傳工程） P49→第 5 分支→1
30	總複習 1	分生 P33→第 3 分支→2→3	67	總複習 2	演化 1 P7→第 2 分支→1
31	總複習 1	遺傳 P20→ 第 1→1→2 小分支	68	總複習 1	演化 2（分類） P16→第 1 分支
32	第 5 回	P46→中間表格第二列	69	總複習 1	演化 2（分類） P16→第 2 分支
33	總複習 1	分生 P34	70	第 11 回	P246→倒數第 10 行
34	總複習 1	分生 P40→ 第 2 分支	71	第 11 回	P249→下方
35	總複習 1	分生 P47→ 第 2 分支	72	總複習 1	植物學 P23
36	總複習 1	分生 P48→ 第 2 分支 →2→1	73	總複習 1	植物學 P28→ 第 2→3→1 小分支
37	總複習 1	分生	74	總複習 1	遺傳分生

		第 4 分支 →1→2			分生＋生理學 P30→ 第 3→2 小分支
38	總複習 1	演化 1 P7→ 第 2 分支	75	總複習 1	演化 I P3 哈溫定律計算應用

《生物》

Ⅰ.【單選題】1-50 題，每題 1 分，共計 50 分。答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答時，不給分亦不扣分。

(D) 1. What type of process can produce coloration differences between a rooster and hens within one species?
(A) balancing selection. (B) directional selection. (C) disruptive selection.
(D) sexual selection. (E) stabilizing selection.

(E) 2. The primary cause for the decline in number of sharks and whales:
(A) pollution. (B) habitat loss. (C) habitat fragmentation.
(D) introduced species. (E) over harvesting.

(C) 3. Physiological ecologists study
(A) nutrient cycling and energy flow through ecosystems.
(B) exchanges of materials, energy, and organisms between communities.
(C) physiological and anatomical mechanisms by which organisms deal with variation in their hysical and chemical environment.
(D) physiological and anatomical mechanisms by which organisms deal with variation in their social environment.
(E) None of the choices are correct.

(E) 4. In many species, the females can reproduce by the process of parthenogenesis. Then why do males persist in those species?
(A) defense. (B) to increase the number of offspring produced.
(C) to assist in rearing of the offspring. (D) to decrease the chance of infertility.
(E) to ensure genetic diversity.

(E) 5. A group of subpopulations living in spatially isolated patches connected by exchange of individuals among patches is called a
(A) micropopulation. (B) megapopulation. (C) isopopulation.
(D) allopopulation. (E) metapopulation.

(B) 6. The acidity of the stomach contents triggers the small intestine to secrete a hormone known as
(A) histones. (B) secretin. (C) TSH.
(D) pepsin. (E) cholecystokinin, or CCK.

(D) 7. In which blood vessel is glucose concentration likely to vary the most?
(A) coronary arteries. (B) abdominal artery. (C) hepatic vein, which drains the liver.
(D) hepatic portal vessel. (E) pulmonary veins.

(A) 8. Which of the following is an example of countercurrent exchange?
(A) The flow of water across the gills of a fish and that of blood within those gills.
(B) The flow of air within the primary bronchi of a human and that of blood within the pulmonary veins.
(C) The flow of blood in the dorsal vessel of an insect and that of air within its tracheae.
(D) The flow of fluid out of the arterial end of a capillary and that of fluid back into the venous end of the same capillary.
(E) The flow of water across the skin of a frog and that of blood within the ventricle of its heart.

(E) 9. What advantage does internal fertilization have compared with external fertilization?
(A) Usually a smaller number of genes are present, which promotes genetic stability.
(B) Usually many offspring are produced, ensuring survival of the species.
(C) The time and energy devoted to reproduction is decreased.
(D) The increased survival rate results in rapid population increases.
(E) The smaller number of offspring often receive a greater amount of parental protection.

(B) 10. Which function associated with muscle would be most directly affected by low levels of calcium?
(A) The muscle fiber resting membrane potential.
(B) Muscle contraction.
(C) The initiation of an action potential.
(D) ATP hydrolysis.
(E) Muscle fatigue.

(D) 11. Phylogenetic trees are best described as
(A) true and inerrant statements about evolutionary relationships.
(B) the most accurate representations possible of genetic relationships among taxa.
(C) theories of evolution.
(D) hypothetical portrayals of evolutionary relationships.
(E) the closest things to absolute certainty that modern systematics can produce.

(E) 12. Estimates of the number of species present in a community
(A) are not affected by the sampling effort devoted to estimation.
(B) usually require only limited effort by ecologists.
(C) can usually be made more easily by sampling only a single indicator taxon.
(D) are all that is necessary to calculate species diversity.
(E) must, to be useful, be based on standardized sampling techniques.

(B) 13. A major perturbation of the carbon cycle by human activity is associated with
(A) release of carbon from carbonate rocks.
(B) release of carbon from fossil fuel deposits.
(C) removal of carbon from the atmosphere in the industrial production of fertilizers.
(D) accelerated removal of carbon from the atmosphere by forests.
(E) respiratory production of CO2 by the large human population.

(B) 14. Which statement about changing ecosystem properties during succession is **FALSE**?
(A) Biomass increases.
(B) Soil depths decrease.
(C) Primary production increases.
(D) Community respiration increases.
(E) Stream spiraling lengths decrease.

(D) 15. The nuclear genomes of eukaryotes are composed of different categories of sequences. Repetitive sequences are one type of the categories. Which of the following is an example of highly repetitive sequences?
(A) Histone gene cluster .
(B) Ribosomal RNA genes.
(C) Homologous genes.
(D) Alu elements.
(E) Multigene families.

(E) 16. If the genes of a cell's spliceosomes were mutated so the spliceosomes no longer action normally. Which of the following would occur?
(A) A functional protein would be produced.
(B) Transcription would stop.
(C) A primary transcript would not be produced.
(D) Translation would stop.
(E) Intron(s) would stay in the mature mRNA.

(E) 17. If the homeotic genes are mutated and cannot be expressed in an orchid during flower development. What would be the consequence?
(A) The orchid will not develop cotyledons.
(B) The orchid will die.
(C) The orchid will become dwarf.
(D) The orchid will develop flowers instead of leaves.
(E) The orchid will develop leaves instead of flowers.

(C) 18. Adenylyl cyclase is to cAMP as _____ is to AMP.
(A) protein kinase C (B) phospholipase C (C) phosphodiesterase
(D) phosphatase (E) Ras

(E) 19. For cloning of genomic DNA sequences, yeast artificial chromosome (YAC) and bacterial artificial chromosome (BAC) are two popular cloning vector systems. Which of the following is **NOT** correct?
(A) A BAC would be circular and a YAC would be linear.
(B) A YAC would have telomeres and a BAC would not.
(C) A YAC would have a centromere and a BAC would not.
(D) A YAC would be bound to histones in the cell and a BAC would not.
(E) A BAC would contain a much larger DNA insert than a YAC.

(E) 20. Which of the following processes does **NOT** occur in the eukaryotic nucleus?
(A) RNA splicing. (B) RNA polyadenylation. (C) DNA synthesis.
(D) RNA capping. (E) Production of charged tRNAs.

(E) 21. Which of the following is true of chromatin?
(A) Heterochromatin has more acetyl groups on the histones.
(B) Heterochromatin has fewer methyl groups on the DNA.
(C) Active genes are not bound by nucleosomes.
(D) Sequence-specific DNA binding proteins can only activate transcription.
(E) The chromatin structure on a particular gene may be different in different cells.

(A) 22. In E. coli, biosynthesis of tryptophan can be repressed. The repressor protein of the trp operon
(A) is activated by the binding of tryptophan.
(B) is inactivated by the binding of tryptophan.
(C) is not affected by tryptophan.
(D) is activated by the binding of free tRNA.
(E) is only synthesized in the presence of tryptophan.

(C) 23. The major lipids found in membranes are
(A) triacylglycerols and cholesterol.
(B) cholesterol and sphingomyelin.
(C) phospholipids, glycolipids, and cholesterol.
(D) phospholipids and free fatty acids.
(E) cholesterol, inositol, and glycolipids.

(D) 24. During glycolysis NADH is produced in the cytosol. Under aerobic conditions, what is the primary fate of this NADH?
(A) It accumulates in the cytosol.
(B) It diffuses into the mitochondria.
(C) It transfers its reducing equivalents directly to $NADP^{+}$.
(D) The reducing equivalents are transferred by a shuttle system to the mitochondrial electron transport system.

(E) It is used to reduce glucose to sorbitol.

(E) 25. Which of the following is **NOT** a post-translational modification?
(A) Phosphorylation. (B) Glycosylation. (C) Acetylation.
(D) Methylation. (E) Ubiquitination.

(B) 26. Which one of the following components is **NOT** necessary in an expression plasmid to be useful in the construction of recombinant DNA?
(A) A multiple cloning site. (B) A tag coding sequence.
(C) A promoter and a terminator. (D) Multiple cloning sites.
(E) A coding sequence that is for antibiotic resistance.

(E) 27. Inheritance of phenotype sometimes does not directly involving the nucleotide is termed epigenetic inheritance. The epigenetic inheritance
(A) only refers to genomic imprinting. (B) only effects female offspring.
(C) only effects male offspring. (D) only refers to X inactivation.
(E) can result in the expression of different alleles in different generations.

(E) 28. Which of the following is a possible application of tandem mass spectrometry?
(A) Cell-specific gene expression. (B) Gene regulation.
(C) Elucidation of metabolic pathways. (D) Tumor profiling.
(E) Determination of the amino acid sequence of a peptide.

(B) 29. Which of the following is **NOT** correct regarding homeotic genes?
(A) Homeotic genes encode transcription factors.
(B) Homeotic genes are the only genes that contain the homeobox.
(C) Homeotic genes are found in clusters called complexes.
(D) The proteins encoded by homeotic genes contain DNA-binding domain.
(E) Homeotic genes activate other developmental genes.

(B) 30. Ribosomes attached to rough ER are the site for synthesis of many types of secretary proteins. Which of the following mechanism is typically used for nascent protein insertion into the mammalian ER membrane?
(A) Pretranslational. (B) Cotranslational. (C) Post-translational.
(D) Cotranscriptional. (E) All of the above.

(C) 31. MPF is a cyclin-Cdk complex that was discovered first in Xenopus egg. Its activity fluctuates during cell cycle. Which of the following is **NOT** its characteristic?
(A) Fluctuation of the cyclin concentration is the same as MPF activity.
(B) The peak of the MPF activity is G2 phase.
(C) The peak of the MPF activity is M phase.
(D) The breakdown of the MPF occurs abruptly during M phase.
(E) The activity of the MPF promotes mitosis by phosphorylating various proteins.

(C) 32. Which of the following human DNA polymerases is responsible for replicating the mitochondrial DNA?
(A) Alpha. (B) Beta. (C) Gamma. (D) Delta. (E) Theta.

(C) 33. Which one is the correct sequence of protein synthesis?
1. An aminoacyl-tRNA binds to the A site
2. A peptide bond forms between the new amino acid and a polypeptide chain
3. tRNA leves the P site, and the P site remains vacant
4. A small ribosomal subunit binds with Mrna
5. tRNA translocates to the P site

(A) 5,4,3,2,1 (B) 2,4,5,1,3 (C) 4,1,2,5,3 (D) 4,1,3,2,5 (E) 1,3,2,4,5

(E) 34. Which one is correct for the description of transposons?
(A) It occurs only in bacteria.
(B) Some transposons do jump from one genome location to another, in what is called replicative transposition.
(C) It plays little or no role in evolution.
(D) Few can move to many alternative locations in the DNA.
(E) None of the above.

(B) 35. Proto-oncogenes can change into oncogenes that cause cancer, which one can best explain the characteristic of proto-oncogenes?
(A) p53 gene and ras gene belong to one of proto-oncogenes.
(B) Pro-oncogenes are the normal cellular genes.
(C) Cells produce proto-oncogenes as they age.
(D) All of the above.
(E) None of the above.

(E) 36. Which one of modifications is likely to alter the rate at which a DNA fragment moves through a gel during electrophoresis?
(A) Altering the charges of the DNA fragment.
(B) Increasing or decreasing the length of the DNA fragment.
(C) Increasing the concentration of a gel.
(D) Methylating the cytosine base within the DNA fragment.
(E) All of the above.

(E) 37. Proteomics is a new kind of challenge because
(A) the number of proteins in humans probably far exceeds the number of genes.
(B) a cell's proteins differ with cell type.
(C) proteins are extremely varied in structure and chemical properties.
(D) some proteins can not be easily analyzed due to their amounts or solubility.
(E) All of the above.

(E) 38. Which of the following is considered an intrinsic isolating mechanism?
(A) Gametic incompatibility. (B) Sterile offspring.
(C) Ecological isolation. (D) Timing of courtship display.
(E) All of the above.

(A) 39. If organisms A, B, C belong to the same phylum, but to different classes and if organism D, E, and F belong to the same class but to different orders, which one of pairs of organisms would be expected to show **the least** degree of structural homology?
(A) A and B (B) C and F (C) A and F (D) B and D (E) D and F

(B) 40. Which one of the statements in the fact that some fungi are **NOT** beneficial to agriculture?
(A) They recycle nutrients that are linked to dead organic matter.
(B) They form mycoses on plants.
(C) They contribute to the initial stages of soil formation from rock.
(D) They may harbor photosynthetic partners that add nitrogenous compounds to the soils.
(E) None of the above.

(C) 41. Which one of pairs is matched correctly for the germ layers from which animals evolve?
(A) Ectoderm-muscle. (B) Mesoderm-outer covering.
(C) Endoderm-internal linings of digestive tract. (D) Mesoderm-nervous system.

(E) Ectoderm-internal linings of liver and lungs.

(A) 42. A plant with high levels of tolerance to heavy metals was applied for mining minerals in potential profitable areas. Such an application of this plant is an example of
(A) bioremediation. (B) nitrogen fixation.
(C) helping locate suitable sites fro toxic waste storage.
(D) minimizing the erosion of soil in arid lands.
(E) None of the above.

(D) 43. Why is nitrogen fixation needed for the growth of some plants?
(A) Nitrogen fixers are sometimes symbiotic with legumes.
(B) Nitrogen fixation can only be done by certain prokaryotes.
(C) Nitrogen fixation can produce metabolic energy for plants' growth.
(D) Fixed nitrogen is a limiting factor for plant growth.
(E) Nitrogen-fixing capacity is varied in many different plants.

(B) 44. Which one is true of micronutrients in plants?
(A) Overdoses of them can not be toxic.
(B) They generally help in catalytic functions in the plants.
(C) They are not required for a plant to grow from seed.
(D) They are essential elements of small size and molecular weight.
(E) They are the elements required in relatively big amounts.

(D) 45. How might a plant respond to cold stress **EXCEPT**
(A) an alteration of membrane lipids.
(B) the production of a specific solute "plant antifreeze" that reduces water loss.
(C) excluding ice crystals from the interior walls.
(D) converting of the fluid mosaic cell membrane to a solid mosaic one.
(E) increasing the proportion of unsaturated fatty aid in the membranes.

(B) 46. Which one of the statements is **FALSE** for digestion and absorption of fat?
(A) The requirement of emulsification.
(B) The absorption of fat in the stomach.
(C) The entrance of lymphatic system of the absorbed fat.
(D) The hydrolysis of fat by lipase.
(E) None of the above.

(A) 47. The function of plasma proteins is **NOT** related to which one of the following?
(A) Oxygen transport. (B) Immune responses.
(C) Transport of water-insoluble lipids. (D) Maintenance of blood osmotic pressure.
(E) Blood clotting.

(E) 48. Which statement about the complement is true?
(A) These proteins are involved in innate immunity only.
(B) These proteins can be induced after the invasion of pathogens into the humans.
(C) These proteins can only defense against the bacteria's infection.
(D) These proteins are selectively antimicrobial proteins.
(E) None of the above.

(E) 49. Melatonin can participate in which one of the following items?
(A) Skin pigmentation. (B) Monitoring day length.
(C) Biological rhythms. (D) Reproduction.
(E) All of the above.

(C) 50. Based on the gene and protein sequences that follow, what type of mutation-polypeptide effect has occurred?
Normal gene: ATGGCCGGCCCGAAAGAGACC
Mutated gene: ATGGCCGGCACCGAAAGAGACC
Normal protein: Met-Ala-Gly-Pro-Lys-Glu-Thr
Mutated protein: Met-Ala-Gly-Thr-Glu-Arg-Asp
(A) Base addition-silent. (B) Base addition-none.
(C) Base addition-missense. (D) Base addition-nonsense.
(E) Base addition-synonymous.

Ⅱ.【單選題】51-75 題，每題 2 分，共計 50 分。答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答時，不給分亦不扣分。

(A) 51. What distinguishes a coelomate animal from a pseudocoelomate animal is that coelomates?
(A) have a body cavity completely lined by mesodermal tissue, whereas pseudocoelomates do not.
(B) have a complete digestive system with mouth and anus, whereas pseudocoelomates have a digestive tract with only one opening.
(C) have a gut that lacks suspension within the body cavity, whereas pseudocoelomates have mesenteries that hold the digestive system in place.
(D) contain tissues derived from mesoderm, whereas pseudocoelomates have no such tissue.
(E) have a body cavity, whereas pseudocoelomates have a solid body.

(C) 52. The pathway leading to the perception of sound begins with the hair cells of the organ of Corti,
(A) which rests on the tympanic membrane, coming in contact with the tectorial membrane.
(B) which rests on the tectorial membrane, coming in contact with the basilar membrane.
(C) which rests on the basilar membrane, coming in contact with the tectorial membrane.
(D) which comes in contact with the tectorial membrane as a result of fluid waves in the cochlea causing vibrations in the round window.
(E) which stimulates the tectorial membrane neurons leading to the auditory section of the brain.

(A) 53. A drug might act as a stimulant of the somatic nervous system if it
(A) increases the sensitivity of the postsynaptic membrane to acetylcholine.
(B) increases the release of substances that cause the hyperpolarization of the neurons.
(C) stimulates the activity of acetylcholinesterase in the synaptic cleft.
(D) makes the membrane permanently impermeable to sodium.
(E) increases the sensitivity of the presynaptic membrane to acetylcholine.

(A) 54. Which of the following word pairs are **MISMATCHED**?
(A) Random distribution: aggressive interaction.
(B) Clumped distribution: attraction to a common source.
(C) Regular distribution: antagonistic behaviors.
(D) Large scale distribution: substantial environmental changes.
(E) Small scale distribution: insignificant environmental changes.

(E) 55. Why would a scientist choose to use DNA analysis rather than isozyme analysis when investigating genetic variations?
(A) Smaller sample size can be used for DNA analysis.
(B) Repeat sampling over a period of time is possible.
(C) Non-injurious to the organism.
(D) Non-lethal.
(E) All of the choices are correct.

(C) 56. Which of the following ecosystems has the highest net primary production (g/m2/yr):

(A) Estuary.
(B) Swamp and marsh.
(C) Algal beds and reefs.
(D) Tropical rain forest.
(E) Temperate deciduous forest.

(C) 57. The frequency of antibiotic resistance increases in human populations which is the result of:
(A) balancing selection.
(B) disruptive selection.
(C) directional selection.
(D) sexual selection.
(E) stabilizing selection.

(D) 58. Bioinformatics is the application of computational methods to the storage and analysis of enormous volumes of biological data. What is the BLAST program in NCBI which has been described by many biologists as the single most important tool in bioinformatics?
(A) It is the tool to find out ESTs (expressed sequence tags).
(B) It is the tool to figure out the protein-protein interaction.
(C) It is the tool to translate the coding sequence.
(D) It is the tool to align the sequences.
(E) It is the tool to look the protein 3D structure.

(D) 59. Which of the following enzyme(s) is/are involved in the human nucleotide excision repair of UV-induced pyrimidine dimers?
1. endonucleases 2. DNA ligase 3. DNA polymerase 4. photoreactivating enzyme (DNA photolyase)
(A) 1. (B) 1 and 3. (C) 2 and 4. (D) 1, 2 and 3. (E) All of them.

(B) 60. Which of the following statement regarding the transcription initiation and RNA Pol I is **NOT** true?
(A) The regulatory sequences include a core element and an upstream element.
(B) RNA Pol I is responsible for synthesizing tRNAs and 5S-rRNA.
(C) An active Pol I initiation complex contains multi-protein complexes assembled in order.
(D) RNA Pol I is responsible for synthesizing rRNA.
(E) RNA Pol I itself is a multi-subunit complex.

(E) 61. Which of the following is **NOT** a characteristic of microRNAs?
(A) MicroRNAs are found in eukaryotes including animals and plants.
(B) MicroRNAs regulate gene expression by degradation of specific mRNAs.
(C) MicroRNAs regulate gene expression by translational inhibition of specific mRNAs.
(D) MicroRNAs usually act as negative regulator of gene expression.
(E) MicroRNAs can function when they are short double-stranded RNA.

(B) 62. Stigmasterol, ergosterol, bile acids, vitamin D, cholesterol and share all the following common features **EXCEPT**
(A) four-ring structure.
(B) a carboxylic acid group.
(C) contain asymmetric structure.
(D) an extending carbon chain derived from the ring structure.
(E) a hydroxyl group on first ring.

(D) 63. Meiosis is a special type of cell division. Which of the following mechanism(s) occur during meiosis guarantees that each haploid germ cell will have a unique combination of gene alleles that is distinct from each parent as well as every other haploid germ cell generated?
(A) Recombination.
(B) Reassortment.
(C) Duplication.
(D) A and B.
(E) A, B and C.

(B) 64. Which of the following statements is true of Trichomonas vaginalis?
(A) It is a prokaryote. (B) It lacks true mitochondria.
(C) It has mitosomes. (D) It infects the human gastrointestinal tract.
(E) It has cilia.

(D) 65. The rate of an enzyme catalyzed reaction:
1. can be determined by measuring the increase in product concentration with respect to time.
2. is usually dependent on temperature and pH.
3. at saturating substrate concentrations, becomes zero-order with respect to substrate.
4. is independent of the enzyme concentration.
(A) 1. (B) 1 and 3. (C) 2 and 4. (D) 1, 2 and 3. (E) All of them.

(E) 66. Which one **FALSELY** describes a genomic library?
(A) A genomic library must be performed with a restriction enzyme, a DNA ligase, and a reverse transcriptase.
(B) A genomic library contains only coding sequences.
(C) Plasmids can be used the cloning vector for making genomic libraries.
(D) A genomic library is a “shotgun” approach-no single gene is targeted for cloning.
(E) None of the above.

(E) 67. The ostrich and the emu look very similar and live in similar habitat. However, they are not very closely related. This is an example of
(A) sympatric speciation. (B) divergent evolution.
(C) exaptation. (D) adaptive evolution.
(E) None of the above.

(E) 68. Which one of the statements about the domain of Archaea is correct?
(A) They must inhabit solution are nearly 30 % salt.
(B) They must not adapt to waters with temperatures above the boiling point.
(C) Based on DNA analysis, they are probably more closely related to bacteria than to eukaryotes.
(D) Archaean cell walls are composed of peptidoglycan.
(E) None of the above.

(C) 69. Which of the following groups is matched with its members?
(A) Proteobacteria-diverse gram-positive bacteria.
(B) Chlamydias-extracellular parasites.
(C) Spirochetes-helical heterotrophs.
(D) Gram-positive bacteria-diverse pathogens whose endotoxins are components of their embrane.
(E) Cyanobacteria-solitiary and no photosynthesis.

(A) 70. Lichens sometimes reproduce asexually using
(A) soredia. (B) ascocarps.
(C) basidiocarps. (D) conidophores.
(E) aseptate fugal hyphae.

(D) 71. Which one of the statements is **INCORRECT** for the major difference between ectomycorrhizae and endomycorrhizae?
(A) Endomycorrhizae but not ectomycorrhizae form a dense sheath over the surface of the root.
(B) Ectomycorrhizae are found in about 90% of plant families.
(C) Ectomycorrhizae do not penetrate root cells, whereas endomycorrhiza grow into the invaginations of the root cell membranes.
(D) A and B only.
(E) A, B and C.

(B) 72. Auxin can be functioned as **EXCEPT**
(A) herbicides.
(B) the detection of photoperiod.
(C) formation of adventitious roots.
(D) phototropism.
(E) cell elongation.

(A) 73. What does the infected plant produce in response to the attacking of a pathogenic fungus?
(A) Phytoalexins.
(B) Phytochrome.
(C) Statoliths.
(D) Antisense RNA.
(E) None of the above.

(E) 74. It is estimated that humans can produce over 1.5 million different types of antibodies. Which of the following statements regarding this extraordinary variation is correct?
(A) V and J domains of antibody light chains are randomly joined.
(B) Random segments of DNA can be removed from antibody genes.
(C) V and J domains of antibody heavy chains are randomly joined.
(D) Cytosines in the variable regions of antibody genes can be converted to uracils via hypermutation.
(E) All of the above.

(C) 75. Blue flower color (B allele) is dominant to white (b allele). In a population plants with white flowers (bb) are at a frequency of 0.04. What frequency of the alleles are for white flower color (b)?
(A) 0.04 or 4%. (B) 0.16 or 16%. (C) 0.2 or 20%. (D) 0.8 or 80%. (E) 0.96 or 96%.