中國文化大學 九十 學年度碩士班入學考試

所(組)別： 生物科技研究所　　考試科目： 分 子 生 物 學

題目共分爲兩大部份，第一部份爲獨立之單一選擇題，共 20 題(第 1 至 20 題)。第二部份爲連鎖填空題，共 3 題(第 21 至 23 題)。關於第一部份請在答案卷上畫一個如下列所示之表格，然後依題序寫下答案，每一題 3 分，第一部份之總分爲 60 分。第二部份之連鎖填空題，總共 20 格，每格 2 分，第二部份總分爲 40 分，也請於答案卷上，依題目所示之表格(標示題號)，畫於答案卷上並依序作答，每一空格只有一種答案，題目紙共 6 頁。

1		6		11		16	
2		7		12		17	
3		8		13		18	
4		9		14		19	
5		10		15		20	

題目：

第一部份

1. By differentially labeling the coat protein and the DNA of phage T2, Hershey and Chase demonstrated that
   A) only the protein enters the infected cell.
   B) the entire virus enters the infected cell.
   C) a metaphase chromosome is composed of 2 chromatids each containing a single DNA molecule.
   D) the phage genetic material is most probably DNA.
   E) the phage coat protein directs synthesis of new progeny phage

2. Below are listed five DNA sequences. One of these sequences is found on one of the two strands of a DNA palindrome. Which one?
   A) AAGCCGTT
   B) CGAAGCTT
   C) GGCCTTAA
   D) TTGATCAA
   E) GCAAGCAA

3. A biochemical pathway making pigments shows the following sequential color conversions. each catalyzed by separate enzymes, A, B, and C

$$\text{Colorless} \xrightarrow[A]{} \text{yellow} \xrightarrow[B]{} \text{blue} \xrightarrow[C]{} \text{red}$$

A null mutation in each of the genes that produce the enzymes A and B will result in a phenotype that is:

A) orange
B) blue
C) yellow
D) red
E) white

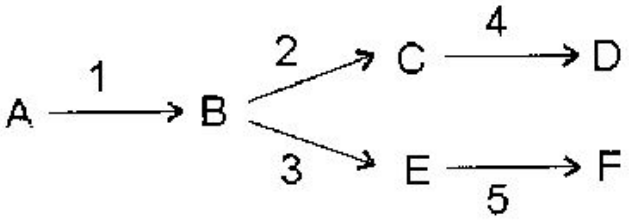
4. Five nutritional mutants in Neurospora were independently isolated They all require compound F to grow. Intermediate compounds in the biosynthesis of compound F are known and tested for their ability to support the growth of each mutant. The results are given in the table below, where "+" indicates growth and "0" indicates no growth.

	Compounds					
Mutants	A	B	C	D	E	F
1	0	0	0	+	0	+
2	0	+	0	+	0	+
3	0	0	0	0	0	+
4	0	+	+	+	0	+
5	+	+	+	+	0	−

Assuming a linear pathway, what is the order of the compounds A through F?

A) EABCDF
B) ECBDAF
C) ECDBAF
D) EACBDF
E) EBACDF

5 A branched biochemical pathway synthesizes two related essential amino acids D and F.



A mutant defective for enzyme 2 will grow on minimal medium supplemented with which of the following (choose the answer for which both amino acids will produce growth when added singly)?

A) A, B
B) E, F
C) C, F
D) D, F
E) C, D

6. Which of the following acts before the others?
   A) tRNA alignment with mRNA
   B) Aminoacyl-tRNA synthetase
   C) RNA polymerase
   D) Ribosome movement to the next codon
   E) Amino acid chain elongation

7. The role of tRNA is
   A) To serve as an intermediate in the decoding of genes
   B) To act as transporters bringing amino acids to the site of protein synthesis
   C) To serve as general translational components of the ribosome
   D) To facilitate splicing of pre-messenger RNAs
   E) To facilitate protein trafficking in protein secretion

8. Which of the following is not translated from an mRNA molecule?
   A) Repressor
   B) RNA polymerase
   C) Permease
   D) Transacetylase
   E) Lactose

9. A null repressor mutation (I^-) results in
   A) No transcription
   B) Inducible transcription
   C) Transcription but no translation
   D) No translation
   E) Constitutive transcription

10. A partial diploid of genotype $I^- P^+ O^+ Z^+ / I^+ P^+ O^+ Z^-$ will show
    A) Inducible production of repressor
    B) Inducible production of β-galactosidase
    C) Constitutive production of β-galactosidase
    D) No production of β-galactosidase
    E) Constitutive production of lactose

11. RNA polymerase binds to the promoter and transcribes the ara operon. In the presence of arabinose, both the CAP-cAMP complex and the araC -arabinose complex must bind to
    A) araO
    B) araI
    C) araA
    D) araB
    E) araD

12. In the presence of the repressor molecule and tryptophan, the trp operon is
    A) Constitutively transcribed
    B) Derepressed
    C) Induced
    D) Repressed
    E) Transcribed but not translated

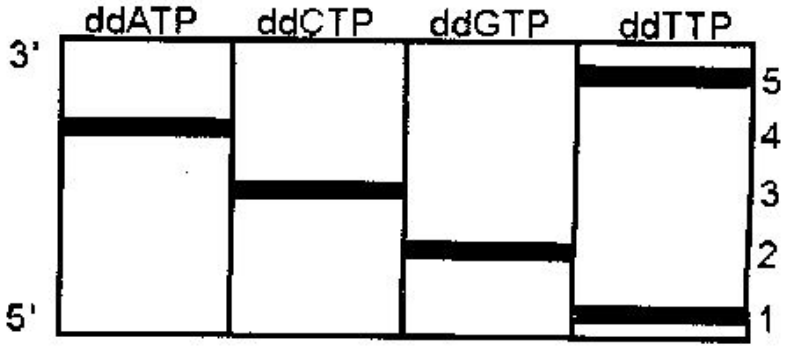
13. A circular DNA molecule has n target sites for restriction enzyme *EcoR*I. How many fragments will be produced after complete digestion?
    A) n -1
    B) n
    C) n + 1
    D) 2n +1
    E) Depends on number of doubled fragments

14. A plasmid vector has a gene for erythromycin resistance (*EryR*) and a gene for ampicillin resistance (*AmpR*). The *Amp* gene is cut with restriction enzyme, and donor DNA treated with the same enzyme is added. What genotype of cells needs to be selected to show evidence of transformation?
A) *AmpREryR*
B) *AmpREryS*
C) *AmpSEryR*
D) *AmpSEryS*

15. Assume a cosmid will carry inserts of about 50 kb, and cosmids are used to clone a 3 Mb (megabase) genome. Assuming you are particularly lucky, what is the smallest number of cosmid clones you would need for a genomic library?
A) 3000
B) 606
C) 303
D) 60
E) 30

16. A 1-kb gene is labeled at one end with ^{32}P and partially digested with restriction enzyme *BglII*. Electrophoresis followed by Southern blotting and autoradiography reveals four bands of sizes 0.1, 0.4, 0.6, and 1 kb. The *BglII* restriction sites are separated by which of the following distances in the order shown (starting from the labeled end)?
A) 0.1—0.4—0.6—1.0
B) 1.0—0.6—0.4—0.1
C) 0.4—0.3—0.2—0.1
D) 0.1—0.3—0.2—0.4
E) 1.0—1.1—1.4—1.6

17. After using the Sanger method for sequencing DNA (dideoxy nucleotide method), you observe the following autoradiogram:



From the autoradiogram determine the base sequence of the template strand:
A) 3'-TACGT-5'
B) 5'-TGCAT-3'
C) 3'-ACGTT-5'
D) 5'-ATGCA-3'
E) 5'-TTGCA-3'

18. In a certain diploid plant 2n = 24 and all the chromosomes are small. If DNA is extracted from plant tissue in mitotic metaphase and run on a pulsed-field electrophoresis gel, how many DNA bands should be visible?
A) 6
B) 12
C) 24
D) 48
E) 96

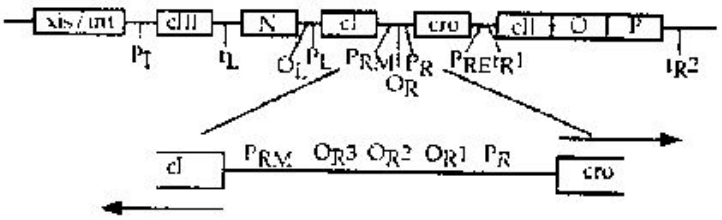
19. If you were making libraries of large genomes such as those of mammals, which of the following vectors would be the best to use?
A) YAC
B) pUC18
C) pBR322
D) Lambda phage
E) A cosmid

20 A RAPD analysis of a culture arising from a yeast ascospore amplified four different-sized bands These bands are
A) From four different chromosomes
B) From two homologous chromosome pairs
C) From four different chromosomal loci
D) From two different chromosomal loci
E) Composed entirely of repetitive DNA

第二部份

21 Bacteriophage lambda can follow either a lytic or a lysogenic infectious cycle in its host cell *E. coli*. Below is shown the genome organization of the lambda DNA where the early events of gene expression take place:

Bacteriophage Lambda Regulatory Region



Predict the result of the following genetic changes in the lambda genome. If the indicated part of the infectious cycle can take place in the presence of the mutation, write "YES." If it cannot, write "NO."

	Can Phage Lambda Carry Out	
Mutations:	The lytic cycle?	The lysogenic cycle?
Deletion of the cI gene		
Deletion of the OR1 region		
Deletion of the OR3 region		
Deletion of the cII gene		

22. Both prokaryotic and eukaryotic cells produce messenger RNA. However, significant differences exist between these molecules in these two cell types. Indicate, with a "YES" or a "NO" in the Table, which of the features is present in which mRNA.

Feature	Prokaryotic mRNA	Eukaryotic mRNA
Shine-Dalgarno sequence upstream from start		
AUG codon as initiation signal		
5' and 3' post-transcriptional modifications made		
Actively translated mRNA present as polyribosomes		

23. You have discovered an extraterrestrial bacterium in samples returned from a Mars expedition. This is a carbon-based life form that utilizes the same mode of gene expression as earth forms. Although the proteins of this bacterium are composed of the same 20 amino acids found on earth, the nucleic acids have different nitrogenous bases. In RNA from this bacterium, the bases are W, X, Y, and Z. Your objective is to begin deciphering the genetic code of this organism. You use the same system as employed years ago by workers to decipher the earth-based genetic code. You prepare synthetic RNAs and incubate them with ribosomes and charged tRNAs in an artificial system that does not require specific initiation signals. Your initial results are as follows:

(Note: the synthetic mRNAs have the sequence shown and are more than 100 nucleotides long. The peptides are as indicated, where the subscript "n" indicates a polymer composed of repeating units as shown within the parentheses.)

What are the triplet codons (composed of the bases X and Y) that specify the following amino acids in this Martian bacterium?

Amino Acid	Codon
pro	
leu	
thr	
ala	

中國文化大學 九十 學年度碩士班入學考試	
所(組)別：生物科技研究所 （乙組）	考試科目：微 生 物 學

（一）簡單說明下列菌種在生物技術的應用（12%；每一小題 3%）

1. Bacillus thurigenesis
2. Penicillum chrysogenum
3. Lactobacillus bulgaricus
4. Saccharomyces cerevisiae

（二）圖示並說明 E. coli 培養於含葡萄糖及乳糖二種碳源的培養基時，其生長曲線及碳源變化。（10%）

（三）請回答下列有關 Gram stain 的問題。

(1)比較 G(+)及 G(-)細胞壁的組成及構造。（10%）

(2)在革蘭氏染色步驟中，有一步驟可以被省略，而仍能區分 G(+)及 G(-)。請問是哪一步驟？並請解釋此結果。（6%）

（四）試舉出四種特性來區別 eucaryotes 及 procaryotes. (8%)

（五）簡要說明細菌可藉由哪三種途徑而達到基因之重組。(9%)

（六）試述 ELISA 應用於檢測微生物的分析原理. (9%)

（七）解釋名詞（每一小題 4%）

1. Pasteruization
2. Temperate phage
3. Prion
4. Selective medium
5. Archaebacteria
6. Autotroph
7. Auxotroph
8. Psychrophiles
9. Endotoxin

壹、簡答題(每題五分；合計七十分)

1.試說明無維管束植物之種類及構造。(5%)

2.試寫出一種植物之學名，並以林奈之二名法說明。(5%)

3.試說明 virus 與 mycoplasma 之構造。(5%)

4.試說明 anabolism 及 catabolism。(5%)

5.試說明主動運輸與擴散之區別。(5%)

6.試說明濕生植物之型態及細胞的特性。(5%)

7.單子葉及雙子葉植物莖之構造上有何不同?(5%)

8.Plastids 依其顏色及作用之特性可分為哪些?(5%)

9.試述 coenzyme 之作用。(5%)

10.Sun leaves 及 shade leaves 之構造上有何不同?(5%)

11.試說明 abscission zone 之構造及分離前之變化。(5%)

12.試舉例說明多花果。(5%)

13.試說明 annual growth ring 之形成，以及以其評估時須注意之問題。(5%)

14.試以 starch-statolith hypothesis 說明向地性。(5%)

貳、問答題(每題十分；合計三十分)

1.試比較薄壁細胞，厚角細胞與厚壁細胞之構造及功能上之差異。(10%)

2.試說明族群〔population〕，群落〔community〕以及生態系〔ecosystem〕。(10%)

3.試說明 CO_2 及 K^+ 濃度對於氣孔開閉之影響。(10%)

中國文化大學 九十 學年度碩士班入學考試

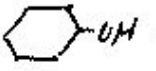
所(組)別：生物科技研究所 (乙組) | 考試科目：有機化學

58% A Give the major products of the following reactions:

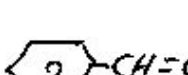
1. $CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2 + HBr \longrightarrow$

2. $(CH_3)_2C=C(H)-H \xrightarrow[-75^\circ C]{O_3} \xrightarrow[H_2O]{Zn} A + B$

3. $CH_3CH_2CH_2CH_2OH \xrightarrow[\Delta]{H_2SO_4}$

4.  $\xrightarrow[H_2SO_4]{K_2Cr_2O_7} A \xrightarrow[H_2, Ni]{2H_2} B$

5.  $\xrightarrow[Conc.\ HCl]{Zn(Hg)}$

6.  $\xrightarrow[peroxides]{HBr}$

7. $CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2 \xrightarrow{(BH_3)_2} \xrightarrow[OH^-]{H_2O_2}$

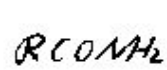
8. $CH_3-C\equiv C-H + H_2O \xrightarrow[HgSO_4]{H_2SO_4}$

9.  $\xrightarrow{H_3O^+}$

10. $CH_3CH_2\underset{O}{C}CH_3 \xrightarrow[H_2O]{NaBH_4}$

11. $RCONH_2 \xrightarrow{OBr^-}$

12. CH_3-  -$OH \xrightarrow[H_2SO_4]{HNO_3}$

13.  $\xrightarrow[NaHSO_3]{NaCN} A \xrightarrow[HCl]{H_2O} B$

14. $CH_3CH=CH_2 + H_2O \xrightarrow{H_2SO_4}$

15. $(CH_3CO)_2O + CH_3OH \longrightarrow A + B$

16. $RMgX + CO_2 \rightarrow A \xrightarrow{HX} B$

17.  $+ C_2H_5MgX \xrightarrow{H_2O}$

4% B Compare the b.p. of the following compounds.

$CH_3CH_2CH_2CH_2OH$, $CH_3CH_2CH_2CHO$, $CH_3CH_2-O-CH_2CH_3$

4% C. (i) How to differentiate $CH_3CHOHCH_3$ and $CH_3-\overset{CH_3}{\overset{|}{\underset{OH}{C}}}-CH_3$?

(ii) How to differentiate CH_3OH and CH_3-CH_2OH ?

4% D. Give the stability order of the following free radicals:

$(CH_3)_3C\cdot$, $(CH_3)_2\dot{C}H$, $CH_3\dot{C}H_2$, $\dot{C}H_3$

( ) 1.下列敘述何者正確 (1)豆科植物缺鉬時，會顯現出缺氮的病徵 (2)過量的磷會提高莖/根比 (3)缺鐵時，最先顯現出病徵是老葉 (4)需要鈉的植物通常是 C3 植物

( ) 2.下列敘述何者錯誤 (1) plasma membrane proton-pumping ATPase 可被 vanadate 離子抑制 (2) tonoplast proton-pumping ATPase 可被 oligomycin 抑制 (3)Mitochondrial proton-pumping ATPase 可被 nitrate 抑制

( ) 3.下列對於初質離現象(incipient plasmolysis)的敘述何者正確 (1)$\psi=0, \psi p=\psi s$ (2) $\psi p=0, \psi=\psi s$ (3) $\psi s=0, \psi=\psi p$ (4) $\psi=\psi p=\psi s$

( ) 4.下列敘述何者錯誤 (1)triazine 除草劑可和 PSII 的 D1 蛋白上的 QB site 結合 (2)玉米根含可分解 triazine 的酵素 (3) triazine 阻斷電子傳遞給 plastoquinone (4) triazine 可還原氧成爲超氧

( ) 5.下列敘述何者錯誤 (1)PS I 分佈於 thylakoid 的非擠壓膜 (2)PS II 分佈於 thylakoid 的擠壓膜 (3)ATP synthase 分佈於 thylakoid 的非擠壓膜 (4)cyt *b/f* 分佈於 thylakoid 的擠壓膜

二、 填充題: 每格 3 分

1.在植物的根或葉片中, NO_3^- 被____(1)____還原爲 NO_2^-，在根部 NO_2^- 移入____(2)____,而在葉部則移入____(3)____，在此 NO_2^- 被____(4)____快速還原爲 NH_4，產生的 NH_4 被____(5)____系統快速同化爲有機氮。

2.植物藉根分秘的____(6)____和____(7)____溶解及吸收溶解度低的無機鐵。

3.在 C4 植物葉片中，___(8)____位於___(9)____細胞，當光呼吸作用產生的 CO_2 擴散通過___(10)____細胞時，會被___(11)____再固定，故無法測出 C4 植物是否有光呼吸作用。

4.合成纖維素的酵素____(12)____位於細胞的____(13)____。

5.IAA 和___(14)____可促進 ethylene 之產生，主要是誘導____(15)____之合成。

三. 問答題:1-6 題，每題 5 分 ； 第 7 題 10 分

1.試述熱帶地區生長之豆科植物如大豆,固化根瘤固定的氨成爲有機氮的方法。

2.試述植物避免光合系統受光氧化作用破壞的兩種方法。

3.試述光敏素系統(phytochrome system)在好光性種子發芽時扮演的角色。

4.試述調節 rubisco 活性之機制。

5.試討論 GA 的結構與活性的關係。

6.試述 ABA 在葉肉細胞之細胞質和葉綠體的分佈變化與水分逆境的關係。

7.試解釋下列各片語: (1) aquaporins
(2) cryptochrome
(3) Emerson enhancement effect
(4) leghemoglobin
(5) kranz anatomy

中國文化大學 九十 學年度碩士班入學考試

所(組)別： 生物科技研究所　　考試科目： 生 物 化 學

I. Plaese define the following terms. (16%)

(1) Active center
(2) Chiral center
(3) Enantiomer
(4) Racemic compound
(5) Holoenzyme
(6) Apoenzyme
(7) Abzyme
(8) Ribozyme

II. Please describe the usefulness of the following reagents in biochemical experiments. (16%)

(1) 2-Mercaptoethanol
(2) Cesium chloride
(3) Ethidium bromide
(4) Cyanogen bromide
(5) Phenylisothiocyanate
(6) Dansyl chloride
(7) Trypsin
(8) Reverse transcriptase

III. Please describe the biochemical or physiological function of the following biomolecules. (18%)

(1) Hemoglobin A
(2) Cytochrome C
(3) Coenzyme Q
(4) Vitamin B_6
(5) tRNA
(6) mRNA

IV. Please give the name and chemical structure of a protein-derived amino acid which contains two asymmetric carbons. (8%)

V. The density of pure water is about 1 g/cm^3 at 4℃. Please calculate the number of molecules in 3 μl of water. (10%)

VI. Assuming the ion product of water, $K\omega=10^{-14}$ (mol/l)^2, please calculate the pH value of 0.01 M NaOH solution. (10%)

VII. An aqueous solution of "compound X" has an absorbance of 1.0 at 280 nm. Assuming its ε_M=5000 M^{-1}cm^{-1}, please determine the concentration of this compound. (10%)

VIII. An aqueous solution contains lysine and glutamic acid. In order to isolate one of them by isoelectric precipitation, what pH you will use? Please give reasons for your decision. (12%)

中國文化大學 九十 學年度碩士班入學考試

所(組)別： 生物科技研究所 （乙組） 考試科目： 生 理 學

I. 問答題: (48 分)

1. 試述腎元(Nephrone)之構造，並詳述其各部位之構造特徵及其與尿液形成之關係。(15 分)
2. 試分別描述內分泌系統負責調節水分與電解質、鈣與磷之腺體、內泌素及其靶器官 (Target tissues)。(15)
3. 試從運動神經之神經衝動傳遞、骨骼肌細胞之接受刺激及肌細胞收縮之發動至肌細胞之收縮之過程描述 Excitation-Contraction Coupling。(18 分)

II. Definition: (52 分)

1. Hypothalamus
2. Hemostasis
3. Thermogenesis
4. Connective tissue
5. Osteoclast
6. Synapse
7. Sympathetic chain
8. Fossa ovalis
9. Respiratory membrane
10. Blood brain barrier
11. Lipoproteins
12. Ovulation
13. Spermatogenesis

中國文化大學 九十 學年度碩士班入學考試

所(組)別： 生物科技研究所 （甲組） 考試科目： 遺 傳 學

生科所遺傳學考題

一. 問答題 每題 10 分

1. Although albino were frequently found in animals or plants, albino tiger was rare, If you find a male albino tiger in a tropical rain forest, how would you reproduce another albino tiger ? please show the pedigree.
2. Presumably that a cross AABBcc × aa bbCC was made in pea, in which A and B are dominant but there is no dominance between C and c. Consider the F2 progeny from this cross. A) How many phenotypes can you find in F2 ? B) What is the probability of the genotype AABbCc in F2 ? c) what is the probability of the genotype aabbcc in F2?
3. What is the main points of doing " Human genome project " ? Since typical human families are quite small and our life span is so long , very few generation can be monitored, genetic experiment is largely restricted to model organism. Please list the five model organism hat are most commonly used in genome analysis. What can "Human genome project " be applied for ?

二. 請寫出英文專有名詞 (English term) 每題 3 分

1. _____ Chromatin that remains condensed and heavily stained during interphase.
2. _____ An extrachromosomal genetic material that replicates independently of the host chromosome. It may exist in one or many copies per cell.
3. _____ The condition in which single mutant gene affects two or more distinct and seemingly unrelatd traits.
4. _____ Eukaryotic DNA that forms a minor band at a different density from that of most of the cellular DNA in equilibrium density gradient centrifugation.
5. _____ A complex structure that forms between synapsed homologous chromosomes in the pachytene substage of the first meiotic prophase.
6. _____ A nuclease that recognizes and cut a short nucleotide sequence at a specific site.
7. _____ A DNA element that can move from one genomic location to another.
8. _____ a genetic disease in which patients can not produce normal β-globin, because of a single amino acid change, the blood protein tends to aggregate under low oxygen condition.
9. _____ a cross between F1 and the recessive parent.
10. _____ a photographic representation of all the chromosome in a given individual.

三. 選擇 每題 3 分 ,第13題4分.

1. 18S rRNA gene was found in A) satellite B) secondary constriction C) nuclear

plasm D) cytoplasm E) telocentric chromosome F) primary constriction .

2. Barr body is darkly staining body , consists of the condensed inactivated X chromosome, it can be found in all the cells of female mammals. A) Yes B) No
3. If you find an organism with 10 bivalents in a metaphase I cell, what would be the chromosome number in its somatic cell ?
   A) 10 B) 20 C) 40 E) 60 F) 80 G) 0 H) none of the above.
4. Okazaki fragment is a short strand of DNA produced during replication of the leading strand. A) Yes B) NO
5. In human population, 40 color blind were found in 1000 female , what will be the frequency of male color blind = ? A)0.04 B)0.02 C) 0.01 D) 0.2. E) none of the above .
6. The chromosome number of a cat's somatic cell is 2N = 44, then what is its genomic chromosome number ? A) 11, B) 22 C) 33 D) 44 E) 66 F) 88.
7. Tay Sach disease patient carry lethal gene, the selection coefficient of a patient will be A) 0.0 B)0.5 C)0.8 D)1.0 E) 100 F) none of the above.
8. In college, students major in biology tend to marry someone major in the same department, genetically this is a kind of A) Disassortative mating B) assortative mating C) random mating D) inbreeding E) outbreeding F) natural selection.
9. In single strand DNA the proportion of (A+G)/ (T+C) = 0.6, what will be the proportion of (A+T)/(G+C) of its complementary strand ? A) 0.4 B) 0.6 C) 1.0 D) 1.2 E) 1.66 F) none of the above.
10. If two pairs of gene are responsible for a single trait , what will be the proportion of F_2 ? A) 1:1 B) 1:2:1 C) 3:1 D) 1:4:6:4:1 E) 9:3:3:1 F) 1:1:1:1 G) none of the above.
11. Which one of the following DNA composition may have the highest melting temperature ? A) double strand DNA with 60% G+C, B) double strand DNA with 30% A+T, C) double strand DNA with 40% G+C, D) double strand DNA with 20% A+T .
12. What kind of chromosome variation was found in Down's syndrome patient ? A) extra chromosome B) duplication C) inversion D) deletion E) translocation .
13. Which of the following may cause gene recombination ? A) transformation B) conjugation C) transduction D) crossing over E) all of the above F) none of the above.