國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

單選題：請從 ABCDE 選項中選出一個最正確的答案 答錯不倒扣. 第 1-15 題 每題 1 分；第 16-45 題 每題 2 分；第 46-70 題 每題 3 分.

1. Glutamic acid contains two carboxylic acid groups (pK_a = 2.2 and 4.2) and an amine group (pK_a = 9.7). What is the pI for glutamic acid? What is glutamic acid's net charge in a solution with pH =7.4?

   A) 3.2, negative charge
   B) 6.0, negative charge
   C) 6.5, no charge
   D) 7.0, positive charge
   E) none of the above

2. Which is the description about an allosteric interaction between a ligand and a protein?

   A) binding of a molecule to a binding site affects binding of additional molecules to the same site
   B) binding of a molecule to a binding site affects binding properties of another site on the protein
   C) binding of the ligand to the protein is covalent
   D) multiple molecules of the same ligand can bind to the same binding site
   E) two different ligands can bind to the same binding site

3. Which of the following is an irreversible form of inhibition?

   A) suicide inhibitor
   B) competitive inhibitor
   C) noncompetitive inhibitor
   D) uncompetitive inhibitor
   E) none of the above

4. Amphetamine and mescaline cause hallucinogenic effect by stimulating the central nervous system. They are the agonist of

   A) acetylcholine
   B) GABA
   C) NMDA
   D) glutamate
   E) dopamine

5. Steroid hormones, such as glucocorticoids, affect their action by:

   A) binding to a plasma membrane receptor and then activating the kinases cascade.
   B) binding the plasma membrane receptor, which stimulates the receptor to enter the cell.
   C) entering into the cell and affecting the production of secondary messengers.
   D) entering into the cell and then acting as transcription regulators.
   E) none of the above.

高點醫護【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

6. Which of the following, when paired with its complementary strand, would have the highest Tm?

A) AAGTTCCAGTAA
B) ATTACGAGCTAT
C) GCAGCAGCATTT
D) GCGAAATCAATA
E) TGACCTTGAATT

7. Diphtheria toxin kills cells by inactivating EF-2 proteins. Which process is inhibited by the diphtheria toxin?

A) Movement of DNA polymerase on the template DNA
B) Promoter clearance of the RNAPII
C) Movement of RNAPII on the template DNA
D) Ribosome assembling on the mRNA
E) Ribosome translocation

8. Glycerol generated from hydrolysis of triacylglycerols enters which one of the following intermediates in glycolysis?

A) glyceraldehyde-3-phosphate.
B) 2-phosphoglycerate.
C) 3-phosphoglycerate.
D) dihydroxyacetone phosphate.
E) 1,3-bisphosphoglycerate.

9. The common product produced by Complex I and Complex II in the electron transport chain is:

A) NAD^+.
B) FAD.
C) reduced O_2.
D) reduced cyt c.
E) reduced coenzyme Q.

10. Which one of the following factors is NOT an antioxidant to cope with oxidative stress?

A) catalase.
B) uric acid.
C) vitamin B6.
D) vitamin C.
E) SOD.

11. The coenzymes used by acetyl-CoA carboxylase is/are:

A) biotin.
B) pyridoxal phosphate and TPP.
C) folic acid and TPP.
D) NADH.
E) FAD.

高點醫護 【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

12. How are glutamic acid, arginine, and proline related in the process of amino acid biosynthesis?

A) All are derived from acetyl CoA.
B) All are derivatives of α-KG.
C) All are derivatives of pyruvate.
D) All are derived from aspartate.
E) All are derivatives of 3-phosphoglycerate.

13. Which one of the following is NOT the substrate of carbamoyl phosphate synthetase II (CPS-II)?

A) ATP.
B) H_2O.
C) HCO_3^-.
D) glutamine.
E) NH_4^+.

14. What is the coenzyme responsible for the addition of two single carbon in purine biosynthesis?

A) biotin.
B) SAM.
C) THF.
D) TPP.
E) none of the above.

15. During the fasting or starvation, the brain will

A) convert endogenous fatty acids into β-hydroxybutyrate.
B) utilize β-hydroxybutyrate from the blood stream.
C) utilize its glycogen stores as a first responding source of fuel.
D) utilize amino acids for fuel from degradation of brain protein.
E) all of the above.

【版權所有，翻印必究】

16. The pH of a blood sample is 7.4, while gastric juice is pH 1.4. Which of the following is *true*?

1) the $[H^+]$ in the blood sample is higher than in the gastric juice
2) the difference of $[H^+]$ between the gastric juice and the blood sample is one million times
3) the $[H^+]$ in a blood sample is lower than in the gastric juice
4) the difference of $[H^+]$ between the gastric juice and the blood sample is 5.29 times
5) the difference of $[H^+]$ between the gastric juice and the blood sample is 6000 times

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

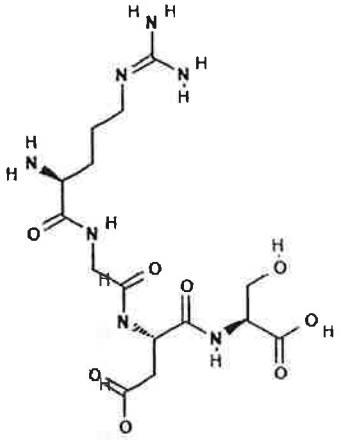
　背面有題，請繼續作答。

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

17. What is the amino acid sequence of the following peptide starting from the N-terminal end?



A) KDS
B) RDT
C) SDGR
D) RGDS
E) KGDS

18. Which of the following type of mutations is correctly defined?

A) silent: change of a single base in the non-coding region of a gene
B) missense: substitution of a single base results in a premature stop codon
C) nonsense: substitution of a single base results in a complete change of amino acid sequence
D) frameshift: deletion of a single base results in a single amino acid change
E) none of the above

19. An enzyme-catalyzed reaction was carried out with the substrate concentration initially a thousand times greater than the Km for that substrate. After 12 minutes, 1% of the substrate had been converted to product, and the amount of product formed in the reaction mixture was 20 μmol. If, in a separate experiment, 30 % as much enzyme and twice as much substrate had been combined, how long would it take for the same amount of product to be formed?

A) 6 min
B) 12 min
C) 40 min
D) 18 min
E) 4 min

20. About DNA replication in eukaryotic cells, which of the following statement is correct?
1) There are multiple replication origins.
2) Two strands of the DNA are replicated independently
3) DNA could only be synthesized in a 5' to 3' direction
4) Semi-conservative replication describes that two DNA copies in diploid cells are replicated separately.
5) Misincorporation of ribonucleotides during replication is possible.

A) 1, 3, 5
B) 2, 3, 4
C) 1, 2, 3
D) 1, 3
E) All of the above

高點醫護【版權所有，翻印必究】

國立中興大學 111 學年度學士後 醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目 不可以使用計算機　　本科目試題共 16頁

21. Post-translational modifications are critical for the regulation of biological processes. Which of the followings are the examples of post-translational modifications of proteins?
1) activation of pro-caspase 3 to caspase 3
2) converting PIP2 to PIP3 by PI3 kinase
3) activation of protein kinase A by cAMP
4) activating NF-κb through Iκb kinase
5) epigenetic regulation by histone codes

A) 1, 3, 4, 5
B) 1, 2, 4, 5
C) 1, 4, 5
D) 2, 3, 4
E) All of the above

22. The Crispr/Cas9 is the approach using DNA damage and repair to modify the genomic DNA. Select the type of DNA damage and the type of repair mechanism involved in this approach.
1) single-strand breakage, 2) double-strand breakage, 3) DNA adduct, 4) inter-strand crosslinking, 5) gap-filling, 6) homologous recombination, 7) nucleotide excision repair, 8) base excision repair, 9) non-homologous end joining

A) 1, 6
B) 2, 5
C) 3, 7
D) 4, 9
E) None of the above

23. Which of the following is known to be involved in transcription initiation by eukaryotic RNA polymerase II?

1) DNA helicase activity
2) DNA polymerase activity
3) Formation of an open complex
4) Protein binding to specific DNA sequences
5) Protein phosphorylation

A) 1, 2, 3, 4
B) 2, 3, 4, 5
C) 1, 3, 4
D) 1 3, 4, 5
E) All of the above

高點醫護【版權所有，翻印必究】

第 5 頁　背面有題，請繼續作答。

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

24. In transforming the Michaelis-Menten equation into a straight-line equation, y = mx + b, the Lineweaver-Burk double reciprocal plot, which of the following is a true representation?

1) slope = K_m/V_{max}
2) y-intercept is $1/V_{max}$
3) x = [S]
4) y = 1/V
5) x-intercept is $1/K_m$

A) 1, 2, 3
B) 1, 2, 4
C) 2, 3, 5
D) 3, 4, 5
E) All of the above

25. Transcription initiation requires the formation of pre-initiation complex (PIC). Which of followings are NOT required for the formation of PIC on the TATA box? 1) enhancer, 2) TAF, 3) RNAPII, 4) TBP, 5) TFIIH, 6) TFIIC

A) 1, 2, 5
B) 1, 6
C) 4, 5
D) 1, 3, 6
E) All of the above are required

26. Which of the following antibiotics function by interfering with the translational process?
1) Chloramphenicol, 2) Vancomycin, 3) Penicillin, 4) Puromycin, 5) Streptomycin

A) 1, 4, 5
B) 2, 4, 5
C) 1, 2, 3
D) 2, 3, 4
E) All of the above

27. Which of the following is true of the lac operon?
1) It is negatively controlled via the lac repressor
2) Lactose is an allosteric regulator of lac repressor
3) Lactose represses the lac operon
4) It is positively controlled via cAMP activator protein (CAP)
5) Glucose has no effect on the regulation of lac operon

A) 1, 3, 4
B) 1, 2, 4
C) 1, 3, 5
D) 1, 2, 3
E) All of the above

高點醫護【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組　　頁

本科目不可以使用計算機　　本科目試題共 16

28. Which of the following is NOT an example of epigenetic regulation?

1) X chromosome inactivation
2) Genomic imprinting
3) Somatic recombination in B cells
4) RNA interference
5) chromatin remodeling

A) 1, 5
B) 2, 4
C) 4
D) 3, 4
E) All of the above are the examples of epigenetic regulation

29. Which one of the following descriptions about the electron number that can be transferred by one FAD or one NAD^+ is correct?

A) 2 for NAD^+; 1 for FAD.
B) 1 or 2 for NAD^+; 2 for FAD.
C) 1 or 2 for NAD^+; 1 for FAD.
D) 2 for NAD^+; 1 or 2 for FAD.
E) 1 for NAD^+; 1 or 2 for FAD.

30. Which one of the following enzymes catalyzes a reversible reaction that is an equilibrium control step of glycolysis?

A) pyruvate kinase
B) glucokinase
C) phosphofructokinase-1
D) aldolase
E) none of the above

31. Please order the following coenzymes according to their sequential involvement in the pyruvate dehydrogenase complex.

I. NAD^+
II. CoA-SH
III. TPP
IV. Lipoate (lipoamide)
V. [FAD]

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

高點醫護【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

32. Which three reactions catalyzed by the enzymes in the citric acid cycle have large negative ΔG values?

I. succinyl-CoA synthetase.
II. fumarase.
III. α-ketoglutarate dehydrogenase.
IV. isocitrate dehydrogenase.
V. citrate synthase.
VI. malate dehydrogenase.
VII. aconitase.
VIII. succinyl-CoA dehydrogenase.

A) I, III, V
B) III, IV, V
C) IV, VI, VIII
D) I, III, VI
E) IV, V, VIII

33. Which one of the following descriptions about the property of uncouplers such as the uncoupling protein-1 is correct?

I. They were briefly used as weight-loss drugs.
II. ATP/ADP ratio increases.
III. Electron transport continues.
IV. They dissipate the proton gradient.
V. Heat is produced.

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

34. Which one of the following is the characteristic of the glycerophosphate shuttle?

A) It only operates efficiently when the [NADH] in the cytoplasm is higher than in the matrix.
B) It shuttles "NADH electron equivalents" across the mitochondrial membrane to yield 1.5 ATP/NADH.
C) It shuttles NADH across the mitochondrial membrane to yield 2.5 ATP /NADH
D) Aspartate is a key component in the shuttle process.
E) Malate is a key component in the shuttle process.

35. Please order the following components of malate-aspartate shuttle into an appropriate sequence.

I. OAA trans-aminated to aspartate
II. OAA reduced to malate
III. Malate oxidized to OAA
IV. Malate translocated to matrix
V. Aspartate translocated to cytosol
VI. Aspartate trans-aminated to OAA

高點醫護 【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

A) I, VI, III, II, IV, V
B) II, I, IV, VI, III, V
C) II, V, IV, III, VI, I
D) III, IV, VI, V, I, II
E) II, IV, III, I, V, VI

36. Which of the following reactions is/are catalyzed by a transketolase in the pentose phosphate pathway?

I. sedoheptulose-7-P + glyceraldehyde-3-P ⇔ ribose-5-P + xyulose-5-P
II. erythrose-4-P + fructose-6-P ⇔ sedoheptulose-7-P + glyceraldehyde-3-P
III. fructose-6-P + glyceraldehyde-3-P ⇔ xylulose-5-P + erythrose-4-P

A) I only
B) II and III
C) II only
D) I and III
E) I and II

37. The first three reactions of β-oxidation of saturated fatty acids are analogous to which sequence of the following metabolic reactions?

A) succinate → fumarate → malate → oxaloacetate
B) oxaloacetate → citrate → isocitrate → α-ketoglutarate
C) isocitrate → α-ketoglutarate → succinate → fumarate
D) phosphoenolpyruvate → pyruvate → acetyl-CoA → citrate
E) α-ketoglutarate → succinyl-CoA → succinate → fumarate

38. The HMG-CoA lyase in ketone body biosynthesis is mechanistically the reverse of the first half of the reaction catalyzed by:

A) aconitase.
B) β-hydroxybutyrate dehydrogenase.
C) pyruvate dehydrogenase.
D) citrate synthase.
E) succinyl-CoA synthase.

39. CDP-diacylglycerols are NOT the precursors for the synthesis of:

A) phosphatidylethanolamine.
B) phosphatidyl glycerol.
C) phosphatidylinositol.
D) cardiolipins.
E) all of the above are false.

高點醫護【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

40. The correct sequence of enzyme activity being used to catalyze reactions in fatty acid synthase is:
I. β-ketoacyl-ACP synthase
II. β-ketoacyl reductase
III. β-hydroxyacyl dehydratase
IV. enoyl reductase
V. acetyl transferase

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

41. The appropriate sequence for the intermediates generated from mevalonate to the synthesis of squalene are:
I. geranyl pyrophosphate
II. isopentenyl pyrophosphate
III. 5-phosphomevalonate
IV. farnesyl pyrophosphate
V. dimethylallyl pyrophosphate

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

42. Which one of the following is directly served as one of the nitrogen atoms of a urea molecule in the Urea cycle?

A) the amide N of Asn
B) the amide N of Gln
C) the R-group N of Lys
D) the N of glucosamine
E) none of the above

43. Which of the following statements of transamination are CORRECT?
I. It is characterized by the transfer of an α-amino group from an amino acid to the α-keto position of an α-keto acid.
II. The amino donor becomes an α-keto acid.
III. The coenzyme needed is thiamin pyrophosphate (TPP).
IV. Humans are capable of synthesizing the α-keto acid analog of nonessential amino acids and using transamination to form the amino acids, but are not able to construct carbon skeletons of the essential amino acids.
V. The α-keto acid acceptor becomes an α-amino acid.

高點醫護
【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

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

44. During the de novo biosynthesis of the purine ring, the generation of AICAR is accompany with the formation of

A) Asp
B) malate
C) fumarate
D) CO_2
E) H_2O

45. Which of the following comments regarding resveratrol is CORRECT?
I. activates SIRT1 NAD^+-dependent deacetylase activity
II. produced in plants, particularly in grape skins, in response to stress
III. inhibits AMPK in the brain
IV. has many of the same effects as caloric restriction

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

46. What types of cells carry out ATP synthesis by chemiosmosis?

A) all cells, exclusively using oxygen as the electron acceptor
B) only eukaryotic cells, exclusively using oxygen as the electron acceptor
C) only eukaryotic cells, using either oxygen or other electron acceptors such as elemental sulfur
D) all respiring cells, using either oxygen or other electron acceptors such as elemental sulfur

47. In which cellular structure are the enzymes of the Calvin cycle localized?

A) chloroplast stroma
B) thylakoid space
C) mitochondrial intermembrane space
D) mitochondrial matrix

高點醫護 版權所有 翻印必究

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

48. Assuming independent assortment at all loci, what is the probability that a cross between the following parents, AABbCc × AaBbCc, will produce an AaBbCC offspring?

A) 1/2
B) 1/8
C) 1/16
D) 3/4

49. Why are males more often affected by X-linked traits than females?

A) Genomic imprinting
B) X-chromosome inactivation
C) Aneuploidy of sex chromosome
D) Hemizygosity of the X chromosome

50. Which of the following statements correctly describes the difference between the leading strand and the lagging strand in DNA replication?

A) Both of the leading strand and lagging strand require an DNA primer.
B) The leading strand is synthesized continuously in the 5'→ 3' direction, while the lagging strand is synthesized discontinuously in the 5'→ 3' direction.
C) The leading strand is synthesized in the 3'→ 5' direction in a discontinuous fashion, while the lagging strand is synthesized in the 5'→ 3' direction in a continuous fashion.
D) There are different DNA polymerases involved in elongation of the leading strand and the lagging strand.

51. Gene expression is often assayed by measuring the level of mRNA produced from a gene. Which of the following levels of the control of gene expression can by analyzed by this type of assay?

A) DNA replication control
B) transcriptional control
C) translational control
D) post-translational control

52. Which of the following enzymes is required to make complementary DNA (cDNA) from RNA?

A) RNA replicase
B) RNA-dependent RNA polymerase
C) Reverse transcriptase
D) RNA ligase

高點醫護【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

53. What is believed to be the most significant result of the evolution of the amniotic egg?

A) Tetrapods are no longer tied to the water for reproduction.
B) Tetrapods can now function with just lungs.
C) Newborns are much less dependent on their parents.
D) Embryos are protected from predators.

54. In humans, the follicular cells that remain behind in the ovary following ovulation become ____.

A) the ovarian endometrium that is shed at the time of the menses
B) a steroid-hormone synthesizing structure called the corpus luteum
C) the thickened portion of the uterine wall
D) the placenta, which secretes cervical mucus

55. The outer-to-inner sequence of tissue layers in a post-gastrulation vertebrate embryo is _____.

A) endoderm → ectoderm → mesoderm
B) mesoderm → endoderm → ectoderm
C) ectoderm → mesoderm → endoderm
D) ectoderm → endoderm → mesoderm

56. A common feature of action potentials is that they

A) cause the membrane to hyperpolarize and then depolarize.
B) can undergo temporal and spatial summation.
C) are triggered by a depolarization that reaches threshold.
D) move at the same speed along all axons.

57. The following description about plants emitting volatile signals is incorrect.

A) Volatile signals may have evolved for intra-plant communication
B) Having defensive neighbors can enhance the emitter's fitness
C) Some volatiles are also inhibitory allelochemicals that reduce competition
D) Volatile hormones (ethylene) and possibly derivatives (jasmonate and salicylate) contribute to the systemic response

58. Most of the ATP supplies for a skeletal muscle undergoing one hour of sustained exercise come from _____.

A) creatine phosphate
B) glycolysis
C) substrate phosphorylation
D) oxidative phosphorylation

【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

59. What is the biological significance of genetic diversity between populations?

A) Genes for traits conferring an advantage to local conditions are unlikely.
B) The population that is most fit would survive by competitive exclusion.
C) Genetic diversity reduces the probability of extinction.
D) Diseases and parasites are not spread between separated populations.

60. What, approximately, is the fraction of genetic variation in the nuclear genome is that is expected to have a harmful effect on gene function?

A) 50%.
B) 25%.
C) 10%.
D) 1%.

61. Mutations are important because they bring about _____.

A) death of the organism in which they develop
B) genetic variation needed for a population to evolve
C) benefits for the individual, not for the population
D) Hardey-Weinberg equilibrium within a population

62. When organisms with disadvantageous traits die out early before much, if any reproduction, this is called?

A) speciation
B) macroevolution
C) gene flow
D) natural selection

63. Which fundamental tissue types are included in all three basic vascular plant organs?

A) Dermal, vascular, and ground
B) Mesophyll, chlorophyll, and microphylls
C) Sclerenchyma, collenchyma, and parenchyma
D) Xylem, Xylene, and phloem

64. The group of molluscs, which possess eyes similar to vertebrates

A) cephalopoda
B) gastropoda
C) bivalvia
D) pelecypoda

高點醫護【版權所有，翻印必究】

國立中興大學111學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

65. Plant cell with a Ψ_S of -0.5 MPa maintains a constant volume when bathed in a solution that has a Ψ_S of -0.3 MPa and is in an open container. The cell has a:

A) Ψ_P of +0.5 MPa
B) Ψ_P of +0.2 MPa
C) Ψ_P of 0 MPa
D) Ψ of -0.5 MPa

66. What would be the most effective method of reducing the incidence of blood flukes in a human population?

A) Reduce the mosquito population.
B) Reduce the freshwater snail population.
C) Purify all drinking water.
D) Avoid contact with rodent droppings.

67. Which animal has a complete digestive system?

A) jellyfish
B) roundworm
C) sponge
D) coral

68. Which of the following shows the correct direction of blood flow through the chambers of the heart?

A) left atrium -> left ventricle -> right ventricle -> right atrium
B) left atrium -> right atrium -> left ventricle -> right ventricle
C) right atrium -> right ventricle -> left atrium -> left ventricle
D) right atrium -> left atrium -> left ventricle -> right ventricle

69. Put the step of the life cycle of a mushroom-forming basidiomycete in the order.

1. Karyogamy in each basidium produces a diploid nucleus
2. Two haploid mycelia of different mating types undergo plasmogamy
3. Environmental cues induce the dikaryotic mycelium to form basidiocarps
4. The basidiospores germinate and grow into short-lived haploid mycelia
5. When mature, the basidiospores are ejected and dispersed

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

【版權所有，翻印必究】

國立中興大學 111 學年度學士後醫學系招生考試試題

科目：普通生物及生化概論　　系所：學士後醫學系甲、乙組

本科目不可以使用計算機　　本科目試題共 16 頁

70. The following description about the apoptosis in the *Caenorhabditis elegansplants* is incorrect.

A) Three proteins, Ced-3, Ced-4, and Ced-9, are critical to apoptosis and its regulation in the nematode.
B) As long as Ced-9, located in the outer mitochondrial membrane.
C) When a cell receives a death signal, Ced-9 is activated, relieving its inhibition of Ced-4.
D) Active Ced-4 activates Ced-3, a protease, which triggers a cascade of reactions leading to the activation of nucleases and other proteases.

高點醫護
【版權所有，翻印必究】

科目：普通生物及生化概論

題號	答案	題號	答案	題號	答案	題號	答案	題號	答案
1.	A	2.	B	3.	A	4.	E	5.	D
6.	C	7.	E	8.	D	9.	E	10.	C
11.	A	12.	B	13.	E	14.	C	15	B
16.	C	17.	D	18.	E	19.	C	20.	A
21.	C	22.	E	23.	D	24.	B	25	B
26.	A	27.	B	28.	D	29.	D	30.	A
31.	C	32.	B	33.	C	34.	B	35.	E
36.	D	37.	A	38.	D	39.	A	40.	A
41.	B	42.	E	43.	E	44.	C	45.	D
46.	D	47.	A	48.	C	49.	D	50.	B
51.	B	52.	C	53.	A	54.	B	55.	C
56.	C	57.	D	58.	D	59.	C	60.	D
61.	B	62.	D	63.	A	64.	A	65.	A
66.	C	67.	B	68.	C	69.	C	70.	C

高點醫護
【版權所有，翻印必究】

生物

張劍鴻(張芸潔)老師提供

中興大學 111學年度 學士後醫學系
生物試題命題範疇分析

- 本年度中興後醫的普通生物及生化概論共有 70 題。其配分如下：
  (1) 第1-15題，每題 1 分，共15分。
  (2) 第16-45題，每題 2 分，共60分。
  (3) 第46-70題，每題 3 分，共75分。

- 在此針對第46-70題的三分題做分析：25 題的三分題全數為生物學課本 Campbell 的生物領域概念，若能循正規的方式準備，確實熟悉 Campbell生物學之概念，該75分要有60以上的表現並不困難。

生物各試題命題範疇分析

46	Unit 3 生物化學	The variety of catabolism，完全命中 正課講義：Chap 16 細胞呼吸， page 74 複習課程：Unit 3 Biochemistry, page 13
47	Unit 7 植物學	Calvin cycle，完全命中 正課講義：Chap 29 植物訊號和行為， page 121 複習課程：Unit 7 Plant Biology, page 25
48	Unit 4 分子生物學	Probability of Mendelian inheritance，完全命中 正課講義：Chap 19 孟德爾， page 35-38 複習課程：Unit 4 Molecular Biology, page 10
49	Unit 4 分子生物學	Heterozygous and hemizygous，完全命中 正課講義：Chap 20 染色體連鎖， page 25 複習課程：Unit 4 Molecular Biology, page 15
50	Unit 4 分子生物學	DNA replication，完全命中 正課講義：Chap 21 核苷酸與遺傳， page 32-34 複習課程：Unit 4 Molecular Biology, page 20-21

【版權所有，翻印必究】

51	Unit 4 分子生物學	Specific transcription factors，完全命中 正課講義：Chap 23 基因表現控制， page 49 複習課程：Unit 4 Molecular Biology, page 36
52	Unit 5 生物科技	cDNA，完全命中 正課講義：Chap 24 DNA 科技 複習課程：Unit 5 Biotechnology, page 3
53	Unit 8 演化學	Terrestrially adapted，完全命中 正課講義：Chap 32 動物多樣性， page 103 複習課程：Unit 8 Evolution, page 13
54	Unit 2 動物生理學	Reproduction cycles of females，完全命中 正課講義：Chap 13 生殖系統， page 55 複習課程：Unit 2 Animal Physiology, page 53
55	Unit 2 動物生理學	Morphogenesis，完全命中 正課講義：Chap 14 動物發育， page 47-48 複習課程：Unit 2 Animal Physiology, page 57
56	Unit 2 動物生理學	Generation of action potentials，完全命中 正課講義：Chap 5 神經元和突觸， page 40-45 複習課程：Unit 2 Animal Physiology, page 7
57	Unit 7 植物學	Plant hormones ，完全命中 正課講義：Chap 29 植物訊號和行為， page 16-17 複習課程： Unit 7 Plant Biology, page 18-19
58	Unit 2 動物生理學	Energy of skeletal muscles，完全命中 正課講義：Chap 8 運動， page 62 複習課程：Unit 2 Animal Physiology, page 20
59	Unit 8 演化學	Genetic diversity，完全命中 正課講義：Chap 38 生態系， page 51-52 複習課程：Unit 9 Ecosystems, page 12
60	Unit 5 生物科技	Functional genes，完全命中 正課講義：Chap 25 基因體演化， page 27 複習課程：Unit 5 Biotechnology, page 11
61	Unit 8 演化學	Evolution，完全命中 正課講義：Chap 33 演化機制， page 44 複習課程：Unit 8 Evolution, page 16-17

【版權所有，翻印必究】

62	Unit 8 演化學	Natural selection，完全命中 正課講義：Chap 33 演化機制， page 84-86 複習課程：Unit 8 Evolution, page 18
63	Unit 7 植物學	Plant tissue system x3，完全命中 正課講義：Chap 28 植物構造和生長， page 23 複習課程：Unit 7 Plant Biology, page 5
64	Unit 8 演化學	Diverse visual system，完全命中 正課講義：Chap 7 感覺， page 86 複習課程：Chap 32 動物多樣性， page 52
65	Unit 7 植物學	Water potential，完全命中 正課講義：Chap 28 植物構造和生長， page 87-88
66	Unit 8 演化學	Invertebrates，完全命中 正課講義：Chap 32 動物多樣性， page 3 複習課程：Unit 8 Evolution, page 9
67	Unit 2 動物生理學	Digestive system，完全命中 正課講義：Chap 11 消化系統， page 31 複習課程：Unit 2 Animal Physiology, page 35-36
68	Unit 2 動物生理學	Systemic circuit pathway，完全命中 正課講義：Chap 9 運輸系統， page 25 複習課程：Unit 2 Animal Physiology, page 24
69	Unit 8 演化學	Basidiomycete，完全命中 正課講義：Chap 31 真菌， page 28-29 複習課程：Unit 8 Evolution, page 5
70	Unit 4 分子生物學	Apoptosis，命中 正課講義：Chap 23 基因表現控制， page 115

【版權所有，翻印必究】

生化概論

莊老師(施政安)老師提供

精選試題解析

1. Glutamic acid contains two carboxylic acid groups (pK_a = 2.2 and 4.2) and an amine group (pK_a = 9.7). What is the pI for glutamic acid? What is glutamic acid's net charge in a solution with pH=7.4?
A) 3.2, negative charge B) 6.0, negative charge C) 6.5, no charge
D) 7.0, positive charge E) none of the above

試解：

a. pI = 1/2 (pKa_1 + pKa_2) = 1/2 (2.2 + 4.2) = 3.2

b. NH_3^+-Asp-COOH **(Asp^{1+})**

COOH

↓ ***pKa_1 = 2.2***

NH_3^+-Asp-COO^- **(Asp^0)**

COOH

↓ ***pKa_2 = 4.2***

NH_3^+-Asp-COO^- **(Asp^{1-})**

COO^-

↓ ***pKa_3 = 9.7***

NH_2-Asp-COO^- **(Asp^{2-})**

COO^-

=> pH 7.4 在 pKa_2 和 pKa_3 的中央處，故此時 Asp 為 -1 價

=> 故選(A)

3. Which of the following is an irreversible form of inhibition?
A) suicide inhibitor B) competitive inhibitor
C) noncompetitive inhibitor D) uncompetitive inhibitor
E) none of the above

試解：

Competitive , non-competitive and uncompetitive inhibitions are reversible reactions.

=> 故選(A) : suicide inhibitor has the irreversible and competitive characteristics.

【版權所有，翻印必究】

5. Steroid hormones, such as glucocorticoids, affect their action by:
A) binding to a plasma membrane receptor and then activating the kinases cascade.
B) binding the plasma membrane receptor, which stimulates the receptor to enter the cell.
C) entering into the cell and affecting the production of secondary messengers.
D) entering into the cell and then acting as transcription regulators.
E) none of the above.

試解：
Steroid hormone receptor is a nuclear receptor, which is a transcription factor with zinc finger DNA-binding domain.
=> 故選(D)

6. Which of the following, when paired with its complementary strand, would have the highest Tm?
A) AAGTTCCAGTAA B) ATTACGAGCTAT C) GCAGCAGCATTT
D) GCGAAATCAATA E) TGACCTTGAATT

試解：
Tm 值和 [G+C]濃度成正比 => 故選(C)

7. Diphtheria toxin kills cells by inactivating EF-2 proteins. Which process is inhibited by the diphtheria toxin?
A) Movement of DNA polymerase on the template DNA
B) Promoter clearance of the RNAPII
C) Movement of RNAPII on the template DNA
D) Ribosome assembling on the mRNA
E) Ribosome translocation

試解
The function of eEF2 is to trigger translocation of ribosome.
(EF2 應寫為 eEF2 才正確, e = eukaryotic)
=> 故選(E)

【版權所有，翻印必究】

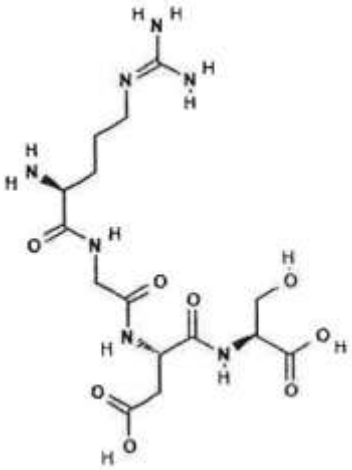
8. Glycerol generated from hydrolysis of triacylglycerols enters which one of the following intermediates in glycolysis?
A) glyceraldehyde-3-phosphate. B) 2-phosphoglycerate.
C) 3-phosphoglycerate. D) dihydroxyacetone phosphate.
E) 1,3-bisphosphoglycerate.

試解：
Glycerol
ATP ↓ glycerol kinase
Glycerol-3-phosphate
↓ glycerol-3-phosphate dehydrogenase
Dihydroxyacetone-phosphate → 進入 **Glycolysis**
=> 故選(D)

9. The common product produced by Complex I and Complex II in the electron transport chain is:
A) NAD^+. B) FAD. C) reduced O_2.
D) reduced cyt c. E) reduced coenzyme Q.

試解：
Complex I
↓
Complex II → CoQ → Complex III → cytochrome c → → O_2
=> CoQ 因從 Complex I 和 Complex II 得到電子, CoQ 故為 reduced CoQ
=> 故選(E)

13. Which one of the following is NOT the substrate of carbamoyl phosphate synthetase II (CPS-II)?
A) ATP. B) H_2O. C) HCO_3^-.
D) glutamine. E) NH_4^+.



試解：
CPSI reaction in area cycle:
$NH_4^+ + HCO_3^- \rightarrow$ carbamoyl phosphate
CPSII reaction in pyrimidine biosynthesis:
Glutamine + HCO_3^- → carbamoyl Phosphate + glutamate
=> 此題考 CPSI 和 CPSII (**c**arbamoyl **p**hosphate **s**ynthetase)之差異
=> 故選(E)

17. What is the amino acid sequence of the following peptide starting from the N-terminal end?
A) KDS
B) RDT
C) SDGR
D) RGDS
E) KGDS

試解：
Arginine-Glycine-Aspartate- Serine = R-G-D-S = RGDS
=> 故選(D)

【版權所有，翻印必究】

18. Which of the following type of mutations is correctly defined?
A) silent: change of a single base in the non-coding region of a gene
B) missense: substitution of a single base results in a premature stop codon
C) nonsense: substitution of a single base results in a complete change of amino acid sequence
D) frameshift: deletion of a single base results in a single amino acid change
E) none of the above

試解：
A. silent mutation at coding strand or ORF (open reading frame)
B. missense mutation: one amino acid → another amino acid
C. nonsense mutation: any amino acid → stop codon
D. frameshift mutation: more than one amino acids change
=> 故選(E)

19. An enzyme-catalyzed reaction was carried out with the substrate concentration initially a thousand times greater than the Km for that substrate. After 12 minutes, 1% of the substrate had been converted to product, and the amount of product formed in the reaction mixture was 20 μmol. If, in a separate experiment, 30 % as much enzyme and twice as much substrate had been combined, how long would it take for the same amount of product to be formed?
A) 6 min B) 12 min C) 40 min D) 18 min E) 4 min

試解：
initial rate 和[E]t (total enzyme concentration)成正比
=> 100% [E]t → 30% [E]t
=> Time 會拉長, 12 min x 100%/30% = 40 min
=> 故選(C)

【版權所有，翻印必究】

21. Post-translational modifications are critical for the regulation of biological processes. Which of the followings are the examples of post-translational modifications of proteins?
1) activation of pro-caspase 3 to caspase 3
2) converting PIP2 to PIP3 by PI3 kinase
3) activation of protein kinase A by cAMP
4) activating NF-κb through Iκb kinase
5) epigenetic regulation by histone codes
A) 1,3,4,5 B) 1, 2, 4, 5 C) 1,4,5
D) 2,3,4 E) All of the above

試解：

1) proteolytic cleavage of pro-caspase3: **covalent** bond changes

2) PIP2 is phospholipid

3) cAMP/PKA: noncovalent binding

4) NF-*k*B/I*k*B

↓ I*k*B kinase

NF-*k*B/I*k*B-P

↓I*k*B-P decayed by **ubiquitin-proteasome system**

Activation of NF-*k*B

(I*k*B-P = phosphorylated I*k*B, B 要大寫)

5) Histone code: methylation, acetylation or phosphorylation of histone Proteins(**covalent** bond changes)

=> Post-transcription modification 是屬 protein 被共價鍵型式造

故不包括 2) 和 3)

=> 故選(C)

22. The Crispr/Cas9 is the approach using DNA damage and repair to modify the genomic DNA. Select the type of DNA damage and the type of repair mechanism involved in this approach.

1) single-strand breakage,
2) double-strand breakage,
3) DNA adduct,
4) inter-strand crosslinking,
5) gap-filling,
6) homologous recombination,
7) nucleotide excision repair,
8) base excision repair,
9) non homologous end joining

A) 1,6 B) 2,5 C) 3,7
D) 4,9 E) None of the above

試解：

CRISPR/Cas9 systems:

a. 國際敘述: DSB (double-strand break) → HDR (**h**omology-**d**irected **r**epair) or NHEJ (**n**on**h**omologous **e**nd-**j**oining)

=> **故選(E) (中興正解)**

b. (Lehniger) principles of biochemistry, 2021, 8 edition, page 323:

(1) DSB → NHEJ or

(2) SSB (**s**inge-**s**trand **b**reak) → HDR (HDR ≈ homologous recombination)

=> 故選(A)

c. 本人較贊同 a.的解法

【版權所有，翻印必究】

25. Transcription initiation requires the formation of pre-initiation complex (PIC). Which of followings are NOT required for the formation of PIC on the TATA box?
1) enhancer,
2) TAF,
3) RNAPII,
4) TBP,
5) TFIIH,
6) TFIIC
A) 1,2,5 B) 1,6 C) 4,5
D) 1,3,6 E) All of the above are required

試解：
a. GTFs (**g**eneral **t**ranscription **f**actor**s**) : TFIIA, TFIIB, TFIID, TFIIE, TFIIF, TFIIH
沒有 **TFIIC or TFIIG**
b. transcription initiation 只討論 promoter
c. transcription controls 才會討論到 upstream control elements:
enhancer, silencer, insulator and LCR (locus control region)
=> 故選(B)

30. Which one of the following enzymes catalyzes a reversible reaction that is an equilibrium control step of glycolysis?
A) pyruvate kinase
B) glucokinase
C) phosphofructokinase-1
D) aldolase
E) none of the above

試解：
Irreversible steps in glycolysis: step1/**hexokinase**, step3/**phosphofructokinase I**
Step10/**pyruvate kinase**
=> Reversible steps: step 2, 4, 5, 6,7, 8 and 9 **(step4/ aldolase)**
=> 故選(D)才對，<u>本題解答有誤!</u>

高點醫護 版權所有，翻印必究