

國立中山大學 111 學年度 學士後醫學系招生考試試題

科目名稱：普通生物及生化概論

— 作答注意事項 —

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卡之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卡應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 不可使用計算機，並不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卡請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

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※選擇題(單一選擇題，共 90 題，總分 150 分)

壹、第 1~30 題每題 1 分，共 30 分，每題答錯倒扣四分之一。

- Where does the Krebs cycle take place?
 - Mitochondrial matrix
 - Inner membrane of the mitochondrion
 - Outer membrane of the mitochondrion
 - Intermembrane space of the mitochondrion
 - Cytoplasm (outside the mitochondria)
- Nitrogen fixation can occur in which of the following organisms?
 - prokaryotes
 - plants
 - animals
 - prokaryotes and plants
 - prokaryotes, plants and animals
- The use of mRNA and reverse transcriptase is part of a strategy to solve the problem of
 - epigenetic regulation.
 - post-translational processing.
 - nucleic acid hybridization.
 - restriction fragment ligation.
 - post-transcriptional processing.
- What is the most common transported sugar in the plant?
 - Glyceraldehyde 3-phosphate
 - Fructose
 - Mannose
 - Starch
 - Sucrose
- The best time to measure an animal's basal metabolic rate is when the animal
 - is resting and has not eaten its first meal of the day.
 - is resting and has just completed its first meal of the day.
 - has recently eaten a sugar-free meal.
 - has not consumed any water for at least 48 hours.
 - has just completed 30 minutes of vigorous exercise.
- When human beings choose a mate, they usually prefer people with the same skin color, same culture, same language, and similar living habits. Which of the following is related to this phenomenon?
 - panmixia
 - heterosis
 - outcrossing
 - backcrossing
 - assortative mating
- Cytoskeleton of a eukaryotic cell is made up of (a)microtubule, (b)microfilament and (c)intermediated filaments. Which of them exhibits polarity?
 - a
 - b

試題請隨卷繳回，請留意背面是否有題

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- C. c
D. a and b
E. b and c
8. Mitochondria are thought to be the descendants of certain alpha proteobacteria. They are, however, no longer able to lead independent lives because most genes originally present on their chromosomes have moved to the nuclear genome. Which phenomenon accounts for the movement of these genes?
A. homologous recombination
B. plasmolysis
C. horizontal gene transfer
D. conjugation
E. translation
9. What controls sex determination in American alligator?
A. Temperature
B. Behavioral interactions
C. Y Chromosome
D. Ratio of X chromosomes to autosomes
E. SRY gene
10. Why are action potentials usually conducted in only one direction along an axon?
A. The nodes of Ranvier can conduct potentials in only one direction.
B. The brief refractory period prevents reopening of voltage-gated Na^+ channels.
C. The axon hillock has a higher membrane potential than the terminals of the axon.
D. Ions can flow along the axon in only one direction.
E. Voltage-gated channels for both Na^+ and K^+ open in only one direction.
11. Which statement about biological homology is correct?
A. Paralogs: Insect wings and bat wings are both used for flight.
B. Orthologs: Humans use different MHC gene copies to identify different pathogens.
C. Analogs: The human eye is structurally similar to the octopus's eye.
D. Homologs: The needles of cacti (仙人掌) and hedgehogs (刺蝟) are used for physical defense.
E. Paralogs: Differentiation of the functions of the forelimb and hindlimb in humans.
12. Which of the following statements regarding photoperiodism is **false**?
A. Photoperiodism is the physiological reaction of organisms to the length of a dark period. It occurs in both plants and animals.
B. Many flowering plants (angiosperms) use photoreceptors such as phytochrome and cryptochrome to sense photoperiod.
C. Long-day plants flower when the night length falls below their critical photoperiod.
D. The shoot apical meristem that senses the photoperiod leading to its transition from a vegetative (leaf) bud to a reproductive (flower) bud.
E. Day-neutral plants such as maize do not initiate flowering based on photoperiodism.
13. All female mammals have one active X chromosome per cell instead of two. What causes this to happen?
A. attachment of methyl (-CH₃) groups to the X chromosome that will remain active
B. only the X chromosome from mother will remain active
C. inactivation of the *XIST* gene on the X chromosome derived from the male parent

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- D. activation of the *BARR* gene on one X chromosome, which then becomes inactive
E. activation of the *XIST* gene on the X chromosome that will become the Barr body
14. A genetic map shows the map distance. The units of genetic distance are called **map units** (mu) or **centiMorgans** (cM). Which of the following indicates the map distance of 23.6 mu between two genes?
- A. The distance between two genes is 23.6 millimeters.
B. There are 23.6 other genes between the two genes of interest.
C. The co-mutation rate of two genes is 23.6%.
D. The survival rate of the offspring is 23.6%.
E. 23.6% of the offspring exhibit recombination between the two genes.
15. A researcher is analyzing the immune response of a patient following the patient's exposure to an unknown agent while out of the country. The patient's blood is found to have a high proportion of lymphocytes with CD8 surface proteins. What is the likely cause?
- A. The patient encountered a bacterial infection which elicited CD8 marked T cells.
B. The disease must have been caused by a multicellular parasite, such as can be encountered in polluted water sources.
C. The CD8 proteins would be discharged from these lymphocytes to lyse the infected cells.
D. The CD8 proteins marked the surfaces of cytotoxic T cells to attack virus-infected host cells.
E. CD8 marks the surface of cells that accumulate after the infection is over and signal patient recovery.
16. What is the name of the protein that is used to form the initial glycogen primer?
- A. phosphoporin
B. glucokinase
C. glycoporin
D. glycogenin
E. pyrophorin
17. Which of the following pairs of amino acids could form electrostatic interactions by their side chains?
- A. Serine and phenylalanine
B. Glutamic acid and arginine
C. Alanine and glutamine
D. Leucine and cysteine
E. Histidine and Isoleucine
18. In humans, gluconeogenesis:
- A. can result in the conversion of protein into blood glucose.
B. helps to reduce blood glucose after a carbohydrate-rich meal.
C. is activated by the hormone insulin.
D. is essential in the conversion of fatty acids to glucose.
E. requires the enzyme hexokinase.
19. Which of the following is (are) NOT found as covalently attached anchors in lipid-linked proteins?
- A. isoprenoid groups
B. fatty acids
C. cholesterol and other sterols
D. glycosylphosphatidyl inositol groups

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- E. All of the above are found as covalently attached anchors in lipid-linked proteins.
20. Aspirin inhibits the synthesis of which of the following sets of eicosanoids?
- A. Prostaglandin E2 and leukotriene A4
 - B. Thromboxane A2 and leukotriene C4
 - C. Prostaglandin F2 and thromboxane A2
 - D. Prostaglandin A2 and 5-hydroperoxyeicosatetraenoic acid
 - E. Thromboxane A2 and 5-hydroperoxyeicosatetraenoic acid
21. In which metabolic pathway does glucose-6-phosphate dehydrogenase play a key role?
- A. glycogenesis
 - B. glycolysis
 - C. gluconeogenesis
 - D. glycogenolysis
 - E. pentose phosphate pathway
22. Which of the following explains are the enzyme effects?
- A. Enzymes release products very rapidly
 - B. Enzymes can lower product energy
 - C. An enzyme stabilizes the transition state of the reaction
 - D. An enzyme can convert a normally endergonic reaction into an exergonic reaction
 - E. An enzyme lowers the energy of activation only for the forward reaction
23. Enzymes are biological catalysts that enhance the rate of a reaction by:
- A. decreasing the activation energy.
 - B. decreasing the amount of free energy released.
 - C. increasing the activation energy.
 - D. increasing the amount of free energy released.
 - E. increasing the energy of the transition state.
24. To determine the isoelectric point of a protein, first establish that a gel:
- A. contains a denaturing detergent that can distribute uniform negative charges over the protein's surface.
 - B. exhibits a stable pH gradient when ampholytes become distributed in an electric field.
 - C. is washed with an antibody specific to the protein of interest.
 - D. neutralizes all ionic groups on a protein by titrating them with strong bases.
 - E. relates the unknown protein to a series of protein markers with known molecular weights, Mr.
25. Which of the following lipids can be formed by the methylation of phosphatidylethanolamine?
- A. Phosphatidylinositol
 - B. Phosphatidylcholine
 - C. Phosphatidylserine
 - D. Sphingomyelin
 - E. Lysophosphatidylcholine
26. Which volatile short-chain fatty acid is believed to lower serum cholesterol by acting as an inhibitor of cholesterol biosynthesis?
- A. acetic
 - B. butyric

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- C. propionic
D. palmitic
E. lauric
27. Which of the following techniques was NOT used to determine the three-dimensional structure of protein?
A. NMR spectroscopy
B. X-ray diffraction
C. Cryogenic electron microscopy
D. UV/Vis spectroscopy
E. All of the above
28. Which of these statements is generally true of integral membrane proteins?
A. A hydropathy plot reveals one or more regions with a high hydropathy index.
B. The domains that protrude on the cytoplasmic face of the plasma membrane nearly always have covalently attached oligosaccharides.
C. They are unusually susceptible to degradation by trypsin.
D. They can be removed from the membrane with high salt or mild denaturing agents.
E. They undergo constant rotational motion that moves a given domain from the outer face of a membrane to the inner face and then back to the outer.
29. In a newly discovered electron transport complex a researcher has identified the redox center Fe-S, cytochrome c, and coenzyme Q. The researcher also knows that this complex ultimately passes its electrons to oxygen. What is most likely the redox center which completes this task?
A. Fe-S
B. 2Fe-2S
C. coenzyme Q
D. cytochrome c
E. None of the above
30. Which of the following pairs of sugars are epimers of each other?
A. D-sorbose and D-fructose
B. D-sorbose and D-xylulose
C. D-arabinose and D-ribose
D. D-fructose and L-fructose
E. D-ribose and D-ribulose

貳、第 31~90 題每題 2 分，共 120 分，每題答錯倒扣四分之一。

31. Which description of fungi is correct?
A. Ascomycota: Multinucleate hyphae lack septa
B. Glomeromycota: Form arbuscular mycorrhizae
C. Ascomycota: In sexual reproduction, four ascospores are formed inside a sac called an ascus
D. Basidiomycota: In sexual reproduction, eight basidiospores are borne on a club-shaped basidia
E. Zygomycota: the heterokaryotic (dikaryotic) stage can be found in the life cycle
32. Developmentally, which type of human tooth is most similar to ivory (象牙)?
A. incisor
B. canine
C. premolar

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- D. molar
E. third molar (wisdom tooth)
33. How many photons are required to generate one O₂ molecule during photosynthesis light reaction?
A. 2
B. 4
C. 8
D. 12
E. 16
34. What is the effect of a nonsense mutation in a gene?
A. It introduces a premature stop codon into the mRNA.
B. It changes an amino acid in the encoded protein.
C. It has no effect on the amino acid sequence of the encoded protein.
D. It alters the reading frame of the mRNA.
E. It prevents introns from being excised.
35. Within a cell, the amount of protein made using a given mRNA molecule depends partly on
A. the rate at which the mRNA is degraded.
B. the number of introns present in the mRNA.
C. the types of ribosomes present in the cytoplasm.
D. the degree of histone acetylation
E. the degree of DNA methylation.
36. Phylogenetic trees constructed from evidence from molecular systematics are based on similarities in _____.
A. phenotypes
B. morphology
C. mutations to homologous genes
D. the pattern of embryological development
E. biochemical pathways
37. Imprinting has a great impact on normal mammalian development, fetal growth, metabolism and adult behavior. The current molecular explanation for imprinting in mammals involves differential _____ of various DNA regions.
A. Mutations
B. Phosphorylation
C. Dephosphorylation
D. Methylation
E. Transcription
38. CRISPR-Cas9 is adapted from a naturally occurring genome editing system that bacteria use as an immune defense. Which of the following characteristics makes the CRISPR-Cas9 system an efficient way to generate knockout cell lines?
A. It precisely cuts DNA.
B. It removes random DNA bases.
C. It forms a complex with proteins.
D. It applies to both in prokaryotes and eukaryotes.
E. Its function is regulated by complementary guide RNAs.

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39. Which of the following would you expect to be a problem for someone with nonfunctional chloride channeling?
- A. inadequate secretion of mucus
 - B. buildup of excessive secretions in organs such as lungs
 - C. buildup of excessive secretions in glands such as the pancreas
 - D. sweat that includes no NaCl
 - E. mental retardation due to low salt levels in brain tissue
40. Plants often use changes in day length (photoperiod) to trigger events such as dormancy and flowering. It is logical that plants have evolved this mechanism because photoperiod changes
- A. are more predictable than air temperature changes.
 - B. alter the amount of energy available to the plant.
 - C. are modified by soil temperature changes.
 - D. can reset the biological clock.
 - E. are correlated with moisture availability.
41. Which description of the lateral line system is **false**?
- A. The lateral line system is found in amphibian larvae and fishes.
 - B. The lateral line system in fish can reflect pressure waves and low-frequency vibrations.
 - C. The lateral line system consists of hair cells within a longitudinal canal in the fish's skin.
 - D. The hair cells in the lateral line system are innervated by motor neurons that transmit impulses to the brain.
 - E. The hair cells' surface processes project into a gelatinous membrane called a cupula.
42. Which of the following statement about the structure of sarcomeres in relaxed and contracted muscles is **false**?
- A. The I bands form the borders of each sarcomere.
 - B. The A bands represent thick filaments.
 - C. The thin filaments are within the I bands and extend into the A bands.
 - D. In the contracted muscle, the I bands and H bands become shorter.
 - E. In the contracted muscle, the Z lines have moved closer together.
43. Plant cells and animal cells both evolve specialized conduits that directly connect the cytoplasm of two cells. What are they?
- A. plasmodesmata in plant cells, desmotubules in animal cells
 - B. desmotubules in plant cells, plasmodesmata in animal cells
 - C. gap junctions in plants cells, plasmodesmata in animal cells
 - D. plasmodesmata in plant cells, gap junctions in animal cells
 - E. gap junctions in plant cells, desmotubule in animal cells
44. In plants, the climacteric is a stage of fruit ripening associated with increased production of which plant hormone?
- A. auxin
 - B. abscisic acid
 - C. cytokinin
 - D. ethylene
 - E. Gibberellin

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45. In humans, ABO blood types refer to glycoproteins in the membranes of red blood cells. There are three alleles for this autosomal gene: I^A , I^B , and i . The I^A allele codes for the A glycoprotein, The I^B allele codes for the B glycoprotein, and the i allele doesn't code for any membrane glycoprotein. I^A and I^B are codominant, and i is recessive to both I^A and I^B . People with type A blood have the genotypes $I^A I^A$ or $I^A i$, people with type B blood are $I^B I^B$ or $I^B i$, people with type AB blood are $I^A I^B$, and people with type O blood are ii . If a woman with type B blood marries a man with type A blood, which of the following blood types could their children possibly have?
- A. A and B
 - B. AB and O
 - C. A, B, and AB
 - D. A, B, and O
 - E. A, B, AB, and O
46. How does the enzyme telomerase meet the challenge of replicating the ends of linear chromosomes?
- A. It adds numerous GC pairs, which resist hydrolysis and maintain chromosome integrity.
 - B. It catalyzes the shortening of telomeres, compensating for the elongation that could occur during replication without telomerase activity.
 - C. It adds a single 5' cap structure that resists degradation by nucleases.
 - D. It is a reverse transcriptase that carries its own RNA molecule that works as a template to lengthen telomeres.
 - E. It causes specific double-strand DNA breaks that result in blunt ends on both strands.
47. Which of the following enzymes is the most abundant protein in the chloroplast and incorporates CO_2 molecules to ribulose diphosphate?
- A. Aldolase
 - B. Rubisco
 - C. Phosphoglycerate kinase
 - D. Triose phosphate isomerase
 - E. Glyceraldehyde 3-phosphate dehydrogenase
48. Several adaptations that facilitate survival and reproduction on dry land emerged after plants diverged from algal. Which of the following traits is found in plants but not in charophyte algae?
- A. Alternation of generations.
 - B. Chloroplasts with chlorophylls a and b .
 - C. Circular rings of cellulose-synthesizing proteins.
 - D. Flagellated sperm.
 - E. Sporopollenin in zygotes.
49. When DNA is compacted by histones into 10 nm and 30 nm fibers, the DNA is unable to interact with proteins required for gene expression. Therefore, to allow for these proteins to act, the chromatin must constantly alter its structure. Which processes contribute to this dynamic activity?
- A. DNA supercoiling at or around H1
 - B. methylation and phosphorylation of histone tails
 - C. hydrolysis of DNA molecules where they are wrapped around the nucleosome core
 - D. accessibility of heterochromatin to phosphorylating enzymes
 - E. nucleotide excision and reconstruction
50. Some viruses can undergo latency, the ability to remain inactive for some period of time. Which of the following is an example?
- A. influenza, a particular strain of which returns every 10-20 years

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- B. herpes simplex viruses (oral or genital) whose reproduction is triggered by physiological or emotional stress in the host
- C. Kaposi's sarcoma, which causes a skin cancer in people with AIDS, but rarely in those not infected by HIV
- D. the virus that causes a form of the common cold, which recurs in patients many times in their lives
- E. myasthenia gravis, an autoimmune disease that blocks muscle contraction from time to time

51. Which of the following regarding the human viral disease is **false**?

	Disease	Pathogen	Genome	Epidemiology
A.	Hepatitis B (viral)	Hepadnavirus	Double-stranded DNA	Infected via body fluids; Vaccine available; No cure; Can be fatal.
B.	Herpes	HSV	Double-stranded DNA	Blisters; Skin-to-Skin Contact; No cure; Exhibits latency for several years
C.	AIDS	HIV	Single-stranded DNA	Acute viral infection of the CNS that can lead to paralysis; Vaccine available; Can be fatal.
D.	Influenza	Influenza viruses	(-) Single-stranded RNA	Extremely contagious; Vaccine available; Usually contracted in childhood; More dangerous to adults
E.	SARS	Coronavirus	(-) Single-stranded RNA	Acute respiratory infection; Can be fatal; Domestic animals can be infected.

52. What period of the malaria parasite (*Plasmodium malariae*) is not inside the human body?

- A. schizont
- B. trophozoite
- C. oocyst
- D. merozoite
- E. sporozoite

53. Which of the following statements regarding abscisic acid (ABA) is **false**?

- A. ABA is a plant-specific hormone and does not found in human body.
- B. It is a 15-carbon weak acid terpenoid hormone.
- C. It is found in high concentrations in newly abscised leaves.
- D. ABA accumulates within seeds during fruit maturation thus preventing premature seed germination.
- E. It is synthesized from carotenoids in a series of reactions in plastids and cytoplasm.

54. A pilus (plural: pili) is a hair like structure found on the surface of many bacteria. Which of the following statements regarding pilus is **false**?

- A. It is made of pilin.
- B. It participates in the process of bacterial conjugation.
- C. Pili are responsible for virulence in many pathogenic strains of bacteria.
- D. Pili can protect bacterial cells against bacteriophage.
- E. Pili are antigenic.

55. The Dunkers are a religious group that moved from Germany to Pennsylvania in the mid-1700s. They do not marry with members outside their own immediate community. Today, the Dunkers are genetically unique and differ in gene frequencies, at many loci, from all other populations including those in their original homeland. Which of the following mechanisms likely explains the genetic uniqueness of this population?

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- A. mutation and natural selection
 - B. founder effect and genetic drift
 - C. disassortative mating and divergent selection
 - D. population bottleneck and Hardy-Weinberg equilibrium
 - E. heterozygote advantage and stabilizing selection
56. Transcriptome analysis is a tool used in genetic research to determine the mRNAs being produced in a particular tissue, and their relative level of expression. Known genes can therefore be assayed for their expression in different situations. One use of the technology is in cancer diagnosis and treatment. If a known gene functions as a tumor suppressor, predict which of the following pieces of evidence would be most useful in diagnosis of a cancer due to a mutation in this tumor-suppressor gene.
- A. The tissue sample shows a high level of gene expression relative to a control (noncancerous) sample.
 - B. The tissue sample responds to treatment with a mitosis-promoting compound.
 - C. The tissue sample shows similar expression level of housekeeping genes with a control sample.
 - D. The mRNAs for cyclins and kinases show unusually high levels of expression.
 - E. The mRNAs for the targeted tumor suppressor sequence are not expressed.
57. An unusual example of natural variation in the ploidy occurs in some species. Which of the following statements describes the endopolyploidy most correct?
- A. The endopolyploidy is due to a cell division defect, and it occurs only in lower animals.
 - B. Endopolyploidy is the occurrence in somatic tissues; the most common is in human nerve and epidermal cells.
 - C. An example of endopolyploidy is in the salivary gland cells of *Drosophila*, the pairs of chromosomes double approximately 9 times.
 - D. The chromosomes undergo repeated rounds of chromosome replication without cellular division, the backup copies of chromosomes kept in vacuoles that segregated away from the functional copies.
 - E. The entire organism has extra copies of certain chromosomes, for producing additional gene products.
58. *Drosophila* is a model animal that is often used in genetic research. Which of the following is the best method for distinguishing the sex of *Drosophila*?
- A. The Y chromosome plays a pivotal role in determining the male sex. *Drosophila* with Y chromosome is male, the rest is female.
 - B. Sex combs are located only on the forelegs of male, but not female *Drosophila*.
 - C. Male *Drosophila* is brighter and larger than female.
 - D. Male *Drosophila* has red eyes, and female *Drosophila* has white eyes.
 - E. Male *Drosophila* has curled wings, and female *Drosophila* has flat wings.
59. How do ADH and RAAS work together in maintaining osmoregulatory homeostasis?
- A. ADH monitors osmolarity of the blood and RAAS regulates blood volume.
 - B. ADH monitors appropriate osmolarity by reabsorption of water, and RAAS maintains osmolarity by stimulating Na^+ reabsorption.
 - C. ADH and RAAS work antagonistically; ADH stimulates water reabsorption during dehydration and RAAS removal of water when it is in excess in body fluids.
 - D. Both stimulate the adrenal gland to secrete aldosterone which increases both blood volume and pressure.
 - E. Only when they are together in the receptor sites of proximal tubule cells, will reabsorption of essential nutrients back into the blood take place.

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60. Which of the following statements about the adrenal gland is correct?
- A. During stress, TSH stimulates the adrenal cortex and medulla to secrete acetylcholine.
 - B. During stress, the alpha cells of islets secrete insulin and simultaneously the beta cells of the islets secrete glucagon.
 - C. At all times, the adrenal gland monitors calcium levels in the blood and regulates calcium by secreting the two antagonistic hormones, epinephrine and norepinephrine.
 - D. At all times, the anterior portion secretes ACTH, while the posterior portion secretes oxytocin.
 - E. During stress, ACTH stimulates the adrenal cortex, and neurons of the sympathetic nervous system stimulate the adrenal medulla.
61. The purpose of the hexose monophosphate shunt is to produce ____.
- A. pentose phosphates and NADPH
 - B. DNA and RNA
 - C. fatty acids
 - D. reducing substrates
 - E. ATP
62. Which integral membrane protein is uniquely found in the mitochondria of brown fat?
- A. fatty acid synthase
 - B. catalase
 - C. ATP Synthase
 - D. UCP1
 - E. FATP
63. What is the mode of action of Vancomycin?
- A. Inhibition of cell wall biosynthesis
 - B. Inhibition of DNA biosynthesis
 - C. Inhibition of protein biosynthesis
 - D. Inhibition of folic acid biosynthesis
 - E. None of the above
64. Glycogen, amylose, and amylopectin are storage polysaccharides. Which one is linear form?
- A. Glycogen
 - B. Amylose
 - C. Amylopectin
 - D. All of the above
 - E. None of the above
65. Which of the following statements about protein-ligand binding is correct?
- A. The K_a is equal to the concentration of ligand when all of the binding sites are occupied.
 - B. The K_a is independent of such conditions as salt concentration and pH.
 - C. The larger the K_a (association constant), the weaker the affinity.
 - D. The larger the K_a , the faster is the binding.
 - E. The larger the K_a , the smaller the K_d (dissociation constant).
66. Which of the following is a heteropolysaccharide?
- A. Cellulose
 - B. Chitin

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：普通生物及生化概論

※本科目依簡章規定「不可以」使用計算機(選擇題)

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- C. Glycogen
D. Hyaluronate
E. Starch
67. The symptoms of severe combined immunodeficiency syndrome (SCID) are caused by a deficiency of which of the following enzymes?
A. adenine phosphoribosyltransferase
B. HGPRT (hypoxanthine-guanine phosphoribosyltransferase)
C. adenosine deaminase
D. dihydrofolate reductase
E. xanthine oxidase
68. Transport of fatty acids from the cytoplasm to the mitochondrial matrix requires:
A. ATP, carnitine, and coenzyme A.
B. ATP, carnitine, and pyruvate dehydrogenase.
C. ATP, coenzyme A, and hexokinase.
D. ATP, coenzyme A, and pyruvate dehydrogenase.
E. carnitine, coenzyme A, and hexokinase.
69. Which of the following enzymes is inhibited by malonyl-CoA?
A. Fatty acid synthase
B. Acetyl-CoA carboxylase
C. Hormone-sensitive lipase
D. Carnitine acyltransferase-1
E. Hydroxymethylglutaryl CoA reductase
70. What is the CORRECT sequence of events involving cyclic AMP as a second messenger of glucagon hormone?
I. the stimulation of the activity of adenylate cyclase.
II. the activation of G-proteins.
III. the conversion of ATP to cyclic AMP.
IV. the activation of protein kinase A.
V. the stimulation of lipid mobilization.
VI. an increase in the activity of hormone-sensitive lipase.
A. II, I, III, VI, IV, V
B. II, I, III, IV, V, VI
C. II, I, IV, III, V, VI
D. II, I, III, IV, VI, V
E. II, I, IV, III, VI, V
71. When the amino group has been removed from an amino acid, the carbon skeleton or α -keto acid may be used in many different ways. Which of the following is NOT a possible fate for the carbon skeleton?
A. conversion to glucose
B. oxidation for energy
C. synthesis of fat
D. synthesis of creatine
E. synthesis of ketones
72. Which process is NOT a source of ammonia in the body?

試題請隨卷繳回，請留意背面是否有題

國立中山大學 111 學年度學士後醫學系招生考試試題

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- A. urea formation in the liver
 - B. deamination of amide groups from glutamine
 - C. degradation of pyrimidines
 - D. bacterial lysis of urea and amino acids in the GI tract
 - E. complete oxidation of amino acids
73. Reduction of the carbonyl group on a sugar rise to the class of polyhydroxy compounds called alditols. Important naturally occurring ones are erythritol, D-mannitol, and D-glucitol, often called sorbitol. When sorbitol accumulates in the lens of the eye of a person with diabetes, it can lead to the formation of _____.
- A. Glaucoma
 - B. Amblyopia
 - C. Cataract
 - D. Strabismus
 - E. None of the above
74. Enzyme kinetics provide the values of the Michaelis constant K_M and the turnover number K_{cat} . Which of the following statements is true?
- A. K_M indicates the substrate concentration at which the reaction rate is V_{max}
 - B. K_M measures the rate of the catalytic process
 - C. K_M indicates the substrate binding affinity; the smaller K_M indicates the higher substrate binding affinity
 - D. In enzyme inhibition study, a competitive inhibitor decreases the apparent K_M
 - E. All of the above
75. Which of the following is not correct concerning cooperative binding of a ligand to a protein?
- A. It is usually a form of allosteric interaction.
 - B. It is usually associated with proteins with multiple subunits.
 - C. It rarely occurs in enzymes.
 - D. It results in a nonlinear Hill Plot.
 - E. It results in a sigmoidal binding curve.
76. Which of the following is not involved in the specificity of signal transduction?
- A. Interactions between receptor and signal molecules
 - B. Location of receptor molecules
 - C. Structure of receptor molecules
 - D. Structure of signal molecules
 - E. Transmembrane transport of signal molecules by receptor molecules
77. The technique known as yeast two hybrid analysis for detecting interacting gene products depend on:
- A. activation of DNA polymerase by the nearby binding of hybridizing protein complexes.
 - B. direct binding of a Gal4p activation domain to a DNA sequence in the promoter region.
 - C. having a promoter that responds directly to one of the two proteins whose interactions is being measured.
 - D. hybridization of DNA segments corresponding to the two genes being examined.
 - E. stimulation of transcription by interaction of two Gal4p domains via fused protein sequences.
78. In DNA sequencing by the Sanger (dideoxy) method:
- A. radioactive dideoxy ATP is included in each of four reaction mixtures before enzymatic synthesis

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科目名稱：普通生物及生化概論

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- of complementary strands.
- B. specific enzymes are used to cut the newly synthesized DNA into small pieces, which are then separated by electrophoresis.
- C. the dideoxynucleotides must be present at high levels to obtain long stretches of DNA sequence.
- D. the role of the dideoxy CTP is to occasionally terminate enzymatic synthesis of DNA where Gs occur in the template strands.
- E. the template DNA strand is radioactive.
79. Which of the following compounds would be most closely associated with the intermediate common to glycogenesis and glycogenolysis?
- A. 6-phosphogluconate
- B. Glucose-1-phosphate
- C. Glucose-6-phosphate
- D. Fructose-6-phosphate
- E. Dihydroxyacetone phosphate
80. Which of the following enzymes and pathways are correctly matched?
- A. Phospholipase D and prostaglandin synthesis
- B. HMG-CoA reductase and ketone body synthesis
- C. Cyclooxygenase and thromboxane synthesis
- D. Ethanolamine kinase and phosphatidylcholine synthesis
- E. Phospholipase A₂ and ceramide synthesis.
81. Which of the following is the major site of expression for the monosaccharide transporter GLUT1?
- A. erythrocytes, CNS, blood brain barrier
- B. liver, pancreatic β -cells, small intestine
- C. neurons, testis, placenta
- D. skeletal muscle, adipose tissue
- E. small intestine, kidney, skeletal muscle, adipose tissue
82. Which of the following is/are the precursor(s) for the amino acid arginine?
- A. glutamate, ammonia
- B. glutamate
- C. phenylalanine
- D. methionine, serine
- E. glutamine, or glutamate, aspartate
83. Fluoroacetate is an inhibitor of aconitase in TCA cycle. Which of the following types of inhibition does fluoroacetate belong to?
- A. Irreversible inhibition
- B. Competitive reversible inhibition
- C. Mixed reversible inhibition
- D. Uncompetitive reversible inhibition
- E. None of the above
84. The complete oxidation of 1 mole of glucose generates about 30-32 moles of ATP synthesized from ADP. What is the reason for 2 moles ATP difference?
- A. The reducing equivalent FADH₂ is shuttled from cytosol into mitochondria via the dihydroxyacetone phosphate/glycerol-3-phosphate shuttle

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- B. The reducing equivalent NADH is shuttled from cytosol into mitochondria via the dihydroxyacetone phosphate/glycerol-3-phosphate shuttle
- C. The reducing equivalent FADH₂ is shuttled from cytosol into mitochondria via the malate/aspartate shuttle
- D. The reducing equivalent NADH is shuttled from cytosol into mitochondria via the malate/aspartate shuttle
- E. The reducing equivalent ATP is shuttled from cytosol into mitochondria via the malate/aspartate shuttle
85. If glucose labeled with ¹⁴C in C-1 were fed to yeast carrying out the ethanol fermentation, where would the ¹⁴C label be in the products?
- A. In C-1 of ethanol and CO₂
- B. In C-1 of ethanol only
- C. In C-2 (methyl group) of ethanol only
- D. In C-2 of ethanol and CO₂
- E. In CO₂ only
86. Which of the following statements concerning the β oxidation of fatty acids is true?
- A. About 1,200 ATP molecules are ultimately produced per 20-carbon fatty acid oxidized.
- B. One FADH₂ and two NADH are produced for each acetyl-CoA.
- C. The free fatty acid must be carboxylated in the β position by a biotin-dependent reaction before the process of β oxidation commences.
- D. The free fatty acid must be converted to a thioester before the process of β oxidation commences.
- E. Two NADH are produced for each acetyl-CoA.
87. Which one of the following statements about the reverse transcriptases of retroviruses and the RNA replicases of other single-stranded RNA viruses, such as R17 and influenza virus, is correct?
- A. Both enzymes can synthesize either RNA or DNA from an RNA template strand.
- B. Both enzymes can utilize DNA in addition to RNA as a template strand.
- C. Both enzymes carry the specificity for the RNA of their own virus.
- D. Both enzymes have error rates similar to those of cellular RNA polymerases.
- E. Both enzymes require host-encoded subunits for their replication function.
88. Ubiquitin-mediated protein degradation is a complex process, and many of the signals remain unknown. One known signal involves recognition of amino acids in a processed protein that are either stabilizing (Ala, Gly, Met, Ser, etc.) or destabilizing (Arg, Asp, Leu, Lys, Phe, etc.), and are located at:
- A. a helix-turn-helix motif in the protein.
- B. a lysine-containing target sequence in the protein.
- C. the amino-terminus of the protein.
- D. a zinc finger structure in the protein.
- E. the carboxy-terminus of the protein.
89. Which of the following nonessential amino acids are synthesized from essential amino acids?
- A. Glutamate and proline
- B. Glutamate and phenylalanine
- C. Tyrosine and cysteine
- D. Cysteine and proline
- E. Methionine and proline

國立中山大學 111 學年度學士後醫學系招生考試試題

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90. Which of the following statements about drugs and inhibitors is TRUE?
- A. Caffeine overdose can prevent sleep because it acts on adenine receptor.
 - B. Viagra is used to treat erectile dysfunction because it acts by increasing NO level.
 - C. Botulinum toxin is used to diminish facial glabellar lines because it acts by blocking voltage-gated Na^+ channel.
 - D. Lovastatin is used for lowering cholesterol because it acts by decreasing low-density lipoprotein level.
 - E. Aspirin is used to treat pain and fever because it acts reversibly by suppressing the cyclooxygenase.

國立中山大學 111 學年度 學士後醫學系招生考試試題

科目名稱：物理與化學

— 作答注意事項 —

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卡之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卡應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 不可使用計算機，並不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卡請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：物理與化學

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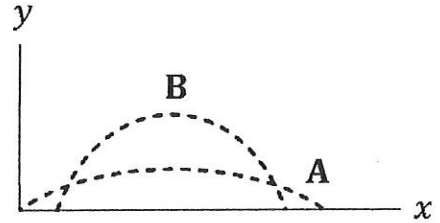
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※選擇題(單一選擇題，共 90 題，總分 150 分)

壹、第 1~30 題每題 1 分，共 30 分，每題答錯倒扣四分之一。

1. Two balls, projected at different times so they don't collide, have trajectories A and B, as shown below. Which statement is correct?

- (A) v_{0B} must be greater than v_{0A} .
- (B) Ball A is in the air for a longer time than ball B.
- (C) Ball B is in the air for a longer time than ball A.
- (D) Ball B has a greater acceleration than ball A.
- (E) Ball A has a greater acceleration than ball B.



2. A shell explodes into two fragments, one fragment 25 times heavier than the other. If any gas from the explosion has negligible mass, then
- (A) the momentum change of the lighter fragment is 25 times as great as the momentum change of the heavier fragment.
 - (B) the momentum change of the lighter fragment is exactly the same as the momentum change of the heavier fragment.
 - (C) the momentum change of the heavier fragment is 25 times as great as the momentum change of the lighter fragment.
 - (D) the kinetic energy change of the heavier fragment is 25 times as great as the kinetic energy change of the lighter fragment.
 - (E) the kinetic energy change of the lighter fragment is 25 times as great as the kinetic energy change of the heavier fragment.
3. Two pure tones are sounded together and a particular beat frequency is heard. What happens to the beat frequency if the frequency of one of the tones is increased?
- (A) It increases.
 - (B) It decreases.
 - (C) It does not change.
 - (D) It becomes zero.
 - (E) We cannot tell from the information given.
4. When a fixed amount of ideal gas goes through an adiabatic expansion,
- (A) no heat enters or leaves the gas.
 - (B) its internal (thermal) energy does not change.
 - (C) the gas does no work.
 - (D) its pressure must increase.
 - (E) its temperature cannot change.

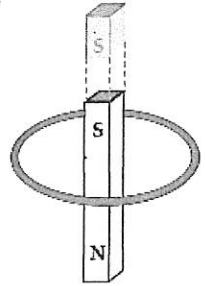
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科目名稱：物理與化學

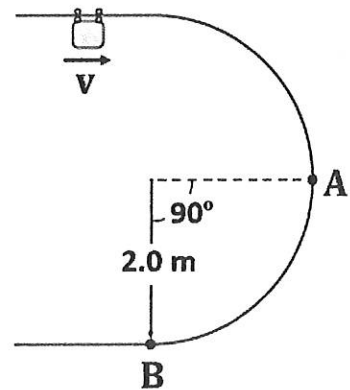
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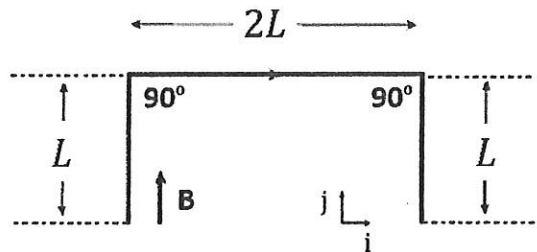
5. A bar magnet is dropped from above and falls through the loop of wire shown below. The north pole of the bar magnet points downward towards the page as it falls. Which statement is correct?
- (A) The current in the loop always flows in a counterclockwise direction.
 (B) The current in the loop always flows in a clockwise direction.
 (C) The current in the loop flows first in a clockwise, then in a counterclockwise direction.
 (D) No current flows in the loop because both ends of the magnet move through the loop.
 (E) The current in the loop flows first in a counterclockwise, then in a clockwise direction.



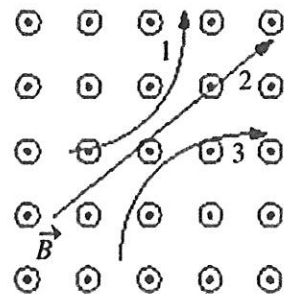
6. A 3.0-kg mass is projected down a rough, circular track (radius = 2.0 m) as shown. The speed of the mass at point A is 4.0 m/s, and at point B, it is 7.0 m/s. What is the change in mechanical energy done on the system between A and B by the force of friction?
- (A) -24 J
 (B) -9.3 J
 (C) -8.1 J
 (D) -7.2 J
 (E) -6.6 J



7. A straight wire is bent into the shape shown. Determine the net magnetic force on the wire when the current I travels in the direction shown in the magnetic field \mathbf{B} :
- (A) $2IBL$ in the $+z$ direction
 (B) $2IBL$ in the $-z$ direction
 (C) $4IBL$ in the $+x$ direction
 (D) $4IBL$ in the $-y$ direction
 (E) zero



8. Three particles travel through a region of space where the magnetic field is out of the page, as shown in the figure. The electric charge of each of the three particles is, respectively,
- (A) 1 is positive, 2 is neutral, and 3 is negative
 (B) 1 is positive, 2 is negative, and 3 is neutral
 (C) 1 is neutral, 2 is negative, and 3 is positive
 (D) 1 is neutral, 2 is positive, and 3 is negative
 (E) 1 is negative, 2 is neutral, and 3 is positive



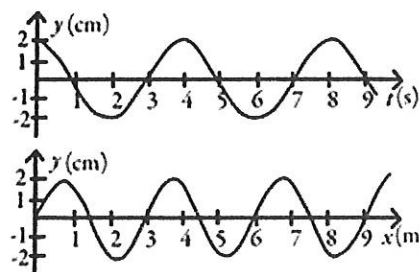
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科目名稱：物理與化學

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9. The figure shows the displacement y of a wave at a given position as a function of time and the displacement of the same wave at a given time as a function of position. Determine the frequency of the wave.



- (A) 4.0 Hz
 (B) 3.0 Hz
 (C) 0.50 Hz
 (D) 0.33 Hz
 (E) 0.25 Hz
10. An ice cube at 0°C is placed in a very large bathtub filled with water at 30°C and allowed to melt, causing no appreciable change in the temperature of the bath water. Which one of the following statements is true?
- (A) The entropy gained by the ice cube is equal to the entropy lost by the water.
 (B) The entropy lost by the ice cube is equal to the entropy gained by the water.
 (C) The net entropy change of the system (ice plus water) is zero because no heat was added to the system.
 (D) The entropy of the system (ice plus water) increases because the process is irreversible.
 (E) The entropy of the water does not change because its temperature did not change.
11. A perfect Carnot engine operates between the temperatures of 300K and 700 K, drawing 60 kJ of heat from the 700 K reservoir in each cycle. How much heat is dumped into the 300 K reservoir in each cycle?
- (A) 26 kJ
 (B) 30 kJ
 (C) 34 kJ
 (D) 38 kJ
 (E) 42 kJ
12. A car of mass 1500 kg collides head-on with a parked truck of mass 3000 kg. Spring mounted bumpers ensure that the collision is essentially elastic. If the velocity of the truck is 18 km/h (in the same direction as the car's initial velocity) after the collision, what was the initial speed of the car?
- (A) 18 km/h
 (B) 38 km/h
 (C) 27 km/h
 (D) 10 km/h
 (E) 54 km/h
13. In which process will the internal energy of the system *not* change?
- (A) An adiabatic expansion of an ideal gas.
 (B) An isothermal compression of an ideal gas.
 (C) An isobaric expansion of an ideal gas.
 (D) The freezing of a quantity of a liquid at its melting point.
 (E) The evaporation of a quantity of a liquid at its boiling point.

國立中山大學 111 學年度學士後醫學系招生考試試題

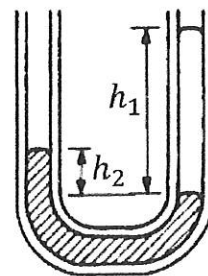
科目名稱：物理與化學

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14. A solid sphere, spherical shell, solid cylinder and a cylindrical shell all have the same mass m and radius R . If they are all released from rest at the same elevation and roll without slipping, which reaches the bottom of an inclined plane first? ($I_{\text{solid sphere}} = \frac{2}{5}MR^2$; $I_{\text{spherical shell}} = \frac{2}{3}MR^2$; $I_{\text{solid cylinder}} = \frac{1}{2}MR^2$; $I_{\text{hoop}} = MR^2$)
- (A) Solid sphere
 (B) Spherical shell
 (C) Solid cylinder
 (D) Hoop
 (E) All take the same time

15. Assume that the two liquids in the U-shaped tube as shown are water and oil. Compute the density of the oil if the water stands 19 cm above the interface and the oil stands 24 cm above the interface.
- (A) 455 kg/m³
 (B) 532 kg/m³
 (C) 664 kg/m³
 (D) 792 kg/m³
 (E) 825 kg/m³



16. Acetylsalicylic acid is commonly used as
 (A) a pain killer (B) a sedative (C) anti-cancer drug (D) tear gas (E) a fertilizer
17. Which of the following classes of organic compounds gives effervescence with a NaHCO_3 solution?
 (A) Aldehydes (B) Alkanes (C) Esters (D) Carboxylic acids (E) None of above
18. According to the Crystal Field Theory, when the valence d orbitals of the central metal ion of a coordination compound are split in energy in an octahedral ligand field, which orbitals are raised least in energy?
 (A) d_{xy} and $d_{x^2-y^2}$ (B) d_{xy} , d_{xz} and d_{yz} (C) d_{xz} and d_{yz} (D) d_{xz} , d_{yz} and d_{z^2} (E) $d_{x^2-y^2}$ and d_{z^2}
19. According to the equations below, please calculate ΔH for the reaction: $\text{IF}_5(\text{g}) \rightarrow \text{IF}_3(\text{g}) + \text{F}_2(\text{g})$.
 $\text{IF}(\text{g}) + \text{F}_2(\text{g}) \rightarrow \text{IF}_3(\text{g}) \quad \Delta H = -390 \text{ kJ}$
 $\text{IF}(\text{g}) + 2\text{F}_2(\text{g}) \rightarrow \text{IF}_5(\text{g}) \quad \Delta H = -745 \text{ kJ}$
 (A) +1135 J (B) -1135 J (C) +355 kJ (D) +35 kJ (E) -35 kJ
20. Which of the following reactions would have a positive ΔS ?
 (A) $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$
 (B) $2\text{H}_2\text{O}(\text{g}) \rightarrow 2\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
 (C) $\text{H}_2\text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\text{s})$
 (D) $\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{NO}_2(\text{g})$
 (E) $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
21. The balanced half-reaction in which a dichromate ion is reduced to chromium metal is a _____ process.
 (A) two-electron (B) six-electron (C) three-electron (D) four-electron (E) twelve-electron

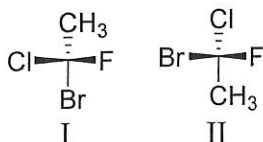
國立中山大學 111 學年度學士後醫學系招生考試試題

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22. The molecules below are:



- (A) constitutional isomers (B) enantiomers (C) diastereomers (D) identical (E) none of above

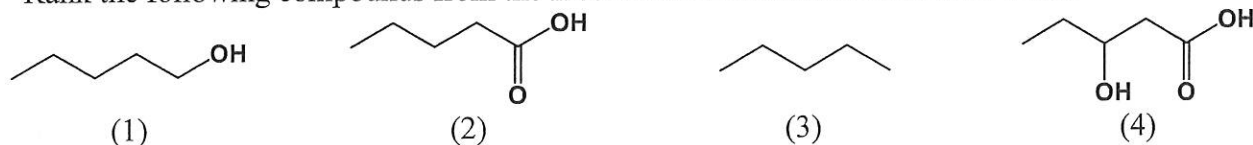
23. Which of the following is a *correct* description of “catalyst?”

- (A) It stabilizes the product.
 (B) It lowers the reaction enthalpy.
 (C) There is no reaction between the catalyst and the reactants.
 (D) It decreases the activation energy.
 (E) It diminishes the energy gap between the starting materials and the products.

24. What is the point group of sulfuric acid (with the highest possible symmetry)?

- (A) T_d (B) C_4 (C) D_{2d} (D) C_{2v} (E) C_s

25. Rank the following compounds from the most soluble to the least soluble in water.



- (A) $1 > 2 > 3 > 4$ (B) $2 > 4 > 1 > 3$ (C) $2 > 1 > 4 > 3$ (D) $3 > 4 > 1 > 2$ (E) $4 > 2 > 1 > 3$

26. There are three types of cubic unit cells, including simple cubic (SC), face-centered cubic (FCC), and body-centered cubic (BCC). Which of the following statements is *correct*?

- (A) BCC has 4 atoms per unit cell.
 (B) FCC has the largest unit cell.
 (C) The coordination number of SC is 8.
 (D) FCC is alternatively called hexagonal close-packed structure.
 (E) In BCC, the atomic packing factor is 0.68.

27. How many aromatic hydrocarbons have the molecular formula of C_8H_{10} ?

- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6

28. Which of the following statements about mass spectrometry is *correct*?

- I. The ions are separated based on their charge-to-mass ratio.
 II. Chemical ionization produces more fragmentation than electron ionization.
 III. Mass spectrometry can be used to accurately measure small differences in isotopic abundance.
 (A) I and II only (B) I and III only (C) II and III only (D) III only (E) I only

29. Which of the following statements associated with collision theory is *incorrect*?

- (A) More collisions correspond to a faster reaction rate.
 (B) It is assumed that the reactant molecules are hard spheres.
 (C) The potential energy and orientation govern the occurrence of collisions between reacting particles.
 (D) Collisions can occur between atoms, ions, and molecules.
 (E) The Arrhenius equation gives the correlation between the rate constant k and temperature T .

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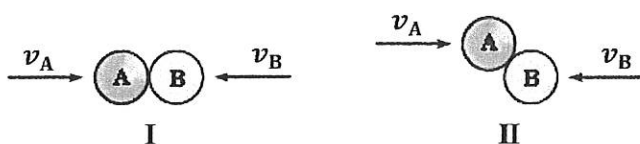
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30. The ionization energy of H is 13.6 eV. The first and second ionization energies of He will be approximately
 (A) 5 eV and 14 eV (B) 5 eV and 54 eV (C) 14 eV and 24 eV
 (D) 14 eV and 34 eV (E) 24 eV and 54 eV

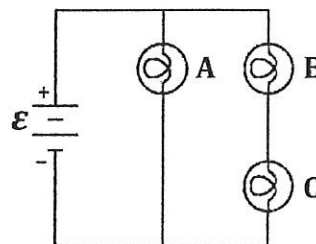
貳、第 31~90 題每題 2 分，共 120 分，每題答錯倒扣四分之一。

31. Two bodies, A and B, collide as shown in Figures I and II below. Which statement is true?



- (A) They exert equal and opposite forces on each other in both I and II.
 (B) They exert equal and opposite forces on each other in II but not in I.
 (C) They exert equal and opposite forces on each other in I but not in II.
 (D) The forces are equal and opposite to each other in I, but only the components of the forces parallel to the velocities are equal in II.
 (E) The forces are equal and opposite in I, but only the components of the forces perpendicular to the velocities are equal in II.
32. Two identical balls strike normal to a wall with the same velocity respectively. Ball A bounces backwards at the same speed. Ball B stops. Which statement correctly describes the change in momentum of the two balls?
 (A) $|\Delta\mathbf{p}_B| > |\Delta\mathbf{p}_A|$
 (B) $|\Delta\mathbf{p}_B| = |\Delta\mathbf{p}_A|$
 (C) $|\Delta\mathbf{p}_B| < |\Delta\mathbf{p}_A|$
 (D) $\Delta\mathbf{p}_B = \Delta\mathbf{p}_A$
 (E) $\Delta\mathbf{p}_B > \Delta\mathbf{p}_A$

33. The circuit right contains three 100-W light bulbs. The emf $\varepsilon = 220$ V. Which light bulb(s) is(are) the brightest?



- (A) A
 (B) B
 (C) C
 (D) B and C
 (E) All three are equally bright

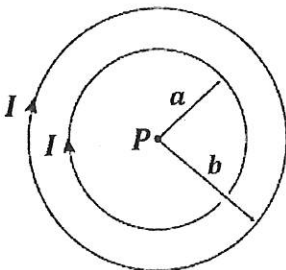
34. In an experiment, different wavelengths of light, all able to eject photoelectrons, shine on a freshly prepared (oxide-free) zinc surface. Which statement is true?
 (A) The number of photoelectrons emitted per second is independent of the intensity of the light for all the different wavelengths.
 (B) The number of photoelectrons emitted per second is directly proportional to the frequency for all the different wavelengths.
 (C) The maximum kinetic energy of the photoelectrons has a linear relationship with the frequency for each wavelength present.
 (D) The maximum kinetic energy of the photoelectrons emitted is directly proportional to the frequency for each wavelength present.
 (E) The maximum kinetic energy of the photoelectrons is proportional to the intensity of the light and independent of the frequency.

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35. Equal volumes of hydrogen and helium gas are at the same pressure. The atomic mass of helium is four times that of atomic hydrogen (H). If the total mass of both gases is the same, the ratio of the temperature of helium (He) to that of hydrogen (H_2) is $T(\text{He})/T(H_2) =$
- (A) 1/4
(B) 1/2
(C) 1
(D) 2
(E) 4
36. A block of material of mass m and specific heat c falls from height h and reaches speed v just before striking the ground. Its temperature is measured immediately after it strikes the ground. If we ignore any change in temperature owing to interaction with the air, the change in temperature of the block of material is
- (A) $\Delta T = \frac{v^2}{2c}$
(B) $\Delta T = \frac{gh}{c}$
(C) $\Delta T = \frac{vgh}{c}$
(D) All of the answers above are correct
(E) Only (A) and (B) above are correct
37. The work done in the expansion of a gas from an initial to a final state of a thermodynamic process
- (A) is the area under the curve of a PV diagram (P and V indicate the pressure and volume of the gas)
(B) depends only on the end point
(C) is independent of path
(D) is the slope of a PV curve
(E) equals $P(V_F - V_i)$
38. What is the magnitude of the magnetic field at point P if $a = R$ and $b = 2R$?
- (A) $\frac{3\mu_0 I}{4R}$
(B) $\frac{\mu_0 I}{4R}$
(C) $\frac{2\mu_0 I}{3R}$
(D) $\frac{\mu_0 I}{3R}$
(E) $\frac{3\pi\mu_0 I}{4R}$
- 
39. The wave function $\psi(x)$ of a particle confined to $0 \leq x \leq L$ is given by $\psi(x) = Ax$. $\psi(x) = 0$ for $x < 0$ and $x > L$. When the wave function is normalized, the probability density at coordinate x has the value
- (A) $\frac{2}{L^2} x$
(B) $\frac{2}{L^2} x^2$
(C) $\frac{2}{L^3} x^2$
(D) $\frac{3}{L^3} x^2$
(E) $\frac{3}{L^3} x^3$

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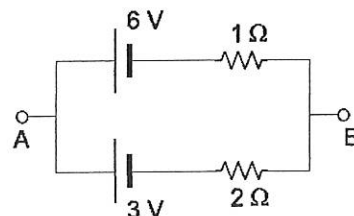
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40. Two conducting spheres, of radii $R_1 = 0.2$ m and $R_2 = 0.1$ m, carry charges $q_1 = 6 \times 10^{-8}$ C, $q_2 = -2 \times 10^{-8}$ C and are placed at a distance $\gg R_1, R_2$ from each other. They are then connected by a conducting wire. What are their final charges (q_1', q_2')?
- (A) 1.85×10^{-8} C, 2.15×10^{-8} C
 (B) 2.67×10^{-8} C, 1.33×10^{-8} C
 (C) 2.33×10^{-8} C, 1.67×10^{-8} C
 (D) 2.15×10^{-8} C, 1.85×10^{-8} C
 (E) 1.33×10^{-8} C, 2.67×10^{-8} C

41. Given a sample of radium-226 having a half-life of 4 days, find the probability that a nucleus disintegrates after two half-lives.
- (A) 1/2
 (B) 1/4
 (C) 2/3
 (D) 3/4
 (E) 1/3

42. Two batteries of different emfs and different internal resistances are connected. The voltage across AB in volt is

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



43. An ideal gas is allowed to undergo a free expansion. If its initial volume is V_1 and its final volume is V_2 , the change in entropy is
- (A) 0
 (B) $nR \ln(V_2/V_1)$
 (C) $nRT \ln(V_2/V_1)$
 (D) $nk \ln(V_2/V_1)$
 (E) nRV_2/V_1

44. The magnetic field of a plane-polarized electromagnetic wave moving in the z -direction is given by $B = 1.2 \times 10^{-6} \sin \left[2\pi \left(\frac{z}{240} - \frac{t \times 10^7}{8} \right) \right]$ in SI units. What is the speed of the EM wave?

- (A) 3×10^8 m/s
 (B) 100 m/s
 (C) 10^6 m/s
 (D) 2×10^7 m/s
 (E) 2×10^8 m/s

45. A wave generated in a medium is a longitudinal wave when
- (A) there is a net transport of matter by the wave.
 (B) the molecules of the medium are unable to exert forces on each other.
 (C) molecular displacements are parallel to the wave velocity.
 (D) molecular displacements are perpendicular to the wave velocity.
 (E) the density of the medium is less than the density of matter.

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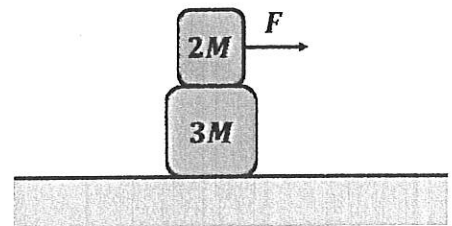
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46. The path difference between two waves is 5 m. If the wavelength of the waves emitted by the two sources is 4 m, what is the phase difference (in degrees)?

- (A) 90
- (B) 400
- (C) 1.57
- (D) 7.85
- (E) 15

47. Two blocks are accelerated across a horizontal frictionless surface as shown below. Frictional forces keep the two blocks from sliding relative to each other, and the two move with the same acceleration. If $F = 1.2 \text{ N}$ and $M = 1.0 \text{ kg}$, what is the horizontal component (frictional force) of the force of the small block on the large block?

- (A) 0.48 N to the right
- (B) 0.72 N to the right
- (C) 0.72 N to the left
- (D) 0.48 N to the left
- (E) 0.65 N to the left

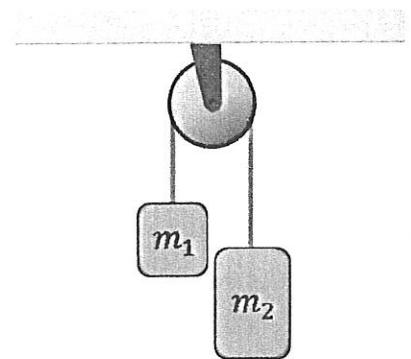


48. Two particles ($m_1 = 0.20 \text{ kg}$, $m_2 = 0.30 \text{ kg}$) are positioned at the ends of a 2.0-m long rod of negligible mass. What is the moment of inertia of this rigid body about an axis perpendicular to the rod and through the center of mass?

- (A) $0.48 \text{ kg} \cdot \text{m}^2$
- (B) $0.50 \text{ kg} \cdot \text{m}^2$
- (C) $1.2 \text{ kg} \cdot \text{m}^2$
- (D) $0.8 \text{ kg} \cdot \text{m}^2$
- (E) $0.7 \text{ kg} \cdot \text{m}^2$

49. Two blocks, $m_1 = 1.0 \text{ kg}$ and $m_2 = 2.0 \text{ kg}$, are connected by a light string as shown right. If the radius of the pulley is 1.0 m and its moment of inertia is $5.0 \text{ kg} \cdot \text{m}^2$, the acceleration of the system is

- (A) $g/6$
- (B) $3g/8$
- (C) $g/8$
- (D) $g/2$
- (E) $8g/5$



50. The moment of inertia of a collapsing spinning star drops to $1/3$ of its initial value without changing the angular momentum. What is the ratio of the new rotational kinetic energy to the initial rotational kinetic energy?

- (A) $1/6$
- (B) $1/3$
- (C) 1
- (D) 3
- (E) 6

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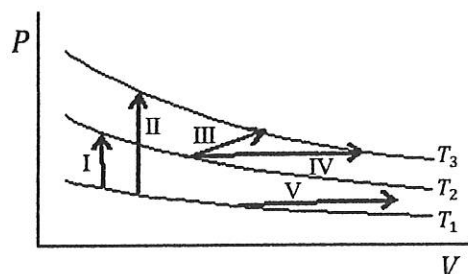
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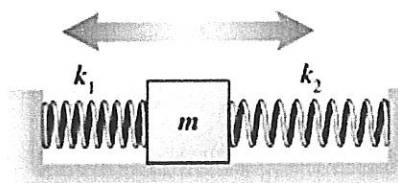
51. The diagram shows three isotherms for an ideal gas, with $T_3 - T_2$ the same as $T_2 - T_1$. It also shows five thermodynamic processes carried out on the gas. Rank the processes in order of the change in the internal energy of the gas, least to greatest.

- (A) I, II, III, IV, V
 (B) V; I; then III, and IV tied; then II
 (C) II; then I, III and IV tied; then V
 (D) II; I; then III, IV, and V tied
 (E) V; then I, III and IV tied; then II



52. A 2.0 kg block on a frictionless table is connected to two ideal massless springs with spring constants k_1 and k_2 whose opposite ends are fixed to walls, as shown in the figure. What is angular frequency of the oscillation if $k_1 = 7.5 \text{ N/m}$ and $k_2 = 5.0 \text{ N/m}$?

- (A) 0.40 rad/s
 (B) 0.56 rad/s
 (C) 1.2 rad/s
 (D) 2.5 rad/s
 (E) 3.5 rad/s



53. Suppose you have a pendulum clock which keeps correct time on Earth (acceleration due to gravity = 9.8 m/s^2). Without changing the clock, you take it to the Moon (acceleration due to gravity = 1.6 m/s^2). For every hour interval (on Earth) the Moon clock will record:

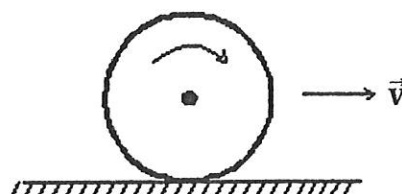
- (A) $\sqrt{1.6/9.8}$ h
 (B) $(1.6/9.8)$ h
 (C) 1 h
 (D) $(9.8/1.6)$ h
 (E) $\sqrt{9.8/1.6}$ h

54. Under electrostatic conditions, the electric field just outside the surface of any charged conductor

- (A) is always parallel to the surface.
 (B) is always zero because the electric field is zero inside conductors.
 (C) is always perpendicular to the surface of the conductor.
 (D) is perpendicular to the surface of the conductor only if it is a sphere, a cylinder, or a flat sheet.
 (E) can have nonzero components perpendicular to and parallel to the surface of the conductor.

55. A wheel of radius 0.5 m rolls without sliding on a horizontal surface as shown. Starting from rest, the wheel moves with constant angular acceleration 6 rad/s^2 . The distance in traveled by the center of the wheel from $t = 0$ to $t = 4 \text{ s}$ is:

- (A) 0 m
 (B) 12 m
 (C) 24 m
 (D) 48 m
 (E) None of these



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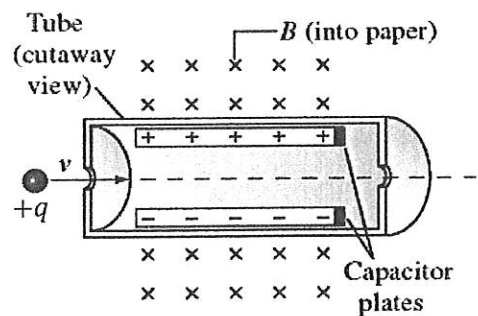
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56. A conducting sphere is charged up such that the potential on its surface is 100 V (relative to infinity). If the sphere's radius were twice as large, but the charge on the sphere were the same, what would be the potential on the surface relative to infinity?
- (A) 25 V
 (B) 50 V
 (C) 100 V
 (D) 200 V
 (E) 400 V

57. Electrons are in a two-dimensional square potential energy well with sides of length L . The potential energy is infinite at the sides and zero inside. The single-particle energies are given by $(h^2/8mL^2)(n_x^2 + n_y^2)$ where n_x and n_y are integers. At most the number of electrons that can have energy $5(h^2/8mL^2)$ is:
- (A) 1
 (B) 2
 (C) 3
 (D) 4
 (E) Any number

58. The figure shows a velocity selector that can be used to measure the speed of a charged particle. A beam of particles is directed along the axis of the instrument. A parallel plate capacitor sets up an electric field E , which is oriented perpendicular to a uniform magnetic field B . If the plates are separated by 2.0 mm and the value of the magnetic field is 0.90 T, what voltage between the plates will allow particles of speed 5.0×10^5 m/s to pass straight through without deflection?
- (A) 900 V
 (B) 1900 V
 (C) 3800 V
 (D) 190 V
 (E) 94 V



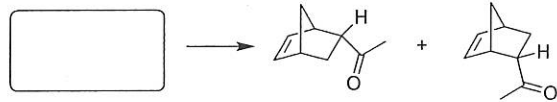
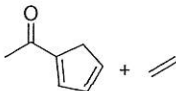
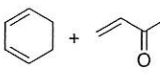
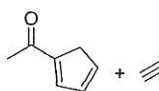
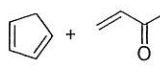
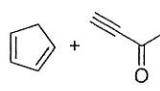
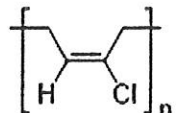
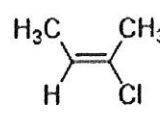
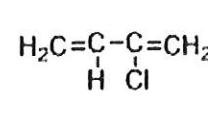
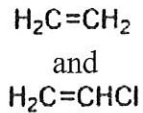
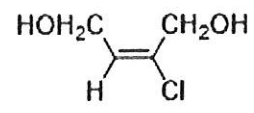
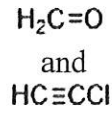
59. In a certain electroplating process gold is deposited by using a current of 14.0 A for 19 minutes. A gold ion, Au^+ , has a mass of approximately 3.3×10^{-22} g. How many grams of gold are deposited by this process? ($e = 1.60 \times 10^{-19}$ C)
- (A) 22 g
 (B) 28 g
 (C) 31 g
 (D) 36 g
 (E) 97 g

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60. One mole of an ideal gas has a temperature of 25 °C. If the volume is held constant and the pressure is doubled, the final temperature (in °C) will be
 (A) 174 (B) 596 (C) 50 (D) 323 (E) 25
61. Which of the following complexes only has σ -bonds between the organic ligand and the central metal?
 (A) Cp_2Fe (Cp = Cyclopentadienyl) (B) $(\eta^6\text{-C}_6\text{H}_6)_2\text{Cr}$ (C) $\text{W}(\text{CH}_3)_6$
 (D) $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$ (E) None of above
62. The rate of a gaseous reaction is given by the expression $k[\text{A}][\text{B}]^2$. If the volume of vessel is reduced to one half of the initial volume, the reaction rate as compared to the original rate is
 (A) 1/4 (B) 1/8 (C) 4 (D) 8 (E) 16
63. The correct order of the bond angles in H_2S , NH_3 , BF_3 and SiH_4 is
 (A) $\text{H}_2\text{S} < \text{NH}_3 < \text{SiH}_4 < \text{BF}_3$ (B) $\text{NH}_3 < \text{H}_2\text{S} < \text{SiH}_4 < \text{BF}_3$ (C) $\text{H}_2\text{S} < \text{SiH}_4 < \text{NH}_3 < \text{BF}_3$
 (D) $\text{H}_2\text{S} < \text{NH}_3 < \text{BF}_3 < \text{SiH}_4$ (E) $\text{BF}_3 < \text{SiH}_4 < \text{NH}_3 < \text{H}_2\text{S}$
64. Which diene and dienophile would you choose to synthesize the following compounds?

 (A)  (B)  (C)  (D)  (E) 
65. *trans*-3-Methylcyclopentanol is treated with $\text{CH}_3\text{SO}_2\text{Cl}$ in the presence of base. The product of this reaction is then heated with 1 equivalent of KI in methanol. What is the final product?
 (A) *cis*-1-Iodo-3-methylcyclopentane (B) *trans*-1-Iodo-3-methylcyclopentane
 (C) 1-Methylcyclopentene (D) 2-Methylcyclopentene (E) 3-Methylcyclopentene
66. Given four oxygen species: O_2^+ , O_2 , O_2^- , O_2^{2-} . Which of the following is the correct order of their O-O bond length?
 (A) $\text{O}_2^+ > \text{O}_2 > \text{O}_2^- > \text{O}_2^{2-}$ (B) $\text{O}_2^{2-} > \text{O}_2^- > \text{O}_2 > \text{O}_2^+$ (C) $\text{O}_2^{2-} > \text{O}_2^- > \text{O}_2^+ > \text{O}_2$
 (D) $\text{O}_2^- > \text{O}_2^+ > \text{O}_2^{2-} > \text{O}_2$ (E) $\text{O}_2 > \text{O}_2^+ > \text{O}_2^- > \text{O}_2^{2-}$
67. Which of the following monomers or pairs of monomers is used to make the addition polymer neoprene shown on the right?

 (A)  (B)  (C)  (D)  (E) 

國立中山大學 111 學年度學士後醫學系招生考試試題

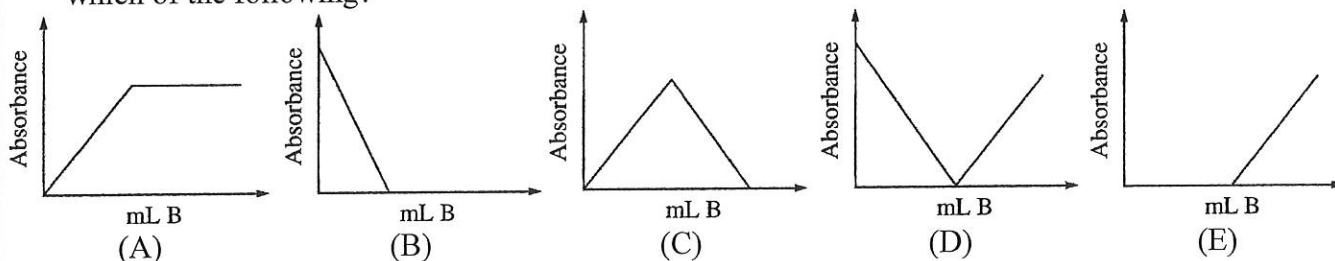
科目名稱：物理與化學

※本科目依簡章規定「不可以」使用計算機(選擇題)

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68. For the titration reaction $A+B \rightarrow C$, where A=analyte, B=titrant, and C=product, the end point is to be detected spectrophotometrically at 550 nm, based on the absorbance information shown on the right. The shape of the titration curve at 550 nm would most closely resemble which of the following?

Substance	Wavelengths Absorbed (nm)
A	400-600, 700-800
B	< 400, 500-700
C	< 400



69. At sufficiently low temperatures, gaseous ammonia has a molar volume that is less than that predicted by the ideal gas law at certain low pressures, but has a molar volume that is greater than that predicted at certain high pressures. Which of the following is a reasonable explanation for this behavior?
- (A) Attractive forces predominate at these low pressures, and repulsive forces predominate at these high pressures.
 (B) Repulsive forces predominate at these low pressures, and attractive forces predominate at these high pressures.
 (C) Repulsive forces operate over greater distances than attractive forces.
 (D) As the pressure of a gas increases, its temperature increases.
 (E) Hydrogen bonding is not a factor at the critical pressure.
70. Analysis of a bottle of 100 mg vitamin C tablets yields an average vitamin C content of 99.8 mg, with a standard deviation of ± 0.3 mg. Assuming Gaussian statistics, which of the following is true?
- (A) None of the tablets contains less than 99.5 mg of vitamin C.
 (B) 68% of the tablets contain between 99.5 and 100.1 mg of vitamin C.
 (C) 97% of the tablets contain between 99.5 and 100.1 mg of vitamin C.
 (D) All of the tablets contain less than 100 mg of vitamin C.
 (E) The average value is incorrect.
71. In emission spectroscopy, which of the following relaxation processes occurs at around 10^{-12} s?
- (A) Fluorescence resonance energy transfer (B) Internal crossing (C) Fluorescence emission
 (D) Phosphorescence emission (E) Vibration relaxation
72. Chelation therapy is known as the administration of chelating agents to eliminate toxic heavy metals from the body and has been practiced for many years in clinical toxicology. EDTA is used for intravenous injection as a detoxification treatment for heavy metal ions. Which of the following statement associated with EDTA is *incorrect*?
- (A) EDTA is a hexadentate ligand.
 (B) The full name of EDTA is ethylenediaminetetraacetate.
 (C) A direct titration method is suitable for analytes that are precipitated in the absence of EDTA.
 (D) EDTA is commonly used as an additive for collecting whole blood and plasma specimens.
 (E) After complexation with Fe^{3+} , the EDTA can be detected by UV-vis absorption spectroscopy.

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：物理與化學

※本科目依簡章規定「不可以」使用計算機(選擇題)

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73. Which of the following methods could be used to determine the molecular weight of bovine serum albumin?
- (A) Matrix-assisted laser desorption/ionization-time of flight mass spectrometry
 - (B) Size-exclusion chromatography
 - (C) Sodium dodecyl sulfate-polyacrylamide gel electrophoresis
 - (D) Electrospray ionization mass spectrometry
 - (E) All of above

74. Titanium dioxide nanoparticles absorb light at wavelengths below 400 nm. After absorbing light, water molecules adsorbed on the surface of titanium dioxide nanoparticles can be directly oxidized to hydroxide radicals. The produced hydroxyl radicals can decompose the adsorbed pollutants. Which of the following instruments is the most suitable to verify the generation of hydroxide radicals from the reaction of water molecules and titanium dioxide nanoparticles?
- (A) High-performance liquid chromatography
 - (B) Fluorescence spectroscopy
 - (C) Electron paramagnetic resonance spectroscopy
 - (D) Nuclear magnetic resonance spectroscopy
 - (E) X-ray photoelectron spectroscopy

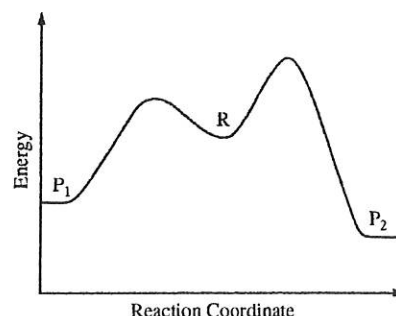
75. Which of the following statements associated with the pH meter is *incorrect*?
- (A) The pH meter should include a working electrode, a reference electrode, and a counter electrode.
 - (B) The pH meter is unable to determine the pH of 0.1 M NaOH.
 - (C) Silver chloride-coated silver wire is commonly used as a reference electrode in the pH meter.
 - (D) The glass membrane must be hydrated.
 - (E) The difference in potential between the inner and outer layers is the boundary potential.

76. The boiling points of halogens (see table right) increases from F_2 to I_2 . This is the result of an increase in which quantity from F_2 to I_2 ?

Compound	Boiling point
F_2	-187.9 °C
Cl_2	-187.9 °C
Br_2	+58.8 °C
I_2	+184.5 °C

- (A) Ionic bonding
- (B) Covalent bond strength
- (C) Electron affinity
- (D) Van der Waals forces
- (E) Nuclear quadrupole moment

77. A reactant, R, can produce either of two products, P_1 or P_2 , with competing pathways, as illustrated in the reaction profile shown right. If the reaction is carried out at low temperature, which of the following best indicates the preferred product and the type of control?



- (A) Preferred product P_1 , kinetic control
- (B) Preferred product P_1 , thermodynamic control
- (C) Preferred product P_2 , kinetic control
- (D) Preferred product P_2 , thermodynamic control
- (E) Preferred product R, thermodynamic control

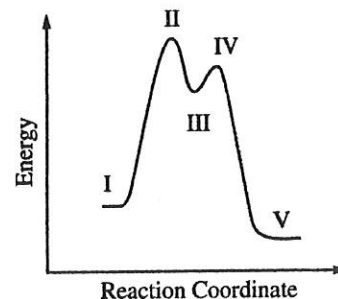
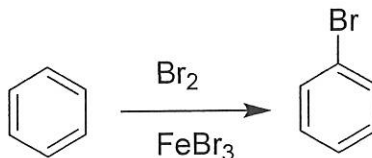
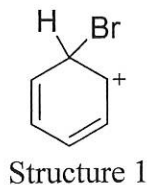
科目名稱：物理與化學

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78. The reaction energy diagram for the electrophilic bromination of benzene with Br_2 and FeBr_3 is shown right. Which position on the energy diagram corresponds to Structure 1?

- (A) I
(B) II
(C) III
(D) IV
(E) V



79. Carbon monoxide is extremely dangerous to living organisms because it
- (A) is an irreversible inhibitor of serine proteases such as acetylcholine esterase.
(B) competes very effectively with oxygen for binding to the sixth coordination position of Fe^{2+} in heme.
(C) causes oxidative DNA damage.
(D) is a small nonpolar molecule and therefore acts like a detergent and rips open cell membranes.
(E) carbamylates free amino groups in a variety of proteins and enzymes, thus disrupting normal hydrogen bonding.
80. Which reagent would convert 1,3-octadiene into 3-octen-2-ol?
(A) $\text{KMnO}_4/\text{OH}^-$ (B) OsO_4 (C) *m*CPBA, then H_3O^+ (D) $\text{Cl}_2/\text{H}_2\text{O}$ (E) H_3O^+
81. At some temperatures, the relative reactivities of 3° , 2° , and 1° alkane hydrogens in free radical chlorination are in the ratio of 5:3:1. Thus, monochlorination of isopentane should produce these percentages of 2-chloro-2-methylbutane (a), combined 1-chloro-2-methylbutane and 1-chloro-3-methylbutane (b), and 2-chloro-3-methylbutane (c):
(A) 8% a, 75% b, 17% c (B) 25% a, 45% b, 30% c (C) 29% a, 44% b, 18% c
(D) 30% a, 35% b, 35% c (E) 36% a, 43% b, 21% c
82. Starting with benzene, the best method for preparing *p*-nitrobenzoic acid is:
(A) $\text{HNO}_3/\text{H}_2\text{SO}_4$, then $\text{CH}_3\text{Cl}/\text{AlCl}_3$, then separation of isomers, then $\text{KMnO}_4/\text{OH}^-/\text{heat}$, followed by H_3O^+
(B) $\text{CH}_3\text{Cl}/\text{AlCl}_3$, then $\text{HNO}_3/\text{H}_2\text{SO}_4$, then separation of isomers, then $\text{KMnO}_4/\text{OH}^-/\text{heat}$, followed by H_3O^+
(C) $\text{CH}_3\text{Cl}/\text{AlCl}_3$, then $\text{KMnO}_4/\text{OH}^-/\text{heat}$, followed by H_3O^+ , then $\text{HNO}_3/\text{H}_2\text{SO}_4$
(D) $\text{HNO}_3/\text{H}_2\text{SO}_4$, then $\text{KMnO}_4/\text{OH}^-/\text{heat}$, followed by H_3O^+ , then $\text{CH}_3\text{Cl}/\text{AlCl}_3$
(E) $\text{HNO}_3/\text{H}_2\text{SO}_4$; then CO_2 , followed by H_3O^+
83. Arrange the following isoelectronic species in order of increasing ionic radius.
(A) $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+}$ (B) $\text{F}^- > \text{O}^{2-} > \text{Mg}^{2+} > \text{Na}^+$ (C) $\text{Mg}^{2+} > \text{O}^{2-} > \text{Na}^+ > \text{F}^-$
(D) $\text{Na}^+ > \text{F}^- > \text{Mg}^{2+} > \text{O}^{2-}$ (E) $\text{Mg}^{2+} > \text{Na}^+ > \text{F}^- > \text{O}^{2-}$
84. What is the formal charge of oxygen in carbon monoxide?
(A) +2 (B) +1 (C) 0 (D) -1 (E) -2

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：物理與化學

※本科目依簡章規定「不可以」使用計算機(選擇題)

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85. Nylon is synthesized via the polycondensation reaction. For example, the Nylon 6,6 is from the condensation reaction of hexamethylenediamine and adipic acid. To obtain the polymeric product with good physical properties, the conversion of the condensation needs to be above 99% to achieve the high molecular weight. Accordingly, when we select the monomer for the production of Nylon, what is the lower limit of the equilibrium constant?
(A) 10 (B) 100 (C) 1000 (D) 10000 (E) 100000
86. How many signals does the unsaturated ketone $(\text{CH}_3)_2\text{CHCH}_2\text{C}(\text{O})\text{CH}=\text{CH}_2$ have in ^1H NMR and ^{13}C NMR spectra?
(A) 5 ^1H signals, 6 ^{13}C signals (B) 6 ^1H signals, 6 ^{13}C signals (C) 6 ^1H signals, 7 ^{13}C signals
(D) 5 ^1H signals, 7 ^{13}C signals (E) 5 ^1H signals, 5 ^{13}C signals
87. X in limited amount is present in soil and is essential for plants nutrients but if present in high concentration can be harmful both for plants, animals and aquatic organisms. What is X?
(A) Hydrogen sulphide (B) Carbon dioxide (C) Ammonia (D) Water (E) All of above
88. Which of the following electrodes are commonly used as a reference electrode in voltammetry?
(A) Platinum wire (B) Carbon paste (C) Mercury thin film (D) Gold disk
(E) Silver chloride-coated silver wire
89. In fall 2017, clouds of ruthenium-106 (^{106}Ru) radioactive contamination appeared over Eastern Europe. Scientists measured the airborne radio-ruthenium isotope ratio ($^{103}\text{Ru}/^{106}\text{Ru}$) and confirmed its concentration. Which of the following techniques is the most suitable for the detection of the $^{103}\text{Ru}/^{106}\text{Ru}$ ratio?
(A) Inductively coupled plasma mass spectrometry (ICP-MS)
(B) Matrix-assisted laser desorption/ionization-time of flight mass spectrometry
(C) Electrospray ionization mass spectrometry
(D) Fourier-transform ion cyclotron resonance mass spectrometry
(E) Elemental analyzers
90. Capillary electrophoresis is powerful in detecting various genetic diseases, such as Thalassemia and Spinal Muscular Atrophy. Which of the following modes in capillary electrophoresis is the most suitable for diagnosing genetic disease (i.e., separation of DNA molecules)?
(A) Capillary zone electrophoresis
(B) Capillary isoelectric focusing
(C) Micellar electrokinetic chromatography
(D) Capillary electrochromatography
(E) Capillary gel electrophoresis

國立中山大學 111 學年度 學士後醫學系招生考試試題

科目名稱：計算機概論與程式設計

— 作答注意事項 —

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卡之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卡請以 **2B** 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卡應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 不可使用計算機，並不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卡請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：計算機概論與程式設計

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 18 頁第 1 頁

※選擇題(單一選擇題，共 90 題，總分 150 分)

壹、第 1~30 題每題 1 分，共 30 分，每題答錯倒扣四分之一。

1. Which of the following is the binary representation of $(6.625)_{10}$?
 - A. 101.101
 - B. 101.11
 - C. 110.101
 - D. 110.11
 - E. 111.11
2. If you have a disk that has a capacity of Petabyte (PB), that is equal to
 - A. 2 to the 20th power of bytes
 - B. 2 to the 30th power of bytes
 - C. 2 to the 40th power of bytes
 - D. 2 to the 50th power of bytes
 - E. 2 to the 60th power of bytes
3. How many bits in length are used for IP address in IPv4?
 - A. 4
 - B. 8
 - C. 16
 - D. 32
 - E. 64
4. Which of the following statement about the Unicode is not true?
 - A. An extended version of the ASCII
 - B. It contains 256 characters
 - C. It is not only for English but also international use
 - D. It is designed to be a superset of ASCII
 - E. Each character is encoded with 16 bits
5. Three security goals are _____.
 - A. Confidentiality, cryptography, and nonrepudiation
 - B. Confidentiality, encryption, and reliability
 - C. Confidentiality, integrity, and availability
 - D. Confidentiality, denial of service, and masquerading
 - E. Reliability, nonrepudiation, and masquerading
6. If the longest path in a binary tree contained exactly four nodes, what is the minimum number of nodes that could be in the entire tree?
 - A. 4
 - B. 5
 - C. 7
 - D. 8
 - E. 15
7. Which of the following data structures is static in the sense that it does not change size as data items are inserted or deleted?
 - A. Array
 - B. Singly linked list

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：計算機概論與程式設計

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 18 頁第 2 頁

- C. Queue
 - D. Stack
 - E. Tree
8. Which one of the following is NOT the characteristic of TCP protocol?
- A. Connection-oriented
 - B. Connectionless
 - C. Congestion control
 - D. Error control
 - E. 3-way handshaking
9. Which of the following methods is suitable for preventing the falsification of medical records?
- A. Natural Language Process
 - B. Neural Network
 - C. Blockchain
 - D. Information Retrieval
 - E. Data Compression
10. The digital transformation of smart medical has always been a hot topic and paid more attention in the post-epidemic era. Which of the following falls within its scope?
- A. Interactive health education
 - B. Precision medicine
 - C. Telemedicine
 - D. Smart long-term care medical
 - E. All of the above
11. Which of the following is used to store the instruction currently being executed?
- A. Program counter
 - B. Cache memory
 - C. Instruction register
 - D. Program register
 - E. CPU
12. $x = 01001010$, $y = 11001100$. What is the Hamming distance between x and y ?
- A. 3
 - B. 65
 - C. 130
 - D. 148
 - E. 278
13. Which one of the following is an unsupervised learning method?
- A. K-means
 - B. Support vector machine (SVM)
 - C. Decision Tree
 - D. Regression
 - E. KNN
14. (a) System Program, (b) Application Program, (c) Operating System, and (d) CPU, can be arranged in order of proximity to the user. Which of the following order is correct?
- A. a, b, c, d

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：計算機概論與程式設計

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 18 頁第 3 頁

- B. d, c, b, a
C. b, a, c, d
D. c, a, b, d
E. None of the above
15. Which of the following statement about GPU is not true?
A. GPU stands for graphic processor unit
B. GPU is a separate computer and can be more powerful than CPU
C. Modern GPUs are very efficient at manipulating computer graphics and image processing
D. GPU usually has less cores than CPU
E. GPUs are used in embedded systems, personal computers, workstations, and game consoles
16. If the function `int volume(int x = 1, int y = 1, int z = 1);` is called by the expression `volume(7, 8)`, how many default arguments are used?
A. None.
B. One.
C. Two.
D. Three.
E. It depends on the runtime environment.
17. If `a=1.0`, `b=6.0` and `c=4.0`, then what is printed by `printf("%.2f", sqrt(a+b*c));`
A. 25
B. 5.00
C. 5
D. 25.00
E. 10.00
18. Which of the following C code is used to declare a two-dimensional array of integers with 5 rows and 3 columns?
A. `int data[5,3];`
B. `int data[5][3];`
C. `int data[5×3];`
D. `int data[5] × [3];`
E. None of the above
19. What is the output of the following statements?

```
int x = 3;
switch(x+1) {
    case 3:
        printf("3 ");
    case 4:
        printf("4 ");
    case 5:
        printf("5 ");
        break;
    case 6:
        printf("6 ");
    default:
```

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：計算機概論與程式設計

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 18 頁第 4 頁

```
printf("X");
```

```
}
```

- A. 3 4 5 6 X
- B. 4 5 6 X
- C. 5 6 X
- D. 4 5 6
- E. 4 5

20. Which following is the correct way to create a dictionary in Python?

- A. `students = {'name'=>'alice'; 'score'=>60}`
- B. `students = {'name'='alice'; 'score'=60}`
- C. `students = {'name': 'alice'; 'score':60}`
- D. `students = {'name'=>'alice', 'score'=>60}`
- E. `students = {'name': 'alice', 'score':60}`

21. What is the output of this code in Python?

```
list = ['a', 'b', 'c', 'd', 'e']  
print(list[1:])
```

- A. []
- B. ['b']
- C. ['a', 'b']
- D. ['b', 'c', 'd', 'e']
- E. None of these

22. What does the following Python program fragment do?

```
s=0  
for i in range(3,10):  
    s+=i  
print(s)
```

- A. Calculate the sum of $1 + 2 + \dots + 10$
- B. Calculate the sum of $1 + 4 + 7 + 10$
- C. Calculate the sum of $3 + 4 + 5 + 6 + \dots + 9$
- D. Calculate the sum of $3 + 4 + 5 + 6 + \dots + 10$
- E. Calculate the sum of $0 + 2 + 4 + 6 + \dots + 10$

23. Which of the following statements about the format specifier for `printf()` function in C is incorrect?

- A. `%b` is used to print a binary number
- B. `%d` is used to print a decimal number
- C. `%x` is used to print a hexadecimal number
- D. `%f` is used to print a floating number
- E. None of the above

24. Consider an array declaration 「`int data[5]={1,2,3,4,5};`」 in C. What is the value of `data[5]`?

- A. 0

國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：計算機概論與程式設計

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 18 頁第 5 頁

- B. 5
- C. 6
- D. 12345
- E. None of the above

25. Which of the following C code is used to declare two pointers of integer?

- A. `int *p,q;`
- B. `int *p,*q;`
- C. `int *(p,q);`
- D. `(int *) p,q;`
- E. None of the above

26. Which of the following code could not be used to ignore all remaining characters in the current input line?

- A. `do {scanf("%c", &ch);} while (ch !='\n');`
- B. `do {ch = getchar();} while (ch !='\n');`
- C. `while ((ch=getchar())!='\n');`
- D. `while (getchar()!='\n');`
- E. None of the above.

27. What is the output of the following program?

```
int a[10] = {3,2,3,4,5,4,7,1,3,2};
int b[10] = {0,0,0,0,0,0,0,0,0,0};
for(i = 0; i < 10; i=i+1)
    b[a[i]-1] = b[a[i]-1] + 1;
printf("%d", b[2] );
```

- A. 3
- B. 1
- C. 2
- D. 4
- E. 5

28. What is the output of this code in python?

```
r = lambda q: q * 2
s = lambda q: q * 3
x = 2
x = r(x)
x = s(x)
x = r(x)
print (x)
```

- A. 2
- B. 4
- C. 6
- D. 12
- E. 24

29. What is the output of this code in C++?

```
#include<iostream>

using namespace std;
```


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科目名稱：計算機概論與程式設計

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 18 頁第 6 頁

```
class Constructor1 {
public:
    Constructor1()
    { cout << "constructor1 called" << endl; }
};

class Constructor2 {
public:
    Constructor2()
    { cout << "constructor2 called" << endl; }
};

class Derived: public Constructor1, public Constructor2 {
public:
    Derived()
    { cout << "Derived's constructor called" << endl; }
};

int main()
{
    Derived d;
    return 0;
}
```

- A. constructor1 called
constructor2 called
Derived's constructor called
- B. constructor2 called
constructor1 called
Derived's constructor called
- C. Derived's constructor called
- D. Compile error
- E. None of the above

30. Assuming that `t` is an array and `tPtr` is a pointer to that array, which expression refers to the address of element 5 of the array?

- A. `*(tPtr+5)`
- B. `tPtr[5]`
- C. `t+5`
- D. `*(t+5)`
- E. `&t[5]`

貳、第 31~90 題每題 2 分，共 120 分，每題答錯倒扣四分之一。

31. Which of the following network attacks is threatening integrity?

- A. Man-in-the-middle
- B. Denial of service
- C. Packet sniffing
- D. Keylogger
- E. SYN flood attack

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32. Which of the following is NOT a necessary condition for deadlock?
- A. Circular wait
 - B. Convey effect
 - C. Hold and wait
 - D. Mutual exclusion
 - E. No preemption
33. Which one of the following operations is not performed by ALU (Arithmetic/Logic Unit)
- A. AND
 - B. OR
 - C. Circular shift
 - D. Jump
 - E. Addition
34. What is the smallest negative number using 1's complement in a 64-bits computer?
- A. -2^{63}
 - B. $-(2^{63} - 1)$
 - C. -2^{64}
 - D. $-(2^{64} - 1)$
 - E. None of the above
35. The widest range of free software licenses available under license terms approved by the Free Software Foundation and the Open Source Software Community. Which of the following statements is inappropriate?
- A. The GNU GPL can protect the rights of software publishers.
 - B. Guaranteed freedom for end users (individuals, organizations, businesses) to operate, learn and share.
 - C. Claim the copyright of the software, provide a license to give legal permission to copy, distribute and/or modify.
 - D. Guarantee that the end user cannot modify the software.
 - E. Claim the copyright of the software, provide a license to give legal permission to modify.
36. Which of the following is an appropriate statement about the Python language?
- A. The Object-oriented programming (OOP) is supported, and procedure-oriented programming (POP) is supported.
 - B. OOP is supported and the POP is not supported.
 - C. OOP is not supported and POP is supported.
 - D. OOP is not supported and POP is not supported.
 - E. None of the above
37. Which of the following statement about recursive functions is true?
- A. **for** or **while** architectures are generally used
 - B. Fewer local variables than the equivalent nonrecursive routine
 - C. Used to reduce the execution time
 - D. Recursion is another name for iteration
 - E. None of the above
38. Given a row-major array $A(i,j)$ is defined as $-2 \leq i \leq 6$, $-6 \leq j \leq -2$, where the location of $A(2,-4)$ is 100 as the base address and the location of $A(4,-3)$ is 122.
Which of the following is the correct storage size for an element stored in the array?

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- A. 1
- B. 2
- C. 3
- D. 4
- E. None of the above

39. According to Amdahl's Law, what is the speedup gain for an application that is 60% parallel and we run it on a machine with 6 processing cores (compared to the machine with 1 core)?

- A. 1.2
- B. 2
- C. 2.5
- D. 3.6
- E. 6

40. Given the relation below

X:	A	B	C
	2	5	7
	3	3	6
	4	4	2
	6	2	2

what values will be retrieved by the following SQL statement?

SELECT A, B FROM X WHERE X.B = X.C

- A. 2, 2
- B. 2, 5
- C. 3, 3
- D. 3, 6
- E. 6, 2

41. Which of the following bit patterns violates odd parity check?

- A. 00011111
- B. 01010101
- C. 01100111
- D. 10000000
- E. 10100001

42. Which one of the following is a loopback address?

- A. 127.0.0.1
- B. 255.255.255.255
- C. 0.0.0.0
- D. 168.5.16.8
- E. 224.3.16.8

43. Which one of the following is NOT considered as a basic concept in object-oriented programming (OOP)?

- A. Parallelism
- B. Inheritance
- C. Encapsulation
- D. Polymorphism
- E. Data abstraction

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44. An image can be represented in HSV color space. Here 'V' means
- A. Hue
 - B. Saturation
 - C. Brightness
 - D. Color intensity
 - E. None of the above
45. In machine learning, when the result of testing error is significantly larger than the training error, it is called
- A. Underfitting
 - B. Overfitting
 - C. Oversampling
 - D. Training bias
 - E. None of the above
46. Which of the following statements is incorrect for the transport layer?
- A. TCP is a reliable and connection-oriented protocol
 - B. TCP uses the IP address
 - C. UDP is not a reliable and connection-oriented protocol
 - D. UDP does not uses the IP address
 - E. None of the above
47. Which of the following statements is incorrect for the Ransomware?
- (a) It is a type of denial-of-service attack
 - (b) It will encrypt the files to prevent the access
 - (c) It will lock the computer to prevent the normal usage
 - (d) It often uses phishing as an entry point
- A. (a)
 - B. (b)
 - C. (c)
 - D. (d)
 - E. (b), (d)
48. Which of the following data structures is in LIFO (Last In First Out) order?
- A. Array
 - B. General Array
 - C. Stack
 - D. Queue
 - E. Double Queue
49. If users including individuals, organizations, and enterprises can obtain computing, computing power, and shared software and hardware resource application services through the Internet, which of the following computing modes belong to the above statements?
- A. Client/server
 - B. P2P
 - C. Broadband
 - D. Decentralized
 - E. Cloud

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50. In application layer protocols including HTTP, SMTP, and FTP, what mechanism is usually used to translate the host name provided by the user into an IP address?
- A. FTP
 - B. Database
 - C. DNS
 - D. IMAP
 - E. None of the above
51. Assume the execution time of a running program is $50(\log n^2) + 8$, then what is the most suitable time complexity?
- A. $O(\log n^2)$
 - B. $O((\log n)^2)$
 - C. $O(\log n)$
 - D. $O(n)$
 - E. $O(n^2)$
52. According to the definition of the major topics of information ethics, "When can information be used for free? Under what circumstances should it be used with a payment or with the consent of the owner?" What does this statement mean?
- A. Accessibility
 - B. Accuracy
 - C. Privacy
 - D. Property
 - E. None of the above
53. Which of the following statement is not the responsibility of an operation system?
- A. Communicate with the computer user
 - B. Manage allocation of memory
 - C. Collect input from input device
 - D. Execute the program
 - E. Convey program output to the output device
54. Which of the following data type conversion may result in data loss?
- A. **float** to **double**
 - B. **int** to **char**
 - C. **short** to **long**
 - D. **int** to **float**
 - E. **bool** to **char**
55. Which of the following statement is true?
- A. A NOT gate accepts two inputs
 - B. The output of an XOR gate is 0 unless both inputs are 1
 - C. The sum of two binary digits (ignoring the carry) is expressed by an OR gate
 - D. The NOR gate produce the opposite results of the XOR gate
 - E. Inverting the output of an AND gate is equivalent to inverting the individual signals first, then passing them through an OR gate
56. Which of the following is NOT essential for a time-sharing operating system?
- A. Interrupt vectors
 - B. Privileged instructions

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- C. Memory protection
 - D. Virtual memory
 - E. Dual mode processor state
57. Which of the following definition is not true?
- A. The Turing Test is based on whether a computer could fool a human into believing that the computer is another human being
 - B. A computer system that can pass the Turing test is considered to be intelligent
 - C. Each element in an artificial neural net is affected by a numeric weight
 - D. Each human has a unique voiceprint that can be used to train voice recognition systems
 - E. None of the above
58. Which one of the following methods is NOT considered as a solution for preventing the overfitting problem in AI training?
- A. Collect more training data
 - B. Use regularization
 - C. Increase model complexity
 - D. Data augmentation
 - E. Use ensemble method
59. Given a postfix expression is $abcde^{*} - *fg / + =$, where $b=2$, $c=3$, $d=4$, $e=5$, $f=6$, and $g=3$. Which of the following is the value of a ?
- A. 31
 - B. -31
 - C. 32
 - D. -32
 - E. None of the above
60. Which of the following statement about sorting algorithm is not true?
- A. A sorting algorithm puts elements of a list into an order
 - B. For Quick sort, the average complexity is $n \log n$ to sort n elements
 - C. For Bubble sort, the average complexity is n^2 to sort n elements
 - D. For Insertion sort, the average complexity is n^2 to sort n elements
 - E. For Selection sort, the average complexity is $n \log n$ to sort n elements
61. Which of the following is not a correct way to initialize an array?
- A. `int n[5]={0, 1, 2, 3, 4, 5};`
 - B. `int n[]={0, 1, 2, 3, 4, 5};`
 - C. `int n[5]={1};`
 - D. `int n[5]={1, 5, 9};`
 - E. `int n[5]={0};`
62. Polymorphism is implemented through:
- A. Non-**const** functions.
 - B. Member functions.
 - C. Non-**virtual** functions.
 - D. **virtual** functions and dynamic binding.
 - E. **inline** functions.

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63. A copy constructor must receive its argument by reference instead of by value because:
- A. Otherwise the constructor will only make a copy of a pointer to an object.
 - B. The copy of the argument passed by value has function scope.
 - C. The pointer needs to know the address of the original data, not a temporary copy of it.
 - D. Otherwise infinite recursion occurs.
 - E. Otherwise the constructor will never be called.

64. What will be the output of the following program?

```
#include <stdio.h>
void swap(int a, int b);
int main(void) {
    int i = 1, j = 2;
    swap(i, j);
    printf("i = %d, j = %d\n", i, j);
    return 0;
}
void swap(int a, int b) {
    int temp = a;
    a = b;
    b = temp;
}
```

- A. i=1, j=2
 - B. i=2, j=1
 - C. i=1, j=1
 - D. i=2, j=2
 - E. i=0, j=0
65. Which of the following conditions correctly describes the output of this code in Python?

```
first = [1, 2, 3, 4, 5]
second = first
second.append(6)
print(first)
print(second)
```

- A. first=[1,2,3,4,5],second=[1,2,3,4,5,6]
- B. first=[1,2,3,4,5,6],second = [1,2,3,4,5]
- C. first=[1,2,3,4,5],second = [1,2,3,4,5]
- D. first=[1,2,3,4,5,6],second = [1,2,3,4,5,6]
- E. None of these

66. The definition

```
char string1[] = "bird";
```

is equivalent to:

- A. char string1[] = {'b', 'i', 'r', 'd', '\\0'};
- B. char string1 = {'b', 'i', 'r', 'd', '\\0'};
- C. char string1[] = {'b', 'i', 'r', 'd'};
- D. character string1[] = {'b', 'i', 'r', 'd', '\\0'};
- E. char string1[4] = {'b', 'i', 'r', 'd', '\\0'};

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67. Consider the following C code fragment:

```
int i=10;
do {
    printf("%d ", i*=2.5);
} while(i<100)
```

What output will be generated?

- A. 25 62
 - B. 25 62 155
 - C. 25 62.5
 - D. 25 62.5 156.25
 - E. None of the above
68. Call-by-reference can achieve the security of call-by-value when:
- A. A large argument is passed in order to improve performance.
 - B. A pointer to the argument is used.
 - C. The **const** qualifier is used.
 - D. The value being passed is small.
 - E. The argument is an array.
69. **Student** is a base class and **TA** is a derived class, with a redefined non-**virtual coding** function. Given the following statements, will the output of the two **coding** function calls be identical?
- ```
TA t;
Student *sPtr = &t;

sPtr->coding();
sPtr->Student::coding();
```
- A. It depends on the implementation of the **coding** function.
  - B. It depends on the value of object **t**.
  - C. Yes.
  - D. Yes, if **coding** is a static function.
  - E. No.
70. The array subscript operator **[]**, when overloaded, cannot:
- A. Be used with linked list classes.
  - B. Take multiple values inside (e.g., **[4,8]**).
  - C. Take a double as an operand.
  - D. Take user-defined objects as operands.
  - E. None of the above.
71. Which of the following arithmetic is not allowed on pointers?
- A. Adding an integer to a pointer.
  - B. Subtracting an integer from a pointer.
  - C. Subtracting one pointer from another.
  - D. Comparing pointers by using **<**.



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E. None of the above.

72. What is the output of this code in Python?

```
L1 = []
L1.append([1, [2, 3], 4])
L1.extend([7, 8, 9])
print(L1[0][1][1] + L1[2])
```

- A. 3
- B. 8
- C. 11
- D. 38
- E. None of these

Question group 73 to 75 : Consider the following code of a singly linked list, with the function F to "rotate" the list by moving the first item of the list to the end of the list. The input to the function is the address of pfirst, the pointer to the first item in the list. You need to select the correct expressions to put into the code in the following three questions so that the function works correctly.

```
struct node {int data; struct node *next};
void F(struct node **pfirst){
 struct node *x, *y, *first = *pfirst;
 if(first && first->next){
 x = first;
 y = *pfirst = AAA ;
 while(y->next) y = y->next;
 BBB = x;
 CCC = NULL;
 }
}
```

73. What expression should be in "AAA"?

- A. x
- B. x->next
- C. y->next
- D. first
- E. x->next->next

74. What expression should be in "BBB"?

- A. y
- B. x->next
- C. y->next
- D. first
- E. \*pfirst

75. What expression should be in "CCC"?

- A. x
- B. x->next
- C. y->next
- D. first
- E. \*pfirst

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76. What will be the declaration of the following requirements?

(i.) An array of 10 pointers to integer named a.

(ii.) A pointer of 10 integers named p.

- A. `a[10]; *p[10];`
- B. `**a[10]; *p[10];`
- C. `*a[10]; (*p)[10];`
- D. `*a[10]; **p[10];`
- E. `(*a)[10]; *p[10];`

77. Which of the following gives the number of elements in the array `int a[]`?

- A. `sizeof(a)`
- B. `sizeof(*a)`
- C. `size(a[])`
- D. `sizeof(*a)/sizeof(int)`
- E. `sizeof(a)/sizeof(int)`

78. Consider the following function and code segment.

```
void me(int x, int & y)
{
 x = 10;
 y = x + 1;
}
int main()
{
 // other code ...
 int j = 5;
 int k = 3;
 me(j, k);
 // other code ..
}
```

After the call to `me(j, k)`; what are the values of `j` and `k`?

- A. `j = 5, k = 6;`
- B. `j = 10, k = 11;`
- C. `j = 5, k = 11;`
- D. `j = 10, k = 6;`
- E. `j = 10, k = 18;`

79. Assume this code fragment is embedded in an otherwise correct and complete program. What should be the output from this code segment?

```
{
 for(int i=0;i<5;i++)
 {
 . . .
 . . .
 }
 cout << i << endl;
}
```

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- A. 5
- B. 4
- C. 6
- D. 0
- E. The variable `i` is undefined in this scope

80. Consider the following C code fragment:

```
int x=38;
int *p=&x;
```

Which of the following code will output 38?

- A. `printf("%d", &*p);`
- B. `printf("%d", *&p);`
- C. `printf("%d", *&x);`
- D. `printf("%d", &*x);`
- E. None of the above

81. Which of the following C statements is incorrect?

- A. `typedef enum {Spade, Heart, Diamond, Club };`
- B. `typedef enum {Spade, Heart, Diamond, Club } Suit;`
- C. `enum {Spade, Heart, Diamond, Club } suit;`
- D. `enum suit {Spade, Heart, Diamond, Club };`
- E. None of the above

82. Suppose the output of the following C code fragment is `0xffff00003a04`:

```
int x=38;
int *p=&x;
printf("%p", p);
```

What is the output of `printf("%p", p+3);` ?

- A. `0xffff00003a04`
- B. `0xffff00003a07`
- C. `0xffff00003a10`
- D. `0xffff00003a16`
- E. None of the above

83. If the line:

```
friend class A;
```

appears in class B, and the line:

```
friend class B;
```

appears in class C, then:

- A. Class A is a friend of class C.
- B. Class A can access private variables of class B.
- C. Class C can access private variables of class B.
- D. Class C can call class A's private member functions.
- E. Class B can access class A's private variables.

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84. Since the postfix increment operator returns objects by value and the prefix increment operator returns objects by reference:
- A. Prefix increment has slightly more overhead than postfix increment.
  - B. The postfix increment operator returns the actual incremented object with its new value.
  - C. Objects returned by postfix increment cannot be used in larger expressions.
  - D. Postfix increment cannot be used in larger expressions.
  - E. The postfix increment operator typically returns a temporary object that contains the original value of the object before the increment occurs.
85. **virtual** destructors must be used when:
- A. The constructor in the base class is **virtual**.
  - B. **delete** is used on a base-class pointer that points to a derived-class object.
  - C. **delete** is used on a derived-class object.
  - D. Every member function of the base class is **virtual**.
  - E. Every data member of the base class is **virtual**.
86. What should be filled in the following blanks if we want to print `{0:[90, 'Alice'],1:[87, 'Bob'],2:[93, 'Apple']}` in this Python code?
- ```
x = [90,87,93]
y = ('Alice','Bob','Apple')
z = {}
for i in range(len(x)):

    print(z)
```
- A. `z[i]=[x[i],y[i]]`
 - B. `z[i]=x[i],y[i]`
 - C. `z[i]=list(zip(x,y))`
 - D. `z[i]=x,y`
 - E. None of these
87. What is the output of the following Python code? `print([(a,b) for a in range(3) for b in range(a)])`
- A. `[(1,0),(2,0),(2,1)]`
 - B. `[(0,0),(1,1),(2,2)]`
 - C. `[(1,0),(2,1),(2,1)]`
 - D. `[(1,0),(2,1),(3,2)]`
 - E. `[(1,0),(2,1),(2,2)]`
88. Consider the recursive function,
- ```
int fun1(int n)
{
 if (1==n)
 return 1;
 else
 return fun1(n-1) + 2*n - 1;
}
```
- Which of these expressions could replace a call to this function?

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- A.  $n^2$
- B.  $n^2 + n + 1$
- C.  $n!$
- D.  $(n + 1)^2$
- E.  $(n - 1)^2$

89. Consider the following C code fragment:

```
char *str1="Hello";
char str2[]={ 'W', 'o', 'r', 'l', 'd', 0 };
int i;
for(i=0;i<5;i++)
 str2[5-i-1]=str1[i/2];
printf("%s", str2);
```

What output will be generated?

- A. leeHH
- B. olleH
- C. oolHH
- D. Hello
- E. None of the above

90. Consider the following C++ code fragment:

```
int &max(int &a, int &b)
{
 if(a>b) return a;
 return b;
}

int main()
{
 int x=35, y=42;
 max(x,y)=10;
 max(x,y)++;
 cout << x << ", " << y;
}
```

What output will be generated?

- A. 36, 10
- B. 36, 43
- C. 36, 11
- D. 11, 11
- E. None of the above

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科目名稱：英文

## — 作答注意事項 —

考試時間：80 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卡之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，後果由考生自負。
- 答案卡應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 不可使用計算機，並不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卡請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

# 國立中山大學 111 學年度學士後醫學系招生考試試題

科目名稱：英文

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 5 頁 第 1 頁

選擇題(單一選擇題，共 50 題，每題 2 分，總分 100 分，每題答錯倒扣四分之一。)

For each question, choose one best answer.

1. Non-Fungible Tokens are all the \_\_\_\_ in the economy right now, even though very few people actually understand what they are and how they are traded.  
(A) cheer (B) rage (C) smile (D) fear (E) melancholy
2. \_\_\_\_ companies should develop new vaccines to target the new prevalent strain of the pandemic instead of lobbying governments to make people take multiple boosters of the old, ineffective ones.  
(A) Retail (B) Pharmaceutical (C) Logistic (D) Start-up (E) Investment
3. Drinking enough water daily should boost your \_\_\_\_.  
(A) maturation (B) production (C) circulation (D) respiration (E) dissemination
4. \_\_\_\_ is treatment with medicines that stop the growth of cancer cells.  
(A) Dizziness (B) Indigestion (C) Obesity (D) Chemotherapy (E) Digestion
5. Health is a state of physical and mental \_\_\_\_.  
(A) method (B) capable (C) disorder (D) wellbeing (E) discord
6. Coma can result from injury to the brain, such as a severe head injury or \_\_\_\_.  
(A) cough (B) sore throat (C) pulled muscle (D) stroke (E) nausea
7. You'd better take these papers with you \_\_\_\_ you need them for your meeting.  
(A) otherwise (B) unless (C) as far as (D) while (E) in case
8. Chinese has long had \_\_\_\_ dialectal variation; hence prestige dialects have always existed, and a lingua franca has always been needed.  
(A) thoughtful (B) considerable (C) solicitous (D) concerned (E) meager
9. The cell membrane can separate the \_\_\_\_ of all cells from the outside environment (the extracellular space) and protect the cell from its environment.  
(A) package (B) waste (C) tunnel (D) maximum (E) interior
10. Allergic \_\_\_\_ usually happen quickly within a few minutes of exposure to an allergen.  
(A) representations (B) recreations (C) relatives (D) reactions (E) reinforcements
11. He's a nice man but he's \_\_\_\_ to drink too much at parties.  
(A) adequate (B) apt (C) common (D) probable (E) suitable
12. No one can \_\_\_\_ a time when the sort of skills we have accumulated will no longer be in demand.  
(A) invade (B) interchange (C) foresee (D) decay (E) prolong
13. Which of the following best defines the word "restrain"?  
(A) The turning point of a disease when an important change takes place.  
(B) To set up in a hasty or makeshift manner.  
(C) To protrude slightly so as to be just visible.  
(D) To limit or prevent movement.  
(E) To double over upon itself.

國立中山大學 111 學年度學士後醫學系招生考試試題

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共 5 頁第 2 頁

14. Overfishing is drastically reducing the population of fish in our oceans, and it is linked to the destruction of underwater foliage and coral reefs. Some even \_\_\_\_ that it could be a major cause of global warming.  
(A) disparage (B) conjecture (C) administer (D) litigate (E) patent
15. Bitcoin led the incredible rise of cryptocurrency, but ecologists have heavily criticized the extreme energy \_\_\_\_ required to maintain its complex blockchain technology.  
(A) delivery (B) reservation (C) deliberation (D) consumption (E) correspondence
16. Wikipedia is a very popular online source for fact-checks and general knowledge, but its \_\_\_\_ is questionable since anyone can edit the information.  
(A) culpability (B) domesticity (C) ethnicity (D) durability (E) validity
17. Digital gaming is one of the most \_\_\_\_ markets for entertainment companies in recent years, especially the fast-expanding mobile gaming market.  
(A) lucrative (B) factitious (C) performance (D) celebratory (E) static
18. The progression of the viral infection is consistent with the recent report on the \_\_\_\_.  
(A) psychology (B) defibrillator (C) carcinogen (D) decimation (E) pathogen
19. All politicians are prone to provide \_\_\_\_ statements that exaggerate the truth.  
(A) synthetical (B) hyperbolic (C) parenthetical (D) symmetrical (E) arrhythmical
20. Rapid eye movement sleep is a phase of sleep, characterized by random rapid movement of the eyes, accompanied by low muscle tone throughout the body, and the \_\_\_\_ of the sleeper to dream vividly.  
(A) asset (B) propensity (C) stance (D) tranquility (E) gadget
21. I have suffered from \_\_\_\_ for two weeks, and counting sheep does not work at all. Maybe sleeping pill is the only solution now.  
(A) insomnia (B) rabies (C) cholera (D) MERS (E) arrhythmia
22. It seems that the central bank is trying to \_\_\_\_ inflationary pressures without obstructing economic growth.  
(A) curtail (B) chase (C) forlorn (D) disclose (E) elucidate
23. Although this league stated that it would not \_\_\_\_ a vaccine requirement for players, it informed all teams earlier that they would have to follow local regulations.  
(A) offer (B) revive (C) flourish (D) showcase (E) implement
24. Physical \_\_\_\_ is an important part of the recovery process, which can be long, difficult and frustrating.  
(A) disability (B) fatigue (C) aspiration (D) rehabilitation (E) drowsiness
25. A general \_\_\_\_ puts you into a deep sleep so that none of your senses is taking in information.  
(A) arthritis (B) angina (C) asthma (D) anesthetic (E) antidote
26. Medical \_\_\_\_ deliver medicine, such as drugs, food nutrients and chemicals, to patients in various physical conditions.  
(A) X-rays (B) thermometers (C) infusion pumps (D) reflex hammers (E) anatomy

試題請隨卷繳回，請留意背面是否有題



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共 5 頁第 3 頁

27. When a person becomes infected with HIV, the virus attacks and weakens the \_\_\_\_ system.  
(A) digestive (B) circulatory (C) nervous (D) immune (E) cardiovascular
28. Mosquito-borne diseases are those that are \_\_\_\_ to people through the bite of an infected mosquito.  
(A) transported (B) translated (C) transcended (D) transformed (E) transmitted
29. Most breast changes are \_\_\_\_, or non-cancerous.  
(A) worse (B) adverse (C) harmful (D) benign (E) ambivalent
30. A \_\_\_\_ involves removing a sample of tissue or tumor from the body and examining it under a microscope for cancer cells.  
(A) biopsy (B) hygiene (C) necropsy (D) autopsy (E) hypocrisy
31. Nasal sprays are liquid medicines you spray into your nose to help relieve \_\_\_\_.  
(A) cholera (B) congestion (C) steroid (D) suffocation (E) hepatitis
32. One of the disadvantages of growing older is that you never seem to have the opportunity to \_\_\_\_ all of the sports you would like to.  
(A) catch sight of (B) make room for (C) lose track of (D) take part in (E) set sail to
33. It is plain that the United Nations will not lift the sanctions unless the Iraqi government fully \_\_\_\_ with the Security Council resolutions.  
(A) matches (B) elaborates (C) complies (D) resumes (E) accomplishes
34. Evidence of racial bias in sentencing helped to convince certain states in America to \_\_\_\_ capital punishment in the late 1960s and early 1970s.  
(A) keep down (B) rule against (C) put out (D) point out (E) break through
35. In his fiction, William Faulkner uses a complex literary style that seems to \_\_\_\_ his intricate themes of good and evil.  
(A) fit in with (B) clear out (C) put up with (D) make out (E) take after
36. You \_\_\_\_ your paper last Friday, but it was not in my mailbox until this morning.  
(A) would have submitted  
(B) should have submitted  
(C) have submitted  
(D) should submit  
(E) would submit
37. Our company makes a full investigation and believes that the pros of this investment \_\_\_\_ the cons.  
(A) overwhelm (B) correlate (C) retain (D) outweigh (E) encompass
38. The urinary system is the main system of body parts involved in \_\_\_\_, which is the expulsion of unwanted substances.  
(A) excrement (B) excrescence (C) excerpt (D) excretion (E) exegesis
39. Kevin will step away from his acting career after being diagnosed with \_\_\_\_, a condition that impedes a person's ability to speak and write.  
(A) insomnia (B) hyposmia (C) parosmia (D) aphasia (E) myopia

國立中山大學 111 學年度學士後醫學系招生考試試題

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共 5 頁第 4 頁

40. It is often prudent to come up with a \_\_\_\_\_ plan in anticipation of possible setbacks and failures.  
(A) debilitating (B) formidable (C) diachronic (D) obstinate (E) contingency
41. If the heads of states and governments behave more \_\_\_\_\_, there would be far less global conflict.  
(A) temperately (B) inexplicably (C) frivolously (D) belligerently (E) manically
42. The torrential rain has not only caused numerous houses to be \_\_\_\_\_ but also brought about mudslides besides the large-scale flooding.  
(A) liberated (B) inundated (C) humidified (D) perforated (E) deliberated
43. \_\_\_\_\_ symptoms, such as nightmares, insomnia, physiological distress at exposure to trauma and exaggerated startle showed either no significant effect or a weakly significant one.  
(A) Sceptic (B) Subdural (C) Stuttering (D) Somatic (E) Saline
44. The patient can relieve \_\_\_\_\_ by increasing the amount of raw vegetables in the diet.  
(A) constipation (B) costochondritis (C) conjunctivitis (D) constellation (E) conspiracy
45. All \_\_\_\_\_ will attend the conference convened by a local coalition for debating several other resolutions of the crisis.  
(A) delegates (B) outcasts (C) congregates (D) contestations (E) collaborations

Please read the following passage and then answer questions 46–47.

Ever since Nobel prize-winner Linus Pauling first advocated vitamin C as a common-cold war weapon more than 20 years ago, researchers have been busy trying to verify that claim. But so far, they've found little proof that vitamin C prevents colds. In fact, there are more studies that say it doesn't. But there is evidence that it can keep coughing and sneezing to a minimum, and that low levels of vitamin C in the body may be related to bronchitis.

46. From the passage, we can learn that Dr. Pauling's view as regards vitamin C \_\_\_\_\_.  
(A) has greatly improved the treatment of bronchitis  
(B) has caused a revolution in medical studies  
(C) aroused very little interest among medical experts  
(D) was based on the results of years of research  
(E) has not been verified scientifically
47. According to the passage, coughing and sneezing \_\_\_\_\_.  
(A) should be taken seriously and treated accordingly  
(B) are the early symptoms of bronchitis  
(C) are now being effectively treated without vitamin C  
(D) can be reduced with the help of vitamin C  
(E) do not respond to any treatment whatsoever

Please read the following passage and then answer questions 48–50.

Psychology is literally the study of the mind (or soul) but its area has broadened somewhat in the last century as we have learned that one cannot consider the mind as totally isolated from the body, and it now includes the study of human personality and behavior. Psychologists also study the behavior and brain of animals whenever such studies throw light on human behavior. It is important

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to realize that psychologists are first and foremost trained as scientists rather than as medical experts and do not necessarily take much interest in abnormalities of the brain and mental process.

48. As can be inferred from the passage, psychology \_\_\_\_\_.  
(A) has in time developed as a branch of medicine  
(B) has always been confined to the study of the mind  
(C) is not concerned with the mind alone, but also with human personality and behavior  
(D) primarily concentrates on the study of animal behavior  
(E) mostly deals with mental abnormalities
49. It is pointed out in the passage that \_\_\_\_\_.  
(A) close cooperation between psychologists and medical experts is essential  
(B) the study of human behavior alone is what interests present-day psychologists  
(C) as a branch of science, psychology is no longer to be understood in its literal sense  
(D) the mind and the body function independently  
(E) in recent years psychologists have concentrated mostly on the study of the mind
50. In the passage, attention is drawn to the fact that \_\_\_\_\_.  
(A) psychologists give great importance to the study of mental processes for medical purposes  
(B) psychologists are basically scientists  
(C) the body and the mind are separate entities in the eyes of psychologists  
(D) the human mind can be best understood through the study of animal behavior  
(E) there have been no noticeable developments in psychology since the last century

111學年度學士後醫學系各科標準答案

學士後醫學系-普通生物及生化概論

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 試題 | 第1題  | 第2題  | 第3題  | 第4題  | 第5題  | 第6題  | 第7題  | 第8題  | 第9題  | 第10題 | 第11題 | 第12題 | 第13題 | 第14題 | 第15題 | 第16題 | 第17題 | 第18題 | 第19題 | 第20題 |
| 答案 | A    | A    | E    | E    | A    | E    | D    | C    | A    | B    | C    | D    | E    | E    | D    | D    | B    | A    | C    | C    |
| 試題 | 第21題 | 第22題 | 第23題 | 第24題 | 第25題 | 第26題 | 第27題 | 第28題 | 第29題 | 第30題 | 第31題 | 第32題 | 第33題 | 第34題 | 第35題 | 第36題 | 第37題 | 第38題 | 第39題 | 第40題 |
| 答案 | E    | C    | A    | B    | B    | C    | D    | A    | D    | C    | B    | A    | C    | A    | A    | C    | D    | E    | B    | A    |
| 試題 | 第41題 | 第42題 | 第43題 | 第44題 | 第45題 | 第46題 | 第47題 | 第48題 | 第49題 | 第50題 | 第51題 | 第52題 | 第53題 | 第54題 | 第55題 | 第56題 | 第57題 | 第58題 | 第59題 | 第60題 |
| 答案 | D    | A    | D    | D    | E    | D    | B    | A    | B    | B    | C.E  | C    | A    | D    | B    | E    | C    | B    | B    | E    |
| 試題 | 第61題 | 第62題 | 第63題 | 第64題 | 第65題 | 第66題 | 第67題 | 第68題 | 第69題 | 第70題 | 第71題 | 第72題 | 第73題 | 第74題 | 第75題 | 第76題 | 第77題 | 第78題 | 第79題 | 第80題 |
| 答案 | A    | D    | A    | B    | E    | D    | C    | A    | D    | D    | D    | A    | C    | C    | C    | E    | E    | D    | B    | C    |
| 試題 | 第81題 | 第82題 | 第83題 | 第84題 | 第85題 | 第86題 | 第87題 | 第88題 | 第89題 | 第90題 |      |      |      |      |      |      |      |      |      |      |
| 答案 | A    | E    | A    | B    | C    | D    | D    | C    | C    | A    |      |      |      |      |      |      |      |      |      |      |

學士後醫學系-物理與化學

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 試題 | 第1題  | 第2題  | 第3題  | 第4題  | 第5題  | 第6題  | 第7題  | 第8題  | 第9題  | 第10題 | 第11題 | 第12題 | 第13題 | 第14題 | 第15題 | 第16題 | 第17題 | 第18題 | 第19題 | 第20題 |
| 答案 | C    | B    | E    | A    | E    | B    | A    | E    | E    | D    | A    | C    | B    | A    | D    | A    | D    | B    | C    | B    |
| 試題 | 第21題 | 第22題 | 第23題 | 第24題 | 第25題 | 第26題 | 第27題 | 第28題 | 第29題 | 第30題 | 第31題 | 第32題 | 第33題 | 第34題 | 第35題 | 第36題 | 第37題 | 第38題 | 第39題 | 第40題 |
| 答案 | E    | D    | D    | D    | E    | E    | C    | D    | C    | E    | A    | C    | A    | C    | D    | E    | A    | A    | D    | B    |
| 試題 | 第41題 | 第42題 | 第43題 | 第44題 | 第45題 | 第46題 | 第47題 | 第48題 | 第49題 | 第50題 | 第51題 | 第52題 | 第53題 | 第54題 | 第55題 | 第56題 | 第57題 | 第58題 | 第59題 | 第60題 |
| 答案 | D    | E    | B    | A    | C    | A    | B    | A    | C    | D    | E    | D    | A    | C    | C    | B    | D    | A    | C    | D    |
| 試題 | 第61題 | 第62題 | 第63題 | 第64題 | 第65題 | 第66題 | 第67題 | 第68題 | 第69題 | 第70題 | 第71題 | 第72題 | 第73題 | 第74題 | 第75題 | 第76題 | 第77題 | 第78題 | 第79題 | 第80題 |
| 答案 | C    | D    | A    | D    | A    | B    | B    | D    | A    | B    | E    | C    | E    | C    | A    | D    | A    | C    | B    | E    |
| 試題 | 第81題 | 第82題 | 第83題 | 第84題 | 第85題 | 第86題 | 第87題 | 第88題 | 第89題 | 第90題 |      |      |      |      |      |      |      |      |      |      |
| 答案 | B    | B    | A    | B    | D    | B    | C    | E    | A    | E    |      |      |      |      |      |      |      |      |      |      |

學士後醫學系-計算機概論與程式設計

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 試題 | 第1題  | 第2題  | 第3題  | 第4題  | 第5題  | 第6題  | 第7題  | 第8題  | 第9題  | 第10題 | 第11題 | 第12題 | 第13題 | 第14題 | 第15題 | 第16題 | 第17題 | 第18題 | 第19題 | 第20題 |
| 答案 | C    | D    | D    | B    | C    | A    | A    | B    | C    | E    | C    | A    | A    | C    | D    | B    | B    | B    | E    | E    |
| 試題 | 第21題 | 第22題 | 第23題 | 第24題 | 第25題 | 第26題 | 第27題 | 第28題 | 第29題 | 第30題 | 第31題 | 第32題 | 第33題 | 第34題 | 第35題 | 第36題 | 第37題 | 第38題 | 第39題 | 第40題 |
| 答案 | D    | C    | A    | E    | B    | E    | A    | E    | A    | E    | A    | B    | D    | B    | D    | A    | B    | B    | B    | E    |
| 試題 | 第41題 | 第42題 | 第43題 | 第44題 | 第45題 | 第46題 | 第47題 | 第48題 | 第49題 | 第50題 | 第51題 | 第52題 | 第53題 | 第54題 | 第55題 | 第56題 | 第57題 | 第58題 | 第59題 | 第60題 |
| 答案 | B    | A    | A    | C    | B    | D    | A    | C    | E    | C    | C    | D    | D    | B    | E    | D    | E    | C    | D    | E    |

