

高雄醫學大學 102 學年度學士後醫學系招生考試試題

科目：英文

考試時間：80 分鐘

說明：一、「選擇題」用2B鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液（帶），未遵照正確作答方法而致電腦無法判讀者，考生自行負責。

二、「非選擇題」部分以「答案卷」作答，作答時不得使用鉛筆，違者該科答案卷不予計分；限用黑色或藍色墨水的筆書寫。

三、試題、答案卡及答案卷必須繳回，不得攜出試場。

I. Vocabulary. 20 points

A. Please choose the best answer to match with each underlined word.

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- The Philippines should make a formal apology, compensate for the losses, punish the perpetrators, and initiate negotiations on a fisheries agreement as soon as possible.  
(A) offenders (B) organizers (C) administrators (D) fishermen (E) founders
- This book is the result of an innovative and collaborative global development process designed to engage students and deliver content and cases with global relevance.  
(A) joint (B) positive (C) elaborate (D) separate (E) consistent
- How the rise of book illustration affected the historic hegemony of the word is the topic of Yousif's study of the complex relationship between the novelist Balzac and the illustrator, Grandville.  
(A) development (B) authenticity (C) supremacy (D) validity (E) epistemology
- Her right hand, bent with arthritis, curved over a stick on which she leant so heavily as to give her the appearance of physical deformity.  
(A) prowess (B) therapy (C) jerks (D) decline (E) defect
- Literature is a luxury; fiction is a necessity.  
(A) accessory (B) extravagance (C) option (D) assortment (E) requirement

B. Please choose the best answer to complete each sentence.

- Originally intended to discredit the common belief that internet addiction impairs a person's ability to interpret the world and to interact with others, Joey's experiment nevertheless seems to \_\_\_\_\_ the assumption.  
(A) attest to (B) opposite to (C) exchange for (D) testimony to (E) substitute for
- A wave of \_\_\_\_\_ overcame me when the old song, YESTERDAY ONCE MORE, came on the radio; hearing it took me back to 1977.  
(A) utopia (B) nostalgia (C) aphasia (D) hypochondria (E) insomnia
- The police \_\_\_\_\_ the riotous crowd by spraying the demonstrators with fire hoses and firing bullets over their heads.  
(A) disparaged (B) disdained (C) discriminated (D) discerned (E) dissipated
- You paid NT \$50,000 for the smartphone? Well, you got \_\_\_\_\_.  
(A) ripped off (B) robbed of (C) ticked off (D) made off (E) knocked off
- Her hard work has paid off--the company now has 10 employees, and sales are \_\_\_\_\_ each year.  
(A) doubling (B) dwindling (C) dropping (D) deteriorating (E) diminishing
- Biologists offer this \_\_\_\_\_ as an explanation: if the genome is the hardware, then the epigenome is the software.  
(A) intuition (B) analogy (C) anticipation (D) appearance (E) propensity
- Bygren and other scientists have now amassed historical evidence suggesting that powerful environmental conditions can somehow leave an \_\_\_\_\_ on the genetic material in eggs and sperm.  
(A) ink (B) mileage (C) showcase (D) imprint (E) imagery
- Her energy, her passion and her relentless optimism are infectious, \_\_\_\_\_ all of us who've had the chance to work with her.  
(A) intimidating (B) enhancing (C) inspiring (D) infringing (E) neglecting

14. By pointing to Shelley's *Frankenstein* and Darwin's *Origin of Species* as foundational myths of modern culture, Page's valuable argument \_\_\_\_\_ important literary discussion about nineteenth-century Britain.  
 (A) submits to (B) contributes to (C) amounts to (D) superior to (E) succumbs to
15. Despite the heated debate that lasted for hours, there was no \_\_\_\_\_ among the committee members last night.  
 (A) consensus (B) complex (C) consciousness (D) compliment (E) conscience
16. The skills she had learnt at school – time and people management, organization, as well as research and analysis – were highly \_\_\_\_\_, so she started her first job with little difficulty.  
 (A) noticeable (B) profitable (C) transferable (D) sustainable (E) rechargeable
17. Despite the obvious \_\_\_\_\_ in their beliefs regarding children's education, there are noticeable resemblances between the husband and wife in their role as a parent.  
 (A) insights (B) similarities (C) correspondence (D) assimilation (E) discrepancy
18. Following the direction of President Ju, the JPG has become well-known around the globe for its innovative blending of East and West, traditional and \_\_\_\_\_.  
 (A) conservative (B) contemporary (C) competitive (D) combative (E) contingent
19. Our sexuality \_\_\_\_\_ every sphere of our lives, and our cultures determine its shades of tolerance and acceptance.  
 (A) permeates (B) permits (C) preserves (D) presumes (E) predicts
20. In the span of a single day, the small town of Riceville is ravaged by an unprecedented \_\_\_\_\_ of tornadoes.  
 (A) upheaval (B) animation (C) onslaught (D) exhilaration (E) slaughter

## II. Grammar and Structure. 20 points

### A. Please choose the best answer to complete each sentence.

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21. \_\_\_\_\_ the vastness of their technology, the aliens perished because they failed to notice a defect in their plans.  
 (A) In addition (B) Therefore (C) While (D) Since (E) Despite
22. \_\_\_\_\_ the obvious need for warmth in cold climates, and for protection from the elements, dress, in all cultures, is essentially about three things: sex differentiation, status signals and affiliation signals.  
 (A) Above all (B) Accordingly (C) Apart from (D) Even if (E) Nonetheless
23. She looks so somber, \_\_\_\_\_ she's about to read a death sentence – her own.  
 (A) even (B) though (C) as if (D) by which (E) hence
24. \_\_\_\_\_ to select certain features as relevant and ignore others.  
 (A) Mapmaking is defined as (B) To make a map is, by definition,  
 (C) By definition, making a map is (D) The mapmaking process involves, by definition,  
 (E) In making a map, the definition is
25. Linen's great tensile strength \_\_\_\_\_ sailcloth and the most delicate handmade laces.  
 (A) make desirable for (B) making desirable  
 (C) makes it desirable for (D) for making it desirable  
 (E) makes it desirable to
26. Among the giants of the sea \_\_\_\_\_, which may weigh up to 900 pounds.  
 (A) the tuna (B) is the tuna (C) tuna (D) being the tuna (E) the tuna is
27. The charity sale went alright, but it would have been perfect if \_\_\_\_\_.  
 (A) more people showed up (B) we had had enough volunteers  
 (C) the mayor should promise to come (D) the prices are higher  
 (E) it hasn't been so warm
28. In November 1865, \_\_\_\_\_, *The Athenaeum* rated Elizabeth Gaskell as "if not the most popular, with small question, the most powerful and finished female novelist of an epoch singularly rich in female novelists."  
 (A) reports about her death (B) a report about her death  
 (C) reported about her death (D) when reporting her death  
 (E) as reporting about her death
29. The enraged Gernimo then launched \_\_\_\_\_ a 30-year guerrilla campaign against the authorities on both sides of the border.  
 (A) that's become (B) that becomes (C) what will be (D) what would become (E) which is become
30. Many personnel managers claim that college graduates begin to write exaggerations in job applications but behave badly at job interviews; even if the applicants are granted jobs, they \_\_\_\_\_ really qualified to hold their positions.  
 (A) do not (B) are found not (C) may not (D) usually don't (E) are usually

**B. For each sentence, please choose one underlined part that contains faulty English.**

31. In the fast-pace modern society, a person can learn to manage stress by setting realistic goals, enjoying a hobby and/or physical exercise, and by maintaining a good, warm relationship with family and friends.
- A B C  
D E
32. In town last week to chair the workshop, Flint was kind enough to take time off her already-brimming schedule to chat with us and proved every bit the creative, driven and down-to-earth person she reported to be.
- A B  
C D E
33. Without scholarships, student athletes often have to make the difficulty choice of athletics or academics, and many of them concentrate on the former; as a result, their grades tend to suffer.
- A B C  
D E
34. Eva was the less talented native speaker of Chinese I had ever met before I became her advisor twelve years ago.
- A B C D E
35. In crowded, seethe India, strains of tuberculosis that are resistant to all known TB drugs have emerged.
- A B C D E
36. The columbine flower, is native to nearly all of the United States, can be raised from seed in almost any garden.
- A B C D E
37. In aging societies, especially in Europe and Japan, youth unemployment makes the burden of funding health care and pensions for retirees even heavier, since the number of taxpaid workers is curtailed and the cost of benefits that governments must provide increases.
- A B  
C D E
38. Much of what we're seeing might well be the tumult that accompany the end of decades of tyranny and the rise of long-suppressed forces, but it raises the question.
- A B C D  
E
39. Studies in other countries, including India's neighbor Pakistan, show that getting the private sector involved is key to increase the number of TB cases that get diagnosed.
- A B C D E
40. Once a week, patients who have tried and failing to treat their tuberculosis line up, frustrated and frightened, outside his small office.
- A B C D E

**III. Reading Comprehension. 30 points**

Please read the following three excerpts/passages closely and then choose the best answer for each of the questions according to the contents.

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Scuba diving has never been easy for me. When I was in fifth grade, the father of one of my classmates died in a scuba-diving accident. His death, along with the scenes I had watched in James Bond's movies of men left to drown hundreds of feet under water with severed air tubes, did not give me the impression that scuba diving was a safe sport. However, in eighth grade, my father asked me if I would take scuba-diving classes with him. Although I was reluctant, the important consideration was that he would be there to support me and that we would do it together. It seemed that as I grew older, we spent less time together. I wanted this opportunity to be with him.

After hours of pool work and classes, I was ready to go for my certification. My first problem was getting to the dive site. I have a slight fear of boats, which probably stems from my first boat ride, during which I developed a major case of seasickness.

This was a small obstacle compared to what was about to come. I spent the first fifteen minutes of the dive standing on the rocking deck of the dive boat, staring at the rough ocean, weak with fear. I was only able to dive into the water after a good pep talk from both my father and my dive master. I repeated the word “relax” to myself over and over and plunged in.

Even now, after five years of scuba diving, I still feel a little uneasy before submerging. However, once I have taken a deep breath and broken the surface of the water, curiosity and astonishment at the variety on the ocean floor calm my apprehensions. No sounds or disturbances break the perfect tranquility. Enormous purple fans wave in the current, and orange and red sponges just out of the coral like poppies in the meadow. When I am underwater, I can hover above the colorful, craggy coral, flying like Superman, watching schools of fish dart around in search of food, oblivious to my presence. Underwater, I am able to leave behind my worries and observe the peaceful beauty of nature.

The experience does not end with my surfacing but continues with the stories my father, the other divers, and I tell afterward. There is a high level of camaraderie among all divers. We sit around like old pirates in a dank tavern, laughing as we talk about the stingrays who search for food in our hair (an experience that was once described as “like being mugged by E.T.”) or about the dive master who found a bicycle down by one of the wrecks and started to ride it around. My fellow divers do not know that I have not yet left behind my fears of diving, because once I submerge, I inhabit a different world with them.

Like learning to scuba dive, learning to read was also not easy for me. Most early-reading programs rely heavily on the teaching of phonetics. However, I have a learning disability that makes understanding sound/symbol relationships difficult. This made learning to read through the use of phonetics impossible. I was lucky, however, because I was accepted into Fenn School’s Intensive Language Program. For two years (fourth and fifth grades), six other boys and I worked together, learning how to compensate for our learning differences. In this class, I developed a trait that I am very proud of: the ability to work hard—not only in my studies, but in everything I do.

But continuing even when the waters were rough, and drawing on the support of my parents and teachers, I learned to read and found an amazing world opened to me. Just as my fellow divers do not know that I am anxious about scuba diving, most of my classmates do not know that I have a learning disability. They just think that I am a diligent worker, but I know that, as with scuba diving, there is a lot more to the story.

41. The author found, initially, scuba diving neither fun nor safe because of all of the following reasons **except** \_\_\_\_\_.  
(A) the accident that claimed the life of a classmate’s father  
(B) the seasickness he suffered during his first boat ride  
(C) the drowning scenes presented in James Bond movies  
(D) the rough ocean he saw before diving into water  
(E) the companionship he shared with fellow divers
42. Which of the following best describes the author?  
(A) a fast learner  
(B) a diligent student  
(C) a reluctant worker  
(D) a low achiever  
(E) an ambitious diver
43. What can be safely inferred from the passage?  
(A) The author goes to movies from time to time and enjoys story telling.  
(B) The author takes great pride in himself for he is now a speed reader.  
(C) Though a single parent, the author’s father is very caring and supportive.  
(D) The Fenn School’s Intensive Language Program is an honor program for elite students.  
(E) People with a learning disability inhabit a totally different world unless they go underwater.
44. What does the author suggest by juxtaposing scuba diving with reading?  
(A) Scuba diving is more challenging than reading.  
(B) Scuba divers can be equally motivated to learn phonetics and reading.  
(C) He’s conquered personal obstacles in both scuba diving and reading.  
(D) Neither scuba diving nor reading can be learned easily by many.  
(E) Unless with a group, it’s impossible to overcome a learning disability.
45. Once he goes underwater, the author feels all of the following **except** \_\_\_\_\_.  
(A) amazement            (B) apprehension            (C) peace            (D) curiosity            (E) astonishment

But at the time Darwin's book caused a conceptual earthquake. It wholly **decries** all ideas, from whatever religion or none, which up to that time had taken it for granted that humankind was special, superior and apart. In the course of doing this, in a book of striking clarity and easy access, Darwin forced a profound rethink of the workings of life, just as Newton's discoveries forced a rethink of the workings of the universe. It exerted and still exerts a radical impact on scholarship and on all the **ramifications** of the information society we now acknowledge to be so important. It has had a great influence on political philosophies ever since, often through willful but not altogether blind misunderstanding, for the worse. And it has been seen as the destroyer of the Christian, even the humanitarian and atheistic, justification for morality and ethics.

According to Daniel Dennett, Professor of Arts and Sciences at Tufts University, Massachusetts: "If I could give an award for the single best idea anybody ever had, I would give it to Darwin, because his idea just unifies in a stroke these two completely disparate worlds, until then, of the meaningless mechanical physical sciences, astronomy, physics and chemistry on the one side and the world of meaning, culture, art and of course the world of biology. One stroke shows how to unify all the sciences." Richard Dawkins, the Charles Simonyi Professor of the Public Understanding of Science at Oxford University, says, "[Darwin] discovered a principle which with hindsight seems enormously simple; it is hard to believe that anybody did not think of it before and yet nobody did, not really."

46. In the first paragraph, the word "**decries**" means \_\_\_\_\_.  
(A) expresses                      (B) implements                      (C) illustrates                      (D) discounts                      (E) extols
47. In the first paragraph, the word "**ramifications**" means \_\_\_\_\_.  
(A) classification                      (B) branches                      (C) inconsequence                      (D) deficits                      (E) conundrums
48. According to Daniel Dennett, which of the following best describes Darwin's contribution to the scholarship?  
(A) His idea is the best single idea in the history of natural science.  
(B) His idea separates physics from chemistry.  
(C) His idea differentiates meaningless world from the meaningful.  
(D) His idea unifies what was once taken as two disparate worlds: the meaningless mechanical world and the meaningful cultural one.  
(E) His idea crisscrosses the empirical science and social science.
49. What is the main idea of the first paragraph?  
(A) Darwin's evolution theory has been pre-empted by other scholars.  
(B) Darwin's theory endorses the traditional idea that humankind is essentially special and superior.  
(C) Darwin's theory is a main destroyer of Christian belief.  
(D) Darwin's theory reforms our preconceptions.  
(E) Darwin's theory is often misread by the political philosophers.
50. Which of the following best fits Richard Dawkins's opinion quoted above?  
(A) Darwin discovered something that is quite complicated.  
(B) It is unbelievable how no one before Darwin had ever come across such a simple principle.  
(C) Darwin's theory is hard to believe in.  
(D) Darwin's theory discovered a principle that had already been stated by other forerunners.  
(E) Darwin made a lucky guess.

Dr. Heidi Memmel understands exactly why Angelina Jolie opted to have a preventive double mastectomy. For a carrier of mutation (a gene which Jolie carries), the risk of developing cancer is as high as 80 to 85 percent, according to Memmel, a breast surgeon and co-medical director of Advocate Lutheran General Hospital's Caldwell Breast Center in Park Ridge. The surgery reduced Jolie's risk to about 5 percent, she said.

Mommel, who was diagnosed with breast cancer herself at age 36 and has been a survivor for nearly eight years, was surprised when Jolie made the announcement. "I was really very impressed," she said, adding that not only did Jolie have the courage and foresight to have genetic testing done and make the decision to have a preventative double mastectomy, she also did a third very important thing: she chose to share the news with the public. Because she's such a celebrity, Memmel hopes that will encourage women with a family history of breast or ovarian cancer to have genetic testing.

"I see a common misperception about genetic testing," Memmel said. "People fear it because they think it's a ticking time bomb or else they will be discriminated against (for carrying a faulty gene)." Neither is true, she said. Instead, doctors can give women who carry the gene more testing, such as an annual MRI in addition to the annual mammogram other women get (after age 40). Doctors can also give women options, such as medication or preventive mastectomy or preventive ovarian removal.

“Ovarian cancer is difficult to detect at an early stage,” she said. Jolie's mother died at age 56 from ovarian cancer, according to NBCnews.com.

Memmel said the Caldwell Breast Center offers women consultations with a medical oncologist or surgeon. The doctors can determine if genetic testing is called for, she said. Women who undergo preventive mastectomy usually have immediate reconstructive surgery, and most surgeries today are a skin-saving or nipple-saving procedure that allows for good cosmetic results, Memmel said. Doctors can reconstruct breasts either by using silicone or saline implants, or by taking tissue from the abdominal area, if a woman has enough fat there. “She (Jolie) probably didn't have **that** done; she looks like a pretty skinny lady,” Memmel said jokingly.

Women who choose preventive mastectomy may be heartened to know they can choose the size of the reconstructed breasts. They can be smaller, the same or bigger than the original breasts.

51. News about Angelina Jolie's recent surgery was \_\_\_\_\_.  
(A) made public by the actress herself  
(B) released by the Caldwell Breast Center  
(C) publicized without Jolie's prior knowledge  
(D) sold to NBCnews.com. by professional paparazzi  
(E) spread by a celebrated cancer specialist
52. Based on the reading, it's evident that \_\_\_\_\_.  
(A) Dr. Heidi Memmel has been Jolie's medical advisor for years  
(B) breast cancer can hardly be detected without a mammogram  
(C) Jolie comes from a family with cancer history  
(D) celebrities tend to rely heavily on genetic testing  
(E) a mutation carrier usually has a short life-span
53. What does “**that**” at the end of paragraph 5 refer to when Dr. Memmel said that Jolie “probably didn't have that done”?  
(A) reconstructive surgery using tissues from her belly  
(B) breast silicone implantation  
(C) annual breast MRI and mammogram  
(D) mastectomy and ovarian removal  
(E) fatty tissue in the abdominal region
54. Which of the following statements represents Dr. Memmel's view?  
(A) Jolie made a hasty decision to have the preventative double mastectomy.  
(B) The public understanding regarding genetic testing is largely accurate.  
(C) Mastectomy can effectively lower a mutation carrier's risk of developing cancer.  
(D) The size of breasts is important to women and, luckily, surgery is readily available.  
(E) Spreading the news about a celebrity's medical condition is important because it's interesting.
55. Which of the following statements is correct, according to the reading?  
(A) Thanks to its great value in preventative care, genetic testing is always conducted to identify a high-risk group.  
(B) Preventive mastectomy is customarily done in hospitals to treat breast cancer.  
(C) To ensure better cosmetic results, immediate reconstructive surgery should be avoided.  
(D) Oncologists and surgeons often work together to cure cancer patients.  
(E) In general, neither saline nor silicone is implanted for breast augmentation.

#### IV. Essay Writing. 20 points

**Please write in at least 200 words a well-organized essay to express your opinion on “Every obstacle is an opportunity.” Do you agree or disagree with the statement above? Give specific reasons or examples to support your ideas.**

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科目：普通生物學

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說明：一、選擇題用 2B 鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液(帶)，未遵照正確作答方法而致電腦無法判讀者，考生自行負責。  
二、試題及答案卡必須繳回，不得攜出試場。

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

1. A fossil that has one fourth the normal proportion of carbon-14 to carbon-12 is approximately \_\_\_\_\_years? (Carbon-14 half life is about 5,700 years)  
(A) 1,350 (B) 2,750 (C) 11,400 (D) 16,800 (E) 22,400
2. Natural selection involves energetic trade-offs between \_\_\_\_\_  
(A) the reproductive strategy of semelparity and iteroparity.  
(B) the population increasing and decreasing.  
(C) high survival rates of offspring and the cost of parental care.  
(D) number of reproductive females and reproductive ability.  
(E) the number of offspring and how long they live.
3. Which option listed in below is **NOT** an antipredator defensive behavior?  
(A) Camouflage  
(B) Aposematic coloration  
(C) Batesian mimicry  
(D) Mullerian mimicry  
(E) Character displacement
4. Which of the following descriptions about "toxin in the environment" is **INCORRECT**?  
(A) The biological magnification is the toxin become more concentrated in trophic level of food web.  
(B) Chlorinated hydrocarbons has demonstrated biological magnification.  
(C) Some low toxic chemicals transform high toxic by exploring sunlight or microbial metabolism.  
(D) Chemicals released into the environment may be relatively harmless but converted to more toxic product by reaction with other substances, by exposure to light, or by the metabolism of microorganism.  
(E) WHO allows that DDT strictly reuse in disease vector control in 2007, so DDT is not environmental toxin anymore.
5. Which of the following descriptions about "regulating of enzyme activity in metabolism" is **INCORRECT**?  
(A) Allosteric regulation is the term used to describe any case in which a protein's function at one site is affected by the binding of a regulatory molecule to a separate site.  
(B) An activating or inhibiting regulatory molecule binds to a regulatory site that is the simplest kind of allosteric regulation.  
(C) Feedback inhibition is a common mode of metabolic control.  
(D) Cooperativity is a type of enzyme activation, not including inhibition.  
(E) Cooperativity is the binding of one substrate molecule that can stimulate binding or activity at other active sites.
6. Mendel used the scientific approach to indentify two laws of inheritance, which comment about "Mendelian genetics" is **NOT** correct?  
(A) Mendelian genetics includes two laws as law of segregation and law of independent assortment.  
(B) The law of segregation states that genes have alternative forms, or alleles.  
(C) The law of independnet assortment states the pair of alleles for a given gene segregates into gametes independently of the pair of alleles for any other gene.  
(D) Traits are inherited in discrete units, and are not the results of blending.  
(E) In heterozygotes, the two alleles are different, and the expression of two different alleles makes phenotypic effects of the other.
7. Which sex determination system is suitable for the following descriptions?  
There is only one type of sex chromosome, the females have two sex chromosomes, males have only one sex chromosome. Sex of the offsprings is determined by whether the sperm cell contains an X chromosome or no sex chromosome.  
(A) The X-Y system  
(B) The X-0 system  
(C) The Z-W system  
(D) The haplo-diploid system  
(E) None

8. Bacteria is one of major group of prokaryotes, which of the following description about "bacterial DNA replication" is **NOT** correct?
- (A) Helicase unwinds the parental double helix DNA.
  - (B) Primase begins synthesis of the RNA primer for the Okazaki fragment in lagging strand.
  - (C) The leading strand is synthesized continuously in the 5' to 3' direction by DNA polymerase II.
  - (D) DNA polymerase I removes the primer from the 5' end of the second fragment, replacing it with DNA.
  - (E) DNA ligase joins the 3' end of the second fragment to the 5' end of the first fragment.
9. Which genes should be turned on first to determinate the body axis during embryogenesis of *Drosophila*?
- (A) Pair rule genes
  - (B) Segmentation genes
  - (C) Segmentation polarity genes
  - (D) Maternal effect genes
  - (E) Homeotic genes
10. The eyes of mammalian and octopus are similar in structure and function. Which of following hypothesis accounts for most of this similarity?
- (A) Balanced polymorphism
  - (B) Convergent evolution
  - (C) Parallel evolution
  - (D) Cladogenesis
  - (E) Macroevolution
11. A new species of plant could be originated by hybridization coupled with \_\_\_\_\_
- (A) autopolyploidy.
  - (B) polymorphic speciation.
  - (C) a super species.
  - (D) sympatric speciation.
  - (E) allopatric speciation.
12. The dengue virus fragments will be presented by virus-infected cells along with which of the following?
- (A) Toll receptor      (B) Complement      (C) Antibodies      (D) Class I MHC molecules
  - (E) Class II MHC molecules
13. The sum of a species' use of the biotic and abiotic resources in its environment is called the species' \_\_\_\_\_?
- (A) niche      (B) ecological niche      (C) resource niche      (D) environment niche
  - (E) ecological statement
14. Which statement about variation is true?
- (A) All new alleles are the result of nucleotide variability.
  - (B) All phenotypic variation is the result of genotypic variation.
  - (C) All genetic variation produces phenotypic variation.
  - (D) All nucleotide variability results in neutral variation.
  - (E) All geographic variation results from the existence of clines.
15. In a hypothetical situation, the genes for sex pilus construction and for tetracycline resistance are located together on the same plasmid within a particular bacterium. If this bacterium readily performs conjugation involving a copy of this plasmid, then the result should be \_\_\_\_\_.
- (A) the rapid spread of tetracycline resistance to other bacteria in that habitat.
  - (B) the subsequent loss of tetracycline resistance from this bacterium.
  - (C) the production of endospores among the bacterium's progeny.
  - (D) the temporary possession by this bacterium of a completely diploid genome.
  - (E) a transformed bacterium.
16. Mendel's observation of the segregation of alleles in gamete formation has its basis in which of the following phases of cell division?
- (A) Anaphase of mitosis      (B) Prophase I of meiosis      (C) Prophase II of meiosis
  - (D) Metaphase I of meiosis      (E) Anaphase I of meiosis
17. Abnormal chromosomes are frequent in malignant tumors. Errors such as translocations may place a gene in close proximity to different control regions. Which of the following might then occur to make the cancer worse?
- (A) Sensitivity of the immune system
  - (B) An increase in non-disjunction
  - (C) Expression of inappropriate gene products
  - (D) A decrease in mitotic frequency
  - (E) Death of the cancer cells in the tumor



18. A chemist wishes to make an organic molecule less acidic. Which of the following functional groups should be added to the molecule in order to do so?  
 (A) phosphate            (B) amino            (C) sulfonyl            (D) sulfhydryl            (E) carboxyl
19. RFLP analysis can be used to distinguish between alleles based on differences in which of the following?  
 (A) the ability of nucleic acid probes to hybridize to the alleles  
 (B) the proteins expressed from the alleles  
 (C) the ability of the alleles to be replicated in bacterial cells  
 (D) the amount of DNA amplified from the alleles during PCR  
 (E) restriction enzyme recognition sites between the alleles
20. The volume enclosed by the plasma membrane of plant cells is often much larger than the corresponding volume in animal cells. The most reasonable explanation for this observation is that \_\_\_\_\_.  
 (A) plant cells contain a large vacuole that increases the volume of the cell.  
 (B) plant cells are capable of having a much higher surface-to-volume ratio than animal cells.  
 (C) plant cells have a much more highly convoluted (folded) plasma membrane than animal cells.  
 (D) animal cells are more spherical, while plant cells are elongated.  
 (E) the basic functions of plant cells are very different from those of animal cells.
21. In the thylakoid membranes, what is the main role of the antenna pigment molecules?  
 (A) concentrate photons within the stroma  
 (B) split water and release oxygen to the reaction-center chlorophyll  
 (C) harvest photons and transfer light energy to the reaction-center chlorophyll  
 (D) synthesize ATP from ADP and P<sub>i</sub>  
 (E) transfer electrons to ferredoxin and then NADPH
22. How do the daughter cells at the end of mitosis and cytokinesis compare with their parent cells when it was in G<sub>1</sub> of the cell cycle?  
 (A) The daughter cells have the same number of chromosomes and half the amount of DNA.  
 (B) The daughter cells have the same number of chromosomes and the same amount of DNA.  
 (C) The daughter cells have the same number of chromosomes and twice the amount of DNA.  
 (D) The daughter cells have half the amount of cytoplasm and half the amount of DNA.  
 (E) The daughter cells have half the number of chromosomes and half the amount of DNA.
23. What is a karyotype?  
 (A) The combination of chromosomes found in a gamete.  
 (B) A system of classifying cell nuclei.  
 (C) A display of every pair of homologous chromosomes within a cell, organized according to size and shape.  
 (D) The set of unique physical characteristics that define an individual.  
 (E) The collection of all the mutations present within the genome of an individual.
24. What is the function of DNA polymerase III?  
 (A) to rejoin the two DNA strands (one new and one old) after replication  
 (B) to degrade damaged DNA molecules  
 (C) to add nucleotides to the end of a growing DNA strand  
 (D) to seal together the broken ends of DNA strands  
 (E) to unwind the DNA helix during replication
25. Phylogenetic trees are best described as \_\_\_\_\_.  
 (A) true and inerrant statements about evolutionary relationships  
 (B) hypothetical portrayals of evolutionary relationships  
 (C) the closest things to absolute certainty that modern systematics can produce  
 (D) theories of evolution  
 (E) the most accurate representations possible of genetic relationships among taxa
26. As cleavage continues during frog development, the size of the blastomeres \_\_\_\_\_.  
 (A) increases as the number of the blastomeres increases  
 (B) decreases as the number of the blastomeres increases  
 (C) decreases as the number of the blastomeres decreases  
 (D) increases as the number of the blastomeres stays the same  
 (E) increases as the number of the blastomeres decreases
27. Which of the following best describes resource partitioning?  
 (A) Two species can coevolve to share the same niche.  
 (B) Competitive exclusion results in the success of the superior species.  
 (C) Slight variations in niche allow similar species to coexist.  
 (D) A climax community is reached when no new niches are available.  
 (E) Differential resource utilization results in the decrease in species diversity.

28. The producers in aquatic ecosystems include organisms in which of the following groups?  
(A) photoautotrophs (B) plants (C) alga (D) cyanobacteria (E) A, B, C, and D are all correct
29. Overexploitation encourages extinction and is most likely to affect \_\_\_\_\_.  
(A) most organisms that live in the oceans  
(B) terrestrial organisms more than aquatic organisms  
(C) edge-adapted species  
(D) animals that occupy a broad ecological niche  
(E) large animals with low intrinsic reproductive rates
30. You are observing a population of lizards when you notice that the number of adults has increased and is higher than previously observed. One explanation for such an observation would include \_\_\_\_\_.  
(A) increased birth rate (B) decreased emigration (C) increased emigration (D) increased immigration  
(E) reduction in death rate
31. Which of the following pair of hormones have antagonistic effects?  
(A) thyroid hormone and parathyroid hormone  
(B) epinephrine and norepinephrine  
(C) glucagon and insulin  
(D) prolactin and oxytocin  
(E) androgen and estrogen
32. Which of the following is true of members of the phylum Cnidaria?  
(A) They are not capable of locomotion because they lack true muscle tissue.  
(B) They are primarily filter feeders.  
(C) They have either, or both, of two body forms: mobile polyps and sessile medusae.  
(D) They may use a gastrovascular cavity as a hydrostatic skeleton.  
(E) They are the simplest organisms with a complete alimentary canal (two openings).
33. The enzyme amylase can break glycosidic linkages between glucose monomers only if the monomers are in the  $\alpha$  form. Which of the following could amylase break down?  
(A) glycogen, starch, and amylopectin  
(B) glycogen and cellulose  
(C) cellulose and chitin  
(D) starch and chitin  
(E) starch, amylopectin, and cellulose
34. Which of the following statements about intermediate filaments is **NOT** TRUE?  
(A) They are cytoskeletal fibers with a diameter of 8-12 nm.  
(B) Their constituent proteins are highly heterogeneous and express in a cell-type specific manner.  
(C) Their main function is to maintain cell shape and anchor organelles such as mitochondria.  
(D) They also express in nucleus and form nuclear lamina.  
(E) Vesicle can travel along intermediate filaments through interaction with motor proteins.
35. Which of the following statements about glycolysis is **NOT** TRUE?  
(A) Glycolysis takes place in cytosol.  
(B) The ATP made during glycolysis is generated by substrate-level phosphorylation.  
(C) Glycolysis will proceed in eukaryotic cells whether oxygen is present or absent.  
(D) During glycolysis, when glucose is catabolized to pyruvate, most of the energy of glucose is transferred to ADP, forming ATP.  
(E) In addition to ATP, the end products of glycolysis are NADH and pyruvate.
36. About Calvin cycle, which of the following statement is true?  
(A) reactions occur within the thylakoid membrane.  
(B) carbon fixation catalyzed by rubisco is the first step of the reaction.  
(C) reaction includes split water and release of oxygen.  
(D) the cycle builds sugar from smaller molecules by using ATP and the reducing power of electrons carried by NADH.  
(E) photophosphorylation occurs and generates ATP.
37. About mitosis and meiosis, which statement is **NOT** TRUE?  
(A) Mitosis conserves the number of chromosome sets, producing cells that are genetically identical to the parent cell.  
(B) Meiosis reduces the number of chromosomes sets from two (diploid) to one (haploid), producing cells that differ genetically from each other and from the parent cell.  
(C) Meiosis occurs in reproductive cells, forming female and male haploid gametes.  
(D) DNA replication occurs twice in meiosis but once in mitosis.  
(E) Cell divides twice in meiosis but once in mitosis.

38. The first cloned cat, called Carbon Copy, was a calico, but she looked significantly different from her female parent. Why?
- The environment, as well as genetics, affects phenotypic variation.
  - Fur color genes in cats are influenced by differential acetylation patterns.
  - X inactivation in the embryo is random and produces different patterns.
  - Cloned animals have been found to have a higher frequency of transposon activation.
  - The telomeres of the parent's chromosomes were shorter than those of an embryo.
39. The leading and the lagging strands differ in that
- synthesize leading strands require RNA primer, but synthesize lagging strands do not require RNA primer.
  - the leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, and the lagging strand is synthesized by adding nucleotides to the 5' end.
  - the lagging strand is synthesized continuously, whereas the leading strand is synthesized in short fragments that are ultimately stitched together.
  - the leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
  - the leading strand is synthesized at twice the rate of the lagging strand.
40. About split gene and RNA splicing, which of the following statements is **NOT** TRUE?
- The coding regions are called exons because they are expressed and usually translated into proteins.
  - The other regions called introns. They are noncoding regions, which contain intervening sequences that are nonfunctional.
  - RNA splicing removes introns and joins exons, creating an mRNA molecule with a continuous coding sequence.
  - Alternative RNA splicing is a type of eukaryotic gene regulation in which different RNA molecules are produced from the same primary transcript, depending on which RNA segments are treated as exons and which as introns.
  - Alternative RNA splicing produces a number of different proteins called isoforms from a single gene, therefore significantly expand the repertoire of an eukaryotic genome.
41. Which of the followings were probably considered the first terrestrial organisms?
- burrowers
  - photosynthetic
  - multicellular
  - prokaryotes
  - eukaryotes
  - plants and their associated fungi
- (A) 2 and 4    (B) 3 and 5    (C) 1, 3, and 5    (D) 2, 3, and 6    (E) 2, 3, 5, and 6
42. Which *two* structures play direct roles in permitting bacteria to adhere to each other, or to other surfaces?
- capsules
  - endospores
  - fimbriae
  - plasmids
  - flagella
- (A) 1 and 2    (B) 1 and 3    (C) 2 and 3    (D) 3 and 4    (E) 3 and 5
43. Which two genera have members that can evade the human immune system by frequently changing their surface proteins?
- Plasmodium*
  - Trichomonas*
  - Paramecium*
  - Trypanosoma*
  - Entamoeba*
- (A) 1 and 2    (B) 1 and 4    (C) 2 and 3    (D) 2 and 4    (E) 4 and 5
44. Which of the following cells or structures are associated with *asexual* reproduction in fungi?
- (A) ascospores    (B) basidiospores    (C) zygosporangia    (D) conidiophores    (E) ascocarps
45. Which of the following is **NOT** a function of rhizobacteria?
- produce hormones that stimulate plant growth
  - produce antibiotics that protect roots from disease
  - absorb toxic metals
  - carry out nitrogen fixation
  - supply growing roots with glucose

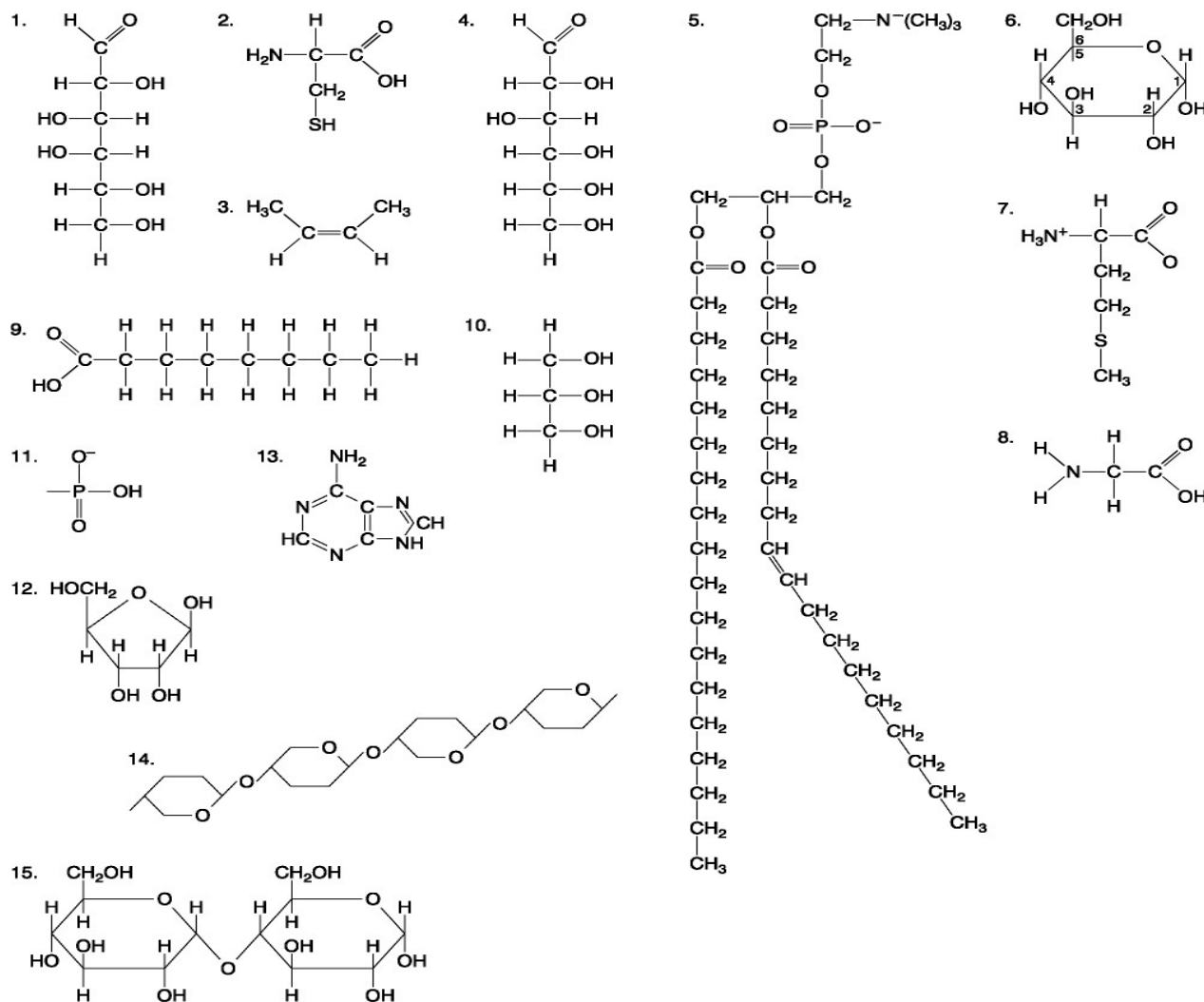
46. Epiphytes are \_\_\_\_\_  
 (A) fungi that attack plants.  
 (B) plants that have a symbiotic relationship with fungi.  
 (C) nonphotosynthetic parasitic plants.  
 (D) plants that live in poor soil and digest insects to obtain nitrogen.  
 (E) plants that grow on other plants but do not obtain nutrients from their hosts.
47. What do Wernicke's and Broca's regions of the brain affect?  
 (A) olfaction      (B) vision      (C) speech      (D) memory      (E) hearing
48. According to Hamilton's rule,  
 (A) natural selection does not favor altruistic behavior that causes the death of the altruist.  
 (B) natural selection favors altruistic acts when the resulting benefit to the beneficiary, corrected for relatedness, exceeds the cost to the altruist.  
 (C) natural selection is more likely to favor altruistic behavior that benefits an offspring than altruistic behavior that benefits a sibling.  
 (D) the effects of kin selection are larger than the effects of direct natural selection on individuals.  
 (E) altruism is always reciprocal.
49. What is the single greatest threat to biodiversity throughout the biosphere?  
 (A) overharvesting of commercially important species  
 (B) introduced species that compete with native species  
 (C) pollution of Earth's air, water, and soil  
 (D) disruption of trophic relationships as more and more prey species become extinct  
 (E) habitat alteration, fragmentation, and destruction
50. All of the followings belong to the Eumetazoa, **EXCEPT**  
 (A) Proifera      (B) Platyhelminthes      (C) Mollusca      (D) Annelida      (E) Nematoda

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

51. About hormonal circuits that link kidney function, which of the following statements is **INCORRECT**?  
 (A) An increase in blood osmolarity triggers the release of antidiuretic hormone (ADH), which helps to conserve water.  
 (B) ADH increases water reabsorption in the descending limb of the Loops of Henle.  
 (C) The Renin-Angiotensin-Aldosterone System (RAAS) is part of a complex feedback circuit that functions in the maintenance of blood pressure and volume.  
 (D) A drop in blood pressure near the glomerulus causes the juxtaglomerular apparatus (JGA) to release the enzyme renin.  
 (E) Renin triggers the formation of the peptide angiotensin II, which increases blood volume and pressure by stimulating the release of aldosterone.
52. About respiratory pigment, which of the following statements is **INCORRECT**?  
 (A) Respiratory pigments are proteins that transport oxygen and greatly increase the amount of oxygen that blood can carry.  
 (B) Arthropods and many molluscs have hemocyanin with copper as the oxygen-binding component.  
 (C) Hemoglobin is involved in the transport of O<sub>2</sub> but not CO<sub>2</sub>.  
 (D) A small change in the partial pressure of oxygen can result in a large change in delivery of O<sub>2</sub>.  
 (E) CO<sub>2</sub> produced during cellular respiration lowers blood pH and decreases the affinity of hemoglobin for O<sub>2</sub>; this is called the Bohr shift.
53. Which of the followings would a paleontologist be most likely to do in order to determine whether a fossil represents a reptile or a mammal?  
 (A) Look for the mammalian characteristics of a four-chambered heart and a diaphragm.  
 (B) Because mammals are eutherians, look for evidence of a placenta.  
 (C) Use molecular analysis to look for the protein keratin.  
 (D) Examine the teeth.  
 (E) Look for the presence of milk-producing glands.
54. Which of the following statements about connective tissue is **INCORRECT**?  
 (A) Loose connective tissue binds to epithelial to underlying tissues and holds organ in place.  
 (B) Fibrous connective tissue is found in tendons and ligaments.  
 (C) Three types of connective tissue fibers are collagenous fibers, reticular fibers and elastic fibers.  
 (D) Both cartilage and bones are connective tissues, but blood composed of blood cells and cell fragments in blood plasma is not.  
 (E) Fibroblasts that secret proteins of extracellular matrix are one major cell type in connective tissue.

55. About human disorders due to chromosomal alterations, which of the following statements is **INCORRECT**?
- (A) Down's syndrome is an aneuploid condition that results from three copies of chromosome 21.  
 (B) Turner syndrome is the only known viable monosomy X in female human.  
 (C) Klinefelter syndrome is the result of an extra chromosome in a male producing XXY individuals.  
 (D) Certain cancers, including chronic myelogenous leukemia are caused by chromosome translocation.  
 (E) *cri du chat* ("cry of the cat") syndrome results from a specific duplication of chromosome 5.
56. Which of the following description of the genetic term is **INCORRECT**?
- (A) Epistasis is a type of gene interaction in which the phenotypic expression of one gene alters that of another independently inherited gene.  
 (B) Codominance is a situation in which the phenotypes of heterozygotes is intermediate between the phenotypes of individuals homozygous for either allele.  
 (C) Pleiotropy is the ability of a single gene to have multiple effects.  
 (D) Epigenetic inheritance is the inheritance of traits transmitted by mechanisms not directly involving the nucleotide sequence of a genome.  
 (E) Polygenic inheritance is an additive effect of two more genes on a single phenotype.
57. About cell membrane, which of the following statements is **NOT TRUE**?
- (A) Cell membranes are fluid mosaics of lipid and proteins, and the phospholipid bilayer is the basic building block of the membrane.  
 (B) Most of the phospholipids can shift about laterally in the plane of the membrane, but it is quite rare for phospholipids to flip-flop transversely across the membrane because the hydrophilic part of the molecule must cross the hydrophobic interior of the membrane.  
 (C) Phospholipids with saturated hydrocarbon tail pack more tightly, therefore decreasing membrane fluidity and viscosity.  
 (D) The presence of unsaturated hydrocarbon tails in phospholipids can enhance membrane fluidity, because unsaturated hydrocarbon tails cannot pack together as closely as saturated carbon tails.  
 (E) The steroid cholesterol in the plasma membrane of animal cells can change membrane fluidity and this effect is temperature-dependent.

58. Based on the following 15 molecules, which of the following statements is **NOT TRUE**?



- (A) 11, 12, and 13 could be linked together to form a nucleotide.  
 (B) 5 is an important component of plasma membrane.  
 (C) 2, 7, and 8 are molecules act as building blocks (monomers) of polypeptides.  
 (D) 3 molecules of 9 and 1 molecule of 10 could be joined together to form a fat.  
 (E) 11 and 13 could be joined together by a phosphodiester type of covalent bond.

59. About adrenal hormones, which of the following statements is **NOT TRUE**?
- (A) The adrenal medulla secretes catecholamines including epinephrine and norepinephrine.
  - (B) Epinephrine and norepinephrine are secreted in response to stress-activated hormone cascade pathway via hypothalamus.
  - (C) The adrenal cortex releases a family of steroids called corticosteroids in response to stress.
  - (D) Humans produce two types of corticosteroids: glucocorticoids and mineralocorticoids.
  - (E) Both glucocorticoids and mineralocorticoids play an important role in regulating blood pressure and volume.
60. Which description is correct about virus infectious diseases?
- (A) Human immunodeficiency virus (HIV) is a mosquito-borne retrovirus that cause acquired immunodeficiency syndrome (AIDS) of human.
  - (B) Dengue virus has four serotypes that all are zoonoses pathogens that are transmitted from animal to human by vector mosquitoes.
  - (C) Japanese encephalitis virus is a pathogen of zoonoses infectious disease that is transmitted between species from animal to human by vector mosquitoes.
  - (D) H7N9 is an avian influenza virus also a subtype of influenza B virus.
  - (E) Hepatitis B virus is a vector-borne virus that cause more than 80% infection in Taiwan.
61. Which option listed in below is **INCORRECT** that describe about "ATP synthesis"?
- (A)  $H^+$  ions flowing down their gradient enter a half channel in a stator, which is anchored in the membrane.
  - (B)  $H^+$  ions enter binding site within a rotor, changing the shape of each subunit so that rotor spins within the membrane.
  - (C) Each  $H^+$  ion makes one complete turn before leaving the rotor and passing through a second half channel in the stator into the mitochondrial matrix.
  - (D) Spinning of the rotor causes an internal rod to spin as well. This rod extends like a stalk into the knob below it, which is held stationary by part of the stator.
  - (E) Turning of the rod activates catalytic sites in the knob that produce ATP from AMP and Pi.
62. Birds and mammals both have negative pressure breathing, but birds are more efficient because of which of the following reasons?
- (A) The bird's mouth movements are able to force air into the lungs.
  - (B) The tidal volume in birds is much larger than in a comparably sized mammal.
  - (C) The flow of air in a bird's lungs is from posterior to anterior.
  - (D) The brain of the bird maximizes oxygen uptake more efficiently.
  - (E) The maximum  $PO_2$  is significantly higher in bird lungs.
63. Choose the **INCORRECT** description regarding the hearing system of human.
- (A) The cochlea can distinguish volume because the basilar membrane is not uniform along its length.
  - (B) The ear conveys information to the brain about two important sound variables that are volume and pitch.
  - (C) Three bones of the middle ear transmit the vibrations to the oval window.
  - (D) The cochlea has two large canals, an upper vestibular canal and a lower tympanic canal, which separated by a smaller cochlear duct.
  - (E) The hearing system of human is a mechanoreceptor system.
64. Which comment about "Global Climate Model" is **INCORRECT**?
- (A) Global climate patterns are determined largely by the input of solar energy and Earth's movement in space.
  - (B) Thermal energy from sunlight warms surface waters to whatever depth the sunlight penetrates, but the deeper waters remain quite cold.
  - (C) Many features in the environment influence microclimate by casting shade, altering evaporation from soil, or changing wind patterns.
  - (D) Climatic variables affect the geographic ranges of most plants and animals, any large-scale change in Earth's climate profoundly affect the biosphere.
  - (E) Climate pattern can be modified by many factors, including seasonal variation.
65. All of the followings have contributed to the diversity of organisms on the Hawaiian archipelago **EXCEPT** that
- (A) The islands are distant from the mainland.
  - (B) Multiple invasions have occurred.
  - (C) Adaptive radiation has occurred.
  - (D) The islands are very young in geologic time.
  - (E) Environmental conditions differ from one island to the next.
66. What is systems biology approach?
- (A) is to define gene circuit and protein interaction network.
  - (B) sequencing and analyzing whole genome sequence.
  - (C) constructing a linkage map on the chromosome.
  - (D) using bioinformatics tool to analyze gene expression and protein structure.
  - (E) is attempt to integrate different levels of information in order to understand the operation of biological systems.

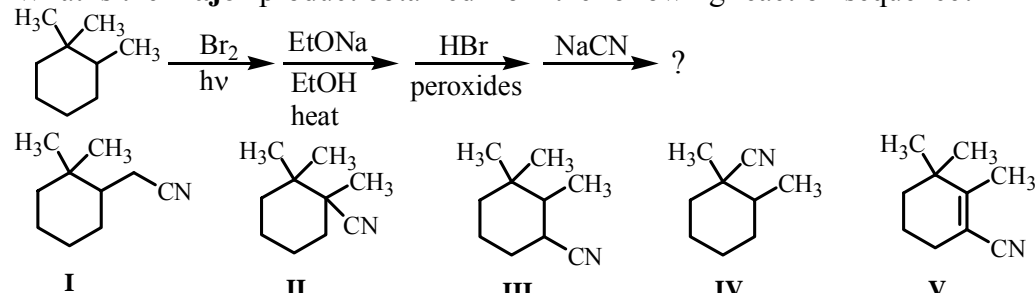
67. The following events are steps of neural transmission at a chemical synapse. Please choose the correct sequence of events.
- (1) Neurotransmitter binds with receptors associated with the postsynaptic membrane.
  - (2) Calcium ions rush into neuron's cytoplasm.
  - (3) The ligand-gated ion channels open.
  - (4) An action potential depolarizes the membrane of the axon terminal.
  - (5) The synaptic vesicles release neurotransmitter into the synaptic cleft.
- (A) 1 → 2 → 3 → 4 → 5
  - (B) 2 → 3 → 5 → 4 → 1
  - (C) 3 → 2 → 5 → 1 → 4
  - (D) 4 → 2 → 5 → 1 → 3
  - (E) 5 → 1 → 2 → 3 → 4
68. Most of the dry weight of a plant is the result of uptake of \_\_\_\_.
- (A) carbohydrates in the root hairs and concentration in the root cortex
  - (B) water and minerals through root hairs
  - (C) water and minerals through mycorrhizae
  - (D) CO<sub>2</sub> through stoma
  - (E) CO<sub>2</sub> and O<sub>2</sub> through stomata in leaves
69. A researcher is trying to construct a molecular-based phylogeny of the entire animal kingdom. Assuming that none of the following genes is absolutely conserved, which of the following would be the best choice on which to base the phylogeny?
- (A) genes involved in eye-lens synthesis
  - (B) genes that cause radial body symmetry
  - (C) genes involved in chitin synthesis
  - (D) collagen genes
  - (E) beta-catenin genes
70. Carbon dioxide (CO<sub>2</sub>) is released during which of the following stages of cellular respiration?
- (A) oxidation of pyruvate to acetyl CoA and the citric acid cycle
  - (B) glycolysis and the oxidation of pyruvate to acetyl CoA
  - (C) fermentation and glycolysis
  - (D) the citric acid cycle and oxidative phosphorylation
  - (E) oxidative phosphorylation and fermentation
71. Species of amphibians belonging to the same genus occasionally mate, but their offsprings do not survive. This is an example of \_\_\_\_.
- (A) the postzygotic barrier called hybrid.
  - (B) the prezygotic barrier called hybrid disjunction.
  - (C) gametic isolation.
  - (D) the postzygotic barrier called hybrid breakdown.
  - (E) adaptative inviability.
72. A solution of starch at room temperature does not readily decompose to form a solution of simple sugars because \_\_\_\_.
- (A) starch hydrolysis is nonspontaneous
  - (B) starch cannot be hydrolyzed in the presence of so much water
  - (C) the activation energy barrier for this reaction cannot be surmounted
  - (D) the hydrolysis of starch to sugar is endergonic
  - (E) the starch solution has less free energy than the sugar solution
73. When an individual is subject to short-term starvation, most available food is used to provide energy (metabolism) rather than building blocks (growth and repair). Which hormone would be particularly active in times of food shortage?
- (A) antidiuretic hormone
  - (B) insulin
  - (C) epinephrine
  - (D) glucagon
  - (E) oxytocin
74. While sampling marine plankton in a lab, a student encounters large numbers of fertilized eggs. The student rears some of the eggs in the laboratory for further study and finds that the blastopore becomes the mouth. The embryo develops into a trochophore larva and eventually has a true coelom. These eggs probably belonged to a(n) \_\_\_\_.
- (A) arthropod
  - (B) nematode
  - (C) echinoderm
  - (D) mollusk
  - (E) chordate
75. How is habitat fragmentation related to biodiversity loss?
- (A) Populations of organism in fragments are smaller and more susceptible to extinction.
  - (B) The temperature in fragments rises to cause biodiversity loss.
  - (C) To keep biodiversity hot spot.
  - (D) Less absorption of carbon dioxide by plants in fragments.
  - (E) Environmental toxins are stable in fragments.

說明:一、選擇題用 2B 鉛筆在「答案卡」上作答,修正時應以橡皮擦擦拭,不得使用修正液(帶),未遵照正確作答方法而致電腦無法判讀者,考生自行負責。  
二、試題及答案卡必須繳回,不得攜出試場。

**I. Choose one correct answer for the following questions**

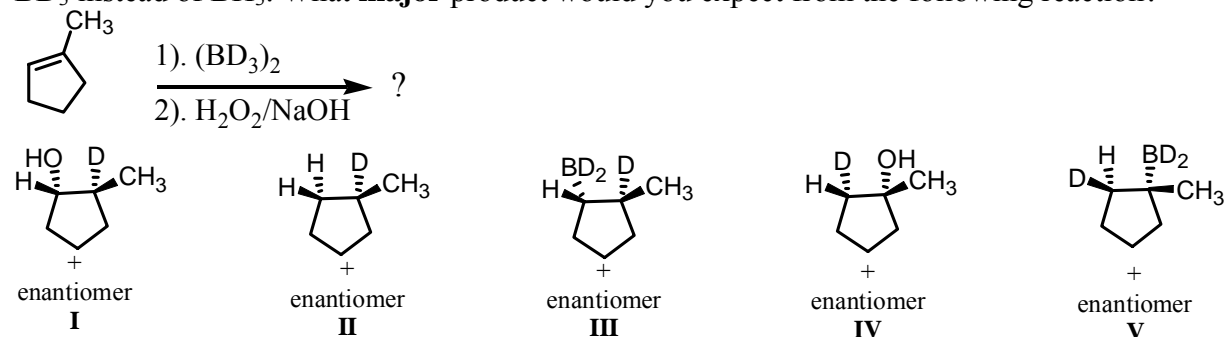
【單選題】每題 1 分,共計 60 分,答錯 1 題倒扣 0.25 分,倒扣至本大題零分為止,未作答,不給分亦不扣分。

1. What is the **major** product obtained from the following reaction sequence?



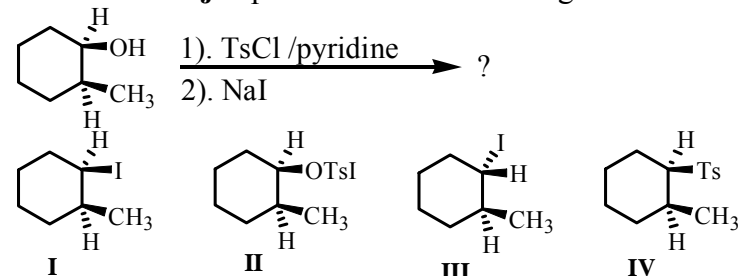
- (A) I (B) II (C) III (D) IV (E) V

2. The hydroboration-oxidation procedure can be successfully employed for synthesis of deuterated derivatives, by using BD<sub>3</sub> instead of BH<sub>3</sub>. What **major** product would you expect from the following reaction?



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

3. Predict the **major** product for the following reaction.



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

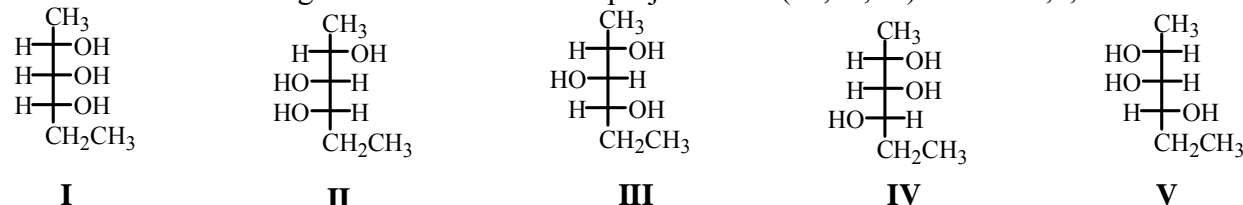
4. The following atoms are commonly encountered in organic molecules. For which is it not possible to isolate enantiomers due to rapid inversion?

- (A) trivalent phosphorus (B) trivalent nitrogen  
(C) divalent sulfur (D) trivalent sulfur (E) both B and C

5. Which of these alkyl halides can **NOT** be used to prepare amines using Gabriel synthesis?

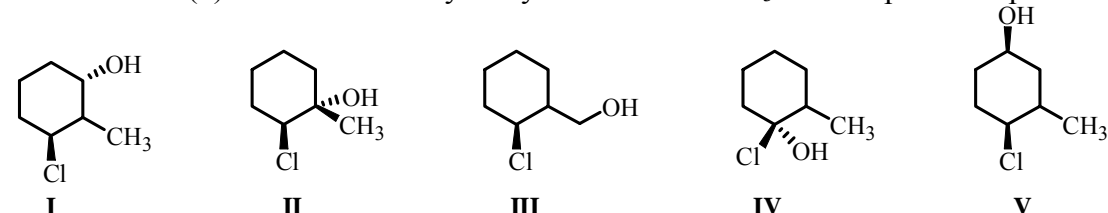
- (A) 1-bromopentane (B) 1-bromo-3-methylbutane (C) 2-bromo-3-methylpentane  
(D) 1-bromo-2,3-dimethylbutane (E) 2-bromo-2,3-dimethylbutane

6. Which of the following structures is a Fischer projection of (2S,3S,4R)-hexane-2,3,4-triol.



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

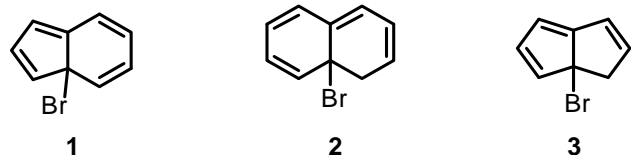
7. Treatment of (S)-6-chloro-1-methyl-1-cyclohexene with H<sub>3</sub>O<sup>+</sup> is expected to produce which of the following product(s)?



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

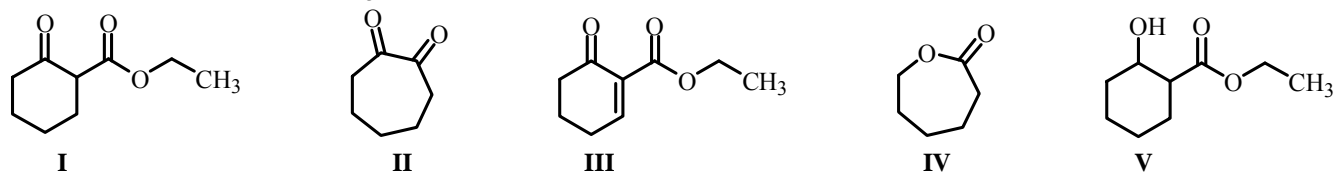
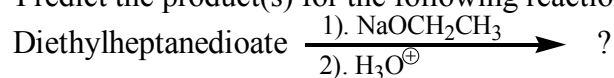


8. Which of the following substituent has the **highest** priority according to the Cahn-Ingold-Prelog system?  
 (A)  $-\text{COOH}$  (B)  $-\text{CHO}$  (C)  $-\text{CH}_2\text{OH}$  (D)  $-\text{CH}_3$  (E)  $-\text{H}$
9. What is the IUPAC name of the expected **major** product formed upon reaction of HCl with 3-methyl-1-butene?  
 (A) 1-Chloro-2-methylbutane (B) 1-Chloro-3-methylbutane (C) 2-Chloro-2-methylbutane  
 (D) 2-Chloro-3-methylbutane (E) 1-Chloropentane
10. Which sequence correctly ranks the following substrates in order of increasing **reactivity** in an  $\text{S}_{\text{N}}1$  reaction?



- (A)  $3 < 2 < 1$  (B)  $2 < 3 < 1$  (C)  $2 < 1 < 3$   
 (D)  $1 < 3 < 2$  (E)  $1 < 2 < 3$
11. A pure sample of (*S*)-phenylalanine has a specific rotation of  $+7.0^\circ$ . A mixture of the two enantiomers of phenylalanine gives a specific rotation of  $-7.0^\circ$ . What are the **percentages** of the *S* and *R* enantiomers in the mixture?  
 (A) 75% *S*, 25% *R* (B) 65% *S*, 35% *R* (C) 55% *S*, 45% *R*  
 (D) 45% *S*, 55% *R* (E) 35% *S*, 65% *R*
12. Predict the **major** product when pyridine is treated with a mixture of nitric acid and sulfuric acid  
 (A) 2-nitropyridine (B) 3-nitropyridine (C) 4-nitropyridine  
 (D) 2,3-dinitropyridine (E) 2,4-dinitropyridine

13. Predict the product(s) for the following reaction.



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

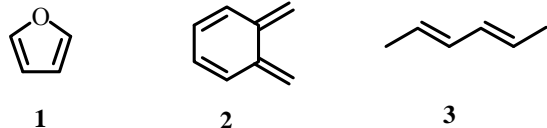
14. Which molecular formula is consistent with the following mass spectrum data?

$\text{M}^{+\bullet}$  at  $m/z=84$ , relative height=10.0%

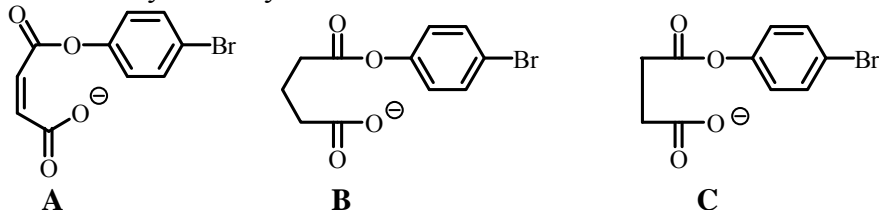
$(\text{M}+1)^{+\bullet}$  at  $m/z=85$ , relative height=0.56%

- (A)  $\text{C}_5\text{H}_{10}\text{O}$  (B)  $\text{C}_5\text{H}_8\text{O}$  (C)  $\text{C}_5\text{H}_{24}$  (D)  $\text{C}_6\text{H}_{12}$  (E)  $\text{C}_4\text{H}_6\text{O}_2$

15. Which sequence correctly ranks the following dienes in order of increasing **reactivity** in the Diels-Alder reaction?

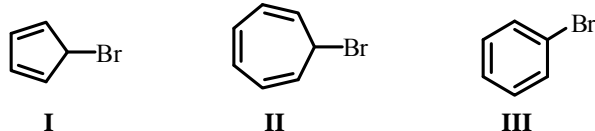


- (A)  $3 < 2 < 1$  (B)  $2 < 3 < 1$  (C)  $2 < 1 < 3$   
 (D)  $1 < 3 < 2$  (E)  $1 < 2 < 3$
16. Rank the following compounds in increasing order of **reactivity** in the intramolecular displacement of *p*-bromophenolate to form a cyclic anhydride.



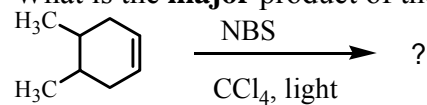
- (A)  $A < B < C$  (B)  $B < A < C$  (C)  $C < A < B$   
 (D)  $B < C < A$  (E) None of above

17. Which of the following undergoes solvolysis in water more **rapidly**?



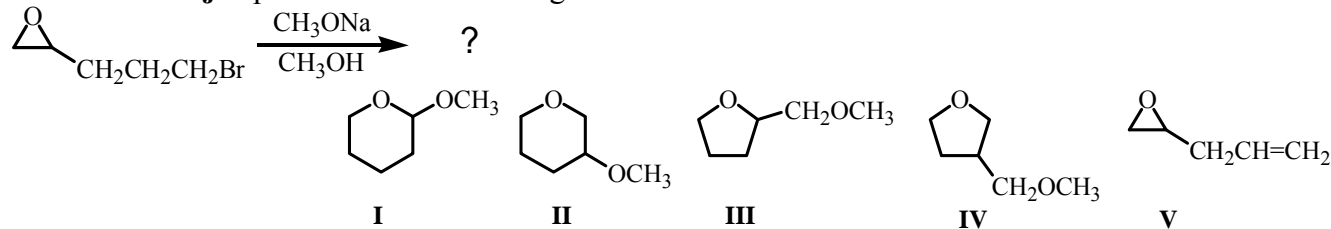
- (A) I (B) II (C) III (D) I and II (E) all of the above
18. Grignard reagents react with oxirane (ethylene oxide) to form  $1^\circ$ -alcohols but **can be prepared** in tetrahydrofuran solvent. Why is this difference in behavior observed?  
 (A) Steric hindrance in the case of tetrahydrofuran precludes reaction with the Grignard.  
 (B) There is a better leaving group in the oxirane molecule.  
 (C) The oxirane ring is the more highly strained.  
 (D) It is easier to obtain tetrahydrofuran in anhydrous condition.  
 (E) Oxirane is a cyclic ether, while tetrahydrofuran is a hydrocarbon.
19. The regioselectivity and stereospecificity in the oxymercuration-demercuration of an alkene is **best** described as:  
 (A) Markovnikov orientation with syn-addition (B) Markovnikov orientation with anti-addition  
 (C) anti-Markovnikov orientation with syn-addition (D) anti-Markovnikov orientation with anti-addition  
 (E) Markovnikov orientation with both syn- and anti-addition

20. What is the **major** product of the following reaction?



- (A) (B) (C) (D) (E) None of the above.

21. What is the **major** product of the following reaction?

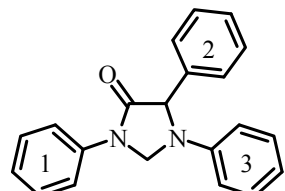


- (A) I (B) II (C) III (D) IV (E) V

22. Which of the following descriptions of the nucleoside uridine does **NOT** apply to the structure of the molecule?

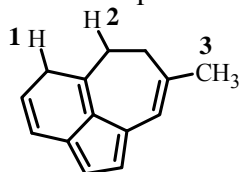
- (A) The uracil base is directly bonded to the 1' position of ribofuranose in the  $\alpha$  position.  
 (B) The ribofuranose moiety is found in only the D configuration.  
 (C) Nitrogen, at position 1 in the uracil base, is directly bonded to the ribofuranose moiety.  
 (D) The 5' OH group is replaced with phosphate(s) in the nucleotide structure.  
 (E) None of the above

23. Which sequence ranks the following aromatic rings of this compound in order of increasing **reactivity** in an electrophilic aromatic substitution reaction (slowest to fastest reacting)?



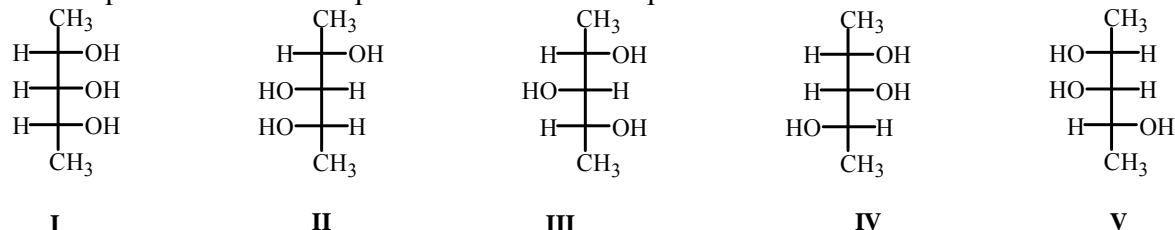
- (A)  $3 < 2 < 1$  (B)  $2 < 3 < 1$  (C)  $2 < 1 < 3$   
 (D)  $1 < 3 < 2$  (E)  $1 < 2 < 3$

24. Which sequence ranks the indicated protons in order of increasing **acidity**?



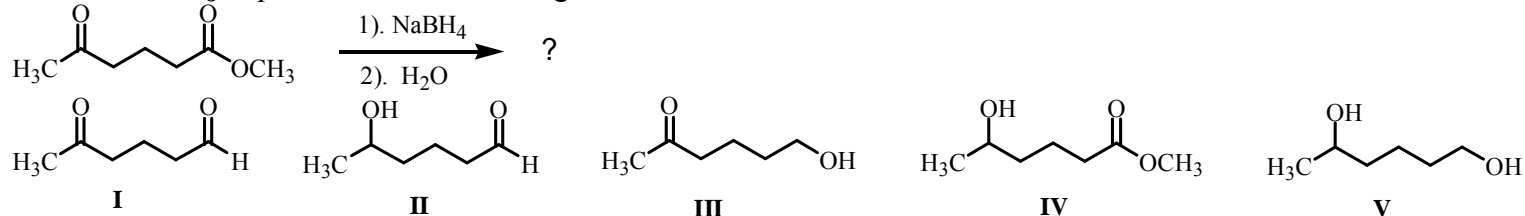
- (A)  $3 < 2 < 1$  (B)  $2 < 3 < 1$  (C)  $2 < 1 < 3$   
 (D)  $1 < 3 < 2$  (E)  $1 < 2 < 3$

25. Which pair of structures represents the **same** compound?



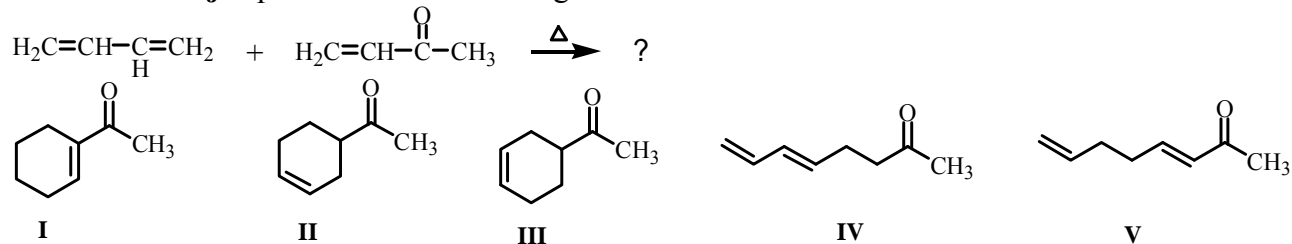
- (A) I and II (B) II and IV (C) III and IV (D) III and V (E) IV and V

26. What is the **major** product of the following reaction?



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

27. What is the **major** product of the following reaction?

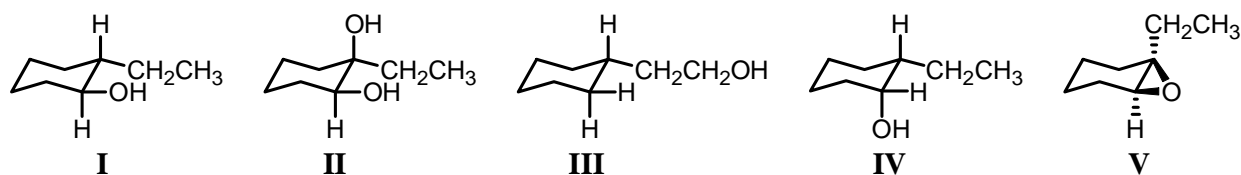
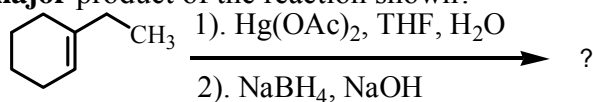


- (A) I (B) II (C) III (D) IV (E) V

28. Which of the following is the **strongest** nucleophile?

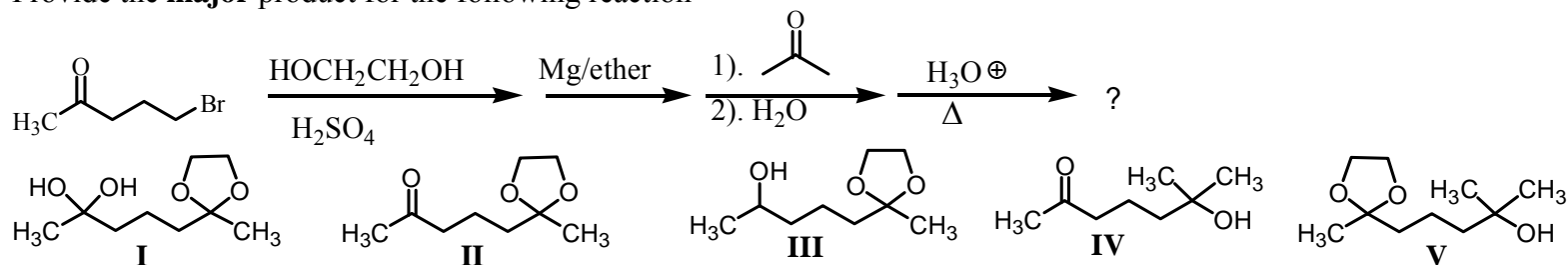
- (A) NaOH (B) NaOMe (C) KOH (D) KOMe (E) KSMe

29. Which would be the **major** product of the reaction shown?



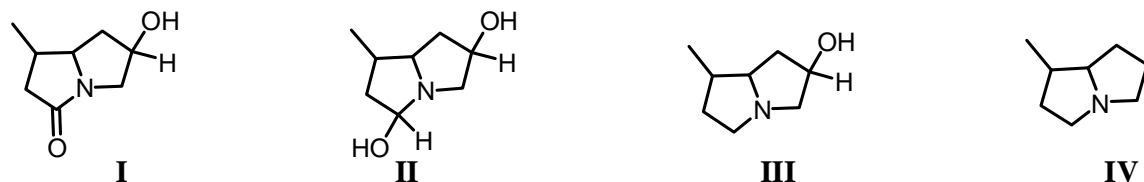
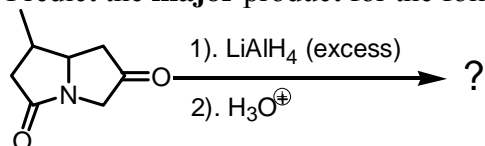
(A) I      (B) II      (C) III      (D) IV      (E) V

30. Provide the **major** product for the following reaction



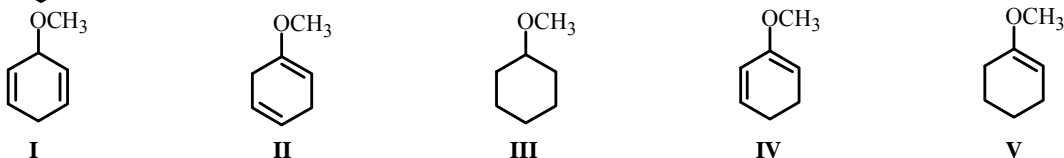
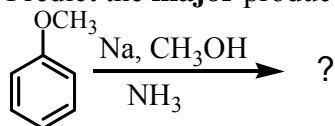
(A) I      (B) II      (C) III      (D) IV      (E) V

31. Predict the **major** product for the following reaction.



(A) I      (B) II      (C) III      (D) IV      (E) I and II.

32. Predict the **major** product for the following reaction.

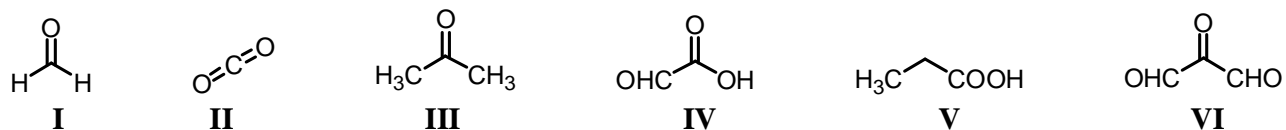
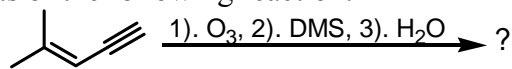


(A) I      (B) II      (C) III      (D) IV      (E) V

33. Which of the alkynes below, after undergoing an acid-catalyzed hydration, would be expected to produce two **different** ketones in nearly equivalent yields?

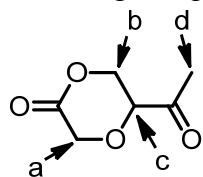
(A) 1-hexyne      (B) 2-hexyne      (C) 3-hexyne  
 (D) 3-methyl-1-pentyne      (E) 4-methyl-1-pentyne

34. Predict the products of the following reaction:



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

35. Which of the following is a correct prediction of the **chemical shifts** (ppm) for the signals in the  $^1\text{H}$  NMR spectrum for the following compound?

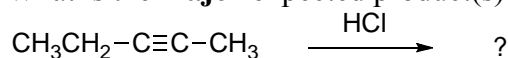


(A)  $a = 5.7, b = 5.2, c = 4.4, d = 1.9$       (B)  $a = 5.2, b = 5.7, c = 1.9, d = 4.4$       (C)  $a = 4.4, b = 5.2, c = 1.9, d = 1.9$   
 (D)  $a = 5.2, b = 4.4, c = 5.7, d = 1.9$       (E)  $a = 1.9, b = 5.7, c = 5.2, d = 4.4$

36. Provide the name of the **major** alkene product that results when (2*R*,3*R*)-2,3-dibromopentane is treated with zinc in acetic acid.

(A) (*Z*)-2-pentene      (B) (*E*)-2-pentene      (C) (*R*)-3-bromo-1-pentene  
 (D) (*S*)-3-bromo-1-pentene      (E) (*R*)-2-bromo-3-pentene

37. What is the **major** expected product(s) of the reaction shown below?

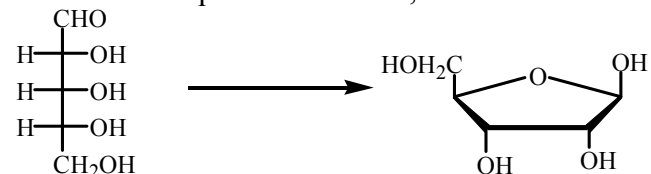


- (A) 2,2-Dichloropentane (B) 3,3-Dichloropentane (C) 2,3-Dichloropentane  
(D) A and B (E) B and C

38. What is the expected **major** organic product from treatment of 4-methyl-2-pentyne with hydrogen in the presence of Lindlar's catalyst?

- (A) (*E*)-4-methyl-2-pentene (B) (*Z*)-4-methyl-2-pentene (C) (*E*)-2-methyl-2-pentene  
(D) (*Z*)-2-methyl-2-pentene (E) 2-methylpentane

39. Refer to the equilibrium below, the correct name for the cyclic structure is \_\_\_\_\_.



- (A)  $\alpha$ -L-ribofuranose (B)  $\beta$ -D-ribofuranose (C)  $\alpha$ -L-ribofuranose  
(D)  $\beta$ -D-ribofuranose (E) None of the above

40. Which of the following best describes the key mechanistic steps in the reaction of an acid chloride and an alcohol to form an ester?

- (A) elimination followed by addition (B) addition followed by decarboxylation (C) addition followed by elimination  
(D) substitution followed by addition (E) rearrangement

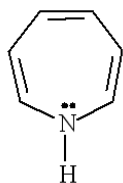
41. Many nucleophilic addition reactions of aldehydes and ketones are catalyzed by acid or base. Bases catalyze hydration by:

- (A) making the carbonyl group more electrophilic  
(B) shifting the equilibrium of the reaction  
(C) making the carbonyl group less electrophilic  
(D) converting the water to hydroxide ion, a much better nucleophile  
(E) None of the above

42. Which of the following would produce a mixture of products when treated under appropriate conditions with ***N*-bromosuccinimide**?

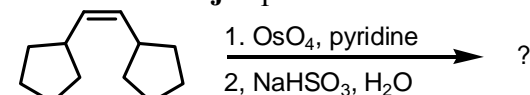
- (A) oct-4-ene (B) hept-1-ene (C) 4,4-dimethylcyclopentene  
(D) 4,5-dimethylcyclohexene (E) all produce a mixture of products

43. Which of the following statements **correctly** characterizes the following compound?



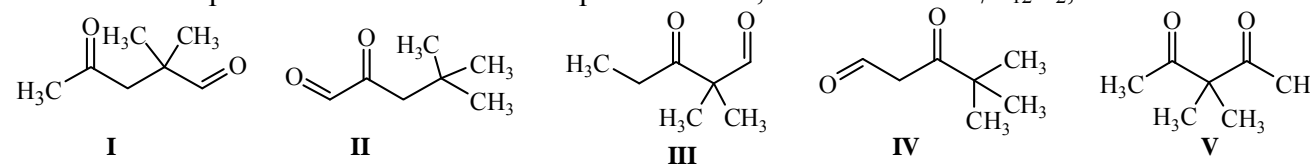
- (A) contains 6  $\pi$  electrons and is aromatic (B) contains 6  $\pi$  electrons and is nonaromatic  
(C) contains 8  $\pi$  electrons and is antiaromatic (D) contains 8  $\pi$  electrons and is aromatic  
(E) contains 8  $\pi$  electrons and is nonaromatic

44. What is the **major** product of the following reaction?



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

45. The  $^1\text{H}$  NMR spectrum of which of the compounds below, all of formula  $\text{C}_7\text{H}_{12}\text{O}_2$ , would consist of **three singlets only**?

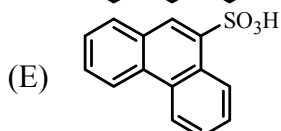
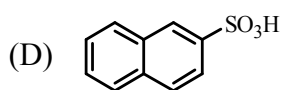
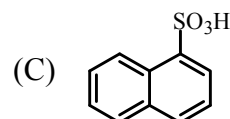
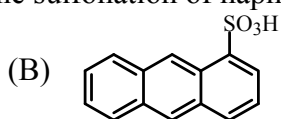
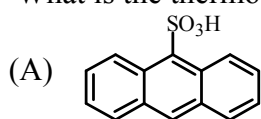


- (A) I (B) II (C) III (D) IV (E) V

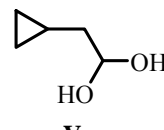
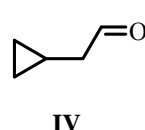
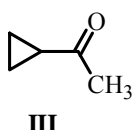
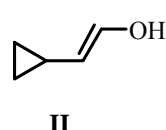
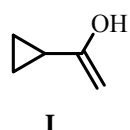
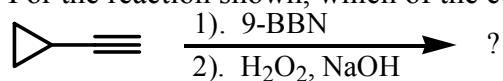
46. Arrange the following in order of increasing **basicity**: aniline, *p*-nitroaniline, *p*-toluidine, and *p*-methoxyaniline.

- (A) *p*-toluidine < *p*-methoxyaniline < aniline < *p*-nitroaniline  
(B) *p*-nitroaniline < *p*-toluidine < aniline < *p*-methoxyaniline  
(C) *p*-nitroaniline < aniline < *p*-toluidine < *p*-methoxyaniline  
(D) *p*-methoxyaniline < *p*-nitroaniline < *p*-toluidine < aniline  
(E) None of the above

47. What is the thermodynamic product of the sulfonation of naphthalene?



48. For the reaction shown, which of the compounds listed below would be the expected **major**, and final, organic product?



(A) I

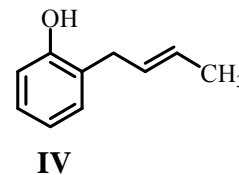
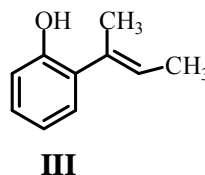
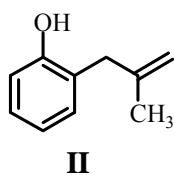
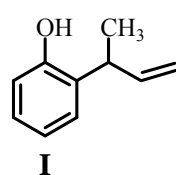
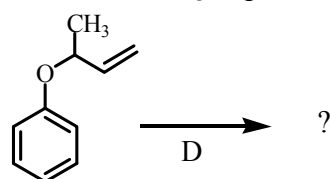
(B) II

(C) III

(D) IV

(E) V

49. Predict the **major** product for the following Claisen rearrangement.



(A) I

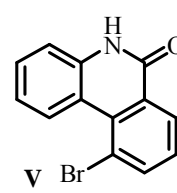
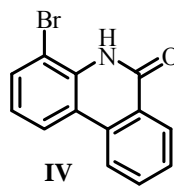
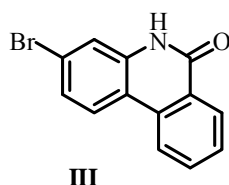
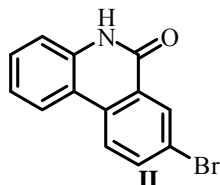
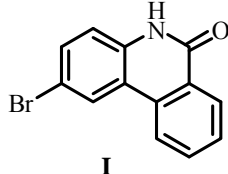
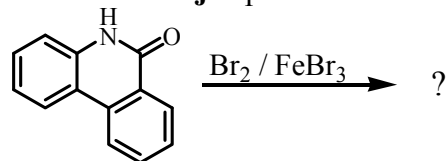
(B) II

(C) III

(D) IV

(E) None of the above

50. Predict the **major** product for the following reaction.



(A) I

(B) II

(C) III

(D) IV

(E) V

51. Which of the following reagents can be used to cleave a *tert*-butoxycarbonyl (Boc) protecting group from a peptide?

(A)  $\text{H}_2/\text{Pd}$

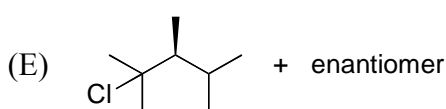
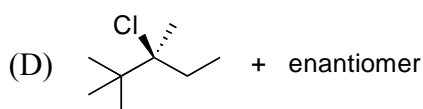
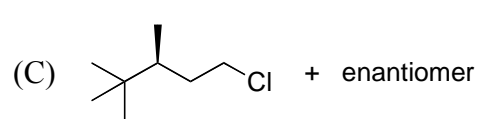
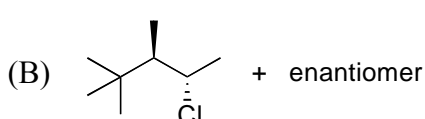
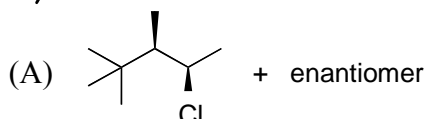
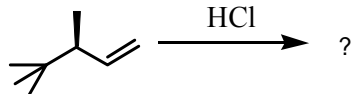
(B)  $\text{CF}_3\text{CO}_2\text{H}$

(C)  $\text{Na}_2\text{CO}_3, \text{H}_2\text{O}$

(D)  $\text{LiAlH}_4$

(E) None of the above

52. The reaction shown below would be expected to produce as **major** products which of the following compounds?



53. What is the **best** method for the preparation of *m*-dibromobenzene from benzene?

(A) 1.  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ; 2.  $\text{Sn}/\text{HCl}$ ; 3.  $\text{NaNO}_2/\text{HCl}, 0^\circ\text{C}$ ; 4.  $\text{Br}_2/\text{FeBr}_3$ , twice.

(B) 1.  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ; 2.  $\text{Sn}/\text{HCl}$ ; 3.  $\text{NaNO}_2/\text{HCl}, 0^\circ\text{C}$ ; 4.  $\text{Br}_2/\text{FeBr}_3$ ; 5.  $\text{H}_3\text{PO}_2$ .

(C) 1.  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ; 2.  $\text{Sn}/\text{HCl}$ ; 3.  $\text{NaNO}_2/\text{HCl}, 0^\circ\text{C}$ ; 4.  $\text{H}_3\text{PO}_2$ ; 5.  $\text{Br}_2/\text{FeBr}_3$ , twice.

(D) 1.  $\text{HNO}_3/\text{H}_2\text{SO}_4$ ; 2.  $\text{Br}_2/\text{FeBr}_3$ ; 3.  $\text{Sn}/\text{HCl}$ ; 4.  $\text{NaNO}_2/\text{HCl}, 0^\circ\text{C}$ ; 5.  $\text{CuBr}$ .

(E)  $\text{Br}_2/\text{FeBr}_3$ , twice.

54. Which is the **best** method for the synthesis of *tert*-butyl methyl ether?

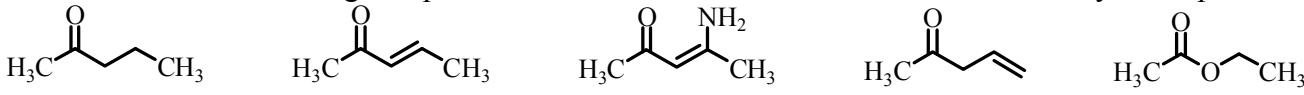
(A)  $\text{CH}_3\text{ONa} + (\text{CH}_3)_3\text{CBr} \longrightarrow$

(B)  $(\text{CH}_3)_3\text{CONa} + \text{CH}_3\text{I} \longrightarrow$

(C)  $\text{CH}_3\text{OH} + (\text{CH}_3)_3\text{COH} + \text{H}_2\text{SO}_4 \text{ at } 140^\circ\text{C} \longrightarrow$

(D)  $(\text{CH}_3)_3\text{CONa} + \text{CH}_3\text{OCH}_3 \longrightarrow$

(E)  $\text{CH}_3\text{ONa} + (\text{CH}_3)_3\text{COH} \longrightarrow$

55. Which of the following will result in **removal** of a benzyl ester protecting group?  
 (A) acid hydrolysis only (B) decarbonylation only  
 (C) catalytic hydrogenation only (D) both acid hydrolysis and decarbonylation  
 (E) both catalytic hydrogenation and acid hydrolysis
56. Which of the following ketones will give a **positive** iodoform test?  
 (A) 3-heptanone (B) 3-hexanone (C) cyclohexanone  
 (D) 2-pentanone (E) 2-methyl-3-hexanone
57. Which of the following compounds will display a **singlet, a triplet and a quartet** in the  $^1\text{H}$  NMR spectrum?  
 (A) 1-chloro-2,2-dimethylbutane (B) 3-chloro-3-methylpentane (C) 3-chloropentane  
 (D) 2-chloro-4-methylpentane (E) 3-chloro-2-methylpentane
58. Examining the infrared spectrum of a compound allows us to:  
 (A) determine the types of functional groups present in the compound  
 (B) determine the carbon-hydrogen framework of the compound  
 (C) determine the molecular weight of the compound  
 (D) determine the nature of the conjugated pi electron system in the compound  
 (E) None of the above is correct
59. Which of these is the **least** reactive type of organometallic compound?  
 (A)  $\text{RK}$  (B)  $\text{R}_2\text{Hg}$  (C)  $\text{RLi}$  (D)  $\text{R}_2\text{Zn}$  (E)  $\text{R}_3\text{Al}$
60. Which one of the following compounds will have the **lowest** wavenumber for carbonyl absorption?  
  
 (A) I (B) II (C) III (D) IV (E) V

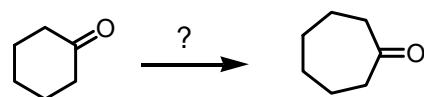
【單選題】每題 2 分，共計 40 分，答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。

61. A student measured the optical activity of an unknown sugar at two different concentrations. The results of his measurements are shown below. Given that the sample cell had a path length of 10.0 cm, calculate the specific rotation for the unknown sugar.

concentration	observed rotation
2.00 g sugar in 10.0 mL water	+159.1°
5.00 g sugar in 10.0 mL water	+127.8°

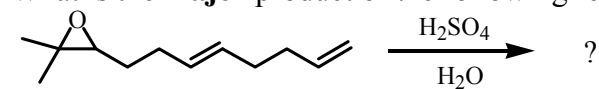
(A) -10.5° (B) +25.6° (C) +79.5° (D) -104.5° (E) +256.2°

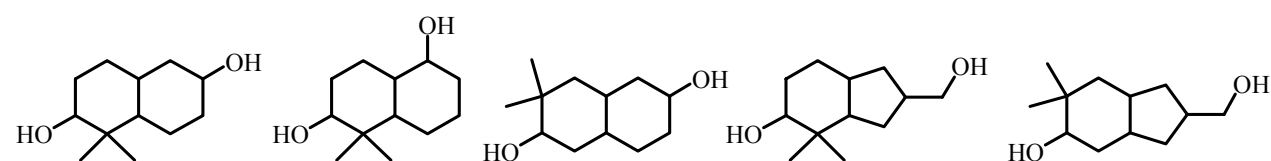
62. Which of the following series of **synthetic steps** could be used to carry out the transformation shown below?



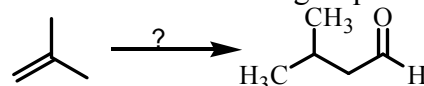
- (I)  $\text{H}_2$ , Pt, (II)  $\text{B}_2\text{H}_6$ , (III)  $\text{NaNO}_2$ ,  $\text{H}_3\text{O}^+$ , (IV)  $\text{NaCN}$ ,  $\text{HCl}$ , (V)  $\text{H}_2\text{O}_2$ ,  $\text{NaOH}$  (VI) PCC  
 (A) I  $\rightarrow$  II  $\rightarrow$  V (B) IV  $\rightarrow$  I  $\rightarrow$  III (C) III  $\rightarrow$  VI  $\rightarrow$  V  
 (D) II  $\rightarrow$  V  $\rightarrow$  III (E) None of the above

63. What is the **major** product of the following reaction?



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

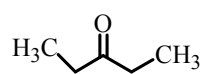
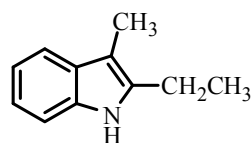
64. Which of the following sequences efficiently converts 2-methylpropene into 3-methylbutanal?



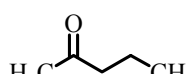
- (A) 1)  $\text{HBr}$ ; 2)  $\text{NaCCH}$ ; 3)  $\text{O}_3$ ; 4)  $\text{H}_2\text{O}$   
 (B) 1)  $\text{HBr}$ ; 2)  $\text{NaCCH}$ ; 3)  $\text{O}_3$ ; 4) DMS  
 (C) 1)  $\text{HBr}$ ,  $\text{ROOR}$ ; 2)  $\text{NaCCH}$ ; 3)  $\text{O}_3$ ; 4)  $\text{H}_2\text{O}$   
 (D) 1)  $\text{HBr}$ ,  $\text{ROOR}$ ; 2)  $\text{NaCCH}$ ; 3)  $\text{H}_2/\text{Ni}_2\text{B}$ ; 4)  $\text{O}_3$ ; 5) DMS  
 (E) 1)  $\text{NaCCH}$ ; 2)  $\text{H}_2/\text{Ni}_2\text{B}$ ; 3)  $\text{O}_3$ ; 4) DMS

65. How many positive and negative peaks appear in the DEPT-135 and in the DEPT-90 spectrum of 2-methylpentane?
- (A) DEPT-135: two positive and one negative, DEPT-90: one positive  
 (B) DEPT-135: three positive and two negative, DEPT-90: one positive  
 (C) DEPT-135: three positive and two negative, DEPT-90: no signals  
 (D) DEPT-135: two positive and three negative, DEPT-90: two positive  
 (E) None of the above is correct

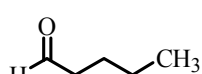
66. The Fischer indole synthesis is the reaction of phenylhydrazine with a carbonyl compound to give the corresponding indole. For the preparation of the following indole, what **carbonyl compound** is needed?



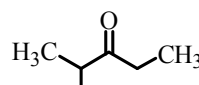
I



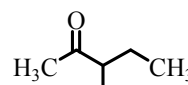
II



III

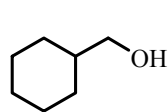
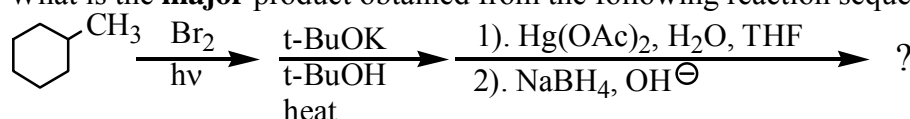


IV

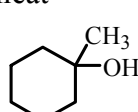


V

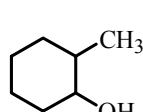
- (A) I (B) II (C) III (D) IV (E) V
67. What is the **major** product obtained from the following reaction sequence?



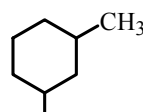
I



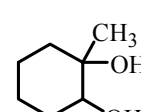
II



III

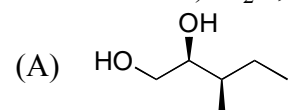
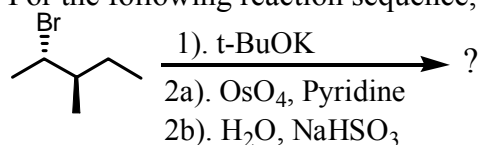


IV

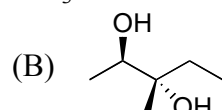


V

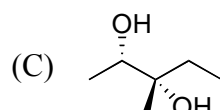
- (A) I (B) II (C) III (D) IV (E) V
68. Which of the following compounds can adopt a chair conformation in which there are no axial methyl groups?
- (A) 1,1-dimethylcyclohexane (B) *cis*-1,2-dimethylcyclohexane (C) *trans*-1,2-dimethylcyclohexane  
 (D) *trans*-1,3-dimethylcyclohexane (E) everyone above have no axial methyl group
69. For the following reaction sequence, which molecule is an expected **major** product?



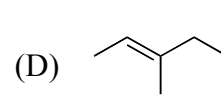
(A)



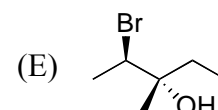
(B)



(C)



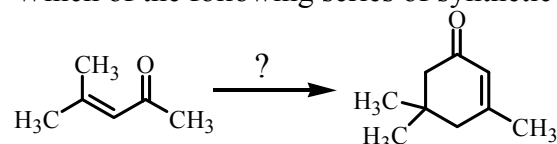
(D)



(E)

70. Which of these is **NOT** a useful method for the synthesis of 1,3-pentadiene?
- (A) 1,4-pentanediol + H<sub>2</sub>SO<sub>4</sub> at 180°C  
 (B) 2,4-dibromopentane + (CH<sub>3</sub>)<sub>3</sub>COK, (CH<sub>3</sub>)<sub>3</sub>COH at 75°C  
 (C) 2,4-pentanediol + H<sub>2</sub>SO<sub>4</sub> at 180°C  
 (D) HC≡CCH=CHCH<sub>3</sub> + H<sub>2</sub>, Ni<sub>2</sub>B (P-2)  
 (E) 1,4-dibromopentane + CH<sub>3</sub>CH<sub>2</sub>ONa, CH<sub>3</sub>CH<sub>2</sub>OH at 75°C

71. Which of the following series of synthetic steps could be used to carry out the transformation shown below?



(I) NaOH, (II) heat, (III) CH<sub>3</sub>COCH<sub>2</sub>COOEt, EtONa, (IV) NaOH, heat, then HCl, H<sub>2</sub>O

(A) I → II → III → IV

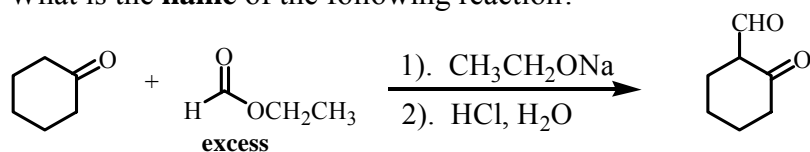
(B) IV → II → I → III

(C) III → IV → II → I

(D) II → IV → III → I

(E) None of the above

72. What is the **name** of the following reaction?



(A) Mixed Aldol condensation

(B) Mixed Claisen condensation

(C) Mixed Dieckmann condensation

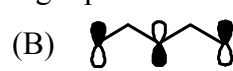
(D) Mixed Michael reaction

(E) Mixed Knoevenagel reaction

73. Which of the following represents the **HOMO** of pentadienyl anion?



(A)



(B)



(C)

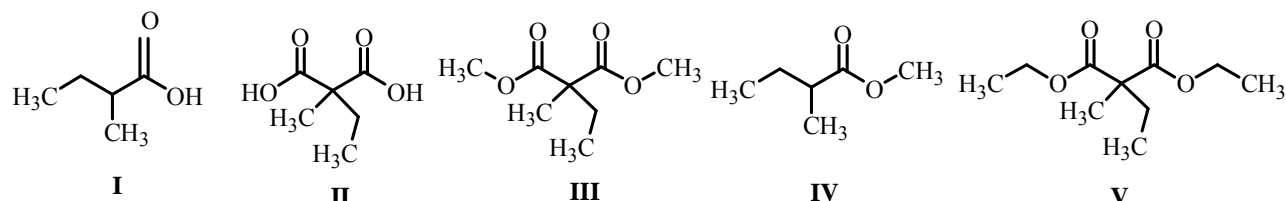
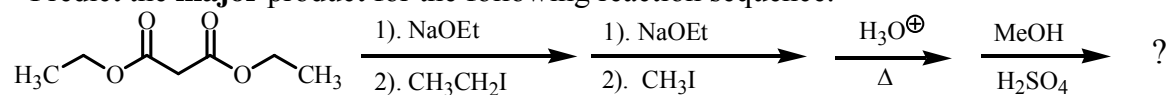


(D)



(E)

74. Predict the **major** product for the following reaction sequence.



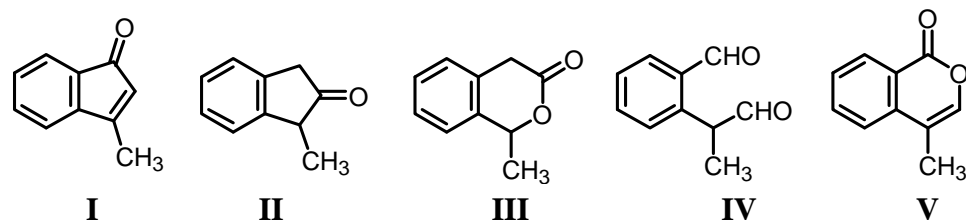
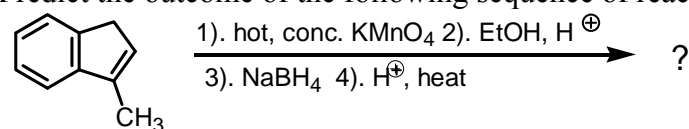
- (A) I      (B) II      (C) III      (D) IV      (E) V

75. The H-bonds formed in the tertiary structure of proteins can be differentiated from those formed in secondary structures.

What is the **major** distinguishing factor?

- (A) The H-bonds in 3° structures are significantly stronger than those found in 2° structures.  
 (B) The H-bonds in 3° structures are more random than those formed in 2° structures.  
 (C) The H-bonds in 3° structures are formed by predictable interactions among the peptide backbone  $\alpha$ -amine and  $\alpha$ -carboxylate groups.  
 (D) The H-bonds in 3° structures are formed by interactions involving the side chain R-groups.  
 (E) Both B and D are correct.

76. Predict the outcome of the following sequence of reactions.



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

77. Which of the following compounds exhibits the pattern of  $m/z$  values: 41, 43, 57, 87, 101, 116?

- (A) *n*-butyl *n*-propyl ether      (B) *sec*-butyl *iso*-propyl ether      (C) 2-heptanol  
 (D) hexanoic acid      (E) None of the above

78. How many different  $\beta$ -hydroxyaldehydes and  $\beta$ -hydroxyketones, including constitutional isomers and stereoisomers, are formed upon treatment of a mixture of acetone and acetophenone with base?

- (A) 4      (B) 6      (C) 9      (D) 10      (E) 12

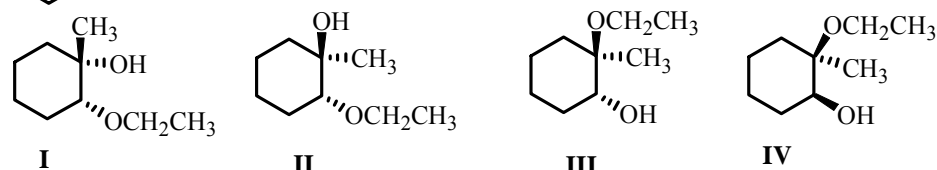
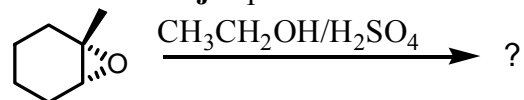
79. Deduce the identity of the compound from the data provided.

$\text{C}_5\text{H}_{10}\text{O}_2$ : IR ( $\text{cm}^{-1}$ ): 3380 (br, s).  $^1\text{H-NMR}$  (ppm): 1.30 (s, 3H), 3.50 (t, 1H), 3.64 (d, 2H),

4.38 (d, 2H), 4.52 (d, 2H).  $^{13}\text{C-NMR}$  (ppm): 20.72 (q), 40.78 (t), 67.59 (t), 79.74 (t).

- (A) (2,3-dimethyloxiran-2-yl)methanol      (B) 1-(2-methyloxiran-2-yl)ethanol  
 (C) 1-(oxetan-3-yl)ethanol      (D) (3-methyloxetan-3-yl)methanol  
 (E) (tetrahydrofuran-2-yl)methanol

80. Predict the **major** product for the following reaction.



- (A) I      (B) II      (C) III      (D) IV      (E) None of the above