

國立中山大學 103 學年度轉學考招生考試試題

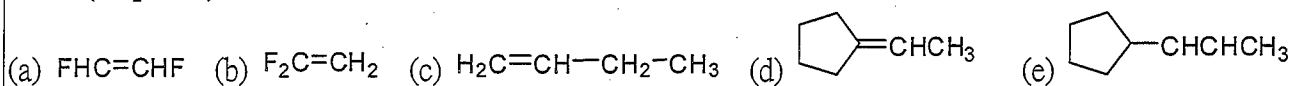
科目名稱：有機化學【海資系三年級】

題號：752003

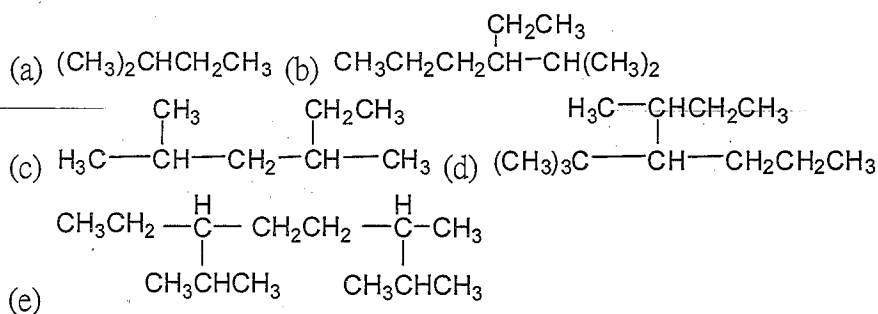
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1. Which of the following compounds show *cis-trans* isomerism? Draw the *cis* and *trans* isomers of those that do. (10 points)



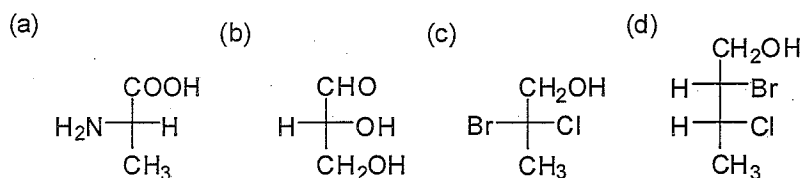
2. Provide IUPAC names for the following compounds. (15 points)



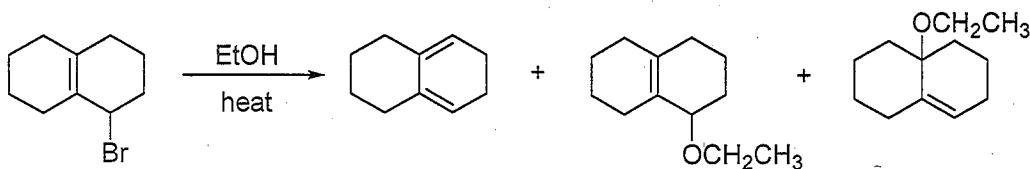
3. Draw the structures of the following compounds. (9 points)

- (a) 4-(1,1-dimethylethyl)octane
 (b) 5-(1,2,2-trimethylpropyl)nonane
 (c) 3,3-diethyl-4-(2,2-dimethylpropyl)octane

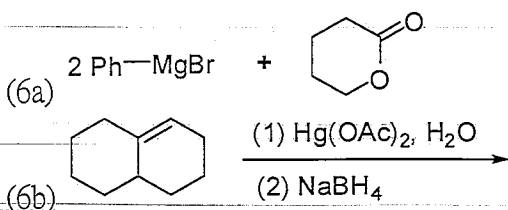
4. Convert the following Fischer projections to perspective formula and please indicate the asymmetric carbon atoms, then determine and **explain** its chiral configuration in (R) or (S) form. (12 points)



5. Please give mechanisms to account for three products. (10 points)



6. Draw the organic products you would expect to isolate from the following reactions **with reasonable mechanisms**. (12 points)



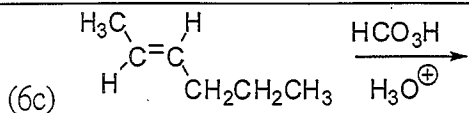
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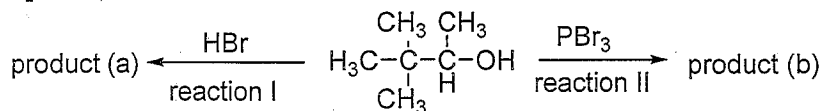
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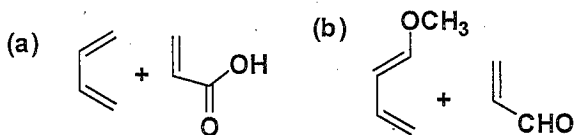
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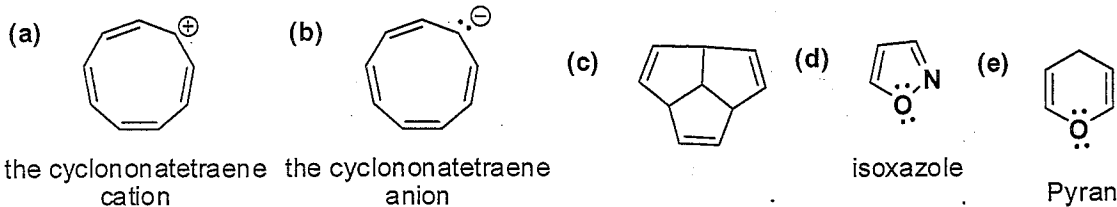
7. Please predict the product (a) and (b) in the reaction I and reaction II with the detailed mechanism. (12 points)



8. Predict the products of the following Diels-Alder reactions with the and **reasonably explain** the stereochemistry where appropriate. (10 points)



9. Explain why each compound or ion should be **aromatic**, **antiaromatic**, or **nonaromatic**. (10 points)



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第一部份、單選題(共75分，每題1.5分，不倒扣)

- 1) Carbohydrates generally have a molecular formula A) in which carbon, hydrogen, and oxygen are present in a 2:1:2 ratio. B) that includes at least one hydrocarbon tail. C) that includes a -SH group. D) in which carbon, hydrogen, and oxygen are present in a ratio of 1:2:1. E) that includes a -NH₂ group.
- 2) Which of the following organelles is not a common destination for small vesicles that bud off the Golgi apparatus? A) plasma membrane B) endoplasmic reticulum C) vacuole D) lysosomes E) all of the above
- 3) What is one of the ways that the membranes of winter wheat are able to remain fluid when it is extremely cold? A) by decreasing the number of hydrophobic proteins in the membrane B) by increasing the percentage of cholesterol molecules in the membrane C) by increasing the percentage of unsaturated phospholipids in the membrane D) A and B only E) A, B, and C
- 4) How can one increase the rate of a chemical reaction? A) Decrease the concentration of the reactants. B) Increase the activation energy needed. C) Increase the entropy of the reactants. D) Cool the reactants. E) Add a catalyst.
- 5) During aerobic cellular respiration, a proton gradient in mitochondria is generated by _____ and used primarily for A) fermentation; NAD⁺ reduction B) the electron transport chain; substrate-level phosphorylation C) diffusion of protons; ATP synthesis D) the electron transport chain; ATP synthesis E) glycolysis; production of H₂O
- 6) Which of the following processes is most directly driven by light energy? A) carbon fixation in the stroma B) ATP synthesis C) removal of electrons from chlorophyll molecules D) creation of a pH gradient by pumping protons across the thylakoid membrane E) reduction of NADP⁺ molecules
- 7) The old saying "one rotten apple spoils the whole barrel" is due to chemical signaling in plants via A) a local regulator for apple development. B) release of ethylene gas, a plant hormone for ripening. C) a signal transduction pathway involving glycogen phosphorylase. D) an increased uptake of carbon dioxide during respiration in target cells. E) an a/α cell signal system in the rotten apple.
- 8) Which of these is *not* a carcinogen? A) testosterone B) fat C) cigarette smoke D) UV light E) All of the above are carcinogens.
- 9) In a cell in which $2n = 6$, the independent assortment of chromosomes during meiosis can by itself give rise to _____ genetically different gametes. A) five B) six C) two D) eight E) four

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- 10) In a cross $AaBbCc \times AaBbCc$, what is the probability of producing the genotype $AABBCC$?
A) 1/16 B) 1/8 C) 1/64 D) 1/4 E) 1/32
- 11) SRY is A) a gene present on the X chromosome that triggers female development. B) required for development, and males or females lacking the gene do not survive past early childhood. C) a gene present on the Y chromosome that triggers male development. D) an autosomal gene that is required for the expression of genes on the Y chromosome. E) an autosomal gene that is required for the expression of genes on the X chromosome.
- 12) The spontaneous loss of amino groups from adenine results in hypoxanthine, an unnatural base, opposite thymine. What combination of molecules could the cell use to repair such damage? A) telomerase, helicase, single-strand binding protein B) nuclease, DNA polymerase, DNA ligase C) nuclease, telomerase, primase D) telomerase, primase, DNA polymerase E) DNA ligase, replication fork proteins, adenylyl cyclase
- 13) Garrod hypothesized that "inborn errors of metabolism" such as alkaptonuria occur because A) certain metabolic reactions are carried out by ribozymes, and affected individuals lack key splicing factors. B) many metabolic enzymes use DNA as a cofactor, and affected individuals have mutations that prevent their enzymes from interacting efficiently with DNA. C) metabolic enzymes require vitamin cofactors, and affected individuals have significant nutritional deficiencies. D) enzymes are made of DNA, and affected individuals lack DNA polymerase. E) genes dictate the production of specific enzymes, and affected individuals have genetic defects that cause them to lack certain enzymes.
- 14) The role of a metabolite that controls a repressible operon is to A) increase the production of inactive repressor proteins. B) bind to the promoter region and decrease the affinity of RNA polymerase for the promoter. C) bind to the repressor protein and activate it. D) bind to the repressor protein and inactivate it. E) bind to the operator region and block the attachment of RNA polymerase to the promoter.
- 15) In humans, the embryonic and fetal forms of hemoglobin have a higher affinity for oxygen than that of adults. This is due to A) nonidentical genes that produce different versions of globins during development. B) histone proteins changing shape during embryonic development. C) identical genes that generate many copies of the ribosomes needed for fetal globin production. D) the attachment of methyl groups to cytosine following birth, which changes the type of hemoglobin produced. E) pseudogenes, which interfere with gene expression in adults.
- 16) The completion of the Human Genome Project revealed that the human genome contains fewer genes than expected, not so many more than simpler organisms. How can this be reconciled with the greater complexity of humans relative to many other organisms? A) Post-translational processing adds diversity to the resulting polypeptides. B) RNA transcripts of human genes are more likely to undergo alternative splicing. C) Gene expression patterns in

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humans are often more complex than those in other organisms. D) Polypeptide domains are combined in a variety of ways. E) All of the above are correct.

17) What do gap genes, pair-rule genes, segment polarity genes, and homeotic genes all have in common? A) Their products act as transcription factors. B) They have no counterparts in animals other than *Drosophila*. C) They act independently of other positional information. D) Their products are all synthesized prior to fertilization. E) They apparently can be activated and inactivated at any time of the fly's life.

18) Charles Darwin was the first to propose A) a mechanism for how evolution occurs. B) a mechanism for evolution that was supported by evidence. C) that evolution occurs. D) that the Earth is older than 6,000 years. E) a way to use artificial selection as a means of domesticating plants and animals.

19) All the genes in a population are the population's A) gene flow. B) phenotype. C) genotype. D) fitness. E) gene pool.

20) Some species of *Anopheles* mosquito live in brackish water, some in running fresh water, and others in stagnant water. What type of reproductive barrier is most obviously separating these different species? A) habitat isolation B) temporal isolation C) postzygotic isolation D) behavioral isolation E) gametic isolation

The following questions refer to the hypothetical patterns of taxonomic hierarchy shown in Figure 25.2.

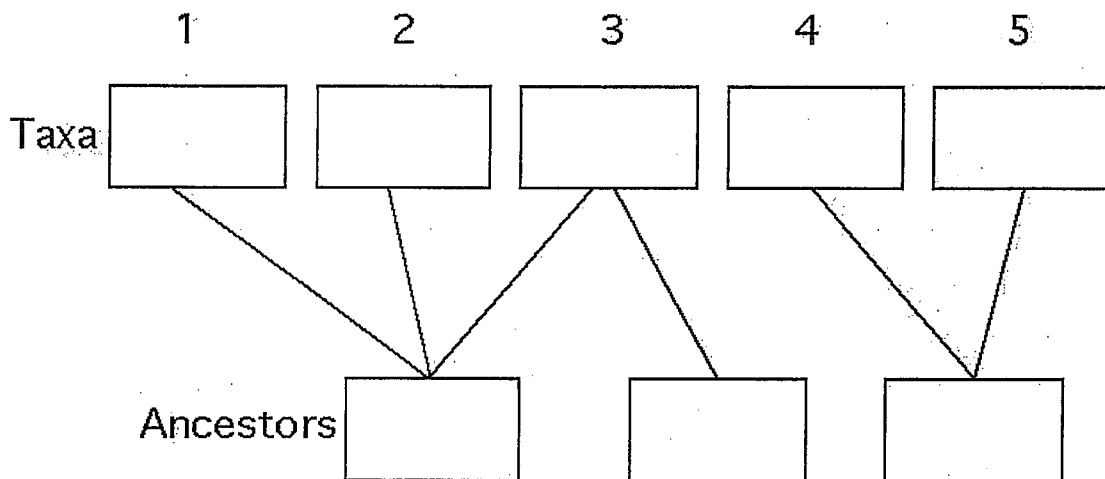


Figure 25.2

21) Which of the following numbers represents a polyphyletic taxon? A) 3 B) 2 C) 5 D) 4 E) more than one of these

The questions below refer to the following list, which uses the five-kingdom classification system.

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Plantae 2.Fungi 3.Animalia 4.Protista 5. Monera

- 22) Which obsolete kingdom includes prokaryotic organisms? A) 1 B) 2 C) 3 D) 4 E) 5
- 23) Which of the following is a *correct* statement about the genomes of prokaryotes? A) Prokaryotic chromosomes are sometimes called "genochromes." B) Prokaryotic cells have multiple chromosomes packaged with a relatively large amount of protein. C) Prokaryotic chromosomes are not contained within a nucleus but, rather, are found at the nucleoid region. D) Prokaryotic genomes are diploid throughout most of the cell cycle. E) Prokaryotic genomes are composed of linear DNA (that is, DNA existing in the form of a line with two ends).
- 24) You are given an unknown organism to identify. It is unicellular and heterotrophic. It is motile, using many short extensions of the cytoplasm, each featuring the 9+2 pattern. It has well-developed organelles and three nuclei, one large and two small. This organism is most likely to be a member of which group? A) foraminiferans B) slime molds C) ciliates D) kinetoplastids E) radiolarians
- 25) Which putative taxon is essentially equivalent to the "embryophytes"? A) Plantae B) Viridiplantae C) Pterophyta D) Charophycea E) Streptophyta
- 26) Which of the following flower parts develops into a fruit? A) ovule B) stigma C) style D) receptacle E) ovary
- 27) Lichens are symbiotic associations of fungi and A) mosses. B) green algae. C) cyanobacteria. D) either A or B E) either B or C
- 28) Cephalization is generally associated with all of the following *except* A) a sessile existence. B) a brain. C) a longitudinal nerve cord. D) bilateral symmetry. E) concentration of sensory structures at the anterior end.
- 29) A stalked, sessile marine organism has several feathery feeding structures surrounding an opening through which food enters. The organism could potentially be a cnidarian, a lophophorate, a tube-dwelling worm, a crustacean, or an echinoderm. Finding which of the following in this organism would allow the greatest certainty of identification?
A) the presence of what seems to be radial symmetry B) a nervous system C) a digestive system with mouth and anus separate from each other D) a water vascular system E) a hard covering made partly of calcium carbonate
- 30) Chondrichthyans can be distinguished from osteichthyans by the A) presence in osteichthyans of a skull. B) absence in chondrichthyans of paired sensory organs. C) absence in chondrichthyans of a swim bladder and lungs. D) presence in osteichthyans of a lateral line system. E) presence in chondrichthyans of unpaired fins.

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- 31) "Pinching off" the tops of snapdragons causes the plants to make many more flowers than they would if left alone. Why does removal of the snapdragon's top cause more flowers to form?
A) Removal of an apical meristem allows the periderm to produce new lateral branches. B) Removal of an apical meristem allows more nutrients to be delivered to floral meristems. C) Removal of an apical meristem causes cell division to become disorganized, much like in the *fass* mutant of *Arabidopsis*. D) Removal of an apical meristem causes outgrowth of lateral buds that produce extra branches, which ultimately produce flowers. E) Removal of an apical meristem causes a phase transition from vegetative to floral development.
- 32) Which of the following would *not* contribute to water uptake by a plant cell? A) a decrease in Ψ of the cytoplasm B) an increase in the water potential (Ψ) of the surrounding solution C) a decrease in pressure on the cell exerted by the wall D) an increase in tension on the solution that surrounds the cell E) the uptake of solutes by the cell
- 33) The transfer of DNA into eukaryotic cells is known as: A) Transduction B) Transformation C) Transcription D) Translation E) Transfection
- 34) Genetic incompatibility does *not* affect the A) growth of the pollen tube in the style. B) germination of the pollen on the stigma. C) membrane permeability of cells. D) attraction of a suitable insect pollinator. E) different individuals of the same species.
- 35) After leaf abscission, growth will resume from the A) palisade layer. B) axillary bud. C) abscission layer. D) protective layer. E) petiole.
- 36) Consider a husband and wife sharing a bed, with each one having an electric blanket. Their controls become switched. When the husband feels cold, he turns up the control. This warms up his spouse, who turns down her control. This chills the husband, who turns up his control even more. The process continues. For both the wife and the husband, this would be an example of
A) integrated control. B) homeostasis. C) negative feedback. D) positive feedback. E) regulated change.
- 37) Which of the following is a fat-soluble vitamin? A) iodine B) vitamin A C) vitamin C D) vitamin B₁₂ E) calcium
- 38) Organisms in which a circulating body fluid is distinct from the fluid that directly surrounds the body's cells are likely to have A) a gastrovascular cavity. B) a closed circulatory system. C) branched tracheae. D) an open circulatory system. E) hemolymph.
- 39) Jenner successfully used cowpox virus as a vaccine against the virus that causes smallpox. Why was he successful even though he used viruses of different kinds?
A) Cowpox and smallpox are antibodies with similar immunizing properties. B) There are

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some antigenic determinants common to both pox viruses. C) The immune system responds nonspecifically to antigens. D) The cowpox virus made antibodies in response to the presence of smallpox. E) All of the above are true.

40) African lungfish, which are often found in small stagnant pools of fresh water, produce urea as a nitrogenous waste. What is the advantage of this adaptation?

A) Urea forms a precipitate and does not accumulate in the surrounding water. B) A buildup of urea in the blood makes a lungfish hypoosmotic to its environment. C) Small stagnant pools do not provide enough water to dilute the toxic ammonia. D) Urea takes less energy to synthesize than ammonia. E) The highly toxic urea makes the pool uninhabitable to potential competitors.

41) Which of the following is an endocrine gland? A) sebaceous gland B) sweat gland C) parathyroid gland D) salivary gland E) gallbladder

42) Which of the following is *not* required for internal fertilization? A) internal development of the embryo B) copulatory organ C) sperm receptacle D) behavioral interaction E) All of the above are necessary for internal fertilization.

43) The least amount of yolk would be found in the egg of a A) frog. B) fish. C) reptile. D) bird. E) eutherian (placental) mammal.

44) Which of the following is a direct result of depolarizing the presynaptic membrane of an axon terminal? A) The postsynaptic cell produces an action potential. B) Synaptic vesicles fuse with the membrane. C) An EPSP or IPSP is generated in the postsynaptic cell. D) Ligand-gated channels open allowing neurotransmitters to enter the synaptic cleft. E) Voltage-gated Ca^{2+} channels in the membrane open.

45) Enzymes that break down DNA catalyze the hydrolysis of the covalent bonds that join nucleotides together. What would happen to DNA molecules treated with these enzymes? A) The pyrimidines would be separated from the deoxyribose sugars. B) The phosphodiester bonds between deoxyribose sugars would be broken. C) The purines would be separated from the deoxyribose sugars. D) All bases would be separated from the deoxyribose sugars. E) The two strands of the double helix would separate.

46) The cell walls of bacteria, fungi, and plant cells and the extracellular matrix of animal cells are all external to the plasma membrane. Which of the following is *not* a characteristic of all of these extracellular structures? A) They are constructed of materials that are largely synthesized in the cytoplasm and then transported out of the cell. B) They must provide a rigid structure that maintains an appropriate ratio of cell surface area to volume. C) They are composed of a mixture of proteins and carbohydrates. D) They must be highly permeable to water and small molecules in order to allow cells to exchange matter and energy with their environment. E) They must permit information transfer between the cell's external

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environment and the cytoplasm.

- 47) Which of the following adheres to the extracellular surface of animal cell plasma membranes? A) carrier proteins B) fibers of the cytoskeleton C) the phospholipid bilayer D) fibers of the extracellular matrix E) cholesterol
- 48) Which of the following statements is *true* concerning catabolic pathways? A) They combine molecules into more energy-rich molecules. B) They build up complex molecules such as protein from simpler compounds. C) They are endergonic. D) They are spontaneous and do not need enzyme catalysis. E) They are usually coupled with anabolic pathways to which they supply energy in the form of ATP.
- 49) Which process in eukaryotic cells will proceed normally whether oxygen (O₂) is present or absent? A) glycolysis B) chemiosmosis C) electron transport D) oxidative phosphorylation E) the citric acid cycle
- 50) All of the following statements are correct regarding the Calvin cycle *except*: A) Rubisco attaches carbon dioxide to ribulose biphosphate. B) The 5-carbon sugar RuBP is constantly being regenerated. C) One of the end products is glyceraldehyde phosphate. D) The energy source utilized is the ATP and NADPH obtained through the light reaction. E) These reactions begin soon after sundown and end before sunrise.

第二部份、簡答題 (共25分，每題5分)

1. Red tide形成的原因及對海洋生態之影響。
2. Protein motif和protein domain之異同。
3. 何謂 RNA interference 及 microRNA (miRNA)。
4. Single nucleotide polymorphisms (SNP)和gene mutation 之關係。
5. 何謂translational medicine。