

科目：普通生物學【生物科學系二年級】

I. 單選題. 每一題1分. (60 points)

1. Which organelle or structure is absent in plant cells? (A) mitochondria (B) Golgi vesicles (C) microtubules (D) centrosomes (E) peroxisomes
2. Which of the following produces and modifies polysaccharides that will be secreted? (A) lysosome (B) vacuole (C) mitochondrion (D) Golgi apparatus (E) peroxisome
3. Ions can travel directly from the cytoplasm of one animal cell to the cytoplasm of an adjacent cell through (A) plasmodesmata. (B) intermediate filaments. (C) tight junctions. (D) desmosomes. (E) gap junctions.
4. A protein that spans the phospholipid bilayer one or more times is (A) a transmembrane protein. (B) an integral protein. (C) a peripheral protein. (D) an integrin. (E) a glycoprotein.
5. Nitrous oxide gas molecules diffusing across a cell's plasma membrane is an example of (A) diffusion across the lipid bilayer. (B) facilitated diffusion. (C) active transport. (D) osmosis. (E) cotransport.
6. Which of the following is the smallest closed system? (A) a cell (B) an organism (C) an ecosystem (D) Earth (E) the universe
7. When a glucose molecule loses a hydrogen atom as the result of an oxidation-reduction reaction, the molecule becomes (A) hydrolyzed. (B) hydrogenated. (C) oxidized. (D) reduced. (E) an oxidizing agent.
8. Where does glycolysis take place in eukaryotic cells? (A) mitochondrial matrix (B) mitochondrial outer membrane (C) mitochondrial inner membrane (D) mitochondrial intermembrane space (E) cytosol
9. The light reactions of photosynthesis supply the Calvin cycle with (A) light energy. (B) CO₂ and ATP. (C) H₂O and NADPH. (D) ATP and NADPH. (E) sugar and O₂.
10. Starting with a fertilized egg (zygote), a series of five cell divisions would produce an early embryo with how many cells? (A) 4 (B) 8 (C) 16 (D) 32 (E) 64
11. If there are 20 chromatids in a cell, how many centromeres are there? (A) 10 (B) 20 (C) 30 (D) 40 (E) 80
12. Where do the microtubules of the spindle originate during mitosis in both plant and animal cells? (A) centromere (B) centrosome (C) centriole (D) chromatid (E) kinetochore
13. Which of the following triggers the cell's passage past the G₂ checkpoint into mitosis? (A) PDGF (B) MPF (C) protein kinase (D) cyclin (E) Cdk
14. At which stage of mitosis are chromosomes usually photographed in the preparation of a karyotype? (A) prophase (B) metaphase (C) anaphase (D) telophase (E) interphase
15. A human cell containing 22 autosomes and a Y chromosome is (A) a sperm. (B) an egg. (C) a zygote. (D) a somatic cell of a male. (E) a somatic cell of a female.
16. How many unique gametes could be produced through independent assortment by an individual with the genotype *AaBbCCDdEE*? (A) 4 (B) 8 (C) 16 (D) 32 (E) 64
17. Which of the following describes the ability of a single gene to have multiple phenotypic effects? (A) incomplete dominance (B) multiple alleles (C) pleiotropy (D) epistasis
18. Of the following human aneuploidies, which is the one that generally has the most severe impact on the health of the individual? (A) 47, +21 (B) 47, XXY (C) 47, XXX (D) 47, XYY (E) 45, X
19. Cytosine makes up 42% of the nucleotides in a sample of DNA from an organism. Approximately what percentage of the nucleotides in this sample will be thymine? (A) 8% (B) 16% (C) 31% (D) 42% (E) variable.
20. Which enzyme catalyzes the elongation of a DNA strand in the 5' → 3' direction? (A) primase (B) DNA ligase (C) DNA polymerase III (D) topoisomerase (E) helicase
21. In a nucleosome, the DNA is wrapped around (A) polymerase molecules. (B) ribosomes. (C) histones. (D) a thymine dimer. (E) satellite DNA.
22. A particular triplet of bases in the template strand of DNA is 5' AGT 3'. The corresponding codon for the mRNA

科目：普通生物學【生物科學系二年級】

- transcribed is (A) 3' UCA 5'. (B) 3' UGA 5'. (C) 5' TCA 3'. (D) 3' ACU 5'. (E) either UCA or TCA, depending on wobble in the first base.
23. During splicing, which molecular component of the spliceosome catalyzes the excision reaction? (A) protein (B) DNA (C) RNA (D) lipid (E) sugar
24. If a protein is coded for by a single gene and this protein has six clearly defined domains, which number of exons below is the gene likely to have? (A) 1 (B) 5 (C) 8 (D) 12 (E) 14
25. Which of the following is a protein produced by a regulatory gene? (A) operon (B) inducer (C) promoter (D) repressor (E) corepressor
26. Mutations in which of the following genes lead to transformations in the identity of entire body parts? (A) morphogens (B) segmentation genes (C) egg-polarity genes (D) homeotic genes (E) inducers
27. Gap genes and pair-rule genes fall into which of the following categories? (A) homeotic genes (B) segmentation genes (C) egg-polarity genes (D) morphogens (E) inducers
28. Which viruses have single-stranded RNA that acts as a template for DNA synthesis? (A) lytic phages (B) proviruses (C) viroids (D) bacteriophages (E) retroviruses
29. Which of the following is used to make complementary DNA (cDNA) from RNA? (A) restriction enzymes (B) gene cloning (C) DNA ligase (D) gel electrophoresis (E) reverse transcriptase
30. Which of the following uses reverse transcriptase to make cDNA followed by amplification? (A) Southern blotting (B) Northern blotting (C) Western blotting (D) Eastern blotting (E) RT-PCR
31. Which of the following could be a density-independent factor limiting human population growth? (A) famines (B) social pressure for birth control (C) plagues (D) pollution (E) earthquakes
32. Positive feedback has occurred when (A) an increase in calcium concentration increases the secretion of a hormone that promotes the storage of calcium in bone. (B) an increase in blood sugar increases the secretion of a hormone that stimulates the movement of sugar out of the blood. (C) uterine contractions needed for the birthing process are expedited by the pressure of a moving baby in its mother's uterus. (D) a decrease in blood calcium increases the amount of the hormone that causes the release of calcium from bone. (E) a decrease in blood sugar increases the secretion of a hormone that increases the conversion of glycogen to glucose.
33. According to the punctuated equilibria model, (A) speciation is usually due to a single mutation. (B) natural selection is unimportant as a mechanism of evolution. (C) most evolution occurs in sympatric populations. (D) given enough time, most existing species will branch gradually into new species. (E) most new species accumulate their unique features relatively rapidly as they come into existence, then change little for the rest of their duration as a species.
34. The ability of some viruses to remain inactive (latent) for a period of time is exemplified by (A) Kaposi's sarcoma, which causes a skin cancer in people with AIDS, but rarely in those not infected by HIV. (B) herpes simplex viruses (oral or genital) whose reproduction is triggered by physiological or emotional stress in the host. (C) influenza, a particular strain of which returns every 10-20 years. (D) the virus that causes a form of the common cold, which recurs in patients many times in their lives. (E) myasthenia gravis, an autoimmune disease that blocks muscle contraction from time to time.
35. You are studying a large tropical reptile that has a high and relatively stable body temperature. How would you determine whether this animal is an endotherm or an ectotherm? (A) You know that it is an ectotherm because it is not a bird or mammal. (B) You subject this reptile to various temperatures in the lab and find that its body temperature and metabolic rate change with the ambient temperature. You conclude that it is an ectotherm. (C) You know from its high and stable body temperature that it must be an endotherm. (D) You measure the metabolic rate of the reptile, and because it is higher than that of a related species that lives in temperate forests, you conclude that this reptile is an endotherm and its relative is an ectotherm. (E) You note that its environment has a high and stable temperature. Because its body temperature matches the environmental temperature, you conclude that it is an ectotherm.

科目：普通生物學【生物科學系二年級】

36. Exercise and emergency reactions include (A) increased activity in all parts of the peripheral nervous system. (B) increased activity in the sympathetic, and decreased activity in the parasympathetic branches. (C) increased activity in the enteric nervous system. (D) reduced heart rate and blood pressure. (E) decreased activity in the sympathetic, and increased activity in the parasympathetic branches.
37. Agricultural lands frequently require nutrient augmentation because (A) nitrogen-fixing bacteria are not as plentiful in agricultural soils because of the use of pesticides. (B) land that is available for agriculture tends to be nutrient-poor. (C) cultivation of agricultural land inhibits the decomposition of organic matter. (D) the nutrients that become the biomass of plants are not cycled back to the soil on lands where they are harvested. (E) grains raised for feeding livestock must be fortified, and thus require additional nutrients.
38. A significant contribution of intestinal bacteria to human nutrition is the benefit of bacterial (A) production of vitamin K. (B) generation of gases needed for elimination. (C) production of vitamins A and C. (D) recovery of water from fecal matter. (E) absorption of organic materials.
39. Trophic efficiency is (A) a measure of how nutrients are cycled from one trophic level to the next. (B) about 90% in most ecosystems. (C) usually greater than production efficiencies. (D) the percentage of production transferred from one trophic level to the next. (E) the ratio of net secondary production to assimilation of primary production.
40. The primary function of the corpus luteum is to (A) nourish and protect the egg cell. (B) stimulate the development of the mammary glands. (C) support pregnancy in the second and third trimesters. (D) maintain progesterone and estrogen synthesis after ovulation has occurred. (E) produce prolactin in the alveoli.
41. What is the single greatest threat to biodiversity? (A) disruption of trophic relationships as more and more prey species become extinct (B) introduced species that compete with native species (C) habitat alteration, fragmentation, and destruction (D) overharvesting of commercially important species (E) pollution of Earth's air, water, and soil
42. In a frog embryo, gastrulation (A) proceeds by involution as cells roll over the lip of the blastopore. (B) occurs within the inner cell mass that is embedded in the large amount of yolk. (C) produces a blastocoel displaced into the animal hemisphere. (D) occurs along the primitive streak in the animal hemisphere. (E) is impossible because of the large amount of yolk in the ovum.
43. The circulatory system of bony fishes, rays, and sharks is similar to (A) that of reptiles, with one pumping chamber driving blood flow to a gas-exchange organ, and a different pumping chamber driving blood to the rest of the circulation. (B) that of birds, with a four-chambered heart. (C) that of humans, where there are four pumping chambers to drive blood flow. (D) that of sponges, where gas exchange in all cells occurs directly with the external environment. (E) the portal systems of mammals, where two capillary beds occur sequentially, without passage of blood through a pumping chamber.
44. Which of the following could be considered the most recent common ancestor of living tetrapods? (A) a salamander that had legs supported by a bony skeleton but moved with the side-to-side bending typical of fishes (B) an early terrestrial caecilian whose legless condition had evolved secondarily (C) an armored, jawed placoderm with two pairs of appendages (D) an early ray-finned fish that developed bony skeletal supports in its paired fins (E) a sturdy-finned, shallow-water lobe-fin whose appendages had skeletal supports similar to those of terrestrial vertebrates
45. The primary difference between estrous and menstrual cycles is that (A) the endometrium shed by the uterus during the estrous cycle is reabsorbed, whereas the shed endometrium of menstrual cycles is excreted from the body. (B) most estrous cycles are of much longer duration compared to menstrual cycles. (C) season and climate have less pronounced effects on estrous cycles than they do on menstrual cycles. (D) behavioral changes during estrous cycles are much less apparent than those of menstrual cycles. (E) copulation normally occurs across the estrous cycle, whereas in menstrual cycles copulation only occurs during the period surrounding ovulation.

背面有題

科目：普通生物學【生物科學系二年級】

46. Antidiuretic hormone (ADH) functions at the cellular level by (A) causing an increase in the number of aquaporin molecules of collecting duct cells. (B) triggering the synthesis of an enzyme that makes the phospholipid bilayer more permeable to water. (C) decreasing the speed at which filtrate flows through the nephron, leading to increased reabsorption of water. (D) causing membranes to include more phospholipids that have unsaturated fatty acids. (E) stimulating the reabsorption of glucose through channel proteins.
47. The most important feature that permits a gene to act as a molecular clock is (A) having a large number of base pairs. (B) having a larger proportion of exonic DNA than of intronic DNA. (C) its recent origin by a gene-duplication event. (D) its being acted upon by natural selection. (E) having a reliable average rate of mutation.
48. 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. Which of the following traits, if found in this organism, would allow the greatest certainty of identification? (A) a nervous system (B) a hard covering made partly of calcium carbonate (C) a digestive system with mouth and anus separate from each other (D) a water vascular system (E) the presence of what seems to be radial symmetry
49. The absorption of fats differs from that of carbohydrates in that the (A) most absorbed fat first enters the lymphatic system, whereas carbohydrates directly enter the blood. (B) fats, but not carbohydrates, are digested by bacteria before absorption. (C) carbohydrates need to be emulsified before they can be digested, whereas fats do not. (D) fat absorption occurs in the stomach, whereas carbohydrates are absorbed from the small intestine. (E) processing of fats does not require any digestive enzymes, whereas the processing of carbohydrates does.
50. A rod exposed to light will (A) undergo a graded depolarization that will increase its release of glutamate. (B) fire action potentials that will increase its release of glutamate. (C) undergo a graded hyperpolarization that will increase its release of glutamate. (D) undergo a graded depolarization that will decrease its release of glutamate. (E) undergo a graded hyperpolarization that will decrease its release of glutamate.
51. Which of the following statements best summarizes evolution as it is viewed today? (A) It is the descent of humans from the present-day great apes. (B) It is synonymous with the process of gene flow. (C) It represents the result of selection for acquired characteristics. (D) It is the differential survival and reproduction of the most-fit phenotypes.
52. What is the most probable explanation for the continued presence of pseudogenes in a genome such as our own? (A) They are duplicates or near duplicates of functional genes but cannot function because they would provide inappropriate dosage of protein products. (B) They are genes with significant inverted sequences. (C) They are genes that are not expressed, even though they have nearly identical sequences to expressed genes. (D) They are genes that had a function at one time, but that have lost their function because they have been translocated to a new location. (E) They are genes that have accumulated mutations to such a degree that they would code for different functional products if activated.
53. The role that humans play in artificial selection is to (A) determine who lives and who dies. (B) train organisms to breed more successfully. (C) create the genetic variants, which nature then selects. (D) perform artificial insemination. (E) choose which organisms breed, and which do not.
54. The following steps refer to various stages in transmission at a chemical synapse. 1. Neurotransmitter binds with receptors associated with the postsynaptic membrane. 2. Calcium ions rush into neuron's cytoplasm. 3. An action potential depolarizes the membrane of the axon terminal. 4. The ligand-gated ion channels open. 5. The synaptic vesicles release neurotransmitter into the synaptic cleft. Which sequence of events is correct? (A) 5 → 1 → 2 → 4 → 3 (B) 1 → 2 → 3 → 4 → 5 (C) 3 → 2 → 5 → 1 → 4 (D) 2 → 3 → 5 → 4 → 1 (E) 4 → 3 → 1 → 2 → 5
55. Imagine that you are designing an experiment aimed at determining whether the initiation of migratory behavior is largely under genetic control. Of the following options, the best way to proceed is to (A) perform within-population matings with birds from different populations that have different migratory habits. Do this in the laboratory and see if offspring display parental migratory behavior. (B) observe genetically distinct populations in the field and see if they

科目：普通生物學【生物科學系二年級】

- have different migratory habits. (C) bring animals into the laboratory and determine the conditions under which they become restless and attempt to migrate. (D) perform within- population matings with birds from different populations that have different migratory habits. Rear the offspring in the absence of their parents and observe the migratory behavior of offspring. (E) All of the options are equally productive ways to approach the question.
56. When a steroid hormone and a peptide hormone exert similar effects on a population of target cells, then (A) the steroid and peptide hormones must use the same biochemical mechanisms. (B) the steroid and peptide hormones must bind to the same receptor protein. (C) the steroid hormones affect the synthesis of effector proteins, whereas peptide hormones activate effector proteins already present in the cell. (D) the steroid hormones affect only the release of proteins from the target cell, whereas peptide hormones affect only the synthesis of proteins that remain in the target cell. (E) the steroid hormones affect the activity of certain proteins within the cell, whereas peptide hormones directly affect the processing of mRNA.
57. Why do tropical communities tend to have greater species diversity than temperate or polar communities? (A) They are less likely to be affected by human disturbance. (B) Tropical communities are low in altitude, whereas temperate and polar communities are high in altitude. (C) There are fewer parasites to negatively affect the health of tropical communities. (D) More competitive dominant species have evolved in temperate and polar communities. (E) Tropical communities are generally older than temperate and polar communities.
58. Generalized global air circulation and precipitation patterns are caused by (A) the revolution of Earth around the sun. (B) mountain ranges that deflect air masses containing variable amounts of moisture. (C) rising, warm, moist air masses that cool and release precipitation as they rise and then, at high altitude, cool and sink back to the surface as dry air masses after moving north or south of the tropics. (D) polar, cool, moist high-pressure air masses from the poles that move along the surface, releasing precipitation along the way to the equator where they are heated and dried. (E) air masses that are dried and heated over continental areas that rise, cool aloft, and descend over oceanic areas followed by a return flow of moist air from ocean to land, delivering high amounts of precipitation to coastal areas.
59. What distinguishes a coelomate animal from a pseudocoelomate animal is that coelomates (A) have a complete digestive system with mouth and anus, whereas pseudocoelomates have a digestive tract with only one opening. (B) have a body cavity completely lined by mesodermal tissue, whereas pseudocoelomates do not. (C) have a body cavity, whereas pseudocoelomates have a solid body (D) have a gut that lacks suspension within the body cavity, whereas pseudocoelomates have mesenteries that hold the digestive system in place. (E) contain tissues derived from mesoderm, whereas pseudocoelomates have no such tissue.
60. If a fossil is encased in a stratum of sedimentary rock without any strata of igneous rock (for example, lava, volcanic ash) nearby, then it should be (A) difficult to determine the absolute age of the fossil, because radiometric dating of sedimentary rock is less accurate than that of igneous rock. (B) easy to determine the absolute age of the fossil, because the radioisotopes in the sediments will not have been "reset" by the heat of the igneous rocks. (C) easy to determine the absolute age of the fossil, because the igneous rocks will not have physically obstructed the deposition of sediment of a single age next to the fossil. (D) easy to determine, as long as there is enough metamorphic rock nearby. (E) difficult to determine the absolute age of the fossil, because the "marker fossils" common to igneous rock will be absent.

問答題

- II. Draw a diagram of a mammalian ear and explain these sensory organs for hearing. (10 points)
- III. Explain the evolutionary adaptations of mammalian digestive systems form dentition and digestive tracts of a carnivore (dog) and an herbivore (cattle). (10 points)
- IV. Describe (and/or illustrate) a life cycle of a typical fern plant. (10 points)
- V. Make a comparison of stem internal structures between a typical monocot plant and a typical dicot plant. (10 points)

科目：普通化學【生物科學系二年級】

Useful information:

Planck's constant = $6.626 \times 10^{-34} \text{ J} \cdot \text{s}$ Gas constant, $R = 0.08206 \text{ L} \cdot \text{atm/K} \cdot \text{mol} = 8.3145 \text{ J/K} \cdot \text{mol}$ Atomic weight: $\text{H} = 1$; $\text{C} = 12$; $\text{O} = 16$ $\text{Log } 2 = 0.301$; $\text{log } 3 = 0.477$; $\ln a = 2.303 \text{ log } a$; $e = 2.718$

一、單選題 (20 題；每題 2.5 分；共 50 分；答錯不倒扣分)

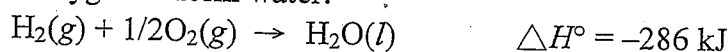
- Order the four metric prefixes from smallest to largest.
 - nano- < mico- < milli- < kilo-
 - milli- < nano- < micro- < kilo-
 - kilo- < micro- < nano- < milli-
 - kilo- < centi- < milli- < nano-
 - micro- < nano- < kilo- < milli-
- How many significant figures are there in the number 0.00012?
 - 5
 - 3
 - 2
 - 4
 - 0
- The atomic number of sodium-23 is 11. What are the numbers of neutrons of the sodium-23?
 - 11
 - 12
 - 23
 - 34
 - none of these
- When 100.0 g of acetylene (C_2H_2) burns in oxygen to give carbon dioxide and water, how many grams of carbon dioxide are formed?
 - 100.0 g
 - 169.2 g
 - 200.0 g
 - 338.5 g
 - 676.9 g
- When carbon burns in oxygen, the reaction is: $\text{C}(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g)$. In the reaction, carbon is _____.
 - the oxidizing agent
 - the electron acceptor
 - reduced
 - the reducing agent
 - more than one of these

背面有題

6. A gaseous mixture containing 2.5 mol Ar and 3.5 mol CO₂ has a total pressure of 8 atm. What is the partial pressure of CO₂?

- (A) 2.5 atm
- (B) 6.0 atm
- (C) 3.5 atm
- (D) 5.3 atm
- (E) 4.7 atm

7. Hydrogen reacts with oxygen to form water:



Which of the following is true?

- (A) The reaction is exothermic.
- (B) The reaction is endothermic.
- (C) The enthalpy of the products is less than that of the reactants.
- (D) Heat is absorbed by the system.
- (E) Both A and C are true.

8. In the hydrogen spectrum, what is the wavelength of light associated with the $n = 4$ to $n = 1$ electron transition? [Hint: $E = -2.178 \times 10^{-18} \text{ J}(Z^2/n^2)$]

- (A) $4.14 \times 10^{-18} \text{ nm}$
- (B) $9.73 \times 10^{-8} \text{ nm}$
- (C) $3.03 \times 10^7 \text{ cm}$
- (D) $7.96 \times 10^{-25} \text{ m}$
- (E) $1.72 \times 10^1 \text{ m}$

9. Which of the following bonds is least polar?

- (A) C—F
- (B) P—C
- (C) S=O
- (D) Cl—Cl
- (E) They are all nonpolar.

10. Which of the following does not contain any pi bonds?

- (A) SO₂
- (B) O₃
- (C) C₂H₄
- (D) C₆H₁₄
- (E) CO₂

11. Which of the compounds below is an example of a molecular solid?

- (A) Ag(*s*)
- (B) SiO₂(*s*)
- (C) MgO(*s*)
- (D) NaCl(*s*)
- (E) C₂₅H₅₂(*s*)

科目：普通化學【生物科學系二年級】

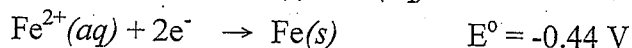
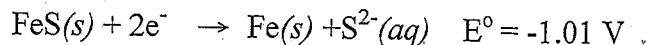
12. A compound (6.54 g) is dissolved in of benzene (250. g). The freezing point of this solution is 1.02°C below that of pure benzene. What is the molar mass of this compound? (Note: K_f for benzene = $5.12^{\circ}\text{C}/\text{m}$.) Ignore significant figures for this problem.
- (A) 65.7 g/mol
(B) 131 g/mol
(C) 5.21 g/mol
(D) 263 g/mol
(E) 32.8 g/mol
13. The rate constant for a reaction is $1.5 \times 10^{-2} \text{ s}^{-1}$ at 600 K and $3.0 \times 10^{-2} \text{ s}^{-1}$ at 900 K. What is the activation energy?
- (A) 10 kJ/mol
(B) 20 kJ/mol
(C) 30 kJ/mol
(D) 300 kJ/mol
(E) This can't be solved without knowing the frequency factor.
14. An equilibrium reaction, $\text{A}_2(\text{g}) + 3\text{B}_2(\text{g}) \rightleftharpoons 2\text{C}(\text{g})$, has a K_p at 27°C of $3.4 \times 10^{-3} / \text{atm}^2$. What is K for this reaction at 27°C ?
- (A) 3.4×10^{-3}
(B) 7.1×10^{-4}
(C) 5.8×10^{-6}
(D) 5.6×10^{-10}
(E) 1.5
15. The K_a of HNO_2 is 4.0×10^{-4} . Calculate the pH of 2.25 M HNO_2 .
- (A) 1.52
(B) 0.22
(C) 3.52
(D) 12.19
(E) none of these
16. A certain indicator HIn has a $\text{p}K_a$ of 9.00 and a color change becomes visible when 10.00% of it is In^- . At what pH is this color change visible?
- (A) 6.00
(B) 7.00
(C) 8.00
(D) 9.00
(E) 10.00
17. The solubility of an unknown salt, M_2X , in a 0.04 M CaX solution is 4.0×10^{-13} mol/L. Calculate the K_{sp} for M_2X .
- (A) 5.3×10^{-27}
(B) 6.4×10^{-27}
(C) 1.5×10^{-16}
(D) 2.3×10^{-20}
(E) none of these

背面有題

科目：普通化學【生物科學系二年級】

18. For the reaction $\text{Cl}_2\text{O}(g) + 3/2\text{O}_2(g) \rightarrow 2\text{ClO}_2(g)$, $\Delta H^\circ = 126.4 \text{ kJ/mol}$ and $\Delta S^\circ = -74.9 \text{ J/K mol}$. At 100°C , what is $\Delta G = ?$
- (A) 154.3 kJ/mol
 (B) 133.9 kJ/mol
 (C) 66.8 kJ/mol
 (D) 126.4 kJ/mol
 (E) -154.3 kJ/mol

19. Calculate K_{sp} for $\text{FeS}(s)$ given the following data:



- (A) 2.1×10^{-18}
 (B) 1.1×10^{-14}
 (C) 3.0×10^{-10}
 (D) 5.1×10^{-20}
 (E) none of these
20. How many structural isomers are there of "hexane" ?
- (A) 2
 (B) 3
 (C) 4
 (D) 5
 (E) 6

二、簡答題 (5 大題; 每題 10 分; 共 50 分)

1. The decay of a radioactive sample is a first-order reaction. Cesium-137 has a half-life of 30.2 years. If a sample contains $10.0 \mu\text{g}^{137}\text{Cs}$, how long will it take for the amount of ^{137}Cs to 1/10 of the original amount? (10 分)
2. The line notation for a galvanic cell is
 $\text{Pt}(s) | \text{Fe}^{2+}(aq) (2.0 \text{ M}), \text{Fe}^{3+}(aq) (1.0 \text{ M}) || \text{Ag}^+(aq) (0.5 \text{ M}) | \text{Pt}(s)$.
 Calculate the cell potential at 25°C . (10 分)
- $$\text{Ag}^+ + e^- \rightarrow \text{Ag} \quad E^\circ = 0.80 \text{ V}$$
- $$\text{Fe}^{3+} + e^- \rightarrow \text{Fe}^{2+} \quad E^\circ = 0.77 \text{ V}$$
3. If a student adds 50.0 mL of 0.10 M $\text{HCl}(aq)$ into 50.0 mL of 1.0 M methylamine, CH_3NH_2 , please calculate the pH value of the aqueous solution. (For CH_3NH_2 , $K_b = 4.4 \times 10^{-4}$) (10 分)
4. Draw molecular structures (including bond angles) for each of following.
 (A) ICl_5 ; (B) XeCl_4 ; (C) CH_4 ; (D) CO_2 ; (E) SO_2 (每小題各兩分; 共 10 分)
5. If a 0.10 M solution of HX, a weak acid, has a pH of 5.68 at 25°C , what is ΔG° for the acid's dissociation reaction at 25°C ? (10 分)