國立高雄大學九十四學年度轉學招生考試試題

系所組別：生命科學系　　科目：普通化學

考試時間：90 分鐘　　本科原始成績滿分 100 分

Part I. 選擇題 (80 %) 答對每題 10 分，未做答不記分，答錯每題倒扣 5 分。

1. In the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, N_2 is
a) oxidized. b) reduced. c) electron donor.
d) reducing agent. e) two of these

2. Which conditions of *P*, *T*, and *n*, respectively, are most ideal?
a) high *P*, high *T*, high *n* b) low *P*, low *T*, low *n* c) high *P*, low *T*, high *n*
d) low *P*, high *T*, high *n* e) low *P*, high *T*, low *n*

3. Given the equation $S(s) + O_2(g) \rightarrow SO_2(g)$, ΔH = -296 kJ, which of the following statement(s) is (are) true?
I. The reaction is exothermic.
II. When 0.500 mole sulfur is reacted, 148 kJ of energy is released.
III. When 32.0 g of sulfur are burned, 2.96×10^5 J of energy is released.
a) All are true. b) None is true. c) I and II are true.
d) I and III are true. e) Only II is true.

4. In Bohr's atomic theory, when an electron moves from one energy level to another energy level more distant from the nucleus
a) energy is emitted. b) energy is absorbed. c) no change in energy occurs.
d) light is emitted. e) none of these

5. Consider the following rate law: Rate = $k[A]^n[B]^m$ How are the exponents *n* and *m* determined?
a) By balancing chemical equation b) By using the subscripts of the chemical formulas
c) By using the coefficients of the chemical formulas
d) By educated guess e) By experiment

6. For a certain process at 355 K, ΔG = -12.4 kJ and ΔH = -9.2 kJ. The ΔS for the process is
a) 0 b) 9.0 J/K·mol c) -9.0 J/K·mol d) -21.6 J/K·mol e) 21.6 J/K·mol

7. Which one of the following decreases as the strength of the attractive intermolecular forces increases?
a) The heat of vaporization. b) The normal boiling temperature.
c) The deviations from the ideal gas law. d) The sublimation temperature of a solid.
e) The vapor pressure of a liquid.

8. Atoms having greatly differing electronegativities are expected to form:
a) no bonds b) polar covalent bonds c) nonpolar covalent bonds
d) ionic bonds e) covalent bonds

Part II. 簡答題 (20 %) 每題 10 分，請詳細寫出過程並標示出答案。
1. Give the Lewis structures, predict the molecular structures, and describe the bonding (in terms of hybrid orbitals for the central atom) of the following molecules: a) XeO_4 and b) CO_2
2. Calculate the root mean square velocity (in meter/sec) for the atoms in a sample of helium gas at 25°C. (gas constant R = 8.3145 J/K·mol, atomic mass of Helium 4.0 g/mol).

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一、 單選題：(52%)　　(共 4 頁)

1. The structural level of a protein least affected by a disruption in hydrogen bonding is the (a). primary level. (b). secondary level. (c). tertiary level. (d). quaternary level. (e). All structural levels are equally affected.
2. Most cells cannot harness heat to perform work because (a). heat is not a form energy. (b). cells do not have much heat ; they are relatively cool. (c). temperature is usually uniform throughout a cell. (d). heat cannot be used to do work. (e). heat denatures enzymes.
3. In what way do the various membranes of a eukaryotic cell differ ? (a). Phospholipids are found only in certain membranes. (b). Certain proteins are unique to each membrane. (c). Only certain membranes of the cell are selectively permeable. (d). Only certain membranes are constructed from amphipathic molecules. (e). Some membranes have hydrophobic surfaces exposed to the cytosol, while others have hydrophilic surfaces facing the cytosol.
4. Which metabolic pathway is common to both fermentation and cellular respiration ? (a). the Krebs cycle. (b). the electron transport chain (c). glycolysis (d). synthesis of acethyl CoA from pyruvate. (e). reduction of pyruvate to lactate.
5. The light reactions of photosynthesis supply the Calvin cycle with (a). light energy. (b). CO_2 and ATP. (c). H_2O and NADPH. (d). ATP and NADPH. (e). sugar and O_2.
6. The decline of MPF at the end of mitosis is cause by (a). the destruction of the protein kinase (Cdk). (b). decreased synthesis of cyclin. (c). the enzymatic destruction of cyclin. (d). synthesis of DNA. (e).an increase in the cell's volume-to-genome ratio.
7. Meiosis II is similar to mitosis in that (a). homologous chromosomes synapse. (b). DNA replicates before the division. (c). the daughter cells are diploid. (d). sister chromatids separate during anaphase. (e). the chromosome number is reduced.
8. Of the following, the most reasonable inference from the observation that defects in DNA repair enzymes contribute to some forms of cancer is that (a). cancer is generally inherited. (b). uncorrected changes in DNA can cause cancer. (c). cancer cannot occur when DNA repair enzymes work properly. (d). mutations generally lead to cancer. (e). cancer is caused by environmental factors that

damage DNA repair enzymes.

9. Which of the following mutations would be most likely to have a harmful effect on an organism ? Explain your answer. (a). a base-pair substitution. (b). a deletion of three bases near the middle of a gene. (c). a single base deletion near the middle of an intron. (d). a single base deletion close to the end of the coding sequence. (e). a single base insertion near the start of the coding sequence.
10. Which of the following is descriptive of an R plasmid ? (a). Its transfer converts an F^-cell into an F^+cell. (b). It contains genes for antibiotic resistance and for sex pili. (c). It is usually transferred between bacteria by transduction. (d). It is a good example of a composite transposon. (e). It makes bacteria resistant to phage.
11. Multigene families are (a). groups of enhancers that control transcription. (b). usually clustered at the telomeres. (c). equivalent to the operons of prokaryotes. (d). collections of genes whose expression is controlled by the same regulatory proteins. (e). identical or similar genes that have evolved by gene duplication.
12. Plants are more readily manipulated by genetic engineering than are animals because (a). plant genes do not contain introns. (b). more vectors are available for transferring recombinant DNA into plant cells. (c). a somatic plant cell can often give rise to a complete plant. (d). genes can be inserted into plant cells by microinjection. (e). plant cells have larger nuclei.
13. The criteria for a good model organism for studying development would probably include all of the following ***except*** (a). observable embryonic development. (b). short generation time. (c). a relatively small genome. (d). preexisting knowledge of the organism's life history. (e). abundant local populations for specimen collection.
14. The smallest biological unit that can evolve over time is (a) a cell (b). an individual organism. (c). a population (d). a species. (e). an ecosystem.
15. An example of bioremediation is (a). the use of prokaryotes to treat sewage or clean up oil spills. (b). the use of antibiotics produced by cultured prokaryotes. (c). the genetic engineering of bacteria to produce human proteins and useful chemical products. (d). the introduction of parasitic bacteria to kill other bacteria. (e). all of the above.
16. Which of the following is ***not*** considered to be a tissue ? (a). cartilage (b). the mucous membrane lining the stomach (c). blood (d). the brain (e) cardiac muscle.
17. Enteropeptidase, a hormone secreted by the small intestine, has which of the following actions ? (a). inhibits bile secretion. (b). inhibits duodenal secretion. (c). activates pancreatic enzymes. (d). inhibits peristalsis in the stomach. (e).

increases the pH of chyme.

18. Which of the following cell types is least likely to have a secondary wall ? (a). sclerenchyma cell. (b).sclereid. (c). fiber cell. (d). tracheid. (e). parenchyma cell.
19. Mycorrhizae enhance plant nutrition mainly by (a). absorbing water and minerals through the fungal hyphae. (b). providing sugar to the root cells, which have no chloroplasts of their own. (c). converting atmospheric nitrogen to ammonia. (d). enabling the roots to parasitize neighboring plants. (e). stimulating the development of root hairs.
20. "Golden Rice" is a transgenic variety that (a). is resistant to various herbicides and thus rice field can be weeded with those herbicides. (b). is resistant to a virus that commonly attacks rice fields. (c). includes bacterial genes that produce a toxin that reduces damage from insect pests. (d). produces much larger, golden grains that increase crop yields. (e). contains daffodil genes that increase the vitamin A content of the rice.
21. In negative-pressure breathing, inhalation results from (a). forcing air from the throat down into the lungs. (b). contracting the diaphragm. (c). relaxing the muscles of the rib cage. (d). using muscles of the lungs to expand the alveolei. (e). contracting the abdominal muscles.
22. Which of the following is ***not*** true about helper T cell ? (a).They function in both cell-mediated and humoral immune responses. (b). They recognize polysaccharide fragments presented by class II MHC molecules. (c) They bear surface CD4 molecules. (d). They are subject to infection by HIV. (e). When activated, they secrete IL-2 and other cytokines.
23. Which of the following correctly describes a case of osmoregulation ? (a). body fluids that are isoosmotic with the external environment (b). discharge of excess water in a hypoosmotic environment (c). expenditure of energy to convert ammonia to less toxic wastes (d). excretion of salt in a hypoosmotic environment (e). secretion of drugs and reabsorption of nutrients by the proximal tubule.
24. Which of the following hormones is ***incorrectly*** paired with its action ? (a). oxytocin---stimulates uterine contractions during childbirth. (b). thyroxine---stimulates metabolic processes. (c). insulin---stimulates glycogen breakdown in the liver. (d). ACTH---stimulates the release of glucocorticoids by the adrenal cortex. (e). melatonin---affects biological rhythms, seasonal reproduction.
25. Peaks of LH and FSH production occur during (a). the period surrounding ovulation. (b). the beginning of the follicular phase of the ovarian cycle. (c). the flow phase of the menstrual cycle. (d). the end of the luteal phase of the

ovarian cycle. (e) the secretory phase of the menstrual cycle.

26. All the following electrical changes of neurons are graded events *except* (a). action potentials. (b). EPSPs. (c). IPSPs. (d). depolarizations caused by stimuli. (e). hyperpolarizations cause by stimuli.

二、 問答題：(48%)

1. 說明細胞的內膜系統(Endomembrane system)包含那些胞器(Organelles)，運輸性液泡(Transport vesicles)如何與此系統結合之？
2. 試敘述鈣離子(Calcium ions)及肌醇三磷酸(Inositol trisphosphate)如何在訊息傳遞途徑(Signaling pathways)中扮演第二訊息(Second messenger)的角色？
3. 說明肌肉收縮時，肌動蛋白(Actin)及肌凝蛋白(Myosin)如何進行 Cross-bridge cycle，同時如何利用 Ca^{++}調節之。
4. 說明原核生物如何以正負基因調控(Positive and negative gene regulation)的機制，操作基因的表現。(以 Lac operon 為例)
5. 試敘述 C4 及 CAM 植物為適應在熱、乾旱環境下所改變之固碳作用機制，同時比較兩者的異同。
6. 簡述被子植物木質部汁液(Xylem sap)運輸的原理。