國立政治大學 九十八 學年度研究所碩士班入學考試命題紙

考試科目	生物化學	所別	神經科學研究所	考試時間	3 月 15 日 星期日 第 1 節

一、選擇題（每題 2 分）

01. Glycogen phosphorylase is activated most directly by (A) epinephrine. (B) phosphorylase kinase. (C) phosphorylase phosphatase. (D) cAMP. (E) glucagon.

02. Which compound does NOT cross the inner mitochondrial membrane due to lack of a specific transport protein? (A) malate (B) glutamine (C) NADH (D) citrate (E) ATP

03. Which mitochondrial enzyme requires acetyl-CoA as a substrate? (A) Citrate synthase (B) Succinyl-CoA synthase (C) Succinic dehydrogenase (D) Pyruvate dehydrogenase (E) Isocitrate dehydrogenase

04. In the oxidation of NADH by the electron transport system, energy released is coupled to the formation of ATP from ADP plus inorganic phosphate. For every mole of NADH oxidized, how many moles of ATP formed are formed? (A) 1 (B) 5 (C) 3 (D) 6 (E) None of the above.

05. Which of the following species of denatured DNA will renature most rapidly in solution, under appropriate conditions of ionic strength, pH, and temperature? (A) Human liver nuclear DNA (B) Vaccinia (viral) DNA (C) E. coli DNA (D) Yeast nuclear DNA (E) Mouse neuronal DNA

06. Reactions occurring during anaerobic GLYCOLYSIS in liver which require the input (use of) of ATP include (A) pyruvate kinase and glucokinase (B) pyruvate kinase and phosphofructokinase (C) glyceraldehyde-3-phosphate dehydrogenase and pyruvate kinase (D) glucokinase and phosphofructokinase (E) glucokinase and glyceraldehyde-3-phosphodehydrogenase

07. DNA sequencing depends on generating a set of molecules that terminate at every possible position. This is done by stopping the synthesis (A) using modified nucleotides lacking the 3' hydroxyl group (B) using a DNA polymerase purified from a thermophilic organism (C) using modified nucleotides phosphorylated at the 5' hydroxyl (D) using modified nucleotides with deaminated bases (E) using a non-processive DNA polymerase.

08. Each of the following may be used to estimate the molecular weight of a protein EXCEPT (A) sucrose density gradient centrifugation (B) ion exchange chromatography (C) SDS (sodium dodecyl sulfate) gel electrophoresis (D) gel filtration chromatography (E) sedimentation and diffusion measurements.

09. When modifying the Southern blot procedure to do a Northern blot, you would want to avoid the step in which (A) the nucleic acid molecules are separated by electrophoresis in agarose (B) the gel is soaked in sodium hydroxide to denature the nucleic acids (C) the nucleic acids are transferred to a solid matrix by capillary action (D) a denatured probe is added to the solid matrix and incubated at 65° C (E) probe that has hybridized to the immobilized nucleic acids is detected.

10. Cells lacking p53 are abnormal because they (A) lack enzymes needed for base excision repair (B) fail to enter S phase if their DNA is damaged (C) arrest in mitosis in the presence of high levels

備考	試題隨卷繳交
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of caffeine (D) fail to die after exposure to low levels of DNA damage (E) A and C are both correct.

11. During agarose gel electrophoresis, DNA molecules (A) all migrate at the same rate because they have the same charge to mass ratio (B) migrate according to size because they all have the same charge to mass ratio (C) migrate differently depending on nucleotide sequence because the different bases change the number of charges found in a sequence (D) migrate at rates independent of their shape (E) fail to migrate into the gel at all if they are larger than about 25,000 base pairs.
12. Insulin will cause (A) enhanced glucose uptake by the muscle (B) increased glycogen synthesis (C) increased oxidation of glucose to carbon dioxide and water (D) increased conversion of glucose to fatty acids (E) all of the above.
13. Superoxide anion is a free radical which can be converted to non-radical products by the action of (A) superoxide hydrolase (B) catalase (C) superoxide dismutase (SOD) and catalase (D) superoxide hydrolase and catalase (E) ferric iron.
14. A simple definition of "oxidative stress" is (A) it involves the oxidation of biological tissues by free radicals (B) it always causes cancer (C) it is the "stress" that follows extreme exercise (D) it describes the over saturation of hemoglobin (E) it results in the formation of methemoglobin.
15. NADPH for fatty acid synthesis is directly supplied by (A) isocitrate dehydrogenase (B) glycogen phosphorylase (C) alpha-ketoglutarate dehydrogenase (D) glucose-6-phosphate dehydrogenase (E) the transfer of reducing power from NADH to NADP in mitochondria.
16. Which amino acid is NOT ionized at physiological pH? (A) glutamate (B) arginine (C) serine (D) lysine (E) aspartate.
17. Muscle glycogen cannot contribute directly to blood glucose levels because (A) muscle glycogen cannot be converted to glucose 6-phosphate (B) muscle lacks glucose 6-phosphatase (C) muscle contains no glucokinase (D) muscle contains no glycogen phosphorylase (E) muscle lacks phosphoglucoisomerase.
18. Dinitrophenol (DNP) uncouples mitochondrial electron transport from oxidative phosphorylation by (A) dissipating the proton gradient (B) inhibiting cytochrome oxidase (C) dissociating the F0 and F1 units of the ATP synthase complex (D) binding irreversibly to ubiquinone (E) blocking the adenine nucleotide carrier (ATP/ADP exchanger).
19. In *E. coli*, the inability of the *lac* repressor to bind an inducer would result in (A) no substantial synthesis of β-galactosidase (B) constitutive synthesis of β-galactosidase (C) inducible synthesis of β-galactosidase (D) synthesis of inactive β-galactosidase (E) synthesis of β-galactosidase only in the absence of lactose.
20. If the genetic code consisted of four bases per codon rather than three, the maximum number of

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unique amino acids that could be encoded would be (A) 16 (B) 64 (C) 128 (D) 256 (E) 512

21. Why does lagging strand synthesis consist of discontinuous Okazaki fragments? (A) There is a shortage of dNTPs for lagging strand synthesis (B) DNA is synthesized 5' to 3'. Replication can only proceed from the unwound portion of DNA outward (C) Lagging strand DNA polymerase can only handle a few nucleotides at a time (D) Okazaki fragments are riddled with mistakes; proofreading enzymes chop up the nucleotide into short fragment.
22. DNA replication is semiconservative. Why do you think this is? (A) Requires less energy (B) Only one DNA strand can be copied at a time (C) RNA primer limitations (D) DNA replication starts at specific sites only (E) Increased fidelity.

二、填充題（每空格 2 分，限以英文作答）

01. The condition of "Lactose Intolerance" can be caused by defective or deficient in ___(1)___ (one enzyme name).
02. The PKU (phenylketonuria) results from the absence of which enzyme ___(2)___.
03. Which citric acid cycle intermediate helps to regulate the rate of glycolysis by directly influencing the activity of phosphofructokinase?___(3)___
04. The ___(4)___ shuttle system transfers electrons from cytosolic NADH to the respiratory chain of mitochondria.
05. The substrate normally utilized as the major source of energy by the brain is ___(5)___.
06. The pair of oligonucleotide primers used to amplify the following "target" sequence in a PCR experiment: 5'-GTATACGACC ----target--- TAGCATAGAC-3' are ___(6)___ and ___(7)___.
07. The increased levels of ATP in the fed state would help to channel acetyl CoA into fat synthesis by inhibiting ___(8)___ (one enzyme)
08. Particular RNAs that are important for development are located in distinct regions of the *Drosophila* embryo. This is most directly demonstrated by using ___(9)___ (one biotechnique)
09. Consider the average *in vivo* turnover rates for proteins, DNA, and mRNA, the turnover rate from fastest (shortest average lifetime) to slowest (longest average lifetime) is ___(10)___ > ___(11)___ > ___(12)___.
10. Match the biomolecule with its precursor by entering the name of the correct precursor in the blank (choose from the following word bank: Glycine, Histidine, Glutamate, Tryptophan, Tyrosine, Arginine, Aspartate)

    Serotonin ___(13)___ Histamine ___(14)___ Epinephrine ___(15)___ Dopamine ___(16)___
11. After synthesis, proteins undergo different kinds of alterations, sorting, and decay. Enter "T" or "F" to indicate if each event is correctly or incorrectly matched with its proper biochemical modification

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category.

(17) Prosthetic Group addition and Heme, NAD, and biotin attachment

(18) Protein Degradation and Ubiquitin pathway

(19) Glycoprotein Synthesis and Carbohydrate attachment

(20) Amino Acid Modification and arginine phosphorylation

三、問答題（請於 200 字內作答，中英文答題均可）

01. Regarding the regulation of glycogen breakdown, describe the sequence of biochemical events after the release of epinephrine into the bloodstream.（8 分）

02. Please explain the promoter and enhancer, and briefly describe the method(s) commonly used to define the promoter elements. （8 分）

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