國立高雄大學 114 學年度研究所碩士班招生考試試題

科目：生物化學　　系所：生命科學系　　是否使用計算機：否
考試時間：100 分鐘　　本科原始成績：100 分

Multiple Choice Questions (90%)

(1) Which of the following, when paired with its complementary strand, would have the highest Tm?

A) AAGTTCCAGT
B) GCAGCAGCAT
C) ATTACGAGCT
D) GCGAAATCAA
E) TGACCTTGAA

(2) The fatty acid designated 18:2c△9,12 is best described as a _____ fatty acid.

A) saturated
B) unsaturated
C) polyunsaturated
D) hydrogenated
E) partially hydrogenated

(3) When glucagon binds to its receptor on a liver cell, which of the following sequence of events occurs to activate protein kinase A?

A) activation of adenylate cyclase, activation of G protein, production of cAMP
B) activation of G protein, activation of adenylate cyclase, production of cAMP
C) activation of G protein, production of cAMP, activation of adenylate cyclase
D) production of cAMP, activation of adenylate cyclase, activation of G protein
E) none of the above

(4) For each molecule of acetyl-CoA that enters the citric acid cycle, which of the following best represents the net products of the cycle?

A) 2 CO2, 2 NADH, 2 FADH2, 1 GTP, 1 oxaloacetate
B) 1 CO2, 3 NADH, 1 FADH2, 2 GTP, 1 oxaloacetate
C) 2 CO2, 3 NADH, 1 FADH2, 1 GTP, 0 oxaloacetate
D) 1 CO2, 2 NADH, 1 FADH2, 2 GTP, 0 oxaloacetate
E) 2 CO2, 3 NADH, 1 FADH2, 1 GTP, 1 oxaloacetate

(5) Which of the following is the most important regulatory enzyme in fatty acid synthesis?

A) citrate lyase
B) malic enzyme

C) acetyl-CoA carboxylase
D) acetyl-CoA-ACP transacylase
E) malonyl-CoA-ACP transacylase

(6) Which of the following would be considered a biosynthetic pathway?
A) glycolysis
B) glycogen synthesis
C) fatty acid β-oxidation
D) citric acid cycle
E) electron transport

(7) What is the oxidant in the following reaction?
A) ethanol
B) NAD+
C) acetaldehyde
D) NADH
E) H+

(8) What is the source of acetyl-CoA for the glyoxylate cycle?
A) pyruvate
B) amino acids
C) fatty acids
D) cholesterol
E) all of the above

(9) Lactose, the disaccharide of galactose and glucose, is synthesized from which of the following activated monosaccharides?
A) uridine triphosphate glucose
B) uridine triphosphate galactose
C) uridine diphosphate glucose
D) uridine diphosphate galactose
E) none of the above

(10) Which of the following coenzymes is required for the decarboxylation of pyruvate by the pyruvate dehydrogenase complex?

A) thiamine pyrophosphate
B) coenzyme A
C) lipoic acid
D) NAD+
E) FAD

(11) Which of the following causes denaturation of a protein when disulfide bonds are present?
A) heat
B) pH changes
C) reducing agent
D) detergent
E) all of the above

(12) Which of the following leads to the formation of atherosclerotic plaques?
A) non-specific interactions between LDL particles
B) oxidation of LDL particles resulting in cross linking with proteins
C) uptake of oxidized LDL particles by macrophages
D) excess uptake of LDL particles converting endothelial cells to foam cells
E) none of the above

(13) Which of the following represents a correct compartmentation of a biochemical process with its cellular location?
A) fatty acid oxidation: endoplasmic reticulum
B) RNA synthesis: Golgi complex
C) citric acid cycle: mitochondria
D) gluconeogenesis: lysosome
E) none of the above

(14) Which of the following polysaccharides contains exclusively glucose in $\alpha(1\rightarrow4)$ glycosidic bonds?
A) amylose
B) amylopectin
C) glycogen
D) cellulose
E) chitin

(15) What is a polyribosome?
A) ribosomes that synthesize different subunits of the same protein
B) several ribosomes all attached to the same mRNA
C) ribosomes that are covalently bonded to each other in a polymer fashion
D) a ribosome that only produces proteins that will be excreted by the cell
E) none of the above

(16) Which of the following DNA polymerases is correctly defined?
A) polymerase I: DNA repair
B) polymerase I: RNA primer excision
C) polymerase II: DNA repair
D) polymerase III: nucleotide incorporation during replication
E) all of the above

(17) Which of the following is the regulatory step in cholesterol synthesis?
A) HMG-CoA synthase
B) HMG-CoA lyase
C) HMG-CoA reductase
D) squalene synthase
E) squalene epoxidase

(18) In the citric acid cycle, acetyl-CoA reacts with _____ to produce _____.
A) fumarate; α-ketoglutarate
B) oxaloacetate; citrate
C) citrate; isocitrate
D) succinyl-CoA; oxaloacetate
E) malate; cis-aconitate

(19) Which of the following correctly identifies key elements present on the exterior of Gram-negative (GN) and Gram-positive (GP) bacteria?
A) GN: single lipid bilayer; GP: two lipid bilayers
B) GN: single peptidoglycan layer; GP: multiple peptidoglycan layers
C) GN: extensively crosslinked peptidoglycans; GP: uncrosslinked peptidoglycan
D) GN: contains both N-acetylmuramic acid and N-acetylglucosamine; GP: contains only N-acetylmuramic acid

E) none of the above

(20) Which of the following undergoes an oxidation reaction to form a disulfide bond?
A) serine
B) cysteine
C) methionine
D) threonine
E) tyrosine

(21) Which of the following does not specifically cause a membrane to be more rigid or fluid, but rather causes the Tm to occur over a greater range?
A) increasing the content of unsaturated fatty acids
B) raising the temperature
C) increasing the cholesterol content
D) decreasing the phosphatidylcholine content while increasing the phosphatidylethanolamine content
E) all of the above

(22) Movement of ions across a cell membrane by the Na/K ATPase is best described as _____.
A) sodium moved outside to inside, potassium inside to outside
B) sodium moved inside to outside, potassium outside to inside
C) sodium moved inside to outside, potassium inside to outside
D) sodium moved outside to inside, potassium outside to inside
E) none of the above

(23) Which of the following formulas would be a carbohydrate
A) C5H12O5
B) C4H8O6
C) C6H10O6
D) C3H8O3
E) C6H12O6

(24) Which enzyme catalyzes the primary regulation site of glycolysis?
A) hexokinase
B) phosphofructokinase-1

C) glyceraldehyde-3-phosphate dehydrogenase
D) phosphoglycerate kinase
E) pyruvate kinase

(25) Which of the following shows the overall equation for the light reactions?
A) 2 H2O + 1 NADP+ 1 H^+ + O2 + 1 NADPH, requires 4 photons
B) 2 H2O + 1 NADP+ 1 H^+ + O2 + 1 NADPH, requires 8 photons
C) 2 H2O + 2 NADP+ 2 H^+ + O2 + 2 NADPH, requires 4 photons
D) 2 H2O + 2 NADP+ 2 H^+ + O2 + 2 NADPH, requires 8 photons
E) 2 H2O + 2 NADP+ 2 H^+ + O2 + 2 NADPH, requires 16 photons

(26) Which of the following would likely form micelles in an aqueous solution?
A) hexane
B) glucose
C) glutamic acid
D) dodecanoic acid
E) none of the above

(27) Which of the following techniques was used to determine the double helical structure of DNA?
A) NMR spectroscopy
B) X-ray diffraction
C) Raman spectroscopy
D) UV/Vis spectroscopy
E) IR spectroscopy

(28) Which of the following types of DNA are often supercoiled?
A) extremely long linear DNA, such as seen in human chromosomes
B) very short linear DNA
C) circular DNA
D) DNA molecules that contain both circular and linear regions
E) all of the above

(29) In C4 plants, CO2 in the mesophyll cell reacts with _____ to form oxaloacetate while in the bundle sheath cell, _____ undergoes decarboxylation to pyruvate.

A) pyruvate; aspartate
B) phosphoenolpyruvate; oxaloacetate
C) pyruvate; malate
D) phosphoenolpyruvate; malate
E) 3-phosphoglycerate; oxaloacetate

(30) Which of the following represents a palindromic sequence?
A) ACCTTCCA
B) ATTCCAAT
C) GATTAATC
D) GGTAATCC
E) none of the above

Short Answer Questions (10%)

Please briefly describe the following terms.

1. Apoptosis
2. Base excision repair
3. C4 cycle
4. Denaturation
5. Epigenetics