國立高雄大學 115 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

單選題(共 50 題，每題兩分)

1) Hydrolysis of a peptide bond produces:
A) an alcohol and an amine
B) an amine and a carboxylic acid
C) a carboxylic acid and an anhydride
D) an amide and a carboxylic acid
E) an alcohol and an amide

2) 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

3) Which of the following is true regarding β-sheet structures?
A) hydrogen bonds in an parallel sheet are non-linear
B) hydrogen bonds in an antiparallel sheet are non-linear
C) the rise per residue is greater for a parallel sheet than for an antiparallel sheet
D) β-sheets are an n=3 helix with each residue rotated 120° with respect to its neighbors
E) none of the above

4) Which of the following elements is considered a second tier biochemical element meaning that it is less abundant than first tier elements but still required for life in all organisms?
A) H
B) N
C) P
D) C
E) O

5) Which of the following would contribute to tertiary structure?
A) charge-charge interaction between lysine and aspartic acid
B) disulfide bond
C) hydrogen bond between serine hydroxyl group and amide of glutamine
D) hydrophobic interaction between leucine and valine
E) all of the above

6) What is the C-4 epimer of glucose?
A) allose
B) mannose
C) gulose
D) galactose
E) fructose

7) Which of the following is a polymer derived from glucose?
A) cellulose
B) ribonucleic acid
C) polypeptide
D) deoxyribonucleic acid
E) none of the above

8) A ceramide is derived from which combination of the following?
A) a molecule of sphingosine and a monosaccharide
B) a molecule of sphingosine and a molecule of phosphocholine
C) a molecule of sphingosine and a fatty acid
D) a molecule of sphingosine and two fatty acids
E) a molecule of sphingosine, a fatty acid and a monosaccharide

9) Which amino acid most commonly serves as a general acid and general base in an enzyme mechanism?
A) serine
B) arginine
C) aspartic acid
D) histidine
E) cysteine

10) What pH range is generally considered to be the physiological pH range?
A) 1.5-3.0
B) 4.5-7.0
C) 5.5-9.0
D) 6.5-8.0
E) 7.5-10.0

11) 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

12) During aerobic glycolysis, pyruvate is most likely oxidized to _____ while in anaerobic glycolysis, pyruvate is converted to _____.
A) acetaldehyde; ethanol
B) acetyl CoA; glyceraldehyde
C) acetyl CoA; lactate
D) acetaldehyde; lactate
E) none of the above

13) 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

14) Which of the following pairs of amino acids could form a hydrogen bond through their R-groups?
A) serine and phenylalanine
B) aspartic acid and methionine
C) histidine and tyrosine
D) alanine and glutamine

E) leucine and cysteine

15) An enzyme that catalyzes the intramolecular movement of a functional group from one carbon atom to another would be called a(n) _____.
A) isomerase
B) transferase
C) oxidoreductase
D) kinase
E) ligase

16) 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

17) Which of the following eukaryotic organisms is both autotrophic and heterotrophic?
A) yeast
B) humans
C) Venus fly trap
D) redwood trees
E) mushrooms

18) Which of the following pairs of pathways, if active at the same time, would be considered a futile cycle?
A) gluconeogenesis and citric acid cycle
B) fatty acid β-oxidation and glycolysis
C) fatty acid synthesis and glycolysis
D) fatty acid synthesis and citric acid cycle
E) glycolysis and gluconeogenesis

19) Which amino acid is complexed to iron-sulfur clusters to enable them to associate with proteins?
A) methionine
B) serine
C) lysine
D) tyrosine
E) cysteine

20) 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

21) Which of the following pathways takes place primarily within the inner mitochondrial membrane?
A) fatty acid β-oxidation
B) electron transport
C) glycolysis
D) citric acid cycle
E) pentose phosphate pathway

22) Which of the following carbohydrates is the most common molecule exported by photosynthetic cells for use in other parts of the plant?
A) amylose
B) amylopectin
C) glucose
D) sucrose
E) fructose

23) 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

24) What is the minimum number of photons that must be absorbed by PSII to reduce two molecules of water to one molecule of oxygen?
A) 1
B) 2
C) 4
D) 8
E) 16

25) Which of the following hormones is correctly described?
A) ghrelin: produced in pancreas, stimulates appetite
B) adiponectin: produced in adipose tissue, stimulates appetite
C) insulin: produced in pancreas, stimulates appetite
D) leptin: produced in intestines, suppresses appetite
E) none of the above

26) Which of the following roles does the liver play in lipoprotein metabolism?
A) production of chylomicrons
B) uptake of VLDL
C) production of LDL
D) uptake of HDL
E) none of the above

27) Which of the following is true of glucagon?
A) it is released from the pancreatic cells when glucose levels are low
B) its synthesis and release are exclusively under the control of epinephrine
C) the primary targets of glucagon are liver, adipose and muscle tissue
D) major pathways promoted by glucagon include glycogenolysis and glycolysis

E) none of the above

28) Phospholipids are synthesized in the _____, then transferred to the _____ via transport vesicles.
A) smooth endoplasmic reticulum; Golgi complex
B) rough endoplasmic reticulum; smooth endoplasmic reticulum
C) smooth endoplasmic reticulum; lysosome
D) Golgi complex; smooth endoplasmic reticulum
E) Golgi complex; cell membrane

29) The primary activation of triacylglycerol mobilization in adipocytes is through _____ of the enzyme _____.
A) phosphorylation; perilipin
B) phosphorylation; hormone sensitive lipase
C) dephosphorylation; hormone sensitive lipase
D) phosphorylation; adipose triglyceride lipase
E) dephosphorylation; adipose triglyceride lipase

30) The synthesis of the glycosphingolipids begins with the reaction of either UDP-glucose or UDP-galactose with _____.
A) ceramide
B) sphinganine
C) sphingosine
D) sphingomyelin
E) none of the above

31) Which of the following is an essential amino acid for humans?
A) alanine
B) serine
C) tyrosine
D) cysteine
E) histidine

32) Which of the following is a role of spermine and spermidine, the polyamines derived from glutamate?
A) stabilization of tRNA duplex structure
B) neutralization of DNA negative charge
C) stabilization of double stranded DNA
D) stabilization of bacterial membranes
E) all of the above

33) What is a PEST sequence in a protein?
A) a sequence where phosphorylation occurs at every serine and tyrosine
B) a sequence that confers resistance to cathepsin-mediated proteolysis
C) a sequence of phenylalanine-glutamate-serine-threonine that is found in many proteins with half lives less than 2 hours
D) a sequence that causes ubiquitination of the protein followed by degradation
E) none of the above

34) Which of the following is the most common promoter element for pol II?
A) CAAT box (GGCCAATCT)
B) GC box (GGGCGG)
C) TRE (GAGGGACGTACCGCA)
D) TATA box (TATAAAA)
E) Octamer (ATTTGCAT)

35) In the presynaptic neuron, _____ influx causes neurotransmitter release while in the postsynaptic neuron, _____ enters the cell following opening of ion channels.
A) Na+; K+
B) K+; Na+
C) Ca2+; K+
D) Ca2+; Na+
E) Na+; Ca2+

36) By saying that the genetic code is degenerate, what does this imply?
A) the code is different for bacteria than for eukaryotes
B) some codons can code for non-standard amino acids
C) most amino acids have more than one codon

D) there is more than one start codon
E) there is more than one stop codon

37) What is present in many eukaryotic genes that drastically increases the size of eukaryotic DNA, but are not present in prokaryotic genes?
A) satellite DNA
B) long interspersed elements
C) Alu sequences
D) exons
E) introns

38) Which of the following is formed by oxidation of a DNA base?
A) uracil
B) 8-oxoguanine
C) 7-methylguanine
D) thymine dimer
E) all of the above

39) A G protein is inactive when the _____ subunit is bound to _____.
A) α; GMP
B) α; GDP
C) β; GMP
D) β; GDP
E) β/γ; GMP

40) What is the correct order of enzyme activities required for nucleotide excision repair?
A) exonuclease, helicase, polymerase, ligase
B) exinuclease, helicase, polymerase, ligase
C) exonuclease, polymerase, ligase, helicase
D) exinuclease, polymerase, ligase, helicase
E) exonuclease, ligase, polymerase, helicase

41) As RNA polymerase moves along the DNA, it creates a single stranded region of about 18 base pairs that is called a _____.
A) transcription bubble
B) transcription single-stranded region
C) transcription droplet
D) transcription vesicle
E) transcription bead

42) During the conversion of IMP to GMP and AMP, _____ serves as the nitrogen source for GMP, while _____ serves as the nitrogen source for AMP.
A) glutamate, asparagine
B) glutamate, aspartate
C) glutamine, asparagine
D) glutamine, aspartate
E) none of the above

43) What chemical modification of host DNA is used to protect it against cleavage by the host's own restriction enzymes?
A) methylation
B) phosphorylation
C) acetylation
D) conversion of some cytosine to uracil
E) conversion of some guanosine to inosine

44) Replication of DNA in E. coli occurs in what type of fashion?
A) unidirectional
B) bidirectional
C) multidirectional
D) directionality can change depending upon specific conditions in the cell
E) none of the above

45) Most steroid hormones exert their effects by initial binding to which of the following receptors?
A) receptor in cell membrane
B) receptor in cytosol

C) receptor in nuclear membrane
D) receptor in nucleus
E) none of the above

46) A pseudogene is a _____.
A) gene that codes for a non-functional protein
B) nonexpressed gene
C) mutated gene
D) gene with multiple promoter regions that causes the start of transcription to be mistaken
E) none of the above

47) A mutation in a gene results in a mutant phenotype. What occurs if the wild-type phenotype is restored by a mutation at another site in the gene?
A) reversion
B) silent mutation
C) conjugation
D) silent conjugation
E) suppression

48) In most cases, the first codon in prokaryotic mRNA codes for _____ while the first codon in eukaryotic mRNA codes for _____.
A) methionine; N-formylmethionine
B) N-formylmethionine; methionine
C) proline; N-formylproline
D) N-formylproline; proline
E) none of the above

49) At the transcriptional level, how does tryptophan control the production of genes within the trp operon?
A) the trp repressor contains a high percentage of Trp residues and is thus only produced when Trp levels are high
B) without sufficient Trp, the production of the trp repressor is truncated, thus producing a protein that cannot bind to the operon, ultimately resulting in structural gene expression
C) high levels of Trp cause the repressor to be proteolytically digested
D) the trp repressor binds to the operon only when bound to Trp

E) none of the above

50) Which of the following accounts for the greater complexity in eukaryotic transcriptional control when compared with prokaryotic control?

A) physical separation of transcription from translation
B) the presence of chromatin instead of naked DNA
C) the larger size of the chromosomes
D) the presence of introns
E) none of the above