請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

單選題 每題 2 分

1. In homologous recombination in *E. coli,* the protein that moves along a double-stranded DNA, unwinding the strands ahead of it and degrading them, is:
   A) RuvC protein (resolvase)
   B) RecBCD enzyme
   C) RecA protein
   D) DNA ligase
   E) *chi*

2. Which of these enzymes is **NOT** directly involved in methyl-directed mismatch repair in *E. coli*?
   A) DNA polymerase III
   B) DNA glycosylase
   C) DNA helicase II
   D) Exonuclease I
   E) DNA ligase

3. In contrast to bacteria, eukaryotic chromosomes need multiple DNA replication origins because:
   A) they have a variety of DNA polymerases for different purposes, and need a corresponding variety of replication origins.
   B) the processivity of the eukaryotic DNA polymerase is much less than the bacterial enzyme.
   C) eukaryotic genomes are not usually circular, like the bacterial chromosome is.
   D) eukaryotic chromosomes cannot usually replicate bidirectionally.
   E) it would take too long with only a single origin per chromosome.

4. The function of the eukaryotic DNA replication factor PCNA (*p*roliferating *c*ell *n*uclear *a*ntigen) is similar to that of the β-subunit of bacterial DNA polymerase III in that it:
   A) forms a circular sliding clamp to increase the processivity of replication.
   B) increases the speed but not the processivity of the replication complex.
   C) has a $3' \rightarrow 5'$ proofreading activity.
   D) facilitates replication of telomeres.
   E) participates in DNA repair.

5. What two amino acids are required for the formation of dehydroxylysinonorleucine in collagen?
   A) Leucine and isoleucine
   B) Lysine and lysine
   C) Tyrosine and isoleucine
   D) Leucine and proline
   E) Lysine and proline

6. What following statement is **NOT** a characteristic or function of RNAs?
   A) Some RNAs can function as an enzyme.
   B) RNAs can have a function to be a genetic information.
   C) Except mRNAs, there is no other RNA in ribosomes.
   D) RNAs can be used as a carrier of an amino acid.
   E) None of the above.

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7. What following enzyme requires FAD as a coenzyme for its catalytic reaction?
   A) Acyl-CoA dehydrogenase
   B) α-Ketoglutarate dehydrogenase
   C) Isocitrate dehydrogenase
   D) Malate dehydrogenase
   E) Glutamate dehydrogenase

8. How does glucose 6-phosphate turn on the activity of glycogen synthase?
   A) Glucose 6-phosphate can directly activate glycogen synthase *via* an allosteric regulation.
   B) Glucose 6-phosphate can inhibit phosphorylase kinase, leading to glycogen synthase activation.
   C) Glucose 6-phosphate is an inducer to turn on glycogen synthase kinase for activation of glycogen synthase.
   D) Glucose 6-phosphate can activate glycogen synthase *via* phosphorylation by a G6P-dependent kinase.
   E) Glucose 6-phosphate can activate phosphoprotein phosphatase-1 for glycogen synthase activation.

9. What following metabolite or product is **NOT** directly generated from the intermediates of the citric acid cycle in human liver cells?
   A) Proline
   B) Asparagine
   C) Porphyrins
   D) Glycine
   E) Aspartate

10. What following statement is **NOT** correct for glucose to stimulate insulin secretion in pancreatic β cells?
   A) Blood glucose is taken by pancreatic β cells *via* glucose transporter GLUT2.
   B) Active metabolism of glucose raises intracellular concentrations of ATP.
   C) Membrane depolarization results in opening voltage-gated Ca^{2+} channels.
   D) ATP opens potassium ion channels to depolarize the membrane potential for insulin secretion.
   E) An increase of cytosolic [Ca^{2+}] triggers the release of insulin exocytosis.

11. The unfolding of a protein is called what ?
   A) Denaturation
   B) Dialysis
   C) Oxidation
   D) Renaturation
   E) Reduction

12. Prions are infectious proteins that:
   A) are encoded by viruses.
   B) cleave DNA at specific sites.
   C) cleave proteins to cause their altered functionality.
   D) can catalyze an alternative folded state of a protein.
   E) protect disulfide bonds from being oxidized by reducing agents.

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13. A hydropathy plot is used to:
A) Determine the water-solubility of a protein.
B) Deduce the water content of a native protein.
C) Estimate for the true molecular weight of a membrane protein.
D) Deduce the quaternary structure of a membrane protein.
E) Predict whether a given protein sequence contains membrane-spanning segments.

14. Glutathione is a:
A) Dipeptide
B) Tripeptide
C) Pentapeptide
D) Polypeptide
E) Hexapeptide

15. All of the following are conjugated proteins except:
A) Nucleoproteins
B) Proteoses
C) Metalloproteins
D) Flavoproteins
E) Hemoproteins

16. Glucose-6-phosphatase (glucose 6-P) deficiency causes type I glycogen storage disease. The enzyme catalyzes:
A) glucose 6-P to glucose 1-P
B) glucose 6-P to glucose
C) glucose 6-P to fructose 6-P
D) glucose 1-P to fructose 6-P
E) glucose 6-P to ribose 5-P.

17. Which of the below participates in biosynthesis of phosphoglycerides, sphingomyelin, and other substituted sphingosines?
A) CTP
B) UDP
C) ADP
D) GTP
E) TTP

18. Which of the following descriptions with regard to arachidonate is right?
A) It is the substrate for the synthesis of prostaglandins by the cyclooxygenase pathway.
B) It is the substrate for the synthesis of leukotrienes by the lipoxygenase pathway.
C) Aspirin, indomethacin and ibuprofen usually inhibit cyclooxygenases by competing with arachidonate.
D) All are right.
E) All are wrong.

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19. In mammals, RNA polymerase I catalyzes the transcription of:
A) mRNA
B) miRNAs
C) rRNA
D) tRNA
E) All are right

20. Oncologists employ 5-fluorouracil (5-FU) in chemotherapy. Which one of the following 5-FU derivates can inhibit thymidylate synthase?
A) 5-FUTP
B) 5-FdUTP
C) 5-FUDP
D) 5-FUMP
E) 5-FdUMP

21. Which kinds of RNA processing described below is through methylation and cleavage?
A) rRNA
B) tRNA
C) siRNA
D) mRNA
E) lncRNA

22. Which description of the difference between prokaryotic and eukaryotic RNA polymerase is **WRONG**?
A) Prokaryotic cells contain only one RNA polymerase.
B) The size of eukaryotic RNA polymerase is around 500 kDa.
C) Prokaryotic RNA polymerase synthesizes polycistronic RNA.
D) The eukaryotic RNA polymerase contains 10-20 subunits.
E) None of the above are wrong.

23. Which mechanism described below is **NOT** tRNA processing?
A) RNase P cut
B) RNase D cut
C) Splicing
D) CCA addition
E) None of the above all are wrong

24. Which subunit described below is **NOT** a core enzyme component of bacterial RNA polymerase?
A) A
B) B
C) β'
D) σ
E) γ

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25. Which description of the difference between DNA and RNA synthesis is **WRONG**?
A) Both DNA and RNA synthesis have highly active and efficient proofreading functions.
B) Deoxyribonucleotides are used in DNA synthesis.
C) RNA polymerase does not need a primer to initiate the synthesis of RNA.
D) U replaces T as the complementary base for A in RNA.
E) Only portions of the genome are transcribed into RNA, whereas the entire genome must be copied once and only once during DNA replication.

26. Which of the following enzyme is the rate limiting step for cholesterol synthesis?
A) HMG-CoA synthase
B) HMG-CoA reductase
C) Squalene synthetase
D) Squalene monooxygenase
E) Cholesterol 7α-hydroxylase (CYP7A1)

27. Which of the following apolipoprotein is acquired from HDL by nascent VLDL to serve as the enzyme co-factor for lipoprotein lipase ?
A) Apolipoprotein A
B) Apolipoprotein B-100
C) Apolipoprotein B-48
D) Apolipoprotein C
E) Apolipoprotein D

28. Which of the following play key role in regulating cholesterol metabolism by both uptake of cholesterol ester in liver and efflux of cholesterol in tissue?
A) ATP binding cassette transporter A1 (ABCA1).
B) ATP binding cassette transporter G1 (ABCG1).
C) Lipoprotein Lipase anchored by heparan sulfate proteoglycans.
D) Class B scavenger receptor B1 (SR-B1).
E) Lecithin cholesterol acyl transferase (LCAT).

29. Which of the following does **NOT** result in increased hormone sensitive lipase activity?
A) Adenylate cyclase activated by epinephrine.
B) Phosphorylated of perilipin.
C) Activation of cAMP-dependent protein kinase.
D) Activation of lipase phosphatase.
E) Administer phosphodiesterase inhibitor.

30. Which of the following descriptions about triacylglycerols metabolism in adipose tissue is **INCORRECT**?
A) Glycerol kinase is not expressed in adipose tissue.
B) The source of glycerol 3-phosphate used for esterification is derived from glycolysis.
C) There is a continuous cycle of lipolysis and re-esterification occurring in the adipose tissue.
D) The major enzyme regulating lipolysis in the adipose tissue is hormone-sensitive lipase.
E) Increase glucose uptake results in reduced rate of lipolysis of the adipose tissue, which is the main cause of lipid accumulation.

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31. Which of the following mechanisms is **NOT** a common way to regulate enzyme activity?
A) feedback inhibition
B) irreversible denaturation
C) covalent modification
D) feedforward activation
E) allosteric regulation

32. In Michaelis-Menten enzyme kinetics, the Km (Michaelis constant) represents:
A) The product concentration at which the reaction rate is half of Vmax.
B) The enzyme concentration at which the reaction rate is half of Vmax.
C) The enzyme-substrate complex concentration at which the reaction rate is half of Vmax.
D) The substrate concentration at which the reaction rate is half of Vmax.
E) The rate constant of the enzyme-substrate complex formation.

33. Which of the following statements describing competitive inhibition of enzymes is **NOT** correct?
A) Competitive inhibitors decrease the product concentration.
B) Competitive inhibitors are most effective at low substrate concentrations.
C) Competitive inhibitors bind to the active site of the enzyme.
D) V_{max} of an enzyme-catalyzed reaction decreases in the presence of competitive inhibitors.
E) Competitive inhibition can be overcome by increasing the concentration of the substrate.

34. Which of the following is generally **NOT** regarded as a coenzyme in enzyme-catalyzed reactions?
A) ATP
B) NADH
C) FAD
D) Heme
E) acetyl-CoA

35. What chemical force does atomic force microscopy operate upon?
A) Hydrogen bond
B) Ionic force
C) Covalent bond
D) van der Waals
E) magnetic force

36. Which amino acid is often found at the water-lipid interface of a lipid bilayer?
A) Tyrosine
B) Phenylalanine
C) Arginine
D) Alanine
E) Valine

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37. What is the highest amount of moles of acetyl-CoA that can be produced from a mole leucine after degradation?
A) 5
B) 4
C) 3
D) 2
E) 1

38. Which enzyme is it that causes homocitrullinuria when defect?
A) carbamoyl phosphate synthetase I
B) ornithine transcarbamoylase
C) ornithine permease
D) argininosuccinate synthetase
E) arginase

39. What is the primary precursor molecule for the synthesis of steroid hormones in humans?
A) Glucose
B) Amino acids
C) Cholesterol
D) Fatty acids
E) Nucleic acids

40. Which of the following statements accurately describes the mechanism of peptide hormone-receptor interaction in signaling pathways?
A) Hormones directly enter the cell and bind to cytoplasmic receptors.
B) Hormones bind to cell surface receptors, initiating an intracellular signaling cascade.
C) Receptors are synthesized by the hormone and transported to the cell membrane.
D) Hormones and receptors undergo direct fusion for signal transduction.
E) Receptors are activated by physical contact with neighboring cells.

41. In the context of hormone signaling, what primary role does the second messenger cAMP (cyclic AMP) play?
A) Direct binding to hormone molecules.
B) Activation of receptor synthesis.
C) Amplification of intracellular signals.
D) Transport of hormones across the cell membrane.
E) Inhibition of the signal transduction pathway.

42. Which of the following is a characteristic feature of steroid hormone receptors?
A) They are primarily located on the cell membrane.
B) They typically bind to DNA and regulate gene expression.
C) They activate intracellular signaling cascades through G proteins.
D) They mediate their effects through second messengers like cAMP.
E) They are exclusively found in prokaryotic cells.

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43. The anaerobic conversion of 1 mol of glucose to 2 mol of lactate by fermentation is accompanied by a net gain of:
A) 2 mol of ATP+ 1 mol of NADH
B) 2 mol of ATP + 2 mol of NADH
C) 2 mol of NADH
D) 2 mol of ATP
E) none of the above

44. Which of the following coenzyme is **NOT** required by this enzyme complex to convert pyruvate to acetyl-CoA?
A) Thiamine pyrophosphate
B) Nicotinamide adenine dinucleotide
C) Lipoamide
D) Flavin adenine dinucleotide
E) none of the above

45. Which of the following is an aldopentose?
A) Glucose
B) Ribulose
C) Ribose
D) Fructose
E) none of the above

46. Which of the following statements about the TCA cycle is correct?
A) Oxygen is used to oxidize the acetyl group carbons of acetyl-CoA in the TCA cycle.
B) Three molecules of NADH and one molecule of $FADH_2$ are produced in one turn of the TCA cycle.
C) Oxygen is not used in the TCA cycle, so the cycle can occur in anaerobic conditions.
D) The TCA cycle produces the water that is formed during the complete oxidation of glucose.
E) none of the above.

47. Which one is **NOT** a lipid modification for a protein:
A) Myristoylation
B) Palmitoylation
C) Isoprenylation
D) SUMOylation
E) Farnesylation

48. In prokaryotes, the small subunit of ribosome contains which rRNA:
A) 5S rRNA
B) 23S rRNA
C) 16S rRNA
D) 28S rRNA
E) 30S rRNA

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49. What is the key feature for a plasmid as a useful cloning vector:

A) Origin of replication

B) Multiple cloning sites

C) Antibiotic resistance genes

D) Markers for positive and negative selection

E) All of above

50. As an RNA virus, which technique is the best way to detect the infection of the SARS-CoV-2 coronavirus:

A) X-ray crystallography

B) Northern blot

C) Mass spectrometry

D) RT-PCR

E) Affinity chromatography

試題隨卷繳回