單選題 共 50 題 (A) (B) (C) (D) (E) 5 選 1 答錯不倒扣
第 1 至 25 題 每題 1.5 分 第 26 至 50 題 每題 2.5 分

1. Which of the following amino acid is branched at β-carbon?
(A) Leucine (B) Threonine (C) Serine (D) Phenylalanine (E) Histidine

2. Eric uses a computer software to simulate a 20-residue peptide in different structures. Structure A is an α-helix structure; structure B is a β-strand; structure C is a helix in the collagen structure. The length of these structures should be:
(A) C>B>A (B) C>A>B (C) B>A>C (D) A>B>C (E) B>C>A

3. Five students are discussing carbohydrate.
Student A says: Glc(1α↔β1)Fru is sucrose.
Student B says: An aldohexose has 16 stereoisomers.
Student C says: Hyaluronate and heparin are sulfated heteropolysaccharides.
Student D says: The α and β anomers of D-glucose can freely interconvert in aqueous solution without breaking any bonds.
Student E says: α-GalNAc is added to the side-chain of asparagine in N-linked glycosylation.
How many students are **correct**?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

4. Five students are discussing hexose structure.
Student A says: D-glucose and D-glucosamine are different on C2.
Student B says: D-glucose and L-glucose are different on C5.
Student C says: D-glucose and D-glucuronic acid are different on C6.
Student D says: α-D-glucose and β-D-glucose are different on C1.
Student E says: D-glucose and D-galactose are different on C4.
How many students are **correct**?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

5. Both water and glucose share an –OH that can serve as a substrate for a reaction with the terminal phosphate of ATP catalyzed by hexokinase. Glucose, however, is about a million times more reactive as a substrate than water. The best explanation is that:
(A) the larger glucose binds better to the enzyme; it induces a conformational change in hexokinase that brings active-site amino acids into position for catalysis.
(B) glucose has more –OH groups per molecule than does water.
(C) the –OH group of water is attached to an inhibitory H atom, while the glucose –OH group is attached to C.
(D) water and the second substrate, ATP, compete for the active site resulting in a competitive inhibition of the enzyme.
(E) water normally will not reach the active site because it is hydrophobic.

見背面

6. All of the following are characteristics of hemoglobin's binding of oxygen **except**:
   (A) CO_2 promotes dissociation of O_2 from hemoglobin by lowering the pH.
   (B) 2,3-*Bis*phosphoglycerate and O_2 are mutually exclusive allosteric effectors of hemoglobin.
   (C) 2,3-*Bis*phosphoglycerate promotes release of O_2 by hemoglobin.
   (D) CO_2 can bind with hemoglobin's free amino groups and stabilize deoxy-hemoglobin.
   (E) Protons promote binding of oxygen by hemoglobin.

7. Which of the following is the major advantage of a multi-enzyme complex?
   (A) It's large size enables it to span an entire membrane.
   (B) The product of one enzyme is passed directly to the next enzyme without the possibility of diffusion.
   (C) Multi-enzyme complexes are much less likely to be inhibited.
   (D) All of the above.
   (E) None of the above.

8. Glycogen phosphorylase displays allosteric activation and inhibition by multiple modes. Which of the following is a **correct** relation?
   (A) Phosphate: positive heterotropic effector.
   (B) AMP: negative heterotropic effector.
   (C) ATP: positive heterotropic effector.
   (D) Glucose-6-phosphate: negative heterotropic effector.
   (E) Phosphorylation: covalent inhibitor.

9. All are characteristics of molecular motors or motor proteins **except**:
   (A) They must be able to associate and dissociate reversibly with a polymeric protein array, a surface or substructure in the cell.
   (B) They use chemical energy (e.g., ATP) to orchestrate movement.
   (C) They transfer ATP energy into mechanical energy.
   (D) ATP hydrolysis is presumed to drive and control protein conformational changes that result in sliding or walking movement of one molecule relative to another.
   (E) All are true.

10. Which of the following statement regarding Cori cycle and pentose phosphate pathway is **false**?
   (A) Cori cycle involves in conversion of lactate produced in the muscle by regeneration of glucose in the liver.
   (B) Cori cycle involves in conversion of lactate produced in the liver by regeneration of glucose in the muscle.
   (C) The pentose phosphate pathway provides precursors for the synthesis of nucleotides.
   (D) The metabolic function of the pentose phosphate pathway is to generate NADPH and pentoses for the biosynthesis of fatty acids and nucleic acids
   (E) All are correct.

11. Which answer represents the **correct** order of electron flow between 1 to 4 factors?
   1. Cytochrome c 2. Co-enzyme Q 3. Oxygen 4. NADH
   (A) 4, 3, 2, 1 (B) 4, 1, 2, 3 (C) 4, 2, 1, 3 (D) 2, 1, 4, 3 (E) 2, 4, 1, 3

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12. Which of the following statements about pyruvate metabolism is **correct**?
    1. ΔG° of hydrolysing phosphoenopyruvate to pyruvate is negative.
    2. Under anaerobic condition, the purpose of reducing pyruvate to lactate is to regenerate NADH.
    3. Conversion of glyceraldehyde-3-hosphate to pyruvate involves enolase and pyruvate kinase.
    4. The pyruvate dehydrogenase complex uses all of the following as cofactors: NAD^+, CoA, FAD, lipoic acid, and thiamine pyrophosphate (TPP).
    5. Pyruvate carboxylase requires biotin for activity.

    (A) 1, 2, and 3 are correct. (B) 1, 3, and 5 are correct. (C) 2, 3, and 4 are correct.
    (D) 2, 4, and 5 are correct. (E) All are correct.

13. Which of the following statements regarding citric acid cycle or glyoxylate cycle is **false**?
    1. One round of citric acid cycle can generate 10 ATP.
    2. The catabolism of proteins, carbohydrates, and fatty acids all feed into the citric acid cycle at one or more points.
    3. The 2nd step of glyoxylate cycle uses malate synthase to convert 2 glyoxylate to 1 malate molecule.
    4. Glyoxylate cycle takes place in glyoxysomes during plant cells are performing photosynthesis.

    (A) 1 and 2 are false. (B) 3 and 4 are false. (C) 2 and 3 are false.
    (D) 2 and 4 are false. (E) None of above is false.

14. NADH, _____ and _____ are products of glycolysis, and the NADH must be recycled to _____ before it becomes limiting in glycolysis.
    (A) ATP; pyruvate; NAD^+ (B) NAD^+; ATP; pyruvate (C) ATP; NAD^+; ATP
    (D) ATP; pyruvate; lactate (E) None are true.

15. The endoplasmic reticulum bound enzyme that hydrolyzes glucose-6-phosphate to glucose in liver is:
    (A) glucokinase. (B) glucose oxidase. (C) hexokinase.
    (D) phosphoglucomutase. (E) glucose-6-phosphatase.

16. If both NADPH and ribose-5-P are needed in the cells which of the following best represents the net reaction of the pentose phosphate pathway?
    (A) 4 Fruc-6-P + 2 glyceraldehyde-3-P → 6 ribose-5-P
    (B) 3 Gluc-6-P + 6 $NADP^+$ → 6 NADPH + 3 CO_2 + 2 Fruc-6-P + 1 glyceraldehyde-3-P + 6 H^+
    (C) Gluc-6-P + 2 $NADP^+$ + 2 H_2O → 2 NADPH + CO_2 + ribose-5-P + 2 H^+
    (D) Gluc-6-P + 12 $NADP^+$ + 6 H_2O → 1 2 NADPH + 6 CO_2 + 12 H^+ + Pi
    (E) None of the above.

17. Shuttle vectors have the property that they:
    (A) contain promoters for the expression of the gene.
    (B) have origins of replication for two different cell types, usually bacteria and yeast.
    (C) are capable of incorporating very large DNA fragments.
    (D) contain more than one antibiotic resistant gene.
    (E) None of the above.

見背面

18. All types of aminotransferase (also known as transaminase) rely on which of the following cofactor/coenzyme?
(A) Pyridoxal phosphate (B) FAD (C) NADH
(D) Thiamine pyrophosphate (E) Biotin

19. Which two amino acids are important for ammonia assimilation(吸收) by an organism?
(A) Glu and Gln (B) Glu and Asp (C) Gln and Asn
(D) Lys and Trp (E) Lys and Arg

20. Which compound serves as the methyl group donor for biological methylation reactions?
(A) Methyl acetate (B) Methy-tetrahydrofolate (C) S-Adenosylmethionine
(D) Methanesulfonic acid (E) Methylephedrine

21. Allopurinol is a drug used to treated chronic gout(痛風) because it inhibits _____.
(A) ureate oxidase (B) adenosuccinase (C) adenosine deaminase
(D) xanthine oxidase (E) guanine deaminase

22. Carbamoyl phosphate synthetase I deficiency is an autosomal recessive metabolic disorder that causes _____ to accumulate in the blood.
(A) bicarbonate (B) ammonium (C) ADP (D) phosphate (E) CO_2

23. 5-Fluorouracil (5-FU) is used to treat cancers. It is a mechanism-based inhibitor of _____.
(A) ribonucleotide reductase (B) thymidylate synthase (C) adenylosuccinate lyase
(D) GMP synthetase (E) xanthine oxidase

24. Fatty-acid biosynthesis is vital in all biology. Which statement is **correct**?
(A) The formation of malonyl-CoA requires micronutrient such as Mn^{2+}.
(B) The fatty-acid chain lengthening occurs either in ribosome or endoplasmic reticulum.
(C) Double bonds can be introduced in Golgi body.
(D) The carbon source at sites of endoplasmic reticulum is malonyl-ACP.
(E) All of the above.

25. What effect would ketone bodies have on blood pH?
(A) Neutralize pH (B) Lower pH (C) Increase pH
(D) Fluctuate pH (E) No effect on pH

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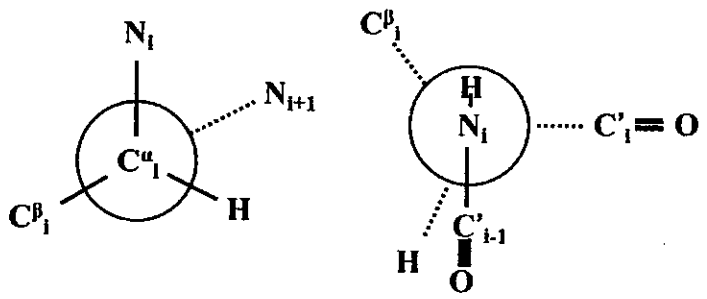
第 26 至 50 題 每題 2.5 分

26. The following figure shows the phi and psi angles of the residue X in a protein.



(A) Phi angle is +45 degree.　(B) Psi angle is –90 degree.　(C) Phi angle is +90 degree.
(D) Psi angle is +60 degree.　(E) Psi angle is +45 degree.

27. There are three proteins X, Y, and Z in 20 mM Tris (pH 7.0) solution.
1. Protein X is a homoheptamer. Its pI is 9.2. The molecular mass of each subunit of the protein X is 20,000 Da and the subunit's pI is 9.2.
2. Protein Y is a monomeric protein with molecular mass of 93,000 Da and its pI is 4.
3. Protein Z is a homodimer. Its molecular mass is 140,000 Da and its pI is 8.

Please choose the **correct** answer?
(A) When this mixture is loaded onto a cation exchange column, only protein Y can bind to the column.
(B) When this mixture is loaded onto a size exclusion column, Protein Y is last eluted.
(C) When this mixture is analyzed by a SDS-PAGE, the lowest band is protein Y.
(D) When this mixture is analyzed by a SDS-PAGE, protein X and Z can**not** be separated.
(E) When this mixture is loaded onto a cation exchange column, protein X is the first eluted protein.

28. There are four peptides. Their sequences are:
Peptide A : STRIKE
Peptide B : ALLRIGHT
Peptide C: CALENDAR
Peptide D: HESSMAN
The pI value of these four peptides should be
(A) A>B>D>C　(B) C>A>B>D　(C) B>A>C>D　(D) B>A>D>C　(E) A>B>C>D

29. Because the enzymatic reaction rate is determined by the difference in energy between ES and _____, the tighter binding of the substrate, the _____ the rate of reaction.
(A) S; higher　(B) P; lower　(C) $EX^{\ddagger}$; lower　(D) $EX^{\ddagger}$; higher　(E) S; lower

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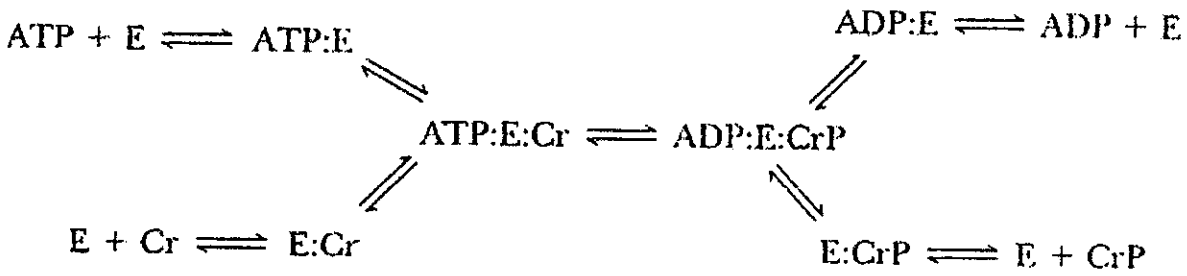
30. In the enzyme catalyzed reaction sequence below, can the E-PO_4^- intermediate be predicted and why?



(A) Yes, the mechanism is a double-displacement reaction.
(B) No, the reaction is order single-displacement.
(C) No, the reaction is double-displacement.
(D) No, the reaction is random single-displacement.
(E) None of the above.

31. Which of the following statement regarding enzyme regulation is **true**?
(A) Addition of an inhibitor to a V system results in kinetics similar to addition of a competitive inhibitor to a typical hyperbolic system.
(B) Allosteric effectors are always more powerful than covalent modification.
(C) Addition of an allosteric activator to a K system changes the plot of V vs. [S] from a sigmoidal curve to a more hyperbolic curve.
(D) The T state of an enzyme generally has more activity than the R state.
(E) None of the above is true.

32. When a mixture of glucose 6-phosphate and fructose 6-phosphate is incubated with the enzyme phosphohexose isomerase, the final mixture contains twice as much glucose 6-phosphate as fructose 6-phosphate. Which one of the following statements is most nearly **correct**, when applied to the reaction below? (R = 8.315 J/mol·K and T = 298 K)?
(A) $\Delta G'^{\circ}$ is −1.7 kJ/mol. (B) $\Delta G'^{\circ}$ is +1.7 kJ/mol. (C) $\Delta G'^{\circ}$ is incalculably large and positive.
(D) $\Delta G'^{\circ}$ is incalculably large and negative. (E) $\Delta G'^{\circ}$ is zero.

33. Which of the following statement regarding citric acid cycle is **false**?
(A) Citric acid cycle is amphibolic because it plays a role in both catabolism and anabolism.
(B) The immediate electron acceptor for the majority of the oxidative reactions of the citric acid cycle is NAD^+.
(C) Many intermediates of citric acid cycle are starting points for synthesis of a variety of compounds
(D) Animals can use fat or acetate as the carbon source because they can replenish citric acid cycle intermediates by anaplerotic reaction.
(E) All of above are false.

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34. Which of the following four statements regarding glycolysis and gluconeogenesis is **correct**?
    1. The conversion of 1 mole of fructose 1,6-bisphosphate to 2 mole of pyruvate by the glycolytic pathway results in a net formation of 2 mole of NAD^+ and 4 mole of ATP.
    2. The step of glycolysis between glyceraldehyde 3-phosphate and 3-phosphoglycerate involves oxidation of NADH to NAD^+.
    3. Acetate can**not** serve as the starting material for the synthesis of glucose via gluconeogenesis in animals.
    4. Pyruvate kinase is used in both glycolysis and gluconeogenesis.
    5. The oxidation of 3 mole of glucose by the pentose phosphate pathway may result in the production of 3 mole of pentose, 4 mole of NADPH, and 3 mole of CO_2.

    (A) 1 and 2 are correct. (B) 3 and 4 are correct. (C) 3 is correct.
    (D) 4 is correct. (E) All are correct.

35. Which of the following statements regarding the enzymes involving in citric acid cycle is **false**?
    1. Citrate synthase is inhibited by NADH and succinyl-CoA.
    2. Isocitrate dehydrogenase requires TPP, lipoic acid, FAD, and NAD^+ as cofactors.
    3. α-ketoglutarate dehydrogenase is activated by ADP and NAD^+.
    4. Reactions catalyzed by Succinate dehydrogenase can be blocked by malonate.
    5. The reaction catalyzed by fumarase is a dehydration reaction.

    (A) 1 and 3 are false. (B) 2 and 5 are false. (C) 1 and 4 are false.
    (D) 2 and 3 are false. (E) 4 and 5 are false.

36. Which statement about ATP synthesis in mitochondria is **false**?
    (A) To form proton gradient for ATP synthesis in mitochondria requires various proteins that serve as electron carriers to be oriented asymmetrically with respect to the two sides of the inner mitochondrial membrane.
    (B) The proton gradient that is generated by electron transfer reactions is used to induce a conformational change in the ATP synthase.
    (C) Evidence for chemiosmotic coupling as the mechanism for ATP synthesis is based on the observation that many different kinds of substances can serve as uncouplers.
    (D) The F_0 part of the ATP synthase serves as a proton channel, and the F_1 part of the ATP synthase is the site of ATP formation.
    (E) None of above is false.

37. Seven of the ten reactions of glycolysis are reversible (ΔG near zero) and can be used in reverse of glycolysis for gluconeogenesis. The three irreversible reactions are catalyzed by:
    (A) hexokinase, phosphoglycerate kinase, and pyruvate kinase.
    (B) triose phosphate isomerase, phosphoglycerate mutase, and pyruvate kinase.
    (C) enolase, phosphoglycerate kinase, and phosphofructokinase-1.
    (D) hexokinase, phosphoglucoisomerase, and glyceraldehyde-3-phosphate dehydrogenase.
    (E) hexokinase, phosphofructokinase-1, and pyruvate kinase.

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38. Addition of water across a double bond, or removal of water to form a double bond, is catalyzed by a subclass of the lyase class of enzymes. Which of the following glycolytic enzymes would be a lyase?
(A) Glyceraldehyde-3-phosphate dehydrogenase (B) Triose phosphate isomerase
(C) Phosphoglycerate mutase (D) Hexokinase (E) Enolase

39. If levels of _____ and/or _____ are low, pyruvate is directed primarily into _____; but if they are high, pyruvate is converted into _____ for gluconeogenesis.
(A) NADH; ATP; glycolysis; oxaloacetate (B) ATP; NADPH; glycolysis; acetyl-CoA
(C) ATP; acetyl-CoA; TCA cycle; oxaloacetate (D) NAD^+; acetyl-CoA; TCA cycle; acetyl-CoA
(E) ATP; acetyl-CoA; glycolysis; malate

40. The 6-phosphogluconate dehydrogenase reaction in the pentose phosphate pathway is an example of _____ and results in the production of _____.
(A) substrate-level phosphorylation; ATP (B) oxidative-decarboxylation; NADPH
(C) TPP-assisted decarboxylation; NADH (D) phosphate addition; ADP (E) None of the above.

41. When a cell with the pentose phosphate pathway has need for more pentose phosphates, but **not** for additional NADPH:
(A) glucose-6-phosphate dehydrogenase is activated.
(B) the oxidative and non-oxidative enzymes of the pentose phosphate pathway are active.
(C) the non-oxidative enzymes produce pentose phosphates from fructose-6-phosphate and glyceraldehyde-3-phosphate.
(D) all enzymes of glycolysis and pentose phosphate pathway are active.
(E) None are true.

42. In the Southern hybridization procedure, the gel after electrophoresis is treated with NaOH and then neutralized before blotting. What is the primary function of the alkaline treatment?
(A) It neutralizes any acid soluble impurities in the gel.
(B) It cleaves the DNA into smaller fragments to permit greater efficiency of transfer.
(C) It inactivates any restriction endonucleases that may be in the gel..
(D) It neutralizes any acidic phosphate groups that might prevent hybridization.
(E) It denatures the duplex DNA to single-stranded DNA (ssDNA).

43. A characteristic of the glycerophosphate shuttle is:
(A) It shuttles NADH across the mitochondrial membrane to yield 2.5 ATP/ADH.
(B) It shuttles "NADH electron equivalents" across the mitochondrial membrane to yield 1.5 ATP/NADH.
(C) It only operates efficiently when the [NADH] in the cytoplasm is higher than in the matrix.
(D) Malate is a key component in the shuttle process.
(E) Aspartate is a key component in the shuttle process.

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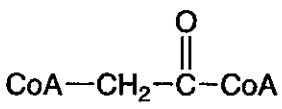
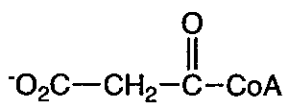
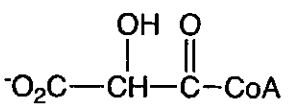
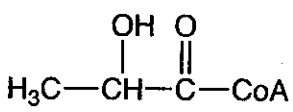
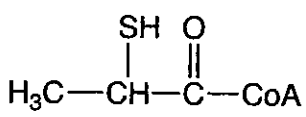
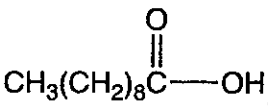
44. Oxaloacetate uniformly labeled with ^{14}C (i.e., with equal amounts of ^{14}C in each of its carbon atoms) is condensed with unlabeled acetyl-CoA. After a single pass through the citric acid cycle back to oxaloacetate, what fraction of the original radioactivity will be found in the oxaloacetate?
(A) All (B) 1/2 (C) 1/3 (D) 1/4 (E) 3/4

45. The oxidation of a particular hydroxy substrate to a keto product by mitochondria has a P/O ratio of less than 2. The initial oxidation step is very likely directly coupled to the:
(A) oxidation of a flavoprotein. (B) oxidation of a pyridine nucleotide.
(C) reduction of a flavoprotein. (D) reduction of a pyridine nucleotide.
(E) reduction of cytochrome a_3.

46. Which of the following statements concerning the biosynthesis of fatty acids is **false**?
(A) Fatty acid synthesis occurs in the cytosol of many organisms but in the chloroplasts of plants.
(B) Biosynthesis of fatty acids requires the participation of a three-carbon intermediate, malonyl-CoA, which is formed via the reaction catalyzed by acetyl-CoA carboxylase.
(C) In nonphotosynthetic eukaryotes, nearly all the acetyl-CoA used in fatty acid synthesis is formed in mitochondria, and the acetyl group used in fatty acid synthesis is shuttled out of mitochondria as citrate.
(D) If malonyl-CoA is synthesized from $^{14}CO_2$ and unlabeled acetyl-CoA, and the labeled product is then used for fatty acid synthesis, the final product (fatty acid) will have radioactive carbon in every even-numbered C-atom.
(E) Fatty acid biosynthesis uses NADPH exclusively, whereas oxidation uses NAD^+ exclusively.

47. What of the following is the essential ingredient for the biosynthesis of fatty acid?
(A) 
(B) 
(C) 
(D) 
(E) 

48. Given the saturated fatty acid,  , how many could ATPs be produced by the β-oxidation of the fatty acid?
(A) 68 (B) 62 (C) 64 (D) 48 (E) 50

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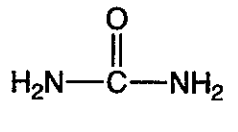
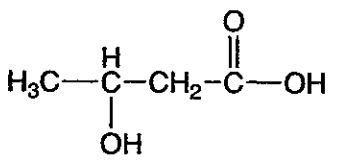
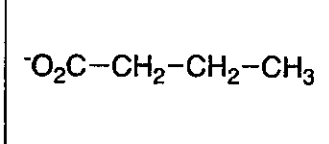
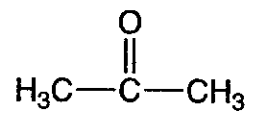
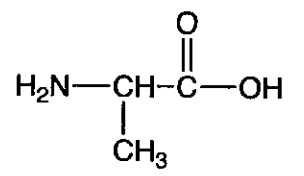
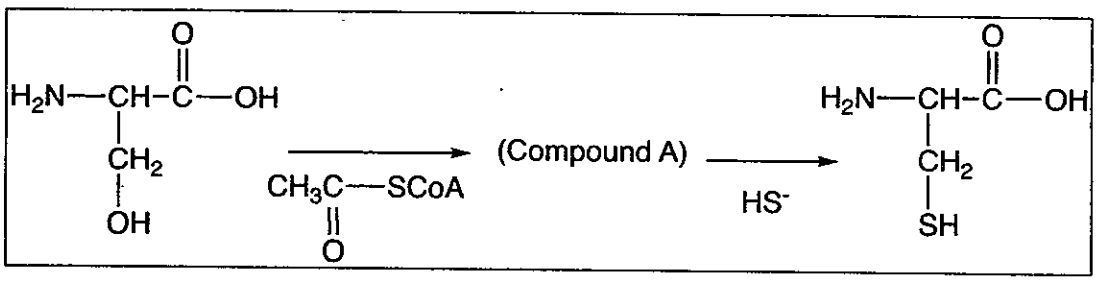
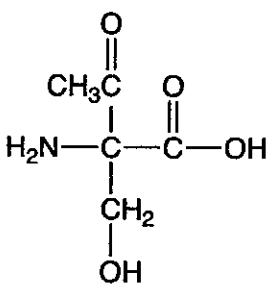
49. Of the following biochemical compounds, what are ketone bodies?

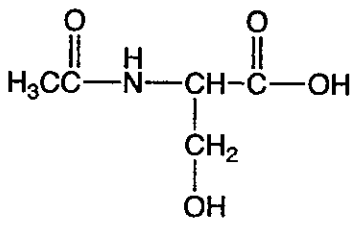
				
①	②	③	④	⑤

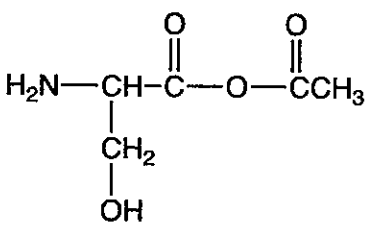
(A) ①④　(B) ②⑤　(C) ①③　(D) ②④　(E) ④⑤

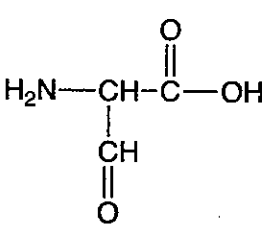
50. Shown is the biological synthesis of cysteine from serine in bacteria. What is the chemical structure of compound A?

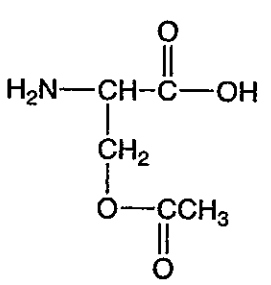


(A) 

(B) 

(C) 

(D) 

(E) 

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