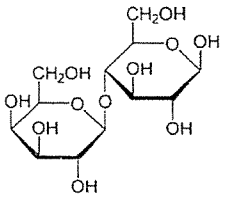
單選題　共 50 題　(A) (B) (C) (D) (E) 5 選 1　答錯不倒扣
第 1 至 25 題 每題 1.5 分　第 26 至 50 題 每題 2.5 分

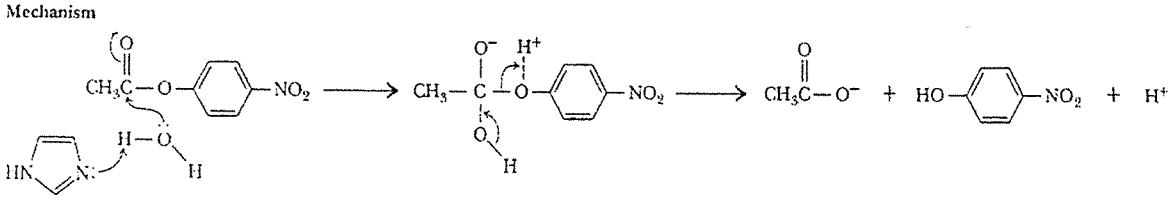
1. Which description is **correct**?
   (A) Mannose is a C4 epimer of glucose.
   (B) D-glucose and D-glucuronic acid is different on C6.
   (C) Dextran is obtained from algae.
   (D) Hyaluronan is sulfated hetereopolysaccharide.
   (E) α-Keratin is a protein which provides strength in connective tissue.

2. Which description is **correct**?
   (A) Every turn of α-helix is 3.6 Å in length.
   (B) Amyloid is homopolysaccharide and composed of glucose linked by the α1→4 linkage.
   (C) Interconversion between α-D-Glc and β-D-Glc is called mutarotation.
   (D) Aldohexose has eight stereoisomers.
   (E) Glc-β1,4-Glc could be drawn as the structure below.



3. In the catalytic triad of chymotrypsin protease, _____ increases the basicity of _____, thus allowing deprotonation of _____ to serve as a nucleophile.
   (A) Ser, His, Asp　(B) His, Ser, Asp　(C) Ser, His, His
   (D) Asp, His, Ser　(E) Cys, His, Ser

4. The catalytic mechanism below is an example of:



   (A) covalent nucleophilic catalysis.　(B) covalent electrophilic catalysis.
   (C) specific base catalysis.　(D) general base catalysis.　(E) general acid catalysis.

5. Which statement below about contrasting Hb and Mb is **false**?
   (A) Hb shows sigmoidal, whereas Mb shows hyperbolic oxygen saturation curves.
   (B) Hb shows cooperativity, whereas Mb does not.
   (C) Hb binds O_2 more tightly than Mb.
   (D) Oxygen binds to a ferrous ion in both proteins.
   (E) Hb-oxygen binding is dependent on physiological changes in pH, whereas Mb-oxygen binding is not.

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6. Which of the following statements regarding enzyme regulation is **true**?
   (A) The conversion of trypsinogen to trypsin is an example of zymogen activation.
   (B) Allosteric effectors are always more powerful than covalent modification.
   (C) Addition of an inhibitor to a reaction system results in kinetics similar to addition of a competitive inhibitor to a typical hyperbolic system.
   (D) The T state of an enzyme generally has more activity than the R state.
   (E) All are true.

7. Which statement regarding glycogen and its metabolism is **correct**?
   1. Highly branched glycogen is less soluble than unbranched glycogen.
   2. Having more ends effectively increases the rate of glycogen synthesis and breakdown.
   3. To enter glycolysis, glucose-1-phosphate must undergo isomerization to glucose-6-phosphate by phosphoglucomutase.
   4. To replenish glucose in the bloodstream, glucose-1-phosphate must be hydrolyzed to free glucose by glucose-1-phosphatase.

   (A) 1, 2, and 3 are correct. (B) 2, 3, and 4 are correct. (C) 1, 2, and 4 are correct.
   (D) All are correct. (E) None is correct.

8. The metabolic function of the pentose phosphate pathway is to?
   (A) act as a source of ADP biosynthesis.
   (B) participate in oxidation-reduction reactions during the formation of H_2O.
   (C) provide intermediates for the citric acid cycle.
   (D) generate NADPH and pentoses for the biosynthesis of fatty acids and nucleic acids.
   (E) synthesize phosphorus pentoxide.

9. Which one has ether bond rather than ester bond?
   (A) Phosphotidylcholine (B) Phosphotidylserine (C) Plasmalogen
   (D) Phosphotidylethanolamine (E) Sphingomyosin

10. Which one is the basic unit for the synthesis of cholesterol?
    (A) Malonyl-CoA (B) Serine (C) Palmitoyl-coA
    (D) Isoprene (E) L-glycerol 3-phosphate

11. How does a bear obtain the most of water during its hibernation?
    (A) Glucose oxidation (B) Fat oxidation (C) Fatty acid synthesis
    (D) Glycogen breakdown (E) Urine and feces

12. Which one is **not** the product of glycerophospholipid breakdown as signal molecules?
    (A) Arachidonic acid (B) Lysophosphatidic acid (C) Diacylglycerol
    (D) Inositol phosphates, including inositol-1,4,5-triPhosphate (E) Palmitate

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13. Which one is **not** the difference between fatty acid breakdown and biosynthesis?
(A) Intermediates linked to -SH groups of acyl carrier proteins
(B) Synthesis in cytosol; breakdown in mitochondria
(C) Synthesis are dependent on the fatty acid synthase.
(D) Biosynthesis uses NADPH/$NADP^+$; breakdown uses NADH/NAD^+.
(E) Biosynthesis in ER; breakdown in cytosol.

14. Which one proceeds with α oxidation?
(A) Palmitic acid (16:0) (B) Lenoleic acid ($18:2^{\Delta 9,12}$) (C) Phytanic acid
(D) Eicosapentaenoic acid ($20:5^{\Delta 5,8,11,14,17}$) (E) Long chain odd number lipid

15. In phosphoryl group transfer reactions, the _____ of the nucleotide serves as an information symbol, channeling the nucleotide to appropriate metabolic activities.
(A) diphosphate anhydride (B) base (C) sugar-phosphate ester
(D) pentose (E) phosphate-Mg^{2+} complex

16. Urea and formamide are agents that denature double-stranded DNA (dsDNA) by
(A) forming ionic bonds with the backbone phosphates.
(B) breaking the phosphodiester bond.
(C) changing the pH to cause hydrolysis.
(D) competing effectively with the H-bonding between the base pairs.
(E) intercalating between base pairs and disrupting van der Waals interactions.

17. 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 denatures the duplex DNA to single-stranded DNA (ssDNA).
(C) It neutralizes any acidic phosphate groups that might prevent hybridization.
(D) It inactivates any restriction endonucleases that may be in the gel.
(E) It cleaves the DNA into smaller fragments to permit greater efficiency of transfer.

18. When transketolase acts on fructose 6-phosphate and glyceraldehyde 3-phosphate, the products are:
(A) dihydroxyacetone phosphate and glucose 6-phosphate.
(B) xylulose 5-phosphate and erythrose 4-phosphate.
(C) 3-phosphoglycerate and two molecules of glyceraldehyde 3-phosphate.
(D) xylulose 5-phosphate and ribose 5-phosphate.
(E) 3-phosphoglycerate and glyceraldehyde 3-phosphate.

19. The _____ of pyruvate to acetyl-CoA is catalyzed by _____.
(A) decarboxylation; pyruvate decarboxylase
(B) carboxylation; pyruvate carboxylase
(C) transacylation; pyruvate transacylase
(D) dehydration; pyruvate dehydration complex
(E) decarboxylation; pyruvate dehydrogenase complex

見背面

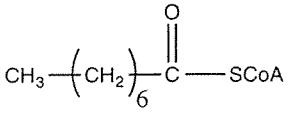
20. The anaplerotic reactions associated with the TCA cycle are a result of the:
(A) use of many of the TCA cycle intermediates in biosynthesis.
(B) decarboxylation reactions.
(C) irreversible nature of some of the TCA cycle reactions.
(D) oxidative nature of the TCA cycle.
(E) production of GTP and reduced coenzymes.

21. ATP made in glycolysis and the TCA cycle is the result of _____ phosphorylation, and NADH-dependent ATP synthesis is the result of _____ phosphorylation.
(A) oxidative; electron　(B) proton-gradient; oxidative　(C) substrate-level; oxidative
(D) substrate-level; electron　(E) oxidative; substrate-level

22. The reaction, ATP + AMP → 2ADP, is catalyzed by:
(A) adenylatephosphorylase.　(B) AMP-phosphotransferase.　(C) ADP mutase.
(D) adenylate kinase.　(E) None are true.

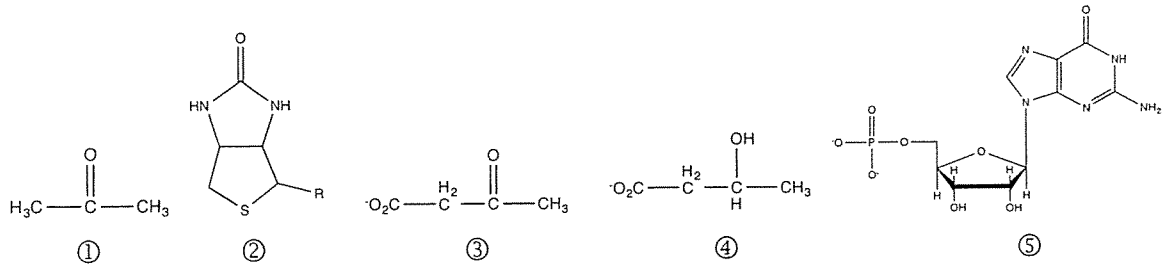
23. The brain prefers to use _____ as fuel, but under prolonged fasting or starvation it adapts to use _____.
(A) fatty acids; glucose.　(B) glucose; β-hydroxybutyrate.　(C) glycogen; fatty acids.
(D) glucose; fatty acids.　(E) β-hydroxybutyrate; amino acids.

24. Given the following saturated fatty acid, how many β-oxidation cycles does it require to completely metabolize the above fatty acid to acetyl-CoA?



(A) 2.　(B) 3.　(C) 4.　(D) 5.　(E) 6.

25. Ketone bodies are produced by the β-oxidation of an excess of acetyl-CoA. Which of the followings are ketone bodies?



(A) ①②③　(B) ①③④　(C) ②④　(D) ③④　(E) ②④⑤

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第 26 至 50 題 每題 2.5 分

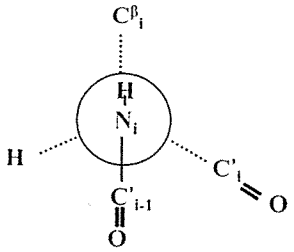
26. Peptide A has amino acid sequence "CKGHNLRYEKDSAI".

1. Sophia used trypsin to digest the peptide. She obtained a peptapeptide. The pI of this pentapeptide is higher than 10.
2. Peptide A does **not** contain any residue with two chiral centers.
3. Peptide A contain only one aromatic residue.
4. Peptide A does **not** contain any residue which could be phosphorylated.
5. Peptide A does **not** contain any residue which could be modified with *N*-linked glycan in glycoproteins.

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

27. Please choose the **correct** answer(s) from the following descriptions:

1. A residue which has the dihedral angle shown below might be in an alpha-helix.

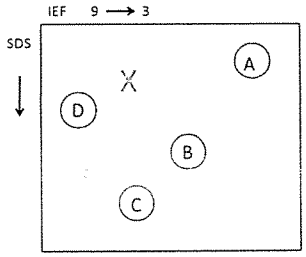


2. Glc(α1→4)Glc linkage appears in the most abundant homopolysaccharide in the world.
3. Phosphorylase releases glucose-1-P from the reducing end of amylopectin.
4. The peptide with the sequence "AFAKLWPIEACQA" does **not** contain any cleavage site for cyanogen bromide.
5. The amino acid "Trp" has the highest extinction coefficient at UV280 nm.

(A) 1, 3, 4 are correct. (B) Only 2 is **in**correct. (C) 2, 5 are **in**correct.
(D) 1, 4, 5 are correct. (E) Only 5 is correct.

28. There are four proteins A, B, C, D. (Protein A: homotetramer, M_r = 280,000, pI =6; Protein B: monomer, M_r = 113,000, pI=7; Protein C: monomer, M_r = 13,000, pI=8; Protein D is unknown). When Samuel used a gel filtration column to separate them, the elution sequence is A-D-B-C. Samuel dissolved the protein mixture in 20 mM phosphate buffer (pH 8) and loaded to a anion exchange column equilibrated with the same buffer. Protein D could not bind to this column. On an SDS-PAGE gel, protein D runs faster than protein B and slower than protein C.

1. If Samuel used SDS-PAGE to separate A, B, and C. The sequence of the protein bands shown in gel from top to bottom should be A-B-C.
2. The molecular mass of protein D must be between 13 and 113 kDa.
3. The pI of protein D might be higher than 8.
4. D is not a monomer.
5. If Samuel used 2-Dimensional electrophoresis to separate them. We could predict that the relative positions of these four proteins is like the image below.



(A) 1, 5 are correct. (B) Only 2 is **in**correct. (C) 1, 3, 4 are correct.
(D) 2, 4 are correct. (E) 3, 4 are correct.

29. The following data were obtained in a study of an enzyme known to follow Michaelis-Menten kinetics:

V_0 (mol/min)	Substrate added (mmol/L)
217	0.8
325	2
433	4
488	6
647	1,000

The K_M for this enzyme is approximately:
(A) 1 mM. (B) 2 mM. (C) 4 mM. (D) 6 mM. (E) 1000 mM.

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30. Carbonic anhydrase has two substrates, carbon dioxide and bicarbonate, which are both converted to carbonic acid. Kinetic data for each is given below. While determining the kinetics of HCO_3^- as a substrate, how would the addition of CO_2 effect the reaction if the rates were measured by the disappearance of bicarbonate?

Substrate	K_M (mM)	k_{cat} (sec^{-1})	k_{cat}/K_M ($mM^{-1}sec^{-1}$)
CO_2	12	1×10^6	8.3×10^4
HCO_3^-	26	4×10^5	1.5×10^4

(A) CO_2 would increase the activity of the enzyme.
(B) CO_2 would cause an apparent decrease in the K_M for HCO_3^-.
(C) CO_2 would act as a noncompetitive inhibitor.
(D) CO_2 would act as a competitive inhibitor.
(E) None of the above is correct.

31. Which of the following statements regarding enzymes and transition states is **true**?
(A) Stabilization of the transition state must be less than stabilization of ES for catalysis to occur.
(B) The transition state conformation of an enzyme catalyzed reaction is identical to the conformation seen in the uncatalyzed transition state.
(C) Binding of substrate to an enzyme often causes strain, thus promoting transition state formation.
(D) Formation of the transition state always assures that the reaction will proceed to product.
(E) All are true.

32. Which of the following statements is **true** regarding enzyme pathways?
(A) The most effective way to control a pathway is to regulate every enzyme in the pathway.
(B) Metabolic pathways are necessary since enzymes usually catalyze only one specific reaction.
(C) A regulatory enzyme is regulated only by molecules within the given pathway.
(D) An enzyme pathway always proceeds in only one direction, never in reverse.
(E) None of the above are true.

33. During strenuous exercise, the NADH formed in the glyceraldehyde 3-phosphate dehydrogenase reaction in skeletal muscle must be reoxidized to NAD^+ if glycolysis is to continue. Which of the following is the most important reaction involved in the reoxidation of NADH?
(A) glucose 6-phosphate → fructose 6-phosphate
(B) dihydroxyacetone phosphate → glycerol 3-phosphate
(C) pyruvate → lactate
(D) isocitrate → α-ketoglutarate
(E) oxaloacetate → malate

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34. In glycolysis, fructose 1,6-bisphosphate is converted to two products with a standard free-energy change ($\Delta G'^{\circ}$) of 23.8 kJ/mol. Under what conditions (encountered in a normal cell) will the free-energy change (ΔG) be negative, enabling the reaction to proceed to the right?
(A) Under standard conditions, enough energy is released to drive the reaction to the right.
(B) If the concentrations of the two products are high relative to that of fructose 1,6-bisphosphate.
(C) The reaction will not go to the right spontaneously under any conditions because the $\Delta G'^{\circ}$ is positive.
(D) When there is a high concentration of fructose 1,6-bisphosphate relative to the concentration of products.
(E) None of the above.

35. In normal mitochondria which statement regarding the rate of NADH consumption is **correct**?
1. Be increased in active muscle, decreased in inactive muscle.
2. Be very low if the ATP synthase is inhibited, but increase when an uncoupler is added.
3. Decrease if mitochondrial ADP is depleted.
4. Decrease when cyanide is used to prevent electron transfer through the cytochrome $a + a_3$ complex.

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

36. Which of the following is **correct** concerning the mitochondrial ATP synthase?
(A) When it catalyzes the ATP synthesis reaction, the $\Delta G'^{\circ}$ is actually close to zero.
(B) It consists of F_o and F_1 subunits, both of which are transmembrane (integral) polypeptides.
(C) It can synthesize ATP after it is extracted from broken mitochondria.
(D) It is actually an ATPase and only catalyzes the hydrolysis of ATP.
(E) It catalyzes the formation of ATP even though the reaction has a large positive $\Delta G'^{\circ}$.

37. The NADH produced by glycolysis produces different amounts of ATP in different tissues. This is because:
(A) some tissues can utilize cytosolic NADH to produce ATP; however, some tissues cannot.
(B) different tissues have different energy need.
(C) different tissues have different shuttle system to transport cytosolic NADH into mitochondria.
(D) the efficiency of the respiratory chain in different tissues are different.
(E) the averaged amounts of mitochondria in the cells of different tissues are different.

38. P/O ratio in electron transport and oxidative phosphorylation is defined as:
(A) molecules of phosphate released from ATP per oxygen utilized by muscle tissue.
(B) molecules of ATP formed per two electrons flowing through electron transport chain.
(C) P_i uptake per oxygen atom by mitochondria.
(D) ratio of atoms of phosphorous to oxygen in phosphate (P_i).
(E) None of the above.

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39. Which of the following statements about mitochondrial transport systems is(are) **correct**?
    1. Glycerophosphate shuttle converts cytosolic $FADH_2$ to mitochondrial NADH.
    2. Glycerophosphate shuttle transports "NADH electron equivalents" across the mitochondrial membrane to yield 1.5 ATP/NADH.
    3. Malate-aspartate shuttle converts cytosolic NADH to mitochondrial $FADH_2$.
    4. One form of glycerol-3-phosphate dehydrogenase in the glycerophosphate shuttle is a flavoprotein.
    5. ATP-ADP translocase transfers ATP and a proton from matrix to cytosol while transferring ADP from cytosol to matrix.

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

40. 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) reduction of a pyridine nucleotide. (B) oxidation of a flavoprotein.
    (C) reduction of cytochrome a_3. (D) oxidation of a pyridine nucleotide.
    (E) reduction of a flavoprotein.

41. 2,4-Dinitrophenol and oligomycin inhibit mitochondrial oxidative phosphorylation. 2,4-Dinitrophenol is an uncoupling agent; oligomycin blocks the ATP synthesis reaction itself. Therefore, 2,4-dinitrophenol will:
    (A) diminish O_2 consumption in the presence of oligomycin.
    (B) block electron transfer in the presence of oligomycin.
    (C) allow oxidative phosphorylation in the presence of oligomycin.
    (D) allow electron transfer in the presence of oligomycin.
    (E) None of the above.

42. Consider a liver cell carrying out the oxidation of glucose under aerobic conditions. Suppose that we added a very potent and specific inhibitor of the mitochondrial ATP synthase, completely inhibiting this enzyme. Which of the following descriptions is(are) **correct**?
    1. The rate of oxygen consumption will increase.
    2. ATP production in the cell will quickly drop to zero.
    3. The citric acid cycle will speed up to compensate.
    4. Mitochondrial ATP synthesis will cease, but to compensate, cells will accelerate the production of ATP by glycolysis, preventing ATP levels from dropping to zero.
    5. The cell will switch to fatty acid oxidation as an alternative to glucose oxidation.

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

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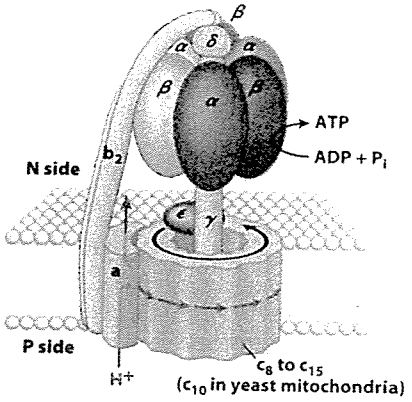
43. A diagram of ATP synthase is shown.

If an ATP synthase contains 12 c subunits, 3 α subunits and 3 β subunits, how many protons must pass through this complex for every ATP molecule synthesized and transported to the cytosol, assuming that each ATP synthesized requires one proton for transport to the cytosol?

(A) 3　(B) 4　(C) 5　(D) 12　(E) 13



44. Bacteria and other prokaryotic cells have the capacity to get more ATP/glucose oxidized than eukaryotic cells because _____, so they are more efficient.
(A) they have a simpler ATP synthase
(B) they **don't** have to use shuttles to reoxidize reduced nucleotides
(C) they do **not** have to translocate ATP-ADP across the mitochondrial membranes
(D) they use an electron transport chain that translocates more protons
(E) their glucose oxidation pathways are different from the pathways in eukaryotes

45. Which of the following statements about the reactions involved in the synthesis of deoxyribonucleotides is **false**?
(A) Deoxyribonucleotides are derived from the corresponding ribonucleotides by direct reduction at the 2'-carbon atom of the D-ribose to form the 2'-deoxy derivative.
(B) Formation of deoxyribonucleotides is catalyzed by ribonucleotide reductase, in which its substrates are ribonucleoside diphosphates.
(C) Glutathione serves as a reducing agent for glutaredoxin in deoxyribonucleotide synthesis.
(D) Ribonucleotide reductase is notable in that its reaction involves free radicals in biochemical transformations.
(E) The immediate precursor of thymidylate (dTMP) is dUMP. The conversion of dUMP to dTMP is a reaction of deamination.

46. Which amino acids are transaminated by the branched-chain amino acid aminotransferase?
(A) valine, isoleucine, and leucine.　(B) proline, valine, and alanine.
(C) leucine, isoleucine, and phenylalanine.　(D) leucine, isoleucine, and proline.
(E) lysine, valine, and leucine.

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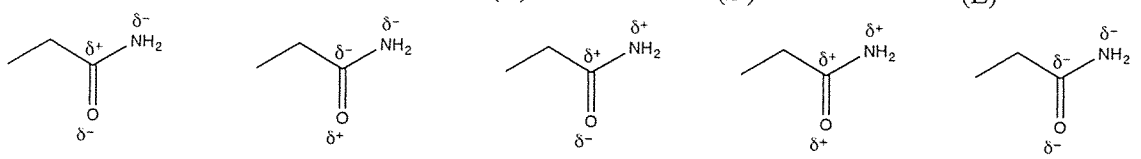
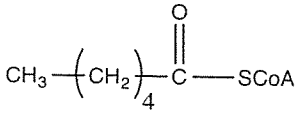
47. Threonine is converted into acetyl-CoA and pyruvate while proline is converted into α-ketoglutarate. Classify each of these amino acids.
(A) Threonine is ketogenic; proline is ketogenic.
(B) Threonine is ketogenic and glucogenic; proline is ketogenic.
(C) Threonine is ketogenic; proline is glucogenic.
(D) Threonine is ketogenic and glucogenic; proline is glucogenic.
(E) None of the above.

48. Which of the following statements explains why allopurinol is able to prevent gout?
(A) It binds to uric acid thus preventing the formation of uric acid crystals.
(B) It acts as a diuretic to increase the elimination of uric acid.
(C) It inhibits the production of uric acid and allows for the more highly soluble xanthine and hypoxanthine to be excreted from the body.
(D) It stimulates the purine salvage pathway, thus eliminating the need for production of uric acid.
(E) None of the above.

49. Which of the following polarity pattern is **correct**?
(A) (B) (C) (D) (E)



50. Given this saturated fatty acid (shown below), how many ATPs can be produced when the fatty acid is metabolized completely?



Some useful information:
i. In the TCA cycle, one acetyl-CoA gives 3 moles of NADH, 1 mole of $FADH_2$, and 1 mole of GTP.
ii. One mole of NADH produces 2.5 mole of ATP.
iii. One mole of $FADH_2$ produces 1.5 mole of ATP.

(A) 30.　(B) 34.　(C) 36.　(D) 50.　(E) 52.

試題隨卷繳回