Multiple Choice

1. The synthesis of glycogen from glucose is known as:
   a) glycogenolysis
   b) gluconeogenesis
   c) glycogenesis
   d) the Embden-Myerhof pathway

2. When a muscle depletes its supply of ATP, the next molecule used as an energy source is:
   a) pyruvate
   b) muscle glycogen
   c) blood glucose
   d) GTP

3. Which of the following does not occur when blood reaches the lungs?
   a) CO₂ is removed from the blood
   b) Blood acidity decreases
   c) Lactate is oxidized
   d) More O₂ binds to hemoglobin

4. McArdle disease is a condition in which:
   a) the body loses the ability to produce insulin.
   b) the liver loses the ability to export glucose.
   c) tissues lose the ability to respond to insulin.
   d) muscles lose the ability to break down glycogen.

5. The Embden-Myerhof pathway produces ATP by:
   a) anabolism
   b) substrate-level phosphorylation
   c) reducing carbon dioxide
   d) oxidative phosphorylation

6. In yeast, pyruvate is converted to ethanol in order to:
   a) recycle NADH to NAD+
   b) directly produce ATP
   c) produce oxygen gas
   d) none of these

7. The single oxidation-reduction reaction in the Embden-Myerhof pathway yields the following product:
   a) glyceraldehyde-3-phosphate
   b) phosphoenolpyruvate
   c) 1,3-bisphosphoglycerate
   d) pyruvate
8. Glycolysis can be termed as:
   a) anaerobic and catabolic
   b) aerobic and anabolic
   c) aerobic and catabolic
   d) anaerobic and anabolic

9. For each glucose molecule metabolized in the Embden-Meyerhof pathway there is a net production of:
   a) 4 ATP
   b) 8 ATP
   c) 6 ATP
   d) 2 ATP

10. How many net moles of ATP will be produced if 0.5 mole of glucose passes through the glycolysis pathway?
    a) 0.5 mol
    b) 1 mol
    c) 2 mol
    d) 4 mol

11. Which the following processes is not restricted to the mitochondria in eucaryotic cells?
    a) the citric acid cycle
    b) substrate-level phosphorylation
    c) electron transport
    d) oxidative phosphorylation

12. Coenzyme A binds to an acetyl group via a:
    a) phosphoric acid anhydride linkage
    b) carboxylic acid ester linkage
    c) carboxylic acid anhydride linkage
    d) thioester linkage

13. Type 1 diabetes mellitus is a disease which is caused by a shortage of:
    a) glucagon
    b) adrenaline
    c) glycogen
    d) insulin

14. The first substance produced in the citric acid cycle is:
    a) Acetyl-CoA
    b) Oxaloacetate
    c) ATP
    d) citrate

15. The end product(s) of anaerobic catabolism of glucose in muscle tissue is(are):
    a) carbon dioxide and water
    b) lactate
    c) sucrose
d) ethanol

16. If the glucose level in the body is high, the body produces more:
   a) insulin
   b) thiamin
   c) glucagon
   d) epinephrine

17. If the glucose level in the body is high, it is called:
   a) homeostasis
   b) hyperglycemia
   c) hypoglycemia
   d) glycogenolysis

18. In muscle glycolysis, pyruvate is converted to:
   a) lactate
   b) glucose
   c) ethanol
   d) acetyl-CoA

19. Liver glycogen can increase blood glucose levels via the process of:
   a) glycolysis
   b) glycogenesis
   c) glycogenolysis
   d) gluconeogenesis

20. The nucleotide product of the citric acid cycle is:
   a) ATP
   b) GDP
   c) CTP
   d) GTP

21. How many carbon dioxide molecules are produced during one citric acid cycle?
   a) 0
   b) 3
   c) 1
   d) 2

22. In the liver, gluconeogenesis can be used to convert the following compound(s) into glucose:
   a) glycerol
   b) lactate
   c) some amino acids
   d) all of these

23. In the Embden-Meyerhof pathway, a high energy phosphate bond is found in:
   a) 3-phosphoglyceric acid
b) glucose-6-phosphate  
c) phosphoenolpyruvate  
d) 2-phosphoglyceric acid

24. Another name for the citric acid cycle is:
   a) Embden-Myerhof pathway  
b) pyruvic acid cycle  
c) Kreb's cycle  
d) glycogenesis

25. The most efficient pathway(s) for obtaining energy from reduced carbons is(are):
   a) glycolysis  
b) the citric acid cycle  
c) the citric acid cycle plus electron transport and oxidative phosphorylation  
d) glycolysis plus substrate-level phosphorylation

26. When blood-glucose is above a normal level the following condition results:
   a) hypoglycemia  
b) hyperglycemia  
c) fasting condition  
d) homeostasis

27. Which hormone is not paired with its function?
   a) glucagon/lowers blood-glucose level  
b) oxytocin/muscle contraction  
c) prolactin/milk production  
d) epinephrine/increases blood-glucose level

28. Which hormone is not paired with its function?
   a) Thyroxin/increases metabolic rate  
b) progesterone/stimulates female sex characteristics  
c) vasopressin/stimulates uterine contraction  
d) cortisone/controls water balance

29. For every glucose molecule that is metabolized in glycolysis in humans, there is a net production of:
   a) 4 ATP + 2 pyruvate + 2 NADH  
b) 2 ATP + 2 pyruvate + 2 NADH  
c) 2 ATP + 2 lactate  
d) 4 ATP + 2 lactate + 2 NAD+

30. The conversion of pyruvate to acetyl-CoA requires the following vitamins:
   a) riboflavin and thiamine only  
b) riboflavin, thiamine and vitamin B12  
c) riboflavin, thiamine, and niacin  
d) thiamine and vitamin B12
31. Which of the following substance(s) is/are not found in coenzyme A?
   a) adenine and ribose
   b) thioethanolamine
   c) thiamine
   d) pantothenic acid

32. Which of the following is not product of the Kreb's cycle?
   a) oxaloacetate
   b) carbon dioxide
   c) ATP
   d) FADH2

33. The anaerobic conversion of glucose to pyruvate is called:
   a) glycolysis
   b) Embden-Meyerhof pathway
   c) fermentation
   d) anaerobic glycolysis

34. Which of the following is not true of a type 1 diabetic?
   a) They are unable to produce insulin.
   b) They lose the ability to import glucose into muscle.
   c) They typically face a life of continuing health problems.
   d) Their muscles become starved for glucose.

35. The Embden-Meyerhof pathway produces:
   a) one ATP per glucose molecule
   b) two NADH per glucose molecule
   c) two lactate per glucose molecule
   d) one FADH per glucose molecule

36. Which of the following is an anabolic pathway?
   a) glycolysis
   b) photosynthesis
   c) fatty acid oxidation
   d) Kreb's cycle

37. After muscle cells deplete glycogen “stores”, further contraction depends on:
   a) ATP supplied from the liver.
   b) glycogen supplied from the liver.
   c) glucose supplied from the liver.
   d) lactic acid supplied from the liver.

38. Which of the following correctly describes conditions in a working muscle cell?
   a) oxygen produced, acidity increases, carbon dioxide forms
   b) oxygen consumed, acidity increases, carbon dioxide forms
   c) oxygen consumed, acidity decreases, carbon dioxide forms
d) oxygen produced, acidity decreases, carbon dioxide consumed

39. Which of the following does not describe the relationship between muscle and liver?
   a) As muscles consume glucose, the liver releases more glucose.
   b) As muscles produce lactate, the liver converts lactate to glucose.
   c) As acidity increases in the muscles, the acidity increases in the liver.
   d) All the above statements are correct.

40. Which of the following is not true about type 1 diabetes mellitus?
   a) It is also known as juvenile-onset diabetes.
   b) A disorder characterized by frequent urination.
   c) A disorder characterized by glucose in the urine.
   d) A disorder characterized by hypoglycemia.

41. The complete oxidation of one glucose molecule produces:
   a) 2 ATP
   b) 32 ATP
   c) 16 ATP
   d) 4 ATP

42. The liver can transform all of the following molecules into glucose except:
   a) glycerol
   b) ethanol
   c) threonine
   d) lactate

43. What process is triggered when the blood glucose level exceeds the renal threshold?
   a) Insulin is secreted by the pancreas.
   b) Glucose is excreted into the urine.
   c) Glucose is converted into lactate.
   d) The liver initiates glycogenesis.

44. Which of the following metabolic pathways is not paired with its product?
   a) gluconeogenesis/glycogen
   b) muscle tissue glycolysis/lactate
   c) glycogenolysis/glucose
   d) yeast cell glycolysis/ethanol

45. The formation of glucose from noncarbohydrate sources is called:
   a) glycogenesis
   b) glycogenolysis
   c) glycolysis
   d) gluconeogenesis

46. Which of the following processes involve an anaerobic pathway?
   a) Embden-Meyerhof pathway
b) Citric Acid Cycle
c) Glycolysis
d) all of the above are correct

47. Which of the following statements involving hormones is not correct?
a) Hormones are chemical substances that act to regulate metabolic pathways.
b) Hormones are secreted by the endocrine system.
c) Hormones are like vitamins and must be obtained through diet.
d) Hormones do not fit into a single chemical structural classification.

48. Which of the following is not an example of a hormone?
a) Insulin
b) Oxytocin
c) Cortisone
d) all of the above are hormones

49. Impaired vision, dizziness, fainting spells, convulsions and unconsciousness may result from:
a) hyperglycemia
b) hypoglycemia
c) both (a) and (b) are correct
d) neither (a) nor (b) are correct

50. The Embden-Myerhof pathway produces equal moles of pyruvate and:
a) NADH
b) NADPH
c) FAD
d) FADH2

51. Which statement is incorrect?
a) A metabolic pathway is a series of biochemical reactions that serve a specific purpose
b) Metabolic pathways occur in every cell
c) Photosynthesis is an anabolic process
d) Glucose oxidation and photosynthesis are processes that are exact reverses of each other

52. Which statement is incorrect?
a) The basal metabolic rate is the same for all individuals
b) The basal metabolic rate represents about 70% of the total energy expenditure on a day-to-day basis
c) When muscles contract the first form of energy used comes from the hydrolysis of ATP
d) The concentration of lactic acid increases when the store of glycogen in the muscle becomes depleted

53. Which statement is incorrect?
a) Glucose is the most important carbohydrate in carbohydrate metabolism
b) Glucose can be metabolized aerobically and anaerobically
c) In humans the catabolism of glucose to produce energy is equally efficient when performed under aerobic and anaerobic conditions
d) In humans the production of ATP from the aerobic oxidation of glucose provides more than 90% of the ATP needed by cells.

54. Which statement is incorrect?
   a) In humans the brain is almost totally dependent on fatty acids for energy
   b) Under anaerobic conditions contracting muscle relies on glucose for energy
   c) Some organs in humans can use carbohydrates, fats, and amino acids for energy
   d) The liver is responsible for maintaining an approximately constant blood glucose concentration

55. During muscle contraction:
   a) the liver removes glucose from the blood
   b) the muscle releases lactate to the blood
   c) the liver removes carbon dioxide from the blood
   d) the muscle releases glucose to the blood

56. Which statement is correct?
   a) The Embden-Meyerhof pathway is anaerobic
   b) Glycolysis is anaerobic
   c) The citric acid cycle is an aerobic sequence.
   d) All these statements are correct

57. Which statement is incorrect?
   a) The anaerobic conversion of glucose to lactate occurs during glycolysis
   b) The anaerobic conversion of glucose to pyruvate occurs during the Embden-Meyerhof pathway
   c) Under aerobic conditions pyruvate enters the citric acid cycle directly to form carbon dioxide and GTP
   d) Lactate can be converted to pyruvate in the liver

58. Which statement is correct about the citric acid cycle?
   a) It is a series of eight reactions
   b) An acetyl group is oxidized to carbon dioxide and water
   c) NADH and FADH2 are produced
   d) All these statements are correct about the citric acid cycle

59. Which statement is incorrect?
   a) Cancer cells grow more rapidly than normal cells
   b) Cancer cells prefer fat metabolism for energy over carbohydrate metabolism
   c) Cancer cells are more tolerant of acid conditions
   d) Cancer cells need to be adept at producing energy under anaerobic conditions

60. Which statement is incorrect?
   a) The pancreas produces insulin
   b) The pituitary gland produces glucagon
   c) Epinephrine is produced by the adrenal glands
   d) Estrogen is produced by the ovaries

True/False
61. A metabolic pathway is a simple biochemical reaction that serves multiple purposes in a cell.
   a) True
   b) False

62. Glycogen formation in the body is called glycogenolysis.
   a) True
   b) False

63. The final product of carbohydrate catabolism is pyruvic acid.
   a) True
   b) False

64. Acetyl-CoA can only be formed from carbohydrates.
   a) True
   b) False

65. The citric acid cycle oxidizes carbons to CO2.
   a) True
   b) False

66. Lactic acid can be converted to glucose via glycogenesis.
   a) True
   b) False

67. The formation of glucose from noncarbohydrate sources is called gluconeogenesis.
   a) True
   b) False

68. The carbons of certain amino acids can be used to make glucose.
   a) True
   b) False

69. A multiple-step biochemical pathway will form intermediates which may be used by other cellular pathways.
   a) True
   b) False

70. Hormones are proteins that control specific metabolic processes.
   a) True
   b) False

71. The carbons of glucose are reduced when glucose is converted to pyruvate.
   a) True
   b) False

72. Gluconeogenesis is an anabolic pathway.
Chapter 35: Metabolism of Lipids and Proteins

Multiple Choice

1. Which statement is not true about Knoop's experiments on fatty acid oxidation and degradation?
   a) He fed test animals a series of straight chain fatty acids with a phenyl group at one end and a carboxyl group at the other end.
   b) Palmitic acid was identified in the urine of animals which had eaten acids with an even number of carbon atoms.
   c) Hippuric acid was identified in the urine of animals which had eaten acids with an odd number of carbon atoms.
   d) Knoop's results indicated that a fatty acid carbon chain is shortened by two carbon atoms at a time.

2. The following is an end product of beta-oxidation:
   a) acetyl-CoA
   b) pyruvic acid
   c) FAD
   d) none of these

3. The following compound is not used during step 1 (activation) of beta-oxidation:
a) coenzyme A  
b) ATP  
c) fatty acid  
d) FAD

4. Reduced coenzymes from beta-oxidation are used to produce ATP in:
   a) mitochondrial electron transport and oxidative phosphorylation  
   b) glycolysis and oxidative phosphorylation  
   c) the mitochondrial electron transport and transamination  
   d) none of these

5. Which compound listed is classified a ketone body?
   a) palmitic acid  
   b) beta-hydroxybutyric acid  
   c) hippuric acid  
   d) hydroxyacetic acid

6. Glucose yields about:
   a) 2 ATP molecules per carbon atom  
   b) 6 ATP molecules per carbon atom  
   c) 8 ATP molecules per carbon atom  
   d) 32 ATP molecules per carbon atom

7. In step 2 of the beta oxidation pathway involve the dehydrogenation of the α- and β-carbons of the activated thioester. This reaction requires the participation of:
   a) ATP  
   b) CoASH  
   c) H2O  
   d) FAD

8. Which of the following statements is not true of adipose tissue?
   a) It serves as an insulating blanket to protect the body form external cold.  
   b) It releases epinephrine to trigger the “fight or flight” response.  
   c) It is the major reserve of potential energy in the body.  
   d) It serves as a cushion to protect internal organs.

9. Lipogenesis differs from beta-oxidation in that:
   a) NADP+ is used in lipogenesis but not in beta-oxidation.  
   b) Lipogenesis occurs in the cytoplasm while beta-oxidation occurs in the mitochondria.  
   c) Lipogenesis uses malonyl-CoA while beta-oxidation does not.  
   d) all of these

10. An amino acid of central importance in amino acid metabolism is:
    a) acetoacetic acid  
    b) D-glutamic acid  
    c) L-glycine
d) L-glutamic acid

11. Which of the following amino acids is not found in the urea cycle?
   a) L-aspartic acid
   b) L-arginine
   c) citrulline
   d) L-asparagine

12. Some soil bacteria convert nitrogen gas to a biochemically-usable form of this element by:
   a) oxidative deamination
   b) transamination
   c) nitrogen fixation
   d) urea cycle

13. Most of the movement of nitrogen through the nitrogen cycle is facilitated by:
   a) lightning
   b) higher plants
   c) animals
   d) bacteria

14. Which of the following processes is not used to fix atmospheric nitrogen?
   a) the Haber process
   b) bacterial action
   c) transamination
   d) lightning flashes

15. The following amino acid serves as a major nitrogen-transport molecule in the bloodstream:
   a) L-glutamic acid
   b) L-glutamine
   c) L-glycine
   d) proline

16. The equation below is an example of:
   a) transamination
   b) saponification
   c) oxidative deamination
   d) catabolism

17. Which is not a possible metabolic fate of amino acids?
   a) conversion to a missing essential amino acid
   b) used in the synthesis of nucleic acids
   c) incorporation into a protein
   d) oxidized for energy
19. An individual on a diet, which is high in carbohydrate and low in protein, would probably have a:
   a) negative nitrogen balance
   b) high blood sugar
   c) positive nitrogen balance
   d) low blood sugar

20. Pyruvic acid results from transamination of:
   a) L-alanine
   b) L-serine
   c) glycine
   d) L-aspartic acid

21. An amino acid which can be used to produce ketone bodies (which will increase the rate of ketone body formation) is called a:
   a) ketophilic amino acid
   b) glucogenic amino acid
   c) body building amino acid
   d) ketogenic amino acid

22. Which of the following is the most important nitrogen molecule excreted by mammals?
   a) L-glutamine
   b) urea
   c) uric acid
   d) ammonia

23. Forming a nontoxic nitrogen excretion molecule is so important that mammals use:
   a) Many ATPs in this process
   b) Many NAD+s in this process
   c) only D-amino acids in this process
   d) all of these

24. A person suffering from PKU is unable to catabolize:
   a) lysine
   b) tryptophan
   c) phenylalanine
   d) proline

25. Of the four amino acid intermediates in the urea cycle, the only one that is commonly used in proteins is:
   a) ornithine
   b) argininosuccinic acid
   c) arginine
   d) citrulline

26. The abbreviation, CoA, stands for:
   a) cobalt A
b) cofactor A
c) coprotein A
d) coenzyme A

27. Which of the following is not true of acetyl-CoA?
a) Its small size allows it to be used to build a variety of structures.
b) It is used to synthesize fatty acids, amino acids, and steroid hormones.
c) It contains an ester bond that is especially stable.
d) It is recognized by a variety of enzymes.

28. Which of the following is not a correct statement?
a) birds excrete urea.
b) fish excrete ammonia.
c) reptiles excrete uric acid.
d) humans excrete urea.

29. An ammonium ion is produced by the oxidation of which of the following?
a) urea
b) glutamic acid
c) alpha-ketoglutaric acid
d) carbamoyl phosphate

30. Which of the following enters the urea cycle?
a) fumaric acid
b) glutamic acid
c) alpha-ketoglutaric acid
d) carbamoyl phosphate

31. Which of the following is not a urea cycle intermediate?
a) carbamoyl phosphate
b) arginine
c) citrulline
d) ornithine

32. Which of the following statements is not true?
a) glucose is a central compound in carbohydrate metabolism.
b) glutamic acid is a central compound in amino acid metabolism.
c) Acetyl CoA is a central compound in carbohydrate, fat, and protein metabolism.
d) Aspartic acid is a central compound in amino acid metabolism.

33. Which of the following is not true about ketone bodies?
a) They cause a decrease in blood pH.
b) They are produced during starvation.
c) They are used for anabolic reactions.
d) They act as a glucose substitute.
34. Nitrogen monoxide is produced by:
   a) lightning
   b) the Haber process
   c) soil bacteria
   d) none of the above

35. People with PKU should not consume:
   a) aspartame
   b) MSG
   c) fatty acids
   d) vitamins

36. Which of the following is not true about transamination reactions?
   a) Each different transamination reaction requires a different enzyme.
   b) A keto group is exchanged with an amino group.
   c) Alpha-keto acids are converted to alpha-amino acids.
   d) These reactions prepare amino acids for incorporation into proteins.

37. Beta oxidation of a fatty acid occurs in the following order.
   a) oxidation, hydration, oxidation, cleavage.
   b) oxidation, oxidation, hydration, cleavage.
   c) hydration, oxidation, hydration, cleavage.
   d) none of the above.

38. Which of the following is not used in the beta-oxidation of a fatty acid?
   a) FAD
   b) NAD+
   c) GTP
   d) CoASH

39. Fatty acids yield about:
   a) 6 ATP molecules per carbon atom
   b) 8 ATP molecules per carbon atom
   c) 32 ATP molecules per carbon atom
   d) none of the above

40. Which of the following is not true?
   a) High fat diets may have too much energy.
   b) No more than 30% of calories should come from fat.
   c) Fats are stored primarily in adipose tissue.
   d) Triacylglycerols are transported from the blood to adipose cells.

41. Which of the following is not a result of a high-protein/low-carbohydrate diet?
   a) Fatty acid transportation through the blood is maximized.
   b) The body has a negative nitrogen balance.
   c) Muscle glycogen level are extremely low.
d) The level of ketone bodies in the blood is increased.

42. Which of the following is an essential fatty acid?
   a) linoleic acid
   b) linoleic acid
   c) arachidonic acid
   d) linoleic acid and linolenic acid

43. Once a protein is digested, the absorbed amino acids can be:
   a) used to synthesize nucleic acids
   b) reduced to carbon dioxide and water
   c) deaminated to a glucogenic amino acid
   d) all of the above are correct

44. Which of the following is often conserved by the cell for reuse?
   a) carbon
   b) hydrogen
   c) oxygen
   d) nitrogen

45. Which of the following is not a part of acetyl-CoA metabolism?
   a) proteins
   b) carbohydrates
   c) fats
   d) nucleic acids

46. Which of the following best describes transamination?
   a) The process by which an amino group from an $\beta$-keto amino acid is transferred to an $\beta$-amino acid.
   b) The process by which an amino group from an $\beta$-amino acid is transferred to an $\beta$-keto amino acid.
   c) The process by which an amino group from an $\beta$-amino acid is transferred to an $\beta$-amino acid
   d) The process by which an $\beta$-amino acid to a $\beta$-amino acid.

47. Which of the following amino acids are ketogenic amino acids?
   a) Phenylalanine
   b) Tryptophan
   c) Leucine
   d) all of the above are correct

48. Which of the following amino acids are glucogenic amino acids?
   a) Arginine
   b) Isoleucine
   c) Serine
   d) all of the above are correct

49. The biosynthesis of fatty acids from acetyl-CoA is called:
   a) Beta Oxidation
b) Lipogenesis
c) Liponeogenesis
d) Transamination

50. Which of the following statements involving amino acid metabolism is not true?
a) Amino acids contain nitrogen which presents unique problems to the cell.
b) The common carbon structure of the amino acids makes the metabolism of their carbon structures more complex.
c) Amino acid metabolism differs markedly from biochemistry of carbohydrates and fatty acids.
d) Amino acids use a different metabolic pathway for almost every amino acid.

51. Which statement is correct?
a) On a weight basis, fatty acids are more energy rich than carbohydrates and proteins
b) Amino acids can be converted to carbohydrates and fatty acids
c) Carbohydrates are the human body’s only energy source under anaerobic conditions
d) All the statements listed above are correct.

52. Which statement is incorrect?
a) The liver stores glycogen
b) The liver converts fatty acids and amino acids to ketone bodies
c) Urea is formed in the kidneys where it is excreted
d) The liver is the site of gluconeogenesis

53. Which statement is incorrect about beta-oxidation of fatty acids?
a) Hydration of a double bond results in the formation of two hydroxyl groups
b) Oxidation of a hydroxyl group results in the formation of a carbonyl group
c) Reaction of a fatty acid with coenzyme A results in the formation of a thioester
d) Oxidation results in the formation of a carbon-carbon double bond

54. Which statement is incorrect?
a) Each reaction in beta oxidation of fatty acids is catalyzed by an enzyme
b) ATP molecules are not produced directly during fatty acid catabolism
c) Fatty acid oxidation is aerobic
d) Fat is the best energy storage molecule for all tissues and organs in the human body

55. Which statement is incorrect?
a) Subcutaneous fat is deposited under the skin
b) Most of the fat in the abdomen is visceral fat
c) Subcutaneous fat is lost more quickly than visceral fat
d) Scientists have found that the accumulation of abdominal fat will predispose humans to some health risks

56. Having large amounts of abdominal fat is associated with which conditions?
a) Cardiovascular disease
b) Myocardial infarction
c) Atherosclerosis
d) Having large amounts of abdominal fat is associated with all these conditions
57. Which statement is correct?
   a) Fat molecules in plasma lipoproteins are hydrolyzed to form fatty acids before transport to the adipose tissue
   b) Epinephrine triggers the formation of fatty acids in the adipose tissue
   c) Fat molecules are stored in the adipose tissue
   d) All the statements listed above are correct

58. Which statement is incorrect?
   a) Lipogenesis is the pathway by which carbohydrates, fats, and proteins are converted to body fat
   b) Nearly all naturally occurring fatty acids contain an even number of carbon atoms
   c) NADPH is reduced during fatty acid biosynthesis
   d) Carbon dioxide is produced during fatty acid biosynthesis

59. Which statement is incorrect?
   a) When humans runs low on carbohydrates as a food source, the liver modifies its metabolic machinery to produce ketone bodies
   b) There are three different ketone bodies
   c) Ketone bodies are metabolized anaerobically
   d) In the absence of carbohydrates the human brain can use ketone bodies as a source of energy

60. Which statement is correct?
   a) Most cells can’t use elemental nitrogen
   b) The incorporation of nitrogen, from diatomic nitrogen, into biological molecules is called nitrogen fixation
   c) The conversion of diatomic nitrogen to ammonia occurs during the Haber process
   d) All these statements are correct

True/False

61. Fatty acid catabolism is an aerobic process.
   a) True
   b) False

62. Lipogenesis uses the same set of enzymes as beta oxidation, only in reverse.
   a) True
   b) False

63. Catabolism of fats can lead to the citric acid cycle just as catabolism of carbohydrates can.
   a) True
   b) False

64. When fats are oxidized, the carbon chain is shortened by two carbon atoms at a time, with the products being molecules of acetyl-CoA.
   a) True
   b) False

65. Transamination is the first step in the conversion of the amino acid carbon skeletons to fats or carbohydrates.
66. Most naturally-occurring amino acids are classified as ketogenic.
   a) True
   b) False

67. Each urea molecule contains two nitrogen atoms.
   a) True
   b) False

68. Beta-oxidation is a catabolic process.
   a) True
   b) False

69. The intermediates in the urea cycle are alpha-amino acids, and they are rarely used in protein synthesis.
   a) True
   b) False

70. One of the nitrogens in urea comes from glutamic acid, and the other comes from aspartic acid.
   a) True
   b) False

71. ATP is to energy metabolism as acetyl-CoA is to carbon metabolism.
   a) True
   b) False

72. The cell must use a different metabolic pathway to metabolize almost every amino acid.
   a) True
   b) False

73. The complete oxidation of a fat produces carbon dioxide and oxygen molecules.
   a) True
   b) False

74. A high protein and low carbohydrate diet can result in ketosis.
   a) True
   b) False

75. The last three steps of fatty acid biosynthesis are approximate reversals of three steps in fatty acid oxidation.
   a) True
   b) False

76. A typical human stores more energy in the form of fat than in the form of protein or carbohydrate.
   a) True
   b) False
77. Eighteen carbon atoms from carbohydrate and eighteen carbons from fatty acid will result in the production of the same amount of ATP at the end of complete oxidation
a) True
b) False

78. Triacylglycerols are stored primarily in adipose tissue.
a) True
b) False