Sample question

Calculate ΔS and ΔH for for the following reaction and decide in which direction each of these factors will drive the reaction.

$$N2 + 3H2 \leftrightarrow 2NH3$$

Solution : Use the standard-state enthalpy of formation and absolute entropy data table:

ΔH= Hprod -Hreact = [2 mol NH_3 x -46.11 kJ/mol] - [1 mol N_2 x 0 kJ/mol + 3 mol H_2 x 0 kJ/mol] = -92.22 kJ, which means that the enthalpy of reaction favors the products of the reaction.

In contrast, the entropy of reaction is unfavorable - increase in the order of the system when N2 and H2 combine to form NH3. ΔS = [2 mol NH_3 x 192.45 J/mol-K] - [1 mol N_2 x 191.61 J/mol-K + 3 mol H_2 x 130.68 J/mol-K] = -198.75 J/K

Compound	ΔHf (kJ/mol)	S(J/mol-K)
N2	0	191.61
H2	0	130.68
NH3	-46.11	192.45

$$\Delta G = \Delta H - T\Delta S$$

ΔG : Change in Gibbs free energy
ΔH : Change in Enthalpy
ΔS : Change in Entropy

Assume that the reaction catalyzed by an enzyme follows Michaelis-Menten kinetics. The substrate concentration (K_m, Michaelis constant) needed to reach 50% of the maximum reaction velocity (V_{max}) is 25 µM. What substrate concentration is required to obtain at least 95% of the maximum reaction velocity?

(A) 25 µM
(B) 50 µM
(C) 100 µM
(D) 250 µM
(E) 475 µM

(6) Assume that the reaction catalyzed by an enzyme follows Michaelis-Menten kinetics. If at a substrate concentration of 100 nM, the reaction proceeds at 98% of the maximum reaction velocity (V_{max}), what is the Michaelis constant (K_m) for this substrate. K_m is the substrate concentration needed to reach 50% of V_{max}.

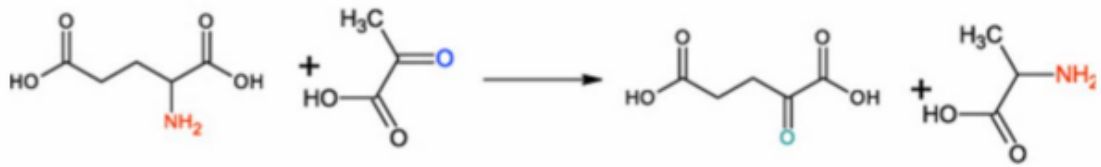
(A) 2 nM
(B) 5 nM
(C) 10 nM
(D) 50 nM
(E) 100 nM

The K_m (Michaelis constant) of an enzyme-catalyzed reaction:

(A) is a measure of the turnover rate of the enzyme.
(B) is a measure of the affinity of the enzyme for its substrate.
(C) has a higher numerical value when the enzyme has high affinity for its substrate.
(D) has a lower numerical value when the enzyme has high affinity for its substrate.
(E) is the substrate concentration when the reaction rate is half of the maximum rate.

1. Which of the statements regarding enzymes is false?

a) Enzymes are proteins that function as catalysts.
b) Enzymes are specific.
c) Enzymes provide activation energy for reactions.
d) Enzyme activity can be regulated.
e) Enzymes may be used many times for a specific reaction.



Glutamate Pyruvate α-Ketoglutarate Alanine

2. The relationship between an enzyme and a reactant molecule can best be described as:

a) a temporary association.
b) an association stabilized by a covalent bond.
c) one in which the enzyme is changed permanently.
d) a permanent mutual alteration of structure.
e) noncomplementary binding.

7. The reaction above is an example of a

a. Lyase
b. Oxidoreductase
c. Hydrolase
d. Ligase
e. Transferase

5) Which of the following has 3' to 5' polymerase activity?
a) DNA polymerase I
b) DNA polymerase II
c) DNA polymerase III
d) none of these

A nucleotide in DNA is composed of _____.
a. a deoxyribose sugar, a phosphate, and a nitrogen base
b. only a deoxyribose sugar and a nitrogen base
c. only a deoxyribose sugar and a phosphate
d. none of the above → Nucleoside + phosphoryl group

1. Create the complimentary strand for the DNA strand below. Make sure to label the parts and direction of the strand.
5'-AACGGTCCAGTCCAAGTTACG-3'
3'-TTGCCAGGTCAGGTTCAATGC-5'

4. Between the two strands of a DNA segment the nitrogen bases are held together by _____. a. covalent bonds b. hydrogen bonds c. ionic bonds d. metallic bonds

5. Nitrogen bases pair with bases that are _____.
a. available b. complimentary c. identical d. both b and c

1) Which of the following separates DNA into single strands?
a) DNA polymerase
b) DNA gyrase
c) DNA helicase
d) DNA ligase

Which of the following is used to remove the RNA primer from Okazaki fragments?
a) DNA polymerase I
b) DNA polymerase II
c) DNA polymerase III
d) DNA ligase

AP endonuclease has which of the following activites?
a) breaks phosphodiester bonds at apurinic sites
b) breaks the n-glycosidic bond of uracil with deoxyribose
c) degrades the ends of DNA
d) breaks down dUTP

Which transcript would be produced on the following template strand sequence 5'-TTGCTA?

A 5'-AUGCUU
B 5'-ATGCTT
C 5'-TUGCAA
D 5'-GCAUCC

In eukaryotes, which RNA polymerase makes rRNA?

A RNA polymerase I
B RNA polymerase II
C RNA polymerase IV
D RNA polymerase III

Which of the following is not dependent on the C-terminal domain (CTD) of RNA polymerase II?

A mRNA splicing
B Transcription termination
C 5' capping
D Polyadenylation
E None of the other answers

Which of the following are methods for termination of transcription in prokaryotes?
I. Release factor binding
II. Rho-mediated termination
III. Hairpin loop (stem loop) formation

A I, II, and III
B II and III
C I only
D III only

Which of the following best describes distant regulatory sequences that influence gene expression?

A Transcriptional start sites
B Enhancers
C Introns
D Exons
E Promoters

When does alternative splicing occur?

A Following mRNA translocation to the cytosol
B Following pre-mRNA transcription in the nucleus
C Following translation
D Following mRNA loading into ribosome
E Following mRNA polyadenylation

1 What does prokaryotic mRNA have that eukaryotic mRNA doesn't?

a. ATP sequences
b. Termination factors
c. Initiation factors
d. Shine-Dalgarno sequences
e. van der Waals forces

2 The anticodon on one tRNA which carries histidine to the site of protein synthesis is CAU. What was the corresponding set of bases in the gene of the DNA molecule which specified placement of histidine at that location?

a. AAA
b. GTA
c. GAU
d. CAT
e. CAU

3 The genetic code is a triplet code, with four bases taken three at a time, giving 64 combinations, enough for 21 amino acids and then some. If it were a duplex code, how many amino acids could be coded for?

a. 32
b. 16
c. 8
d. 4
e. 2

4 Chloramphenicol is an antibiotic which is effective against many microorganisms. It interferes with translation by:

a. Releasing the partially-formed peptide before translation is complete
b. Hydrolyzing peptides prematurely
c. Preventing the peptidyl-tRNA from moving from the amino acid site to the peptide site of the ribosome
d. Causing misreading of the codes on mRNA
e. Interfering with aminoacyl-tRNA binding

5 Degeneracy in the genetic code seems wasteful. Of what possible value could degeneracy be, when it allows or requires more than one possible codon for most amino acids?

a. Degeneracy prevents mutations which might result from changing the second base of the codon
b. In fact, all codons for a particular amino acid are the same
c. Degeneracy provides protection against some point mutations
d. Degeneracy refers to the fact that there are some codons which do not code for any amino acid
e. Degeneracy helps to prevent aberrant behavior among teenage biochemists

1. Phospholipids are molecules that contain:

A positively charged functional groups.
B long water-soluble carbon chains.
C cholesterol.
D hydrophilic heads and hydrophobic tails.
E The third and fourth answers are both correct.

2. Micelles of fatty acids in water are organized such that the ___ face the solvent and the ___ are directed toward the interior.
A hydrophilic heads; hydrophobic tails
B carboxylic acid groups; hydrocarbon chains
C hydrocarbon chains; carboxylic acid groups
D hydrophobic tails; hydrophilic heads
E The first and second answers are both correct.

3. The glycerophospholipids are composed of two fatty acids attached to glycerol and one of the following head groups:
A ethanolamine.
B choline.
C serine.
D threonine.
E All but the fourth choice are correct.

5. Cholesterol is essential for normal membrane functions because it
A cannot be made by higher organisms, e.g. mammals.
B spans the thickness of the bilayer.
C keeps membranes fluid.
D catalyzes lipid flip-flop in the bilayer.
E plugs up the cardiac arteries of older men.

6. The main difference between saturated and unsaturated fatty acids is
A the number of carbons.
B the presence of keto groups.
C the presence of double bonds.
D that one is absent from phospholipids.
E none of the above.

1. According to the fluid mosaic model of cell membranes, which type of molecule spans the membrane, from its inner to outer surface?
A carbohydrate.
B cholesterol.
C hydrocarbon tails.
D phospholipid.
E Protein.

2. What are the membrane structures that function in active transport?
A peripheral proteins.
B carbohydrates.
C integral proteins.
D hydrophobic molecules.
E Cholesterol.

3. All of the following are found in membranes except:
A nucleic acids.
B phospholipids.
C glycoproteins.
D glycolipids.
E Steroids.

4. The membrane proteins that catalyze active transport reactions differ from soluble enzymes in that
A they do not enhance the rates of reaction.
B the product(s) of the reaction move in a specific direction.
C the substrate(s) of the reaction are all outside the cell.
D they are not specific.
E they are permanently changed during the reaction.

5. Which of the following is not an example of a lipid found in lipid-linked proteins?
A Farnesyl groups.
B Palmitic acid.
C Myristic acid.
D Stearic acid.
E Glycosylphosphatidylinositol.

Paracrine signalling is involved in which of the following? Please select all that apply.

a) Hormonal communication.
b) Chemical signals that can only travel limited distances between cells.
c) Autostimulation of a cell.
d) Synaptic transmission

Which of the following plasma membrane receptors activate signalling pathways usually by forming molecular dimers that result in protein phosphorylation reactions upon binding of their specific ligand?

a) Steroid hormone receptors
b) Receptor tyrosine kinases
c) Ligand-gated ion channels
d) G protein-coupled receptors

Which of the following has an antagonistic action to adenylate cyclase?

a) Cyclic adenosine monophosphate (cAMP)
b) Protein kinase
c) The active GTP-á subunit of a G protein
d) Phosphodiesterase

The target cells of a lipid soluble hormone such as cortisol, are able to respon to it because of which of the following?

a) Their genome includes the appropriate transcriptional response elements.
b) They have membrane bound cell surface receptors.
c) Only target cells express appropriate cytosolic receptors.
d) The hormone-receptor complex stimulates the phosphorylation/dephosphorylation of subsequent proteins in the signalling pathway.

The second messenger IP_3 increases the cytoplasmic concentration of
a) antigen.
b) calcium.
c) Class I MHC.
d) phosphate.
e) sodium.

13. DAG and IP3 are released from PIP2 by the action of

a) adaptor protein.
b) phospholipase C (PLC).
c) protein kinase C (PKC).
d) small G protein.
e) TdT.

Question 1

Paracrine signalling is involved in which of the following? Please select all that apply.

a) Hormonal communication.
b) Chemical signals that can only travel limited distances between cells.
c) Autostimulation of a cell.
d) Synaptic transmission.

Question 2

Which of the following statements are true of the group of signalling molecules called eicosanoids? Please select all that apply.

a) Eicosanoids are derivatives of arachidonic acid.
b) Eicosanoids include prostaglandins, thromboxanes and leukotrienes.
c) Eicosanoids are usually autocrine signalling molecules.
d) Eicosanoids can be synthesized from fatty acids derived from membrane phospholipids.

Question 3

Which of the following plasma membrane receptors activate signalling pathways usually by forming molecular dimers that result in protein phosphorylation reactions upon binding of their specific ligand?

a) Steroid hormone receptors
b) Receptor tyrosine kinases
c) Ligand-gated ion channels
d) G protein-coupled receptors

Question 4

Which of the following has an antagonistic action to adenylate cyclase?

a) Cyclic adenosine monophosphate (cAMP)
b) Protein kinase
c) The active GTP-á subunit of a G protein
d) Phosphodiesterase

Question 5

Serine, threonine and tyrosine residues are all subjected to phosphorylation in various signal transduction pathways.

a) True
b) False

Question 1
Paracrine signalling is involved in which of the following? Please select all that apply.
cells.
Correct answer/s:
b) Chemical signals that can only travel limited distances between cells.
d) Synaptic transmission.
Feedback:
Paracrine signalling involves the use of chemical messengers that can normally travel only a limited distance from the cell where they are synthesized.

Question 2
Which of the following statements are true of the group of signalling molecules called eicosanoids? Please select all that apply.
Correct answer/s:
a) Eicosanoids are derivatives of arachidonic acid.
b) Eicosanoids include prostaglandins, thromboxanes and leukotrienes.
d) Eicosanoids can be synthesized from fatty acids derived from membrane phospholipids.
Feedback:
Eicosanoids include prostaglandins, thromboxanes and leukotrienes that generally effect their actions in a paracrine manner. They are synthesized from arachidonic acid using fatty acids obtained in the diet or from cellular sources such as membrane lipids.

Question 3
Which of the following plasma membrane receptors activate signalling pathways usually by forming molecular dimers that result in protein phosphorylation reactions upon binding of their specific ligand?
Correct answer/s:
b) Receptor tyrosine kinases
Feedback:
Binding of ligand alters the conformation of the receptor, allowing it to activate a G protein by GDP-GTP exchange and the subsequent release of the GTP-á subunit.

Question 4
Which of the following has an antagonistic action to adenylate cyclase?
Correct answer:
d) Phosphodiesterase
Feedback:
This enzyme catalyzes the hydrolysis of cAMP (formed by adenylate cyclase) to AMP.

Question 5
Serine, threonine and tyrosine residues are all subjected to phosphorylation in various signal transduction pathways.
Correct answer:
a) True
Feedback:
Serines, threonines and tyrosines residues in proteins are specific phosphorylated in various signal pathways such as those associated with adrenalin, insulin, glucagon and erythropoietin stimulation.

Question 6
The target cells of a lipid soluble hormone such as cortisol, are able to respond to it because of which of the following?
a) Their genome includes the appropriate transcriptional response elements.
b) They have membrane bound cell surface receptors.
c) Only target cells express appropriate cytosolic receptors.
d) The hormone-receptor complex stimulates the phosphorylation/dephosphorylation of subsequent proteins in the signalling pathway.

Question 7
Most organelles of a neuron are distributed throughout the cytoplasm.
a) True
b) False

Question 8
Neurotransmitters are released into the synapse at which of the following?
a) Presynaptic membrane
b) Postsynaptic membrane
c) Golgi apparatus
d) Axon hillock

Question 9
Which of the following apply to the nicotinic acetylcholine receptor? Please select all that apply.
a) Binding of acetylcholine to the receptor induces a conformational change that activates a G protein.
b) Binding of acetylcholine to the receptor induces a conformational change that opens a transmembrane pore allowing Na^+ and Ca^{2+} to flow into the cell.
c) The nicotinic acetylcholine receptor is a pentamer consisting of five integral polypeptides.
d) Binding of acetylcholine to the receptor induces a conformational change that opens a transmembrane pore allowing Na^+ and K^+ to flow into the cell.

Question 10
Transducin is a typical trimeric G protein
a) True
b) False

Question 6
The target cells of a lipid soluble hormone such as cortisol, are able to respond to it because of which of the following?
Correct answer:
c) Only target cells express appropriate cytosolic receptors.
Feedback:
The hormone-receptor complex enters the nucleus and modulates the transcription of an altered protein complement.

Question 7
Most organelles of a neuron are distributed throughout the cytoplasm.
Correct answer:
b) False
Feedback:
Most organelles in a neuron are restricted to the cell body.

Question 8
Neurotransmitters are released into the synapse at which of the following?
Correct answer:
a) Presynaptic membrane
Feedback:
The axon hillock is that part of the neuron where action potentials are triggered.
Neurotransmitters released into the synapse when intracellular vesicles containing the fuse with the part of the plasma membrane of the neuron that forms the presynaptic membrane.

Question 9
Which of the following apply to the nicotinic acetylcholine receptor? Please select all that apply.
Correct answer/s:
c) The nicotinic acetylcholine receptor is a pentamer consisting of five integral polypeptides.
d) Binding of acetylcholine to the receptor induces a conformational change that opens a transmembrane pore allowing Na^+ and K^+ to flow into the cell.
Feedback:
The nicotinic acetylcholine receptor is a pentamer consisting of five integral polypeptides. Binding of acetylcholine to the receptor induces a conformational change that opens a transmembrane pore through the receptor allowing Na^+ and K^+ to flow into the cell.

Question 10
Transducin is a typical trimeric G protein
Correct answer:
a) True
Feedback:
Transducin resembles other trimeric G proteins in being a lipid anchored trimeric protein, with an á subunit capable of changing conformation in response to the binding of GDP or GTP.

Which of the following statements concerning glycoproteins is TRUE?

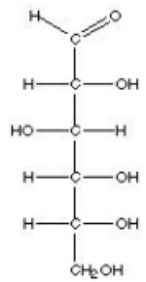
A. They are usually positively charged.
B. They never contain branched oligosaccharide chains.
C. They contain oligosaccharides that are synthesized on dolichol phosphate and transferred to serine residues.
D. They are degraded by lysosomal enzymes.
E. They are all secreted into the blood.

Glycoproteins frequently have their carbohydrate portion attached to the following amino acids EXCEPT

A. Glutamate
B. Serine
C. Threonine
D. Asparagine

Which of the following best describes the molecule illustrated above?

A. D-glucose
B. L-glucose
C. D-fructose
D. L-fructose



6. Enolase catalyzes

a) the oxidation of an alkene to an alcohol.
b) the reduction of an alkene to an alcohol.
c) the conversion of an alkene to an alcohol.
d) the conversion of an aldose to a ketose.
e) none of the above.

Which of the following statements concerning glycoproteins is TRUE?

A. They are usually positively charged.
B. They never contain branched oligosaccharide chains.
C. They contain oligosaccharides that are synthesized on dolichol phosphate and transferred to serine residues.
D. They are degraded by lysosomal enzymes.
E. They are all secreted into the blood.

In a eukaryotic cell, the enzymes of glycolysis are located in the

a) plasma membrane.
b) inner mitochondrial membrane.
c) cytosol.
d) mitochondrial matrix.
e) intermembrane space.

3. Energy released by oxidation of glucose is stored as

a) a concentration gradient across a membrane.
b) ATP.
c) NADH.
d) ADP.
e) both b and c are correct.

5. The regulation of the glycolytic pathway involves

a) feedback inhibition by ATP.
b) allosteric inhibition by ATP.
c) allosteric stimulation by ADP.
d) All three are correct.
e) Only a and b are correct.

1. In a eukaryotic cell, most of the enzymes of the citric acid cycle are located in the
   A. mitochondrial matrix.
   B. inner mitochondrial membrane.
   C. intermembrane space.
   D. outer mitochondrial membrane.
   E. Cytosol.

2. Pyruvate, the end product of glycolysis, enters the citric acid cycle after it has been converted to
   A. acetaldehyde.
   B. lactic acid.
   C. acetic acid.
   D. acetyl-CoA.
   E. None of the above.

3. Most of the ATP made during cellular respiration is generated by:
   A. substrate-level phosphorylation.
   B. oxidative phosphorylation.
   C. glycolysis.
   D. photophosphorylation.
   E. The third and fourth choices are both correct.

4. Energy that is released from glucose during respiration but not transferred to ATP bonds can be detected as:
   A. H_2O.
   B. CO_2.
   C. ADP.
   D. turgor pressure.
   E. heat.

5. In a eukaryotic cell, most of the enzymes of the electron transport chain are located in the
   A. cytosol
   B. outer mitochondrial membrane.
   C. intermembrane space.
   D. inner mitochondrial membrane.
   E. mitochondrial matrix.

6. During electron transport, protons are pumped out of the mitochondrion at each of the major sites except for:
   A. *Complex I*.
   B. *Complex II*.
   C. *Complex III*.
   D. *Complex IV*.
   E. *Complex MIM* (a.k.a. MCMXCIX).

7. Coenzyme Q is involved in electron transport
   A. as a lipid-soluble electron carrier.
   B. as a water-soluble electron donor.
   C. as a covalently attached cytochrome cofactor.
   D. as a water-soluble electron acceptor.
   E. directly to O_2.

8. The cytochrome c oxidase complex
   A. accepts electrons from cyt c.
   B. donates four electrons to O_2.
   C. produces 2 H_2O per O_2 reduced.
   D. pumps 2 protons out of the matrix space.
   E. All of the above are correct.

You have broken down a typical glycerophospholipid. You find that it consists of a saturated fatty acid, an unsaturated fatty acid, glycerol, a phosphate and:

A. alanine
B. cholesterol
C. inosine
D. serine
E. sphingosine

The first step in the β-oxidation of fatty acids is catalyzed by fatty acyl-CoA dehydrogenase. There are four kinds of fatty acyl-CoA dehydrogenase each with a different set of substrates. The substrates differ from each other in:

a. branching
b. charge
c. oxygenation
d. saturation
e. Size

The committed step in the synthesis of fatty acids is the formation of:

a. acetoacetyl CoA
b. acetyl CoA
c. malonyl CoA
d. propionyl CoA
e. stearoyl CoA

In what compartment does the de novo fatty acid synthesis occurs?

A. Mitochondria
B. Perioxosome
C. Endoplasmic reticulum
D. Cytosol

The conversion of acetyl CoA to malonyl CoA is the rate limiting step in fatty acid synthesis. Which of the following enzyme catalyzes the above mentioned reaction?

A. Acetyl CoA carboxylase
B. Malonyl CoA synthetase
C. Acetyl CoA decarboxylase
D. Malonyl CoA synthase

Which of the following event inactivates acetyl CoA carboxylase?

A. ADP-Ribosylation
B. Glycosylation
C. Phosphorylation
D. Farnesylation

Free fatty acids in the plasma

A. Circulate in unbound state
B. Bind to lipoproteins and circulated
C. Bind to albumin and circulated
D. Bind to fatty acid binding protein and circulated

Drugs called statins are now used to decrease plasma cholesterol levels by inhibiting the rate-limiting step of cholesterol synthesis. This step is catalyzed by:

a. Lipoprotein lipase
b. β-ketothiolase
c. Acyl carrier protein
d. HMG-CoA reductase
e. Transacylase

1) Free fatty acids in the plasma
a) Circulate in the unbound state
b) Bind to lipoproteins and circulated
c) Bind to albumin and circulated
d) Bind to a fatty acid-binding protein and circulated

2) In what compartment does the de novo fatty acid synthesis occur?
a) Mitochondria
b) Peroxisome
c) Endoplasmic reticulum
d) Cytosol

3) What is the precursor for fatty acid synthesis?
a) Acetyl CoA
b) Propionyl CoA
c) Succinyl CoA
d) Acetoacetyl CoA

4) The conversion of acetyl CoA to malonyl CoA is the rate-limiting step in the fatty acid synthesis.
Which of the following enzyme catalyzes the above-mentioned reaction?
a) Acetyl CoA carboxylase
b) Malonyl CoA synthetase
c) Acetyl CoA decarboxylase
d) Malonyl CoA synthase

5) The acetyl CoA is produced in the mitochondria and must be transported into the cytosol for the synthesis of fatty acid.
Which of the following is true regarding the transport of Acetyl CoA?
a) Acetyl CoA is diffused from the mitochondrial membrane
b) Acetyl CoA is transported by its specific transporter protein
c) Acetyl CoA is converted into pyruvate, enters into the cytosol and acetyl CoA is regenerated
d) Acetyl CoA is converted into citrate, enters into the cytosol and acetyl CoA is regenerated.

6) What is the allosteric regulator of acetyl CoA carboxylase?
a) Fatty acid
b) ATP
c) Citrate
d) Acetyl CoA

7) Which of the following event inactivates acetyl CoA carboxylase?
a) ADP-Ribosylation
b) Glycosylation
c) Phosphorylation
d) Farnesylation

8) Which of the following is not a positive regulator of acetyl CoA carboxylase?
a) Excess calories
b) Insulin
c) Citrate
d) Long-chain fatty acid

9) Which of the following enzyme statement is not true regarding fatty acid synthase?
a) Fatty acid synthase is a multifunctional enzyme
b) Fatty acid synthase is active as a dimer
c) Fatty acid synthase is activated by high-calorie food
d) Fatty acid synthase complex is inhibited by its phosphorylation

10) What form of energy is required for fatty acid biosynthesis?
a) ATP
b) NADH
c) NADPH
d) FADH2

11) What is the source of NADPH required for fatty acid synthesis?
a) Pentose phosphate pathway
b) Malic enzyme
c) Both
d) None

12) What is the fate of fatty acid entering the cells?
a) Fatty acid diffuses into mitochondria for beta-oxidation
b) Fatty acid is converted into fatty acyl CoA (activated form)
c) Fatty acid is bound to albumin in the cytosol
d) None of the above

13)What is the role of L-carnitine in fatty acid metabolism?
a) Facilitate the transport of fatty acid from the cytosol to mitochondria
b) Serve as a cofactor for enzyme fatty acid synthase
c) Activator of acetyl CoA carboxylase
d) None of the above

14) Identify the correct sequential enzymatic step for fatty acid synthesis**:**
a) Delta-2-enoyl CoA Dehydrate, Acyl CoA Dehydrogenase, Hydroxy acyl dehydrogenase, Thiolase
b) Hydroxy acyl dehydrogenase, Acyl CoA Dehydrogenase, Delta-2-enoyl CoA Dehydrate, Thiolase
c) Thiolase, Acyl CoA Dehydrogenase, Delta-2-enoyl CoA Dehydrate, Hydroxy acyl dehydrogenase
d) Acyl CoA Dehydrogenase, delta-2-enoyl CoA Dehydrate, Hydroxy acyl dehydrogenase, Thiolase

15) The complete beta-oxidation of palmitoyl CoA yield
a) 8 molecules of Acetyl CoA and 16 NADH
b) 8 molecules of Acetyl CoA and 16 FADH2
c) 8 molecules of Acetyl CoA, 8 NADH, and 8 FADH
d) 8 molecules of Acetyl CoA and 16 NADPH

16) High rate of beta-oxidation in the liver leads to ketogenesis **(**ketone body synthesis**)**.
Which of the following condition may result in ketogenesis?
a) Uncontrolled Type I diabetes
b) Pregnancy
c) Starvation
d) All of the above

17) **Which of the following step is unique to the formation of ketone bodies**?
a) Formation of Acetoacetyl CoA catalyzed by thiolase
b) Formation HMG CoA catalyzed by HMG CoA synthase
c) Splitting of HMG CoA to acetyl CoA and acetoacetate catalyzed by HMG CoA lyase
d) Reduction of acetoacetate to 3-hydroxybutyrate catalyzed by 3-hydroxybutyrate dehydrogenase

18) Identify the key regulators of the ketogenic pathway**:**
a) Acyl CoA**/**CoA ratio
b) NADH**/**NAD ratio
c) Insulin**/**Glucagon ratio
d) All of the above

19) Dicarboxylic aciduria is characterized by the excretion of C6–C10 ω-dicarboxylic acids and by nonketotic hypoglycemia.
Identify the defective enzyme from the following?
a) Long Chain Acyl CoA Dehydrogenase
b) Medium Chain Acyl CoA Dehydrogenase
c) Short Chain Acyl CoA Dehydrogenase
d) Very Long Chain Acyl CoA Dehydrogenase

20) Which of the following is the rate-limiting step of fatty acid oxidation and is also inhibited by malonyl CoA?
a) Thiokinase
b) Carnitine Palmitoyl transferase I
c) Acyl CoA Dehydrogenase
d) Thiolase

1-**c) Bind to albumin and circulated**
2-**d) Cytosol**
3-**a) Acetyl CoA**
4-**a) Acetyl CoA carboxylase**
5-**d) Acetyl CoA is converted into citrate, enters into the cytosol and acetyl CoA is regenerated.**
6-**c) Citrate**
7-**c) Phosphorylation**
8-**d) Long-chain fatty acid**
9-**d) Fatty acid synthase complex is inhibited by its phosphorylation**
10-**c) NADPH**
11-**c) Both**
12-**b) Fatty acid is converted into fatty acyl CoA (activated form)**
13-**a) Facilitate the transport of fatty acid from the cytosol to mitochondria**
14-**d) Acyl CoA Dehydrogenase, delta-2-enoyl CoA Dehydrate, Hydroxy acyl dehydrogenase, Thiolase**
15-**c) 8 molecules of Acetyl CoA, 8 NADH, and 8 FADH**
16-**d) All of the above**
17- **Option c)** and **d)**
18-**d) All of the above**
19-**b) Medium Chain Acyl CoA Dehydrogenase**
20-**b) Carnitine Palmitoyl transferase I**

Urea is synthesized in:
a. Adipocytes
b. Erythrocytes
c. Hepatocytes
d. Websites
e. Astrocytes

Degradation of ketogenic amino acids results in two-carbon fragments which may be formed into ketone bodies or fatty acids, or oxidized to carbon dioxide and water by:
a. Glycolysis
b. The dark cycle
c. The pentose phosphate pathway
d. Gluconeogenesis
e. The TCA cycle

Metabolism of fats and carbohydrates differs from nitrogen metabolism in that:
a. Nitrogen can be stored, fat and carbohydrate can't
b. Fat can be stored, nitrogen and carbohydrate can't
c. Fats and carbohydrate can be stored, nitrogen can't
d. Carbohydrate can be stored, nitrogen and fat can't
e. Nitrogen and fat can be stored, but carbohydrates can't

In which form the nitrogen is incorporated into an amino acid?
a) Nitrite
b) Glutamate
c) Nitrate
d) Ammonium ion

Transamination reaction in amino acid synthesis is catalyzed by enzyme_____
A. Nitric oxide synthase
B. Decarboxylase
C. Aminotransferase
D. Glutamate decarboxylase

Which of the following produce pyruvate?
A. Leucine
B. Isoleucine
C. Lysine
D. Alanine

3-phosphoglycerate is not the metabolic precursor for
A. Serine
B. Glycine
C. Cysteine
D. Arginine

The cyclized derivative of glutamate is
A. Proline
B. Arginine
C. Glutamine
D. Serine

Which of the following can be formed by hydroxylation of phenylalanine?
A. Serine
B. Tyrosine
C. Tryptophan
D. Leucine

Thioredoxin is involved in the:
A. conversion of AMP to ATP.
B. conversion of dUMP to dTMP.
C. conversion of a ribonucleotide to a deoxyribonucleotide.
D. inhibition of xanthine oxidase as a treatment for gout.
E. degradation of nucleoprotein.

The major control of de novo pyrimidine nucleotide synthesis in man is:
A. feedback inhibition of glutamine-PRPP amidotransferase.
B. feedback inhibition of aspartate transcarbamylase.
C. availability of N-acetyl glutamate.
D. substrate availability.
E. competitive inhibition of carbamoyl phosphate synthetase II.

Direct sources of purine ring atoms in the de novo synthesis of IMP include:
1. Glutamine. 2. a component of the tetrahydrofolate one-carbon pool. 3. Aspartate. 4. glycine.
A. 1, 2 and 3
B. 1 and 3
C. 2 and 4
D. 4 only
E. All four

Which one of the following enzymes of nucleotide metabolism is correctly paired with its pharmacologic inhibitor?
A. Dihydrofolate reductase—methotrexate
B. Inosine monophosphate dehydrogenase—hydroxyurea
C. Ribonucleotide reductase—5-fluorouracil
D.Thymidylate synthase—allopurinol
E. Xanthine oxidase—probenecid