Exam Procedures:

STEP 1 - NAME (*Print clearly*) _____

(first) *(last)*

STEP 2 – Fill in your answer sheet with a #2 scoring pencil, as follows:

- ☑ Your Student PID Number (excluding "A")
- ☑ Your last name and first name
- ☑ Course ID in "subject" …… **this is BMB 514 Exam #3**
- ☑ Date ……**10/21/13**
- ☑ Exam form in "period" …..**this is form A**
- ☑ By signing this coversheet for this exam, the student certifies that he/she has adhered to the policies of academic honesty in the performance of this exam.

_____

Signature

STEP 3 - Read these instructions:

- ☑ Page 2 of this exam contains information that may be useful to you: (a) abbreviations for the amino acids; (b) pKa values of functional groups; and (c) table of logarithms.
- ☑ Make sure your exam has **64** questions.
- ☑ Read each question very carefully. Choose the single, best answer and mark this answer on your answer sheet. No points will be added for correct answers which appear on the exam page but not on the answer sheet.
- ☑ A simple calculator is supplied for your use during this exam. Cell phones must be off (not on vibrate) and stored with your bags/backpacks/other materials.
- ☑ The proctors have the authority/responsibility to assign any student a different seat at any time, without implication and without explanation, before or during the examination, as they deem necessary. Accomplish any relocation quietly and without discussion.
- ☑ We will not answer questions of clarification. However, if you think there is an error on your exam, summon an exam proctor.
- ☑ When you finish, place all exam materials (except the tear sheet) into the manila envelope. When you leave the exam room, please turn in your envelope to the proctors. Once you exit the auditorium, please leave the area. Hallway conversations disturb those still taking the exam.
- ☑ There will be answer keys to this exam posted on the course website by 5:00 p.m. the day of the exam. You may wish to copy your responses from your answer sheet onto the answer grid on the LAST page of this exam so that you can check your results. You can tear off the last page and take it with you.
- ☑ We will close the exam promptly at **10:10 a.m.** At the announcement of the examination end time, the examination and scantron and images (if provided as part of the examination) must immediately be placed into the manila envelope provided.

STEP 4 – Wait until instructed to proceed with the exam!

INFORMATION THAT MAY BE USEFUL FOR THE EXAM

Abbreviations for Amino Acids			
Amino Acid	3-Letter Abbreviation	Amino Acid	3-Letter Abbreviation
Alanine	Ala	Leucine	Leu
Arginine	Arg	Lysine	Lys
Asparagine	Asn	Methionine	Met
Aspartic Acid	Asp	Phenylalanine	Phe
Cysteine	Cys	Proline	Pro
Glutamine	Gln	Serine	Ser
Glutamic Acid	Glu	Threonine	Thr
Glycine	Gly	Tryptophan	Trp
Histidine	His	Tyrosine	Tyr
Isoleucine	Ile	Valine	Val

Ionizable Group	pKa
α-COOH of any aa	2
β-COOH of Asp	4
γ-COOH of Glu	4
imidazole of His	6
SH of Cys	8
α-NH_2 of any aa	9
phenolic OH of Tyr	10
ϵ-NH_2 of Lys	10
guanidino of Arg	12

Tables of Logarithmic Relationships

Number	Decimal									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
1.	.00	.04	.08	.11	.15	.18	.20	.23	.26	.28
2.	.30	.32	.34	.36	.38	.40	.41	.43	.45	.46
3.	.48	.49	.51	.52	.53	.54	.56	.57	.58	.59
4.	.60	.61	.62	.63	.64	.65	.66	.67	.68	.69
5.	.70	.71	.72	.72	.73	.74	.75	.76	.76	.77
6.	.78	.79	.79	.80	.81	.81	.82	.83	.83	.84
7.	.85	.85	.86	.86	.87	.88	.88	.89	.89	.90
8.	.90	.91	.91	.92	.92	.93	.93	.94	.94	.95
9.	.95	.96	.96	.97	.97	.98	.98	.99	.99	1.00
10.	1.00					logs				

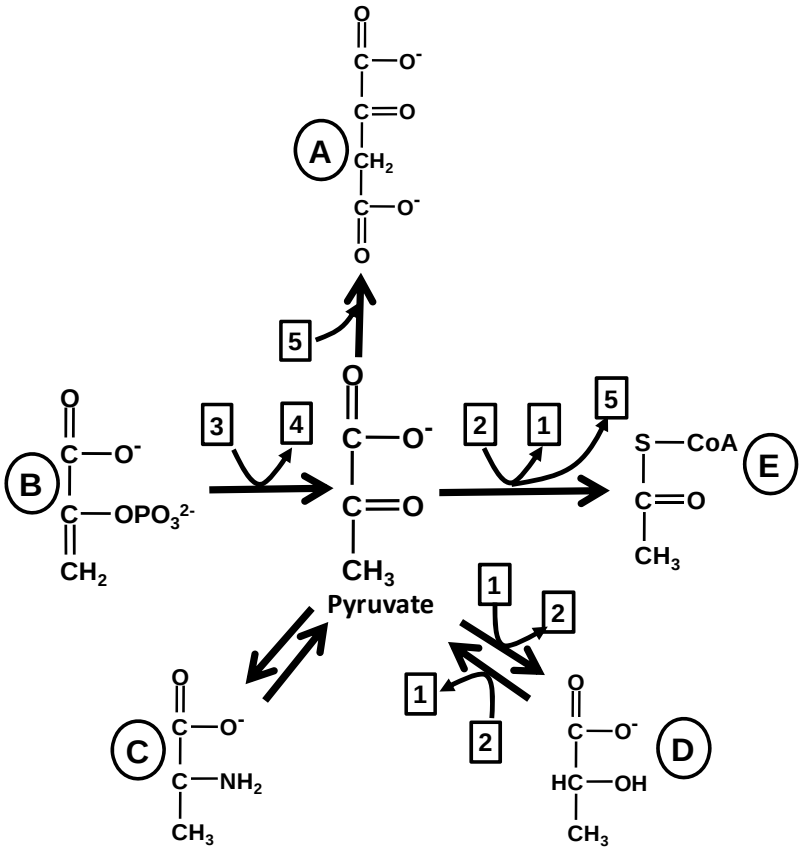
E.g. log 3.5 = 0.54

Reminder: How to form logs of multiples .....

log 35 = log (3.5×10^1) = (log 3.5 + log 10^1) = (0.54 + 1) = 1.54

log 350 = log (3.5×10^2) = (log 3.5 + log 10^2) = (0.54 + 2) = 2.54

log 0.35 = log (3.5×10^{-1}) = (log 3.5 + log 10^{-1}) = (0.54 - 1) = - 0.46



The above figure describes the metabolic sources/fates of pyruvate. The molecules that can be converted to or converted from pyruvate are labeled A-E. The cofactors and byproducts of each reaction are labeled 1-5. **Use this figure to answer the following 7 questions (Questions 1-7)**.

1) A cancer cell under hypoxic stress will require the production of which molecule to maintain glycolytic capacity?

2) The conversion of pyruvate to which molecule requires an alpha-amino acid?

3) Patients suffering from a deficiency in the enzyme responsible for converting pyruvate into this molecule can sometimes be successfully treated with lipoic acid or thiamine therapy?

4) A body builder has been consuming large quantities (i.e > 20 per day) of raw eggs with the hopes of building more muscle mass, however, he has noticed when he has not eaten in several hours he was becoming more lethargic than normal. You deduce the patient is suffering from a diet-induced biotin deficiency. Under these conditions, which molecule will the patient be unable to make?

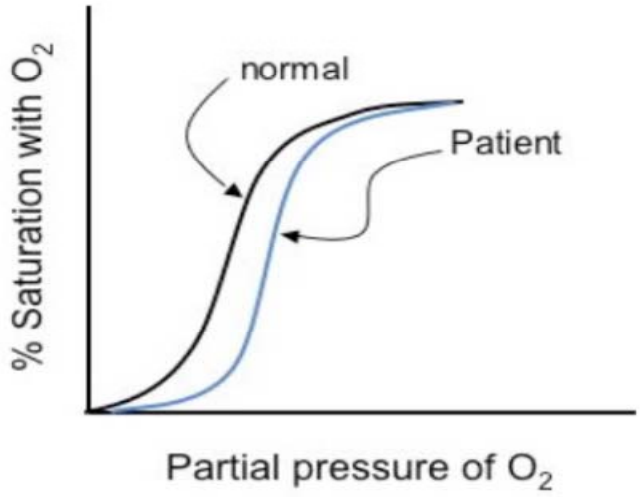
5) High cellular concentrations of which cofactor, a marker of low energy in the cell, acts as a positive regulator of the pyruvate dehydrogenase complex?

   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

6) The bidirectional mitochondrial transport of the reducing power carried by which cofactor is dependent upon malate dehydrogenase isozymes?

A. 1
B. 2
C. 3
D. 4
E. 5

7) A 9-month old girl presents with a hemolytic anemia. She is found to have a deficiency in the enzyme responsible for the conversion of molecule B to pyruvate. Shown below is the oxygen saturation curve for hemoglobin in the erythrocytes of this patient, compared to the corresponding curve in normal red blood cells (RBCs). Which of the following is the most likely explanation for the observed oxygen saturation curve in this patient? [Hint: Integrate information about RBC metabolism learned in PSL 534 with information on metabolic pathways learned in BMB 514.]



A. decreased 2,3-diphosphoglycerate
B. decreased blood glucose
C. increased 2,3-diphosphoglycerate
D. increased blood glucose
E. normal levels of pyruvate

8) The hydrophobic forces that stabilize the conformation of some proteins are best illustrated by:

A. clustering of nonpolar amino acid side chains in the interior of globular proteins.
B. heat denaturation of globular proteins.
C. the unfolding of proteins at high pH.
D. the unfolding of proteins at low pH.

9) Proteins are effective buffers over a wide range of pHs because they usually contain:

A. a large number of amino acids
B. amino acid residues with different pK_a values
C. amino-terminal and carboxyl-terminal residues that can donate or accept protons
D. peptide bonds that readily ionize, consuming H^+ and OH^- ions
E. a large number of hydrogen bonds in α-helices

10) In vigorously exercising muscle, a combination of compounds facilitates the release of O_2 to the tissue. Increased concentrations of which of the following combinations contribute most significantly to O_2 delivery to the tissue?

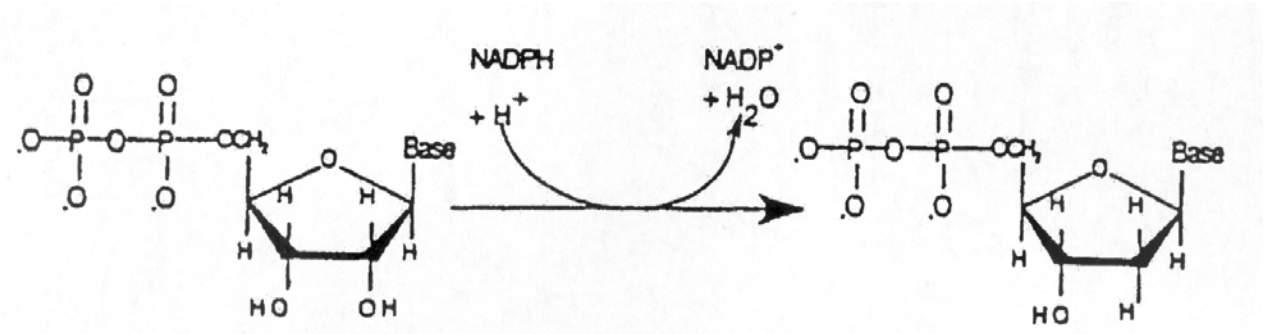
	carbonic acid	**citric acid**	**folic acid**	**lactic acid**
A.	no	yes	no	yes
B.	no	yes	yes	no
C.	yes	no	no	yes
D.	yes	no	yes	no

11) A 45-year-old man was treated for Pneumocystis carinii pneumonia with sulfa drugs (trimethoprim-sulfamethoxazole). Two days after therapy started, he became slightly jaundiced and his urine was red-brown due to free hemoglobin. This patient most likely has a genetic deficiency in which of the following enzymes?

A. glycogen phosphorylase
B. glucokinase
C. glucose 6-phosphatase
D. glucose 6-phosphate dehydrogenase
E. glutamate dehydrogenase

12) Which of the following enzymes catalyzes the set of reactions shown below?

(The word "base" shown in the structures could be A, G, C, or U.)



A. adenine phosphoribosyl transferase
B. carbamoyl phosphate synthetase II
C. ribonucleotide reductase
D. thymidylate synthase
E. xanthine oxidase

Questions 12-14 refer to the case below.

A patient arrives in the trauma center suffering from unknown internal injuries as a result of a traffic accident. She is semiconscious with a blood pressure of 64/40 (mmHg) and appears to be going into shock.

Laboratory data indicate:

	patient	**normal**
pCO_2 (mmHg)	39	35-45
$[HCO_3^-]$ (mM)	15.21	22-26
pH	?	7.35-7.45

Note: (a) solubility coefficient for CO_2 at 37 ^oC is 0.03 mM/mm Hg;
(b) pK_a = 6.1 for the bicarbonate – CO_2 buffer system

13) A determination of the patient's blood pH would be expected to be closest to:

A. 6.1
B. 7.2
C. 7.4
D. 7.6
E. 8.7

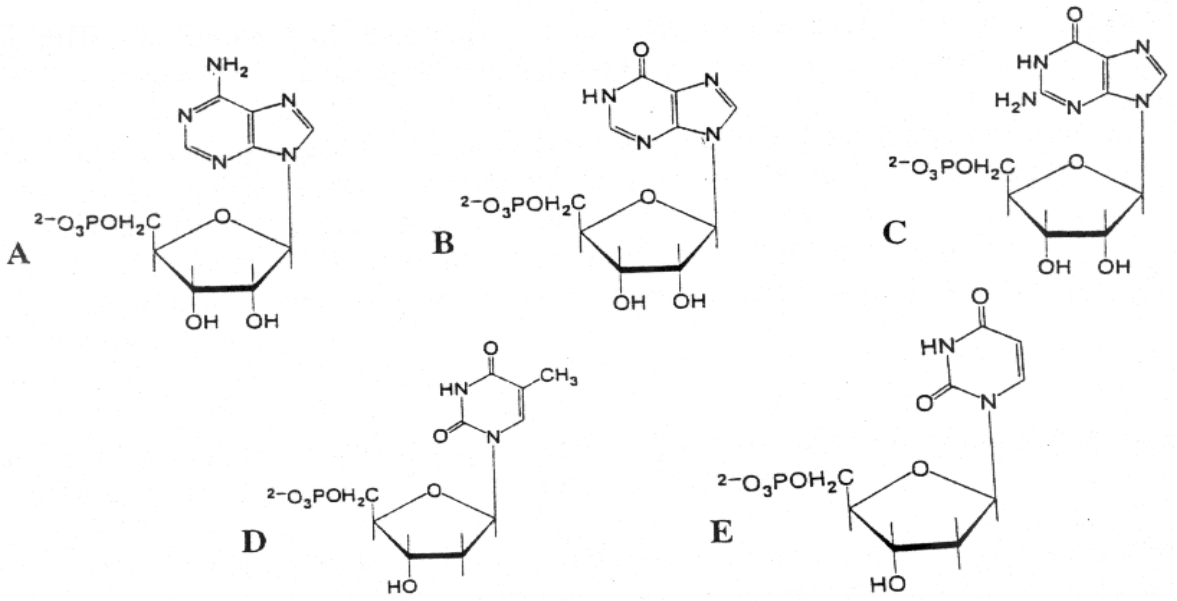
14) This patient can be best characterized to have:

A. Acid-base normalcy
B. Respiratory acidosis
C. Respiratory alkalosis
D. Metabolic alkalosis
E. Metabolic acidosis

15) The Total CO_2 for this patient is closest to:

A. 1.2 mM
B. 15.2 mM
C. 39 mM
D. 16.4 mM
E. 54.2 mM

For the next two questions (questions 16-17), choose the best answer from the structures below:
(You might find it helpful if you identify each compound by its name before attempting to answer the questions.)



16) A nucleotide that inhibits the enzyme of the committed step of *de novo* purine nucleotide biosynthesis (PRPP amidotransferase) but NOT the enzyme of the activation step of the same biosynthetic pathway (PRPP synthetase).

17) A nucleotide that is the direct substrate of thymidylate synthase.

18) Which of the following reactions is catalyzed by the enzyme HGPRT (hypoxanthine-guanine phosphoribosyl transferase) in the pathway to salvage purine bases?

[PRPP = 5-phosphoribosyl 1-pyrophosphate] [THF = tetrahydrofolate]

A. PRPP + hypoxanthine → IMP + PPi
B. glutamine + bicarbonate → glutamate + carbamoyl phosphate
C. glutamine + PRPP → glutamate + 5-phosphoribosyl 1-amine
D. dUMP + N^5, N^{10}-methylene THF → dTMP + dihydrofolate
E. CDP + NADPH → dCDP + $NADP^+$

19) Methotrexate is a potent anti-cancer agent that starves proliferating cells of deoxythymidylate through direct inhibition of which of the following enzymes?

A. ribonucleotide reductase
B. xanthine oxidase
C. carbamoyl phosphate synthetase II
D. 5'-nucleotidase
E. dihydrofolate reductase

20) A 52-year-old woman presents with fatigue of several months' duration. Blood studies reveal a macrocytic anemia, reduced levels of hemoglobin, elevated levels of homocysteine, and normal levels of methylmalonic acid. There were no neurologic symptoms. Which of the following is most likely deficient in this woman?

A. vitamin B_6 (pyridoxal)
B. vitamin B_9 (folic acid)
C. vitamin B_{12} (cobalamin)
D. vitamin C (ascorbic acid)
E. vitamin H (biotin)

21) A 23-year-old woman was diagnosed with genital herpes. As part of her treatment, she was prescribed acyclovir (acycloguanosine). This drug works in herpes-infected cells by:

A. activating cyclic GMP hydrolysis
B. inhibiting folate degradation
C. activating respiratory burst
D. inhibiting DNA synthesis
E. activating ribonucleotide reductase

22) Consider the lab findings of three patients summarized below (+ indicates presence; +++, markedly increased). On the basis of these data, which of the patients has the least risk of gout?

	Patient I	**Patient 2**	**Patient 3**
Serum uric acid	**+++**	**+++**	**+**
Urinary uric acid	**+++**	**+**	**+++**

A. Patient 1
B. Patient 2
C. Patient 3

23) Allopurinol is used to treat which aspect of a patient with Von Gierke's disease (glycogen storage disease type 1)?

A. Hyperglycemia, due to excessive release of glucose from cornstarch
B. Hyperuricemia, due to elevated levels of glucose 6-phosphate and decreased excretion
C. Hypoglycemia, due to inability to metabolize glycogen
D. Hypouricemia, due to elevated activity of xanthine oxidase
E. Hypercholesterolemia, due to elevated HMG-CoA lyase activity

24) A 1-year-old female patient suffers from orotic aciduria (elevated level of orotic acid in urine). Which of the following laboratory tests would be most helpful in distinguishing an orotic aciduria caused by a defect in one of the urea cycle enzymes (e.g. carbamoyl phosphate synthetase I or ornithine transcarbamylase) from that caused by a defect in uridine monophosphate synthesis (e.g. orotate phosphoribosyl transferase)?

A. Blood ammonia level determination
B. Blood ascorbate level determination
C. Blood citrate level determination
D. Blood folate level determination
E. Blood glucose level determination

A patient is to undergo a routine arthroscopic surgery on her knee and is instructed to fast for 12 hours before reporting to the clinic. With this in mind, answer the following 2 questions (questions #25-26).

25) During the fast, the patient's blood glucose level has decreased from the normal value of about 4 mM to approximately 3 mM. Which of the following statements describes the most likely activity levels of Glucokinase and/or Hexokinase given the information below?

Reaction catalyzed: Glucose + ATP → Glucose-6-phosphate (G6P) + ADP

	Glucokinase	**Hexokinase**
Tissue distribution	liver & β-cells	most tissues
Km for glucose	10 mM	0.1 mM
Vmax	High	Low
Inhibited by G6P	No	Yes

A. Both enzymes will be maximally active
B. Hexokinase activity will have increased following the starvation period
C. Hexokinase will be at half maximal velocity following the starvation period
D. Glucokinase will be at maximal velocity following the starvation period
E. Hexokinase activity will be unchanged following the starvation period

26) Following the 12 hour fast, which of the following enzymes will be active in the liver?

A. Phosphofructokinase
B. Carnitine acyl transferase I
C. Acetyl CoA carboxylase
D. Glycogen synthase

27) Which of the following would be present in a patient suffering from von Gierke's disease in a fasting state but absent from a patient with uncontrolled Type I diabetes?

A. Increased hepatic gluconeogenesis
B. Higher than normal levels of hemoglobin A_{1c}
C. Increased rate of hepatic beta-oxidation
D. Insulin/glucagon proportional to serum glucose levels
E. Decreased rate of glycogenesis

28) Which of the following correctly describes the synthesis or metabolic role of linoleic acid (omega 6 (ω-6)-$C_{18:2}\Delta 9, 12$)?

A. Mammalian cells can synthesize the molecule from acetyl CoA
B. It is necessary for the synthesis of prostaglandins
C. Is required for the synthesis of sphingomyelin
D. Is required for the synthesis of cholesterol

The following three questions (questions 29-31) refer to the case report:
Mrs. Smith is a 40 year old woman with a family history of hypertension. During her routine checkup she expressed concern about her family history and what her current weight (BMI = 29, overweight, borderline obese) means for her risk of heart disease. You order some tests and the results are listed below.

	Patient	Normal
Total Cholesterol	**300 mg/dL**	**125-200**
Low Density Lipoprotein (LDL)	**220 mg/dL**	**60-130**
High Density Lipoprotein (HDL)	**40 mg/dL**	**30-60**
Triglycerides (TAGs)	**200 mg/dL**	**10-150**
Fasting Blood Glucose	**110 mg/dL**	**65-110**
ALT	**25 U/L**	**0-48**
AST	**30 U/L**	**0-42**

29) Given the lab reports, you realize that Mrs. Smith is suffering from hypercholesterolemia. The main class of drugs for the treatment of hypercholesterolemia is statins. What is the basis for statins in the treatment of high cholesterol?

A. Competitive inhibitors of HMG-CoA reductase, thus lowering intracellular cholesterol levels and increasing expression of LDL receptors.
B. Competitive inhibitors of HMG-CoA reductase, thus increasing the endogenous synthesis of cholesterol, forcing more excretion of cholesterol
C. Competitive inhibitors of apolipoprotein B-100, thus forcing the excretion of cholesterol
D. Competitive inhibitors of cytosolic β-ketothiolase, forcing circulating cholesterol to be broken down into ketone bodies
E. Competitive inhibitors of pancreatic lipases thus decreasing the absorption of dietary cholesterol

30) Mrs. Smith is considering getting pregnant and thus is not a good candidate for statins. You decide to prescribe Colesevelem, a bile acid binding polymer to help lower her cholesterol. What is therapeutic rationale for the use of this type of polymer?

A. Removal of bile acids will activate HMG-CoA reductase degradation
B. Removal of bile acids will remove a strong negative regulator of HDL synthesis
C. It acts like dietary fiber and facilitates the excretion of bile acids, a breakdown product of cholesterol.
D. Since bile acids are positive regulators of cholesterol synthesis, their removal will decrease cholesterol levels.
E. Bile acids increase the expression of apolipoprotein C-II thus activating the degradation of cholesterol esters.

31) Another treatment option is to change Mrs. Smith's diet with the hope of increasing her HDL levels. Why would increasing HDLs help lower her cholesterol?

A. HDLs are the only mechanism for taking cholesterol from tissues back to the liver
B. HDLs can remove cholesterol esters from membranes
C. HDLs will increase the activity of pancreatic lipases
D. HDLs will inhibit chylomicron synthesis thus increase bile acid excretion
E. HDLs will recycle more apolipoprotein C-II thus lowering levels of VLDLs

32) Which of the following is required for the synthesis of sphingomyelin that is not also used for phosphatidate (diacylglycerol phosphate) synthesis?

A. Fatty acids
B. Glycerol
C. Coenzyme A
D. Serine

The following two questions (questions 33 and 34) refer to the clinical case described below:

A 5 week old male infant was admitted to determine the cause of decreased feeding and alertness. The patient was exhibiting slow respirations (i.e. bradypnea), poor muscle tone, and brain computed topography (CT) hypodense lesions in the basal ganglia. One week later the patient required complete ventilation and starting developing seizures and another CT scan revealed increased size and number of lesions in the basal ganglia. The patient died 2 weeks later.

33) A muscle biopsy was performed and it was determined that the patient suffered from a complex I deficiency. You purified the mitochondria from these muscles cells and determine they were not consuming oxygen. What would you expect to find with regard to electron transport chain intermediates and the effects of 2,4 dinitrophenol (2,4-DNP) on oxygen consumption in these mitochondria

	ETC intermediates	**Effect of 2,4-DNP**
A.	Increased reduced CoQ	no effect
B.	Increased reduced cytochrome c	Increased
C.	Increased NADH	Increased
D.	Increased reduced CoQ	Increased
E.	Increased NADH	No effect

34) Given that the patient is suffering from complex I-induced Leigh's syndrome which of the following would you expect to find in this patient's lab reports compared to normal values

	Pyruvate	**Lactate**
A.	Increased	Increased
B.	Decreased	Increased
C.	Normal	Normal
D.	Increased	Normal
E.	Decreased	Increased

35) Which of the following correctly describes the uptake of low density lipoproteins by endocytosis?

A. Requires apolipoprotein C-II
B. Is responsible for lowering the cholesterol levels in peripheral tissues
C. Is mediated by apolipoprotein B-100 and clathrin coated vesicles
D. Can stimulate the expression of LDL receptors via feed-forward activation
E. Only occurs in muscle cells

36) In the intestinal mucosa cells, the constituents of the mixed micelles absorbed during the digestion of dietary lipids will be

A. completely metabolized to acetyl CoA
B. transported directly into circulation via exocytosis with no further processing
C. resynthesized into triacylglcerols and phospholipids and packaged into chylomicrons
D. used in the synthesis of high density lipoproteins
E. further digested by lipases and bile salts for transport to the gall bladder

37) A patient with Von Gierke's Disease has a high plasma concentration of uric acid. What is one likely explanation for this increase?

A. A decrease in uric acid incorporation into nucleic acids
B. lactic acidosis causes a decreased excretion of uric acid
C. glycogen stores decrease hormone stimulated uric acid breakdown
D. Excess fatty acids are broken down into uric acid
E. Decreased pentose phosphate pathway activity leading to less uric acid utilization.

38) Which of the following statements is true regarding metabolism in muscle tissue?

A. Glucose-6-phosphatase is expressed to allow release of free glucose
B. Alanine is exported as its water soluble, non-toxic nitrogen carrier
C. Glutamate dehydrogenase runs predominantly in the oxidative deamination direction
D. It responds to glucagon by inhibiting cellular glucose uptake
E. It will only use ketone bodies as a last resort and prefers glucose as a fuel

39) You are seeing a 52 yr old male patient with chronic severe liver damage where the estimated functional capacity of the liver is about 15%. What metabolic changes would be expected in this patient when he is in a fasting state?

A. His kidneys will participate in ketone body production
B. His muscle will release free glucose into circulation
C. His heart will switch to utilization of glucose to conserve oxygen
D. His red blood cells will switch to utilization of ketone bodies
E. He will have a high insulin to glucagon ratio

40) An 89 yr old female patient is brought into your office by her adult daughter who is visiting from out of state. The patient lives alone as her spouse died about two years ago, and due to distance and busy schedules, she is visited infrequently. The patient reports that her daily diet consists of a cup of coffee and a couple buttered soda crackers. What physical exam findings would be expected?

A. fatty liver
B. protuberant abdomen
C. general wasting
D. wide spread edema
E. increased skin pigmentation

41) A patient who chooses to adhere to a strict vegan diet of no animal products would be at a higher risk for deficiency of what amino acids?

A. Alanine & Glycine
B. Proline & Glutamate
C. Asparagine & Serine
D. Tryptophan & Lysine
E. Glutamine & Aspartate

42) Deficiency in which of the following enzymes would be most detrimental?

A. Trypsin
B. Elastase
C. Chymotrypsin
D. Carboxypeptidase A
E. Enteropeptidase

43) In the liver, 2 hours after a large balanced meal, what would be the status of the enzyme glutamate dehydrogenase?

A. High energy state would activate the forward direction
B. It would run in reverse to supply NH_4^+ to the urea cycle
C. High concentrations of ATP and NADH would inhibit the forward direction
D. High energy state would inhibit the mode that uses the cofactor NADPH
E. The mode characterized as an oxidative deamination would be favored

44) L-arginine is capable of binding to and activating another enzyme, N-acetylglutamate synthase. Since arginine is neither a substrate nor a product of this enzyme, how would this effector be classified?

A. negative homotropic effector
B. feedforward activator
C. positive heterotropic effector
D. negative heterotropic effector
E. positive homotropic effector

45) Glutamine synthetase catalyzes the conversion of glutamate to glutamine. Which of the following statements is correct regarding this reaction?

A. The ammonia used in this reaction comes from glutamate dehydrogenase running in reverse'
B. This reaction is freely reversible
C. This reaction incorporates a phosphate from ATP into its product
D. This reaction takes place predominantly in peripheral tissue
E. This reaction generates oxidative stress for the cell

46) A healthy 24 yr old male is in your office for a physical. He is excited and talkative, telling you that he began training for an Iron Man (physical endurance feat) including intense weight training about 4 -5 days ago. Though he is used to moderate physical activity, he admits he's never done anything like this before. All exam components are normal, you congratulate him on his good health, and inform him that he will receive a call when his labs are completed. He has the following notable blood lab values (status: fasting):

pH	7.38	(7.35-7.45)
$[HCO_3^-]$	25	(20-30)
pCO_2	44	(35-45)
Glucose	69	(65-110)
Lactate DH	410	(0-250)
Creatine Kinase	350	(25-200)
alanine aminotransferase (ALT)	180	(0-48)
aspartate aminotransferase (AST)	630	(0-42)

Which of the following would be the best advice for the patient?

A. Your liver is failing, please return for more tests
B. Ease into those workouts, you have some muscle damage
C. You are acidemic, please return for more tests
D. You are prone to hypoglycemia, you need to eat more

For the following 3 questions (questions 47-49), choose from the list of vitamins below:

A. pyridoxine
B. biotin
C. folate
D. niacin
E. ascorbate

47) This vitamin is required for the activity of aminotransferases

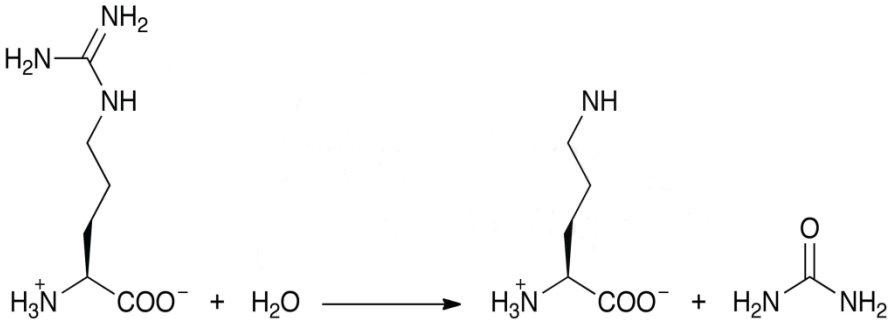
48) This vitamin is critical for synthesis of functional collagen molecules.

49) Deficiencies in this vitamin lead to a development of Pellagra characterized by diarrhea, dermatitis, dementia, and eventually death.

50) Which of the following correctly describes an action of glucagon?

A. Dephosphorylates Glycogen phosphorylase to activate it
B. Inhibits glucose uptake by muscle
C. Has strongest effect on adipose tissue
D. Activates protein kinases through cAMP
E. Stimulates glycolysis in the liver

Use the following reaction to answer the next 3 questions (questions 51 - 53):



L-Arginine L-Ornithine Urea

51) The reaction above is catalyzed by the enzyme Arginase. What would be the classification of this enzyme?

A. Hydrolase
B. Transferase
C. Ligase
D. Lyase
E. Oxidoreductase

52) N-hydroxy-L-arginine (an intermediate in nitric oxide biosynthesis) can bind to the active site of arginase making its manganese reactive metal center unavailable for catalysis. How would an increased concentration of this intermediate be expected to affect the kinetic parameters of this enzyme?

A. The apparent Vmax will decrease
B. The apparent Km for arginine will decrease
C. The apparent Vmax will increase
D. The apparent Km for arginine will increase

53) Knowing in which tissue the above reaction takes place and what happens to the products of this reaction, what can you predict about the ΔG'?

A. A high ΔG' will mean the reaction will go fast
B. Removal of product will make ΔG' more negative
C. The reaction will reach equilibrium in the cell
D. The reaction will be freely reversible

54) Which of the following processes would be stimulated by insulin in the liver?

A. Gluconeogenesis
B. Glycolysis
C. Lipolysis
D. Glycogenolysis

Use the scenario below to answer the next 4 questions (question 55-58)

A patient comes into your clinic suffering from anorexia nervosa. Her mother brought her in concerned as the patient has not eaten in over 3 days. She has the classic presentation including low body weight, decreased muscle mass, glycogen, and fat stores, and she is anemic.

55) What would be the expected phosphorylation state and activity of her liver enzymes glycogen phosphorylase and pyruvate kinase?

	Glycogen Phosphorylase	**Pyruvate Kinase**
A.	phosphorylated & active	phosphorylated and inactive
B.	dephosphorylated & active	phosphorylated and inactive
C.	phosphorylated & inactive	phosphorylated and inactive
D.	dephosphorylated & active	dephosphorylated and active
E.	dephosphorylated & active	dephosphorylated and inactive

56) Under these circumstances, which tissue will have the most preferential access to circulating glucose?

A. brain
B. muscle
C. red blood cells
D. liver
E. heart

57) What would be the expected rate of nitrogen excretion in this patient?

A. proportional to nitrogen intake
B. undetectable due to lack of intake
C. constant at about 5 g per day
D. increased to greater than 7 g per day due to wasting

58) Why would the acetyl-CoA generated by this patient not enter the TCA cycle in her liver?

A. The liver does not express the enzyme necessary to utilize acetyl-CoA in this way
B. The PDH complex will not run in reverse
C. Oxaloacetate is unavailable due to predominance of gluconeogenesis
D. Acetyl-CoA is being used to generate glucose
E. The high insulin to glucagon ratio in this patient would inhibit the TCA cycle

59) Which of the following amino acids would yield breakdown products which could never result in net glucose production?

A. Threonine & Glycine
B. Leucine & Lysine
C. Phenylalanine & Threonine
D. Isoleucine & Tryptophan
E. Valine & Histidine

60) Which of the following key enzymes is part of an anabolic pathway?

A. Nucleoside phosphorylase
B. Glycogen phosphorylase
C. Carnitine acyltransferase I
D. Phosphofructokinase I
E. Carbamoyl phosphate synthetase I

61) The urea cycle has two net output products. One product of the urea cycle is directly excreted while the other is recycled. How does the second product feed back into the cycle?

A. The aspartate generated can be reconverted to fumarate through the TCA cycle
B. The fumarate generated can be directly converted to arginine through TCA cycle reactions
C. The arginine generated can be used as a substrate by urea cycle enzymes
D. The fumarate generated can be converted to aspartate by the TCA cycle and the malate-aspartate shuttle
E. The fumarate generated can be converted to aspartate by the TCA cycle and the malate-pyruvate-citrate shuttle

62) Which of the following insulin:glucagon ratios would be most typical of a patient with type I diabetes?

	Insulin	**Glucagon**	**Ratio**
A.	40 uU	80 pg/mL	(0.5)
B.	15 uU	100 pg/mL	(0.15)
C.	6 uU	120 pg/mL	(0.05)
D.	0 uU	70 pg/mL	(0.0)
E.	0 uU	0 pg/mL	(0.0)

63) Which of the following correctly describes fatty acid synthesis?

A. It is stimulated during fasting conditions
B. Carnitine acyltransferase I (CATI) catalyzes the major regulatory reaction
C. Linoleic acid is the primary fatty acid produced
D. A cytosolic complex of enzymes carries out the four repeated steps
E. Is an energy independent process.

64) You have a bed time snack of Fruit Loops while watching “The Matrix”. Eight hours later, while still sleeping, the needs of your hepatocytes have changed. How will the cells respond to these metabolic needs?

A. Degrade unneeded endogenous proteins in the lysosome and make new ones
B. Stop everything and wait until you eat again
C. Use stored amino acid pools to make needed enzymes
D. Synthesize all needed amino acids and make proteins
E. Turnover unneeded proteins via ubiquitin targeting to the proteosome

END OF EXAMINATION - Tear off this sheet and save to check your answers.

- You may write in your answer to each question on this sheet. DO NOT make any other marks on this sheet. If there are any extraneous marks on this page it will be confiscated.
- Only the answer on the scantron is the official answer. **WE CANNOT USE THE ANSWERS ON THIS TEAR OFF SHEET TO DETERMINE YOUR GRADE.**

Please remember to:

- Write in the **letter of your form** in the area titled "Period" on the exam scantron.
- **Return your examination** in the envelope provided to a proctor **before leaving the exam room**.

BMB 514 SS 2013 Exam #3

FORM: A

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