



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

**SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELLOR OF
SCIENCE IN BIOCHEMISTRY**

SBC 407N: VITAMIN BIOCHEMISTRY

DATE: Thursday 5th April 2012

TIME: 8.00a.m – 10.00a.m

INSTRUCTIONS:

Section A: Answer **ALL** the Questions; Choose the **ONE** best answer (1 mark each)

1. The coenzyme required in oxidative decarboxylation is:

- A) Biotin.
- B) Vitamin B₁₂
- C) Pyridoxal phosphate
- D) Ascorbic acid
- E) Thiamine pyrophosphate

2. Which one of the following compounds is synthesized from glutamic acid, p-aminobenzoic acid, and a pteridine nucleus?

- A) Vitamin B₁₂
- B) Cyanocobalamin
- C) Folic acid
- D) Biotin
- E) Coenzyme A

3. Which one of the following statements about vitamin B₁₂ is INCORRECT?
- A) It can be converted to cofactor forms containing a 5'-deoxyadenosine or methyl group attached to cobalt.
 - B) It can serve as a source of a cofactor required for the conversion of methylmalonyl CoA to succinyl CoA.
 - C) It requires a specific glycoprotein for its absorption.
 - D) It may be present in inadequate quantities in a strictly vegetarian diet.
 - E) It contains a heme group
4. Which one of the following statements about ascorbic acid is INCORRECT?
- A) It is readily oxidized, particularly in the presence of divalent metal ions.
 - B) It is a cofactor required for the hydroxylation of proline and lysine.
 - C) Its requirement varies with the caloric intake
 - D) It is metabolized in part to oxalate, which can form an insoluble salt with calcium
 - E) It facilitates the absorption of dietary iron.
5. The nutritional requirement for niacin in humans is:
- A) Increased when the diet includes large amounts of raw egg white
 - B) Decreased when the diet is supplemented with commercial 'liquid protein' consisting largely of hydrolyzed collagen (which does not contain tryptophan).
 - C) Independent of the composition of the diet
 - D) Decreased when the diet contains large amounts of animal protein
6. A deficiency of biotin in a higher animal is likely to be accompanied by:
- A) Defective oxidation of fatty acids to acetyl CoA
 - B) Decreased formation of lactate in skeletal muscular contraction
 - C) Decreased oxidation of succinate by mitochondria isolated from the liver of such animals
 - D) Defective synthesis of fatty acids
7. Which of the following reactions involve the participation of thiamine?
- A) Lactate – pyruvate
 - B) Glucose – Glucose - 6 - phosphate
 - C) Acetyl CoA – malonyl CoA

D) Ribose 5-phosphate – sedoheptulose 7-phosphate

8. Which of the following statements about niacin is not true?

- A) Niacin forms part of the structure of NADP⁺
- B) Niacin is derived from the degradation of tryptophan
- C) Niacin is involved as a cofactor in oxidation-reduction reactions
- D) Niacin is a constituent of FAD

9. Which of the following statements about Vitamin B₁₂ is not true?

- A) Participates in the conversion of homocysteine to methionine
- B) Contains cobalt
- C) When injected into patients with pernicious anemia overcomes the lack of intrinsic factor
- D) Can be obtained in the diet from peas and carrots

10. Which of the following statements about Vitamin A (or one of its derivatives) is not true?

- A) Can be enzymically formed from dietary β -carotene
- B) Is transported from the intestine to the liver in chylomicrons
- C) Is the light-absorbing portion of rhodopsin
- D) Is phosphorylated and dephosphorylated during the visual cycle

11. Prolonged deficiency of vitamin D will result in:

- A) Increased secretion of calcitonin
- B) Increased urinary excretion of calcium
- C) Increased density of bone
- D) Increased secretion of parathyroid hormone

12. Vitamin D:

- A) Increases absorption of iron from the intestine
- B) Is required in the diet of individuals exposed to sunlight
- C) Is not really a vitamin because the active form, 1, 25-dihydroxycholecalciferol, can be synthesized in humans.
- D) Opposes the effect of parathyroid hormone

13. Vitamin K:

- A) Plays an essential role in preventing thrombosis
- B) Decreases the coagulation time in newborn infants with hemorrhagic disease
- C) Is present in high concentration in cow's or breast milk
- D) Is not synthesized by intestinal bacteria

14. α -Tocopherol:

- A) functions primarily as an antioxidant
- B) deficiency is commonly found in adults
- C) requirements decrease with the amount of polyunsaturated fatty acids in the diet.
- D) Is found in high concentrations in whole grains cereals

For questions 15 – 20 select the most appropriate vitamin from the list given:

15. Is required for oxidative decarboxylation

16. Contains a glutamate residue

17. A water-soluble antioxidant

18. Participates in the conversion of homocysteine to methionine

19. High doses are contraindicated in pregnancy

20. Precursor of a vitamin (provitamin)

List of vitamins

- A. Biotin
- B. Vitamin B₁₂
- C. Ascorbic acid
- D. Thiamine
- E. Riboflavin
- F. Folic acid
- G. Vitamin A
- H. Vitamin D

- I. Vitamin K
- J. Vitamin E
- K. β -carotene

Section B: Answer **ALL** the Questions (5 marks each)

21. Fill in the missing information

22. Fill in the missing information.

Deficiency of (i) _____ alone rarely occurs. However, a widely used antituberculosis drug (ii) _____ can induce an isolated (iii) _____ deficiency by forming a hydrazine with Pyridoxal which is rapidly excreted in urine. (iv) _____ is normally acylated in the liver but some individuals are (v) _____ whereby (vi) _____ of (viii) _____. There is also evidence that in renal failure, (ix) _____ is inhibited and deficiency of (x) _____ may occur despite an adequate intake of vitamin B6.

23. (a) Draw the structure of folic acid.

(b) Draw the structural formulas of the following C-1 groups transported by tetrahydrofolate in its metabolic inter-conversions:

- i) Methyl
- ii) Methylene
- iii) Methenyl
 - i) Formyl
 - ii) Formimino

24. Fill in the missing information.

There are in humans only two enzymatic reactions for which (i) _____ serves as a coenzyme. Methylation of (ii) _____ to _____ occurs in the cytoplasm and utilizes (iii) _____ as a coenzyme and (iv) _____ as a source. The methyltransferase apoenzyme binds (vi) _____ and (vii) _____ transfers its methyl group (viii) _____ prosthetic

group. The methyl group bound to the cabolamin is then transferred to (ix)_____ generating (x)_____.

25. Fill in the missing information

<u>VITAMIN</u>	<u>Coenzyme forms</u>	<u>Reaction Catalyzed</u>
i) Thiamine	_____	_____
ii) Riboflavin	_____	_____
iii) Nicotinic acid	_____	_____
iv) Pantothenic acid	_____	_____
v) Pyridoxine	_____	_____
vi) Lipoic acid	_____	_____
vii) Biotin	_____	_____
viii Folic acid	_____	_____
ix) Vitamin B ₁₂	_____	_____
x) Ascorbic acid	_____	_____

26. Draw the structural formulas of the following fat-soluble vitamins:

- i) Vitamin A
- ii) Vitamin E
- iii) Vitamin K

Section C: Answer any **TWO** Questions (10 marks each)

27. Describe some of the mechanisms involved in the functioning of flavoproteins which contain FMN or FAD.

28. Explain the role of biotin in the biotin dependent enzymes.

29. Draw the structure of thiamine and explain its function in decarboxylation reactions.