THE OPEN UNIVERSITY OF SRI LANKA

Q. No	Max	Marks
1	50	
2	50	
Total	100	

B.Sc Degree Programme 2014/15

CMU3126 – LEVEL 5 – BIOCHEMISTRY

Continuous Assessment Test 1I   Duration : One Hour

Date : 05th September 2015   Time: 2.30-3.30 pm

Instructions to candidates: Answer all questions only in the spaces provided. Answers written in additional sheets will not be graded.

1) a) i) Name the three ways of pyruvate metabolism.

(06 marks)

ii) Name the enzyme responsible for the catalysis of pyruvate to lactate.

(06 marks)

iii) Explain the three ways of pyruvate metabolism briefly including their products.

(10 marks)

b) i) Name the two parts of the pentose phosphate pathway.

(02 marks)

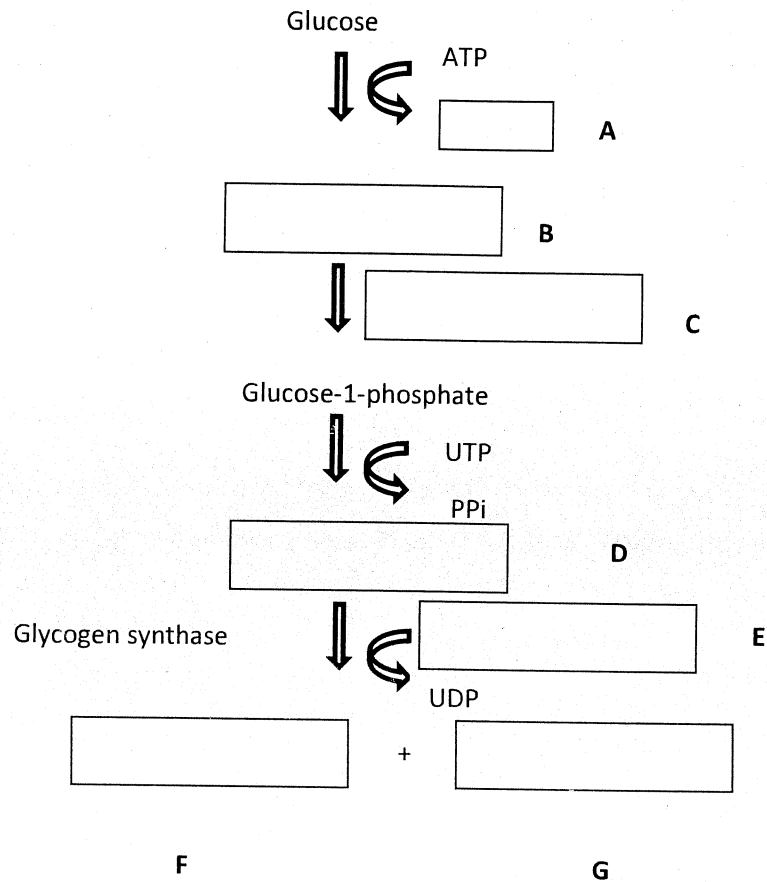ii) Give the main reactants and products of each pathway.

(08 marks)

c) i) What is gluconeogenesis?

(03 marks)

ii) Name four precursors of gluconeogenesis.

(08 marks)

d) i) The following diagram represents the normal flow of glycogen metabolism. Fill the boxes **A** to **G**.

Glucose

ATP

[ ] **A**

[ ] **B**

[ ] **C**

Glucose-1-phosphate

UTP

PPi

[ ] **D**

[ ] **E**

Glycogen synthase

UDP

[ ] + [ ]

F   **G**

(01 X 7 marks)

2) a) Stearic acid is a saturated, C-18 fatty acid.
   i.)   How many cycles would it undergo for complete degradation?
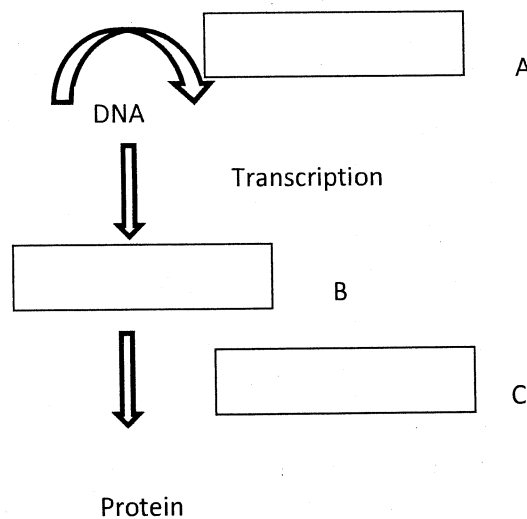
(04 marks)

ii.) Calculate how much NADH, FADH$_2$ and acetylCoA are produced on a per molar basis.

(04 marks)

iii.) Calculate the total no moles of ATP obtained when steric acid undergoes oxidation. Show the calculation.

(10 marks)

b) The following diagram represents the normal flow of biological information from DNA to protein. Fill the boxes A, B and C.

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         ⤻  ┌──────────────┐
            │              │  A
       DNA  └──────────────┘
        ⇓      Transcription
   ┌──────────────┐
   │              │   B
   └──────────────┘
        ⇓    ┌──────────────┐
             │              │  C
             └──────────────┘
(06 marks)

       Protein
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b) i) Name the three phases of protein synthesis.

(06 marks)

ii) Briefly describe each phase of protein synthesis.

(10 marks)

c) Mark whether the following statements are true (√) or false (X).

i) The genetic code is ambiguous.   -------------

ii) The codon AUG is the initiation codon.   -------------

iii) The peptide bond formation in the elongation step of protein synthesis is catalyzed by peptidyl transferase.   -------------

iv) RNA polymerase reads the DNA strand from 5' → 3' end. ---------------

v) Erythromycin has an affinity for the 30 S ribosome subunit.   -------------

(10 marks)

Biochemistry – Level 5
Answer guide to CAT (II)

1) a) i) In aerobic organisms
        Under anaerobic conditions
        Alcohol fermentation

   ii) Lactate dehydrogenase

   iii) i) Aerobic organisms
   - Products: acetyl coenzyme A + CO_2 + NADH+ H^+
   - This conversion requires the enzymes of pyruvate dehydrogenase complex.
   - Require several cofactors such as TTP lipolate, FAD
   - Acetyl Co A enters to citric acid cycle.
   - Produces very high energy.

   ii) Under anaerobic conditions
   - Products: Lactic acid (or ethanol)
   - Happens under low oxygen conditions.
   - Requires NADH
   - Uses lactate dehydrogenase.
   - Some cell types use this process even under aerobic conditions.

   iii) Alcohol fermentation
   - Products: ethanol, NAD^+, CO_2
   - Uses pyruvate decarboxylase and alcohol dehydrogenase.
   - Pyruvate is first converted to aldehyde(acetaldehyde) and then to ethanol .
   - Plant tissues, yeast and some invertibrates uses this method.

   b) i) Linear portion and the cyclic portion.

   (ii)

	Reactants	products
Linear potion	Glucose-6-phospate	D-ribose-5-phospate (5 carbon sugar ribulose)
Cyclic portion	Glucose-6-phosphate	Glyceraldehyde-3-P

   c) i) Formation of glucose from non-hexose precursors.

       ii) Pyruvate, lactate, glycerol,amino acids.

   d) i) A–ADP   E – glycogen
           B– Glucose-6-phosphate   F – glycogen
           C – Phospho glucomutase   G – glucose-1-phosphate
           D – Uridine diphosphate glucose (UDP glucose)

20 a)   i) Stearic acid (C-18) is a saturated fatty acid with even no. of carbon atoms. Therefore no. of cycles needed for degradation $= \frac{n-2}{2} = \frac{18-2}{2} = 8$

ii) This gives $\frac{n-2}{2}$ moles of NADH, FADH$_2$ and $\frac{n-2+1}{2}$ or $\frac{n}{2}$ moles of acetyl co A

- NADH = 8 moles
- FADH$_2$ = 8 moles
- Acetyl co A = 9 moles

iii)   ATP moles from 1 mole of NADH   = 3
        ATP moles from 1 mole of FADH$_2$ = 2
        ATP moles from 1 mole Acetyl Co A   = 12

        ATP moles from 1 mole of NADH   = 3× 8   = 24
        ATP moles from 1 mole of FADH$_2$ = 2× 8   = 16
        ATP moles from 1 mole Acetyl Co A   = 9× 12   = 108

        24 + 16 + 108 = 148

b)   A – Replication
        B – RNA / m-RNA
        C – Translation

i) Initiation
    Elongation
    Termination

ii) <u>Initiation</u>
- Ribosomes bind to 5' end of mRNA
- This binding process is assisted by initiation factors and other proteins
- mRNA is positioned in a way that start codon is at p site.
- Start codon is AUG
- Fmet- tRNA is in the P site. The 50S subunit binds to the complex.
- m-RNA is translated in 5' to 3' direction.

    <u>Elongation</u>
- Requires GTP and elongation factor.
- t-RNA with correct anticodon attaches to A site.
- New peptide bond forms between amino acids in the 50S subunit.
- Peptidyl transferase assist this process.
- Ribosome translocates along m-RNA

    <u>Termination</u>
- Happens when stop codon comes to A site.
- Stop codons are UAA/UAG/UGA
- Then the polypeptide chain is released.
- Releasing factor recognizes the stop codons.
- Unchanged tRNA is released.
- Ribosome dissociates into its sub units.

c) i) ×   ii) √   iii) √   iv) ×   v) ×