UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY AND FOOD TECHNOLOGY

NATIONAL DIPLOMA: BIOTECHNOLOGY

MODULE **BIC2BMB**

MICROBIAL BIOCHEMISTRY 3

CAMPUS **DFC**

NOVEMBER 2019 EXAMINATION PAPER

DATE : **14/11/2019** **SESSION: 12:30 –15:30**

EXAMINER **Dr. A.M Abrahams**

EXTERNAL MODERATOR **Dr. N.N Mehlomakulu**

DURATION **3 HOURS** **MARKS** **100**

NUMBER OF PAGES: **4**

INSTRUCTIONS: **ANSWER ALL THE QUESTIONS**
MOBILE PHONES MUST BE SWITCHED OFF
TAKE CAREFUL NOTE OF THE MARK ALLOCATION AND ANSWER ACCORDINGLY

REQUIREMENTS: **ANSWER SHEET**

QUESTION 1 (20 marks)

Write brief notes on the following concepts/molecules

1.1 a) Co-enzyme A (CoA) (2)
b) Anabolism (2)
c) 1st law of thermodynamics (2)
d) Pyridoxal-5-phosphate (2)
e) NADPH (2)
f) Ubiquinone (2)
g) Porins (2)

1.2) How do prokaryotic cells differ from eukaryotic cells? (4)

1.3) Are viruses considered prokaryotic or eukaryotic? Give a reason for your answer.
. (2)

QUESTION 2 (25)

2.1) Describe the two stages of glycolysis. Your answer should include the number of irreversible reactions for each stage. (5)

2.2) With reference to the two stages mentioned in question **[2.1]**, write down in full the reactions where energy is used or produced, including formation of high energy molecules. In your answer, clearly indicate all metabolites (substrate, enzyme, products formed and any other co-factors) (15)

2.3) Why is the hexokinase step (STEP 1) NOT the committed step in glycolysis since it is irreversible and occurs prior to the phosphofructokinase step (STEP 3)? (2)

2.4) Does ATP act as an activator or inhibitor on the enzymes mentioned in **[2.3]**? How does it regulate their activity? (3)

QUESTION 3 (25)

3.1) Why is the pentose phosphate pathway called a “shunt” and what purpose does this pathway serve? (6)

3.2) Complete the following statement: The pathway mentioned in question **[3.1]** above, uses … **[A]**……. as a starting point and is**…. [B]….**to **…. [C]….** and **…. [D]….** (4)

3.3) Briefly describe with aid of a schematic diagram/pathway, under what conditions will:
3.3.1) **MORE** NADPH be produced?
3.3.2) **MORE** Ribose-5-phospate be produced?
In each of your answers, clearly specify/mention whether the oxidative, non-oxidative or both stages of the pentose phosphate pathway are switched on or off. (10)

3.4) Under gluconeogenic conditions, the body uses non-carbohydrate precursors to generate glucose. Describe how glucose is made from lipids. Your answer may include a schematic diagram to illustrate this. (5)

QUESTION 4 (15)

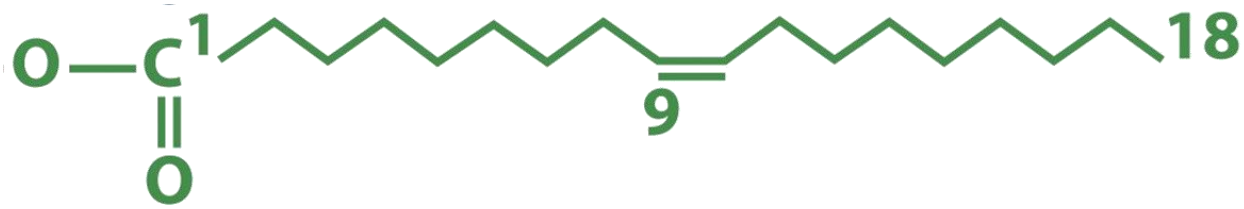
4.1) The process of electron transport chain (ETC) taking place in the inner mitochondrial membrane is coupled with ATP synthesis. List the four steps involved in this process. (4)
4.2) Describe the structure of ATP synthase (5)

4.3) Animals store glucose in a form of glycogen and in the absence or low food supply, glycogen break down is favored. List the enzymes involved in this metabolic process (3)
4.4) During the cost of a biology assay, a young female rat was conditioned without food for 18 hour. Following this conditioning, the animal was provided with large amount of carbon skeleton of amino acid.

4.4.1) Predict what metabolic pathway is likely to occur in the presence of large amount of carbon skeleton of amino acid. (1)
4.4.2) What metabolic process would take place if the animal was provided with lactate and not carbon skeleton of amino acid? (1)
4.4.3) What is the name the universal intermediate common to all gluconeogenesis precursors? (1)

QUESTION 5 (15)

5.1 Identify the compound shown below and give the full name of the molecule. (1)



5.2) Fatty acids represent one of major sources of energy production in the cell and are well known generate more energy when compared to carbohydrates. Like carbohydrates, the degradation of fatty acids take place in the cytosol however their transportation to the site of catabolism is not evident due to their hydrophobic nature. In the cytoplasm, their transportation is facilitated by special proteins called lipoproteins.

5.2.1) Name and briefly describe the different lipoproteins associated with the transport of fatty acid in the cell. (5)

5.3) Describe what is happening during the light phase of photosynthesis. (4)

5.4) Why can't humans perform photosynthesis? (1)

5.5) Explain why the organelle mentioned in your answer in **[5.4]** are suited to carry out photosynthesis. In your answer, briefly describe the processes that takes place in these organelles. (4)