

Bio

[Science](#), [Biology](#)



Enzyme reactions Question i. An enzyme is a biological catalysts that has a functionality of increasing bodily reaction rates.

ii. Roles of enzymes

Speeding Up rates of reaction

iii. An Active site is part of the enzyme that that sticks to a substrate during the reaction process.

iv. A substrate is a compound in the cells that react chemically

v. Factors affecting enzyme reaction are;

Enzyme concentration

Substrate concentration

Temperature

vi. Free energy refers to the energy available and has ability to do work i. e. the potential energy

vii. Entropy refers to the measure of degree of randomness in a biological system.

viii. Kinetic energy is a form of energy and is the energy of movement while potential energy is the energy that is stored in a biological system.

ix. The first law of thermodynamics states that energy is constant and it can never be created nor destroyed. Instead, it can be transformed from one form to another.

x. The second law of thermodynamics states that as energy is transformed from one form to another, energy available at the end of the process is less than energy available at the start of the process.

xi. In exergonic reaction, energy is liberated while in endergonic reaction, energy is consumed.

Question 2

i. Metabolism are the processes that occurs in livings cells with an ultimate goal of producing energy

ii. Anabolism is the process in which complex organic molecules are built up from simpler organic molecules e. g. conversion of protein to amino acids.

While catabolism is the breaking up of complex organic molecules into equivalent simpler organic molecules e. g. conversion of amino acids to polypeptides

iii. Exergonic reactions combines with unfavourable reaction to result in a forward reaction.

iv. ATP (adenosine triphosphate) is an organic compound made up of three phosphate groups and adenosine. Generally, ATP is used in storing and providing energy in chemical reactions and to biological reactions

v. In ATP the energy is stored in the phosphate bonds(between the second bond and the third bond)

vi. Bond between phosphate bonds have high energy

vii. ADP is adenosine Diphosphate whale AMP is adenosine monophosphate.

ADP is made up of two phosphate molecules while AMP is made up of a single phosphate molecule. Combination of two molecules of results in the production of AMP. As shown here $2ADP \rightarrow ATP + AMP$

viii. Coenzymes refers to specific organic compounds that must be present for certain enzymes to do catalysis process e. g. nicotine adenine dinucleotide. Cofactor are specific organic compounds that are only required to change the rate of catalysis i. e. to increase the rate of catalysis.

ix. Coenzyme are used to make up part of the active site while cofactor are

used to increase the rate of catalysis.

x. A substrate refers to a molecule that is acted on by an enzyme.

Question 3

i. Reduction reactions are reactions in which compounds involved gain electrons while oxidation reaction is a reaction in which compounds involved lose electrons.

ii. An “excited electron” means the particular electron is unstable.

iii. Reductants are compounds that facilitate the reduction process, i. e. reducing agents

iv. Oxidants are compounds that facilitate oxidation i. e. oxidizing agents

v. Electron carriers refers to a compound/molecule that has the ability to accept one or several electrons from a donor molecule and carries the accepted electrons to another molecule.

vi. NADH is an abbreviation for Nicotinamide adenine dinucleotide.

Nicotinamide adenine dinucleotide refers to a high energy molecule that is usually utilized in the generation of ATP.

vii. FAD is an abbreviation for Flavin Adenine Dinucleotide. Flavin Adenine Dinucleotide is a riboflavin that is made up of hydrogen acceptor molecule during the Krebs cycle.

viii. Reduced form of FAD is FADH while the reduced form for NADH is NADH

ix. Redox potential is a scale used to measure the affinity of a compound for electrons.

Question 4

i. Electron transport chain is used in the production of ATP.

ii. The electron transport chain is made up NADH, H⁺

- iii. Electrons are passed to the electron transport chain by NADPH. These electrons combine to form water.
- iv. Cellular respiration consumes energy while fire liberates heat/energy
- v. The electrons entering the chain comes from NADPH
- vi. The electrons in the chain react to form water
- vii. Terminal electron acceptor is a compound that usually accepts electrons in the oxidation process.
- viii. Cytochrome oxidase is a type of protein that acts as a terminal enzyme in respiratory chains.
- ix. Electron transport chain is bounded on the inner membrane of the mitochondria
- x. Proteins involved in the Electron transport chain are transport proteins ATP synthase
- xi. Electron transport chain leads to ATP synthesis through the process of chemiosmosis.
- xii. Chemiosmosis is the process in which ions move from area that they are highly concentrated to areas that they're lowly concentrated via transport proteins on the selective permeable membrane
- xiii. The protein gradient develops between the matrix and the intermembrane space.
- xiv. The protons originates from the matrix and they go ATP synthase.
- xv. protonmotive force is the resultant energy produced from proton/electron transfer via an energy transducing membrane
- xvi. ATP synthase is an enzyme responsible for the production of energy for a cell through synthesis of ATP.

xvii. ATP synthesis is found in mitochondria

Question 5

i. Glucose provides energy by providing substrate that is acted upon by enzymes.

ii. The process of glucose breakdown is called glycolysis

iii. Stages of glycolysis

Step 1 - In the first step, there is conversion of glucose to fructo-1, 6-biophosphate using ATP. At the same time, there is trapping of glucose inside the cell which is then converted to an unstable form that can easily be cleaved to 3 - carbon units. The formed fructo-1, 6-biophosphate is then cleaved into glycerldehyde-3-phosphate.

Step 2 - there is oxidation of Glyceraldehyde-3-phosphate to pyruvate.

iv. All the steps in glycolysis process requires energy

v. ATP is used since it produces enough energy to be used in the process.

vi. Kinase is an enzyme responsible for the catalyation of phosphate group in ATP conversion to a specified molecule

vii. Two molecules of ATP are used in the activation of sugar to glycolysis

viii. Six carbon molecules are used as the starting material

ix. NADH is formed during the conversion of 2 PGALs to pyruvates

x. In substrate level phosphorylation, there is reduction of FAD and NAD, and 4 ATPs are produced. In oxidative phosphorylation, there is oxidation of FADH⁺ and NADH⁺ resulting in production of 34 ATP

xi. The products of glycolysis are NADH, pyruvate and ATP

xii. Net ATP production from the glycolysis process is 2 ATP.

Question 6

- i. In cases of aerobic conditions, pyruvate is converted by pyruvate dehydrogenase complex to acetyl-CoA
- ii. pyruvate formed is formed in the cytoplasm due to the glycolysis process
- iii. Pyruvate enters the Krebs's cycle via an intermediate process which results in the conversion of pyruvate by pyruvate dehydrogenase complex to acetyl-CoA
- iv. The preliminary stages of Krebs Cycle involves the following reactions
- v. The products of krebs cycle per glucose molecule are
- vi. The reaction is an oxidation reaction
- vii. CoA stands for Coenzyme A. CoA is an enzyme responsible for the transmission of carbon atoms from glycolysis to citric acid for oxidation to produce energy.
- viii. CoA does not have a high energy bond
- ix. Major Product of Krebs cycle is ATP.
- x. Krebs cycle is important since it results in production of energy
- xi. Six carbon of glucose enters the krebs cycle.
- xii. Citric acid accepts acetyl group from acetylCoA
- xiii. None
- xiv. Conversion of Pyruvate to Acetyl CoA produces two NADH.
- xv. Succinyl-CoA is a combination of coenzyme A succinic acid and.
- xvi. substrate level phosphorylation produces ATP in the krebs Cycle

Question 7

- i. Fermentation is a chemical process that converts sugar to acids, alcohol and gases. The metabolic process occurs in bacteria, yeast and muscles that lack sufficient oxygen.

- ii. Cells ferment due to lack of, or insufficient oxygen.
- iii. Cells ferment under anaerobic conditions.
- iv. The types of reactions that take place during fermentation process are Glycolysis and phosphorylation processes.
- v. The products of lactic acid fermentation include: Lactic acid, Carbon (IV) oxide and ATP.
- vi. Pyruvate is broken down into ethanol or lactic acid, with two ATPs during fermentation.
- vii. The products of ethanol fermentation are ethanol and Carbon (IV) oxide.
- viii. The types of reactions that occur during ethanol fermentation include Glycolysis and phosphorylation.
- ix. During the process of fermentation, sugar molecules are converted into ethanol and CO_2 , and in the process, two moles of ATP are produced.
- x. Organisms respire without oxygen through incomplete breakdown of glucose in the absence of Oxygen. This causes a reduced oxidation of NADH to NAD^+ and the process of glycolysis becomes ineffective. Instead, reduction of pyruvate to lactate generates NAD^+ , leading to production of only two ATPs of energy.
- xi. Other compounds that can make suitable terminal electron acceptors include; sulfate, nitrate and sulphur or fumarate.

Question 8

- i. Autotrophs are organisms that use inorganic materials and basic energy sources to manufacture organic molecules that contain energy. A prime example is plants. Plants use oxygen and sunlight to manufacture food through the process of photosynthesis.

- ii. Heterotrophs are organisms that obtain their food from autotrophic organisms in form of carbohydrates, fats and proteins.
- iii. Organotrophs are organisms which obtain energy in the form of electrons or hydrogen from organic compounds.
- iv. Lithotrophs are organisms that use inorganic compounds for biosynthesis process to obtain energy.
- v. Lithotrophs obtain energy by the process of redox chemical reactions that occur in the inorganic energy sources.
- vi. Light harvesting complexes are pigment molecules that are capable of transferring light energy to the reaction site in an organism.
- vii. The role of chlorophyll in plants is to absorb sunlight that is in turn used in the synthesis of energy from water and carbon dioxide.
- viii. Other pigments involved in light harvesting include bacterial antenna.
- ix. The photosynthetic apparatus in the chloroplast is found in plants. The chloroplast is filled with a proteinaceous fluid called stroma.
- x. A thylakoid membrane is a sac like structure that bounds the stroma in the chlorophyll.
- xi. The reaction centre is the site on which chemical reactions take place. It is a complex of numerous pigments, proteins and other co-factors that act together to perform the main energy conversion reaction processes of photosynthesis.
- xii. What happens in at the reaction centre is transformation of light energy into chemical energy.
- xiii. Photosystem 2 appears before and produces ATP while photosystem 1 occurs after Photosystem 2 and it produces NADPH. Photosystem 1 is more

sensitive to 700 nm of light wavelengths while photosystem 2 is sensitive to 680 nm of light wavelengths.

xiv. Cyclic photophosphorylation is the production of ATP during photosynthesis in the presence of light.

xv. The products of the Z scheme include; ATP and NADPH.

xvi. NADPH is used in the reduction of CO₂ into more useful products such as glucose.

xvii. The electrons of the Z scheme in oxygenic photosynthesis originate from the light.

xviii. The major phases of the Calvin cycle are: Carbon fixation, Reduction phase and finally, regeneration phase.

xix. Carbon dioxide is fixed to a five-carbon sugar called ribulose biphosphate (RuBP).

xx. The CO₂ comes from carbon atoms.

xxi. The type of reactions used in the Calvin cycle are fixation of Carbon dioxide into RuBP using carboxylase as an enzyme catalyst, reduction reaction in which ATP and NADPH are converted to ADP and reconversion of glyceraldehyde 3-phosphate to RuBP.