

BIOLOGY FOR ENGINEERS 21BE45

SCHEME & SOLUTION IAT#1

Qn.No	Solution.	Marks
1.	<p>Poly Hydroxyl Alkanaote (PHA), are intracellular, carbon storage compounds produced by bacteria, as energy reserve to combat carbon limiting unfavorable conditions. Bacteria endure this environmental stress, by initiating a cascade of metabolic events that leads to PHA degradation.</p> <p>The PHAs are synthesized by both gram-negative and gram-positive bacteria, which store them, within the cells in the form of granules and few bacteria can accumulate PHA as much as 90% of dry weight of cell.</p> <p>Due to its biodegradability and potential to create bio-plastics with novel properties, much interest exists to develop the use of PHA-based materials. PHA fits into the green economy as a means to create plastics from non-fossil fuel sources.</p> <p>Polylactic acid plastic, also named PLA plastic, is a type of polymer derived from renewable sources like tapioca roots, cornstarch and sugarcane. Its properties are similar to synthetic plastic, and it is eco-friendly. Hence it entered the plastic industry as a competitive commodity.</p> <p>Polylactic plastic is made by fermenting carbohydrate sources like sugarcane, maize or corn starch under controlled conditions. The building blocks of PLA plastic, which is lactide monomer or lactic acid, are later polymerized into PLA.</p>	10
2	<p>Enzyme is a substance that acts as a catalyst in living organisms, regulating the rate at which chemical reactions proceed without itself being altered in the process.</p> <p>Lignolytic enzymes are a group of enzymes produced by certain organisms, particularly fungi and bacteria, that have the ability to degrade lignin, a complex and highly stable polymer found in plant cell walls.</p> <p>Ligninolytic enzymes play a key role in degradation and detoxification of lignocellulosic waste in environment.</p> <p>Lignin provides rigidity and strength to the plant, making it resistant to microbial degradation. The major ligninolytic enzymes are laccase, lignin peroxidase, manganese peroxidase, and versatile peroxidase.</p> <p>Lignocellulosic waste is considered as a chief component of renewable biomass on the Earth this consists of three major components such as cellulose (40%–50%), hemicelluloses (25%–30%) and lignin (15%–20%).</p> <p>Cellulose is the primary polysaccharide as constituent of lignocellulosic materials that consist of hundred to over ten thousands β-1, 4 linked D-glucose units in unbranched linear chains. This is known as microfibrils with 3–5nm wide and many micrometers in length.</p>	10

<p>3.</p>	<p>Biodiesel refers to a type of renewable fuel made from biological sources such as vegetable oils, animal fats, or recycled cooking oils. It is considered an alternative to conventional diesel fuel, which is derived from fossil fuels.</p> <p>The production process of biodiesel involves a chemical reaction known as trans esterification. During this process, the vegetable oil or animal fat is mixed with an alcohol (usually methanol) and a catalyst, which helps break down the oil into its basic components. The result is biodiesel, along with a byproduct called glycerin.</p> <p>Biodiesel can be used in various applications, including transportation, power generation, and heating. It can be used as a pure fuel or blended with petroleum-based diesel in different ratios, such as B20 (20% biodiesel, 80% diesel) or B5 (5% biodiesel, 95% diesel). Biodiesel blends can be used in standard diesel engines without requiring significant modifications.</p> <p>One of the primary advantages of biodiesel is its renewable nature. Since it is derived from biological sources, such as plants and animals, it can be continually produced as long as these sources are available. Additionally, biodiesel has a lower carbon footprint compared to conventional diesel fuel, as it emits fewer greenhouse gases during combustion.</p>	<p>10</p>
<p>4.</p>	<ul style="list-style-type: none"> • Brain is significantly more complex and diverse in its operations than a traditional CPU. Parallel Processing: CPUs typically handle tasks sequentially, executing one instruction at a time. In contrast, the brain is capable of parallel processing, allowing it to perform multiple tasks simultaneously. • The brain's billions of neurons work in interconnected networks, allowing for the parallel processing of information. CPUs use electronic circuits to perform calculations, whereas the brain relies on interconnected networks of neurons to process and transmit information. Neurons of the Brain communicate through electrochemical signals, creating complex pathways and circuits that enable various cognitive functions. • CPUs have a fixed architecture and operate based on predefined instructions. In contrast, the brain exhibits remarkable plasticity, allowing it to adapt, learn, and reorganize its connections based on experiences and environmental stimuli. CPUs primarily process data in a digital form, whereas the brain integrates information from various sensory modalities, such as vision, hearing, touch, taste, and smell. The brain processes these inputs simultaneously, enabling us to perceive and make sense of the world around us. • CPUs are designed to be energy-efficient, but the brain, while highly 	

	<p>efficient compared to artificial systems, still requires a significant amount of energy to function. The brain's energy consumption is necessary to maintain its complex neural networks, sustain neurotransmitter activity, and support various metabolic processes.</p> <p>The brain also contains several deep structures, including the thalamus, hypothalamus, hippocampus, and amygdala, among others. These structures play vital roles in regulating various functions such as sensory processing, emotions, learning, and memory.</p> <p>In terms of overall architecture, the human brain exhibits a high degree of structural and functional organization. Different brain regions are specialized for specific functions, and information processing occurs through the interconnected networks of neurons. This intricate architecture allows for the complex cognitive abilities and behaviours observed in humans.</p>	10
5.	<p>Water treatment aims to remove or mitigate the toxicity of pollutants that could be metal ions, organic dyes, drugs, or microorganism species. The pollutants can be inorganic (e.g., metal ions), organic (dyes, drugs, proteins, and antibiotics), or microorganisms (e.g., fungus, bacteria, and algae). They can be classified as degradable (e.g., dyes, proteins, and antibiotics), or non-degradable (e.g., metal ions). The toxicity of the water contaminants is varied and depends on several factors including the form of the pollutants, concentration, administration method, and exposure time.</p>	
6.	<p>Nanotechnology has been advanced in several applications including water treatment. Nano material's can be applied for several methods such as chemical precipitation, adsorption, ion exchange, membrane, separation, filtration, coagulation/flocculation, flotation, catalysis, and electrochemical-based methods. Among the wide number of Nano material's cellulose-based materials are promising. Cellulose exhibits several advantages being an abundant and non-toxic chemical.</p> <p>A carcinogen refers to any substance or agent that has the potential to cause cancer. Although WHO and USEPA have set an arsenic maximum contaminant level (MCL) for public drinking water at 10ppb, in most of the arsenic-affected Asian countries, including India; the permissible limit of arsenic in drinking water is 50 ppb. The World Health Organizations (WHO) current provisional guideline for arsenic in drinking water is 10 ppb</p> <p>The central nervous system (CNS) is a complex network of structures located within the brain and spinal cord. It serves as the command centre of the body, responsible for processing and coordinating information from the body's sensory receptors and initiating appropriate responses.</p> <ul style="list-style-type: none"> • The main regions of the brain include: • Cerebrum: This is the largest part of the brain and is responsible for higher 	10

7.	<p>cognitive functions such as conscious thought, reasoning, perception, and voluntary movement.</p> <ul style="list-style-type: none"> • Cerebellum: Located at the back of the brain, the cerebellum is responsible for coordination of movement, balance, and posture. It helps fine-tune motor activities and plays a role in motor learning. • Brainstem: The brainstem connects the brain to the spinal cord and regulates basic bodily functions necessary for survival, such as breathing, heart rate, and digestion. • It also serves as a pathway for information between the brain and the rest of the body. • Within the brain, there are billions of specialized cells called neurons that communicate with each other through electrical and chemical signals. These neurons form intricate networks and pathways that transmit information throughout the CNS. • The spinal cord, which is a long, cylindrical bundle of nerves, extends from the base of the brain down the back. It relays signals between the brain and the peripheral nervous system, which consists of nerves that extend throughout the body. The spinal cord is responsible for reflex actions and also serves as a conduit for sensory and motor information. <ul style="list-style-type: none"> • Protein is found throughout the body—in muscle, bone, skin, hair, and virtually every other body part or tissue. • It makes up the enzymes that power many chemical reactions and the hemoglobin that carries oxygen in your blood. At least 10,000 different proteins make you what you are and keep you that way. • Protein is made from twenty-plus basic building blocks called amino acids. Because we don't store amino acids, our bodies make them in two different ways: either from scratch, or by modifying others. • Nine amino acids—histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine—known as the essential amino acids, must come from food. • The National Academy of Medicine recommends that adults get a minimum of 0.8 grams of protein for every kilogram of body weight per day, or just over 7 grams for every 20 pounds of body weight. • Whey protein is a supplement that people use alongside resistance exercise to help boost muscle protein synthesis and the growth of lean muscle mass. Other possible benefits include helping with weight loss and lowering cholesterol. • Milk is made of two proteins, casein and whey. Whey protein can be separated from the casein in milk or formed as a by-product of cheese making. Whey protein is considered a complete protein as it contains all 9 essential amino acids. It is low in lactose content. 	10
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