

Time allowed: 20 minutes	Questions: 93	Total marks: 93
1. What is the natural process that allows continuity of supply of nutrients to organisms in an ecosystem? (1)	A. Photosynthesis B. Sedimentation C. Respiration D. ✓ Recycling	
Answer: D Nutrient recycling (biogeochemical cycling) ensures that essential elements like carbon, nitrogen, and phosphorus are continuously cycled through the ecosystem, maintaining a constant supply for living organisms.		
2. The nitrogen content of dead plants and animals enters into the nitrogen cycle by a process of (1)	A. nitrification B. ✓ ammonification C. nitrogen fixation D. assimilation	
Answer: B Ammonification is the process by which decomposers (bacteria and fungi) break down the nitrogenous waste and organic remains of dead plants and animals into ammonia or ammonium ions.		
3. Which of the following is correct about primary and secondary succession? (1)	A. Secondary succession starts from bare ground and previously uncolonized habitat B. ✓ Primary succession takes much longer to be completed C. Secondary succession passes through phases of decline before reaching climax D. Primary succession doesn't attain a climax community	
Answer: B Primary succession takes significantly longer to reach a climax community because it begins in a completely barren habitat (like bare rock) and requires hundreds to thousands of years for soil formation to occur.		
4. Which one of the following is NOT considered as one of the terrestrial biomes? (1)	A. Boreal forest B. Tropical rainforest C. ✓ Estuarine D. Hot desert	
Answer: C An estuary (estuarine ecosystem) is a coastal body of water where freshwater from rivers mixes with saltwater from the ocean, making it an aquatic ecosystem rather than a terrestrial biome.		
5. Our knowledge and understanding of the evolutionary history of extinct animals such as dinosaurs come from the study of bone and other hardened structural remains. What is the category of evidence for such knowledge and understanding? (1)	A. Analogy B. ✓ Palaeontology C. Comparative biochemistry D. Comparative physiology	
Answer: B Palaeontology is the scientific study of prehistoric life through the investigation of fossils, which include bones, shells, and other preserved structural remains of extinct organisms like dinosaurs.		

6. The effect of natural selection as a cause of evolutionary changes can be supported by evidence from (1)
- A. palaeontology
 - B. comparative embryology
 - C. comparative biochemistry
 - D. ✓ **animal breeding**

Answer: D

Darwin used plant and animal selective breeding (artificial selection) as a powerful, observable demonstration of how selective pressure can drive dramatic evolutionary changes in a population over generations.

7. The evolutionary process that allows survival of well adapted and successfully reproducing individuals is called (1)
- A. ✓ **natural selection**
 - B. random selection
 - C. differentiation
 - D. co-evolution

Answer: A

Natural selection is the evolutionary mechanism where individuals with favorable, heritable traits are more likely to survive, reproduce, and pass those adaptive traits to the next generation.

8. Assume the climate in a certain region gradually became hotter and hotter. Foxes living in this area with thin fur survived better than those which had thick fur that were also severely affected by the heat. Through time, the population was dominated by individuals with thin fur. What was the type of selection that has been operating on this population of foxes? (1)
- A. Normalizing
 - B. Stabilizing
 - C. ✓ **Directional**
 - D. Disruptive

Answer: C

Directional selection occurs when environmental changes favor individuals at one extreme of a phenotypic distribution (in this case, thin fur due to rising temperatures), shifting the population's average phenotype over time.

9. Regarding human evolution, which hominid was unable to run faster and had small brain size as compared to the others? (1)
- A. Homo sapiens
 - B. Homo neanderthalensis
 - C. Homo erectus
 - D. ✓ **Homo habilis**

Answer: D

Homo habilis is the earliest and most primitive species of the genus Homo listed; it possessed a significantly smaller brain size (around 600-700 cc) and lacked the anatomical adaptations for endurance running found in Homo erectus.

10. Identify the shape of bacterium which correctly matches with its example? (1)
- A. Bacilli - Borrelia
 - B. ✓ **Spiral - Treponema**
 - C. Rod shaped - Streptococcus
 - D. Spherical - Lactobacillus

Answer: B

Treponema (such as Treponema pallidum) is a genus of spiral-shaped, helical bacteria (spirochetes). Bacilli (rod-shaped) and cocci (spherical) do not match the other options correctly.

11. Assume you are attempting to distinguish gram-negative and gram-positive bacteria using the Gram's staining procedure. At which step of the procedure do you expect purple and pink pigmentation of the gram-positive and gram-negative bacteria respectively? (1)

A. Crystal violet staining
B. Iodine treatment
C. Decolourisation
D. ✓ **Counter staining**

Answer: D

In Gram staining, the counterstaining step (using safranin) dyes the decolorized, thin-walled Gram-negative bacteria pink/red, while the thick-walled Gram-positive bacteria retain the primary crystal violet-iodine complex and remain purple.

12. The main importance of bacteria in recycling of nutrients is their role in (1)

A. sewage treatment
B. industrial production
C. energy transduction
D. ✓ **ecosystem functions**

Answer: D

Bacteria play a vital role as decomposers in ecosystems, breaking down organic matter and recycling nutrients back into the soil and atmosphere, which is a fundamental ecosystem function.

13. What is the main mechanism of disease causing by infectious bacteria? It is through (1)

A. digesting substances in tissues
B. ✓ **releasing toxins**
C. disrupting metabolic systems
D. destroying cells

Answer: B

Most pathogenic bacteria cause disease primarily by producing and releasing toxins (exotoxins and endotoxins) that disrupt host cellular processes, rather than directly digesting tissues.

14. Which type of industrial production used a culture of special bacterium called Acetobacter? (1)

A. Yoghurt production
B. ✓ **Vinegar production**
C. Antibiotic production
D. Beer production

Answer: B

Bacteria belonging to the genus Acetobacter are acetic acid bacteria that convert ethanol into acetic acid, which is the key component of vinegar.

15. If a phagocytic white blood cell is unable to digest bacteria that have been engulfed, which organelles could be failed to do this function? (1)

A. ✓ **Lysosomes**
B. Ribosomes
C. Endoplasmic reticulum
D. Golgi body

Answer: A

Lysosomes contain hydrolytic enzymes that fuse with phagosomes to digest engulfed pathogens; if lysosomes fail to function, the phagocytic cell cannot digest the bacteria.

16. Which of the following is correct if a molecule is transported across the plasma membrane using active transport involving a carrier protein? The molecule is (1)

A. ✓ **polar**
B. small size
C. non - charged
D. lipid soluble

Answer: A

Polar and charged molecules are hydrophilic and cannot easily pass through the hydrophobic lipid bilayer by simple diffusion; hence, they require carrier proteins for active transport against their concentration gradient.

- 17.** A student was doing a demonstration to show how water is transported across a semi-permeable membrane. He used a thistle funnel with cellophane to act as the cell membrane. The funnel was filled at different points with 0.2 M, 0.4 M, 0.6 M and 0.8 M sucrose solution and immersed in distilled water. At which concentration do you expect the thistle funnel volume will be the highest?
- A. 0.6 M B. 0.4 M
C. ✓ **0.8 M** D. 0.2 M

Answer: C

The 0.8 M sucrose solution has the highest solute concentration and lowest water potential, which creates the strongest osmotic gradient, drawing the maximum volume of water into the thistle funnel.

18. Assume you wanted to demonstrate osmosis across a semi-permeable membrane. If you prepare two solutions I and II with 5% and 10% concentration respectively separated by a membrane and left for 1 hour, what results do you expect to show the occurrence of osmosis?
- A. Concentration of solution II
- B. ✓ Dilution of solution II
- C. Gain of water by Solution I
- D. Dilution of Solution I

Answer: B

During osmosis, water moves from a region of higher water potential (the less concentrated 5% Solution I) to a region of lower water potential (the more concentrated 10% Solution II), resulting in the dilution of Solution II.

19. Which of the following is the correct composition of ATP? (1)
- A. ✓ **Adenine, pentose sugar and three phosphate groups**
- B. Thymine, hexose sugar and two phosphate groups
- C. Thymine, pentose sugar and two phosphate groups
- D. Adenine, hexose sugar and three phosphate groups

Answer: A

Adenosine triphosphate (ATP) is composed of an adenine nitrogenous base, a ribose pentose sugar, and three phosphate groups.

- 20.** What is the ratio of individuals showing both dominant phenotypes resulting from a dihybrid cross of heterozygote pea plants with yellow and round seeds? (1)
- A. 12:16 B. 3:16
- C. ✓ **9:16** D. 1:16

Answer: C

A dihybrid cross of two heterozygous individuals (e.g., YyRr x YyRr) yields a classic 9:3:3:1 phenotypic ratio, where 9 out of 16 individuals display both dominant phenotypes.

21. Which of the following correctly describes the structure of chromosome? It is a (1)
- A. naked DNA that is loosely organized
 - B. complex of DNA and histone proteins that is loosely organized
 - C. ✓ **complex of DNA and histone proteins that is densely organized**
 - D. naked DNA that is densely organized

Answer: C

A chromosome is a densely organized, highly condensed complex of DNA wrapped around histone proteins, visible during cell division.

22. During cloning of animals such as the famous sheep Dolly, (1)
- A. the enucleated egg is stimulated to divide by hormone treatment
 - B. ✓ **somatic cell nucleus from nuclear donor is inserted into enucleated egg of cytoplasmic donor**
 - C. the embryonic development starts right after the enucleated cell is implanted
 - D. nucleus from an egg cell is inserted into enucleated somatic cell

Answer: B

During somatic cell nuclear transfer (the method used to clone Dolly), the nucleus from a somatic cell of the nuclear donor is transferred into an enucleated egg cell from a cytoplasmic donor.

23. Which of the following is correct about transcription? (1)
- A. ✓ **Only the antisense strand is transcribed**
 - B. Both the antisense and sense strands are transcribed
 - C. The resulting mRNA will have longer chain than the coding gene
 - D. DNA polymerase is used to catalyse the process

Answer: A

During transcription, only the antisense (template) strand of the DNA molecule is transcribed by RNA polymerase to synthesize a complementary mRNA strand.

24. Individual traits such as height, eye color and metabolic efficiency are determined by the type of (1)
- A. vitamins
 - B. lipids
 - C. ✓ **proteins**
 - D. carbohydrates

Answer: C

Physical and metabolic traits of an organism are ultimately determined by proteins, which are synthesized based on the genetic instructions coded in DNA.

25. A biome characterized by its frozen soil, cold temperature, dry precipitation and inhabited by lichens and migrating animals? (1)
- A. Thorn forest
 - B. Hot Desert
 - C. Boreal forest
 - D. ✓ **Tundra**

Answer: D

The tundra biome is characterized by permafrost (permanently frozen soil), extremely cold and dry conditions, and vegetation dominated by lichens and mosses, with highly migratory animal populations.

26. According to the Millennium Assessment (MA) findings, biodiversity loss contributes to "Increasing vulnerability". (1)
This refers to
- A. loss of cultural and religious values that are attached to biodiversity
 - B. ✓ **aggravated natural disasters such as flooding due to loss of trees**
 - C. wide-spread health problems due to lack of medicinal resources
 - D. famine and starvation due to loss of biodiversity

Answer: B

In the Millennium Ecosystem Assessment, 'increasing vulnerability' refers to the decreased capacity of ecosystems to buffer against environmental hazards, leading to aggravated natural disasters like flooding and landslides.

27. How does agriculture decrease biodiversity? By (1)
- A. reducing diversity of insect pollinators
 - B. reducing nitrogen content of the soil
 - C. promoting the growth of shrubby and thorny species
 - D. ✓ **allowing a single species to dominate**

Answer: D

Agricultural practices, particularly monoculture, decrease biodiversity by clearing diverse natural habitats to allow only a single crop species to dominate a large area.

28. Which of the following is a recommended principle of conservation? (1)
- A. Protection of individual species should be given priority than conserving their habitat
 - B. ✓ **It is always better to assist ecosystems to recover than to replace them**
 - C. Small areas should be given equal conservation priority as large areas with similar habitats
 - D. The use of natural resources should be avoided as much as possible

Answer: B

A key principle of conservation biology is that maintaining or assisting the recovery of degraded ecosystems is far more feasible and biologically sound than trying to replace them.

29. What was the population growth control policy used by the USA? (1)
- A. Banning the birth of more than one child per family
 - B. Reserving job opportunities only for those who have one children
 - C. Compulsory contraception use training before marriage
 - D. ✓ **Availability of contraception for free**

Answer: D

Unlike some countries that adopted coercive or restrictive population control measures, the USA's approach to population management has focused on voluntary family planning and making contraception widely available and affordable or free.

30. Which one of the following is correct about the evolution and racial divisions of current humans? (1)
- A. ✓ **Human races are unlikely to evolve into separate species due to their creative brain that modifies the environment**
 - B. Reproductive isolation of human races is expected to lead to speciation
 - C. The classification of humans into different races has no genetic basis
 - D. They are under continuous selection pressure and expected to evolve into different species

Answer: A

Human populations (races) are unlikely to undergo speciation because genetic exchange (gene flow) is continuous, and humans use their cognitive abilities to modify their environments rather than adapting through biological speciation.

31. Which of the following is the most accurate definition of behavior? It is (1)
- A. ✓ **the coordinated response of an organism to a stimuli**
 - B. the way of acting during eating, drinking or mating
 - C. a movement of an organism in any situation
 - D. an observable response organisms make to any situation

Answer: A

In biology, behavior is formally defined as the coordinated response of an organism to a stimulus or a change in its environment.

32. All are the common advantages of studying animal behavior EXCEPT (1)
- A. improving conditions for breeding of endangered species
 - B. ✓ **avoiding race and ethnic interactions**
 - C. providing early clues of environmental damage
 - D. understanding of social bonding in human societies

Answer: B

Avoiding ethnic and racial interactions is not a goal or advantage of studying animal behavior, whereas understanding conservation, environmental health, and human social bonds are.

33. Which one of the following activities is categorized in innate behavior? (1)
- A. Avoiding contact after a harmful experience
 - B. ✓ **Nest building by birds**
 - C. Pressing a button to get a reward by a mouse
 - D. Dog salivating to the sound of a bell

Answer: B

Nest building in birds is a genetically programmed, species-specific behavior that occurs without prior learning, making it a classic example of innate behavior (fixed action pattern).

34. Which types of reflexes are used for protective actions such as withdrawal from heat? (1)
- A. Parasympathetic
 - B. Sympathetic
 - C. ✓ **Somatic**
 - D. Autonomic

Answer: C

Somatic reflexes involve the contraction of skeletal muscles to produce rapid, protective responses such as pulling a hand away from a hot surface (withdrawal reflex).

35. Mutations become more serious and threatening if they occur on genes that regulate (1)
- A. lactose metabolism
 - B. fatty acid metabolism
 - C. hair growth
 - D. ✓ **cell division**

Answer: D

Mutations in genes that regulate cell division (such as proto-oncogenes and tumor suppressor genes) can lead to uncontrolled cell division and cancer, making them highly life-threatening.

36. Frameshift mutations are those that occur due to (1)
- A. substitution or deletion
 - B. duplication
 - C. ✓ **addition or deletion**
 - D. inversion

Answer: C

Frameshift mutations are caused by the insertion (addition) or deletion of a number of nucleotides that is not a multiple of three, which alters the reading frame of the genetic message from that point onwards.

37. The origin of life proposed by Oparin and Haldane makes the assumption that the primitive Earth had (1)
- A. low moisture
 - B. ✓ **reducing atmosphere**
 - C. cooler temperature
 - D. oxygen rich atmosphere

Answer: B

The Oparin-Haldane hypothesis proposes that the primitive Earth had a strongly reducing atmosphere, containing gases like methane, ammonia, water vapor, and hydrogen, but lacking free oxygen.

38. Which theory proposes the origin of life to be from resistant spores landing on Earth from outer space? (1)
- A. ✓ **Cosmozoan**
 - B. Eternity of life
 - C. Spontaneous generation
 - D. Biochemical

Answer: A

The Cosmozoan theory (also known as the Panspermia theory) proposes that life on Earth originated from resistant spores or microorganisms that arrived from outer space.

39. Which one of the following forms the basis of Darwin's theory of evolution? (1)
- A. Individuals of the same species cooperate for co-survival
 - B. Acquired characters are inherited by descendants
 - C. ✓ **Varieties that have low reproductive success are eliminated**
 - D. The frequent use of body parts leads to perfection

Answer: C

Darwin's theory of evolution by natural selection is based on the idea that individuals with traits poorly suited to their environment (low reproductive success) are eliminated, while those with advantageous traits survive and reproduce.

40. If a population showed no change and remained constant, which of the following is the most likely scenario taking place? (1)
- A. ✓ **Natality is equal to mortality**
 - B. Mortality is equal to immigration
 - C. There is no emigration
 - D. There is no natality

Answer: A

A population remains constant in size (zero growth rate) when the factors increasing the population (natality and immigration) are balanced by the factors decreasing it (mortality and emigration); in a closed system, this simplifies to natality being equal to mortality.

41. Which one of the following is true about arithmetic and exponential growth rates? (1)
- A. In exponential growth, the population increases beyond the carrying capacity
 - B. ✓ **In arithmetic growth, a uniform rate of growth over the time period is produced**
 - C. In arithmetic growth, the population doubles in each time period
 - D. In exponential growth, the numbers increase by the same fixed amount in each time period

Answer: B

Arithmetic growth is characterized by a constant addition of individuals per unit of time, resulting in a constant, uniform rate of growth over time, whereas exponential growth involves a compounding increase where the population size doubles periodically.

42. Which of the following is correct about the events that take place during the different stages of meiosis? (1)
- A. The final segregation of a chromosome pair with another at meiosis II
 - B. ✓ **Sister chromatids become genetically different due to crossing over at meiosis I**
 - C. Homologous chromosomes end up in the same cell at the end of Meiosis II
 - D. Four daughter cells are produced at the end of Meiosis I

Answer: B

During Prophase I of meiosis, crossing over occurs between non-sister chromatids of homologous chromosomes, which leads to genetic recombination and makes the sister chromatids genetically distinct.

Territorial behavior often involves ritualized, non-lethal combat (ritual fighting) to defend a specific area or resources from competitors without causing serious injury to either individual.

49. Aggregation of a large number of penguins staying close to each other to conserve heat can be an example of a (1)
- A. defense behavior
 - B. courtship behavior
 - C. mating behavior
 - D. ✓ **social behavior**

Answer: D

The cooperative huddling of penguins to conserve heat is a group interaction that enhances survival, which is a classic example of social behavior.

50. Which of the following is correct about the structural levels of protein molecules? The (1)
- A. primary structure is formed by hydrogen bonds
 - B. ✓ **tertiary structure is formed by disulfide bridges**
 - C. secondary structure is formed by an ionic bond
 - D. quaternary structure is formed from ester bonds

Answer: B

The tertiary structure of proteins is stabilized by several types of interactions, including covalent disulfide bridges between cysteine residues, whereas primary structures are held by peptide bonds and secondary structures by hydrogen bonds.

51. Which groups of lipids are bipolar due to the presence of hydrophilic and hydrophobic regions? (1)
- A. ✓ **Phospholipids**
 - B. Steroids
 - C. Triglycerides
 - D. Waxes

Answer: A

Phospholipids are amphipathic (bipolar) molecules consisting of a hydrophilic (polar) phosphate head and two hydrophobic (non-polar) fatty acid tails.

52. How do you differentiate a Benedict's test for reducing and non-reducing sugar? When the sample is directly tested, the non-reducing sugar (1)
- A. acts as reducing agents in alkaline solution
 - B. reduces copper (II) ions to copper (I) ions
 - C. uses highly concentrated reagent
 - D. ✓ **gives a negative result**

Answer: D

When tested directly with Benedict's reagent, non-reducing sugars (like sucrose) cannot reduce the copper(II) ions, thus yielding a negative result (remaining blue) unless they are first hydrolyzed into monosaccharides.

53. A student wanted to test the presence of biological organic molecules in an unknown solution. She took samples from the solution in four separate test tubes, I, II, III, and IV. Then she conducted Benedict's test, Iodine test, Biuret test and Emulsion test respectively. At the end of the test she observed the following: I=Red color, II=Yellow color, III=Purple color, IV=Dissolved solution. Based on the results obtained, the student can conclude that the unknown solution contains (1)
- A. ✓ **reducing sugar and protein**
 - B. protein and lipid
 - C. reducing sugar and starch
 - D. non-reducing sugar and protein

Answer: A

A red color in Benedict's test (Tube I) indicates the presence of reducing sugars, and a purple color in the Biuret test (Tube III) indicates proteins; the yellow iodine test (Tube II) and dissolved emulsion test (Tube IV) indicate the absence of starch and lipids, respectively.

54. Which one of the following is INCORRECT about the properties of enzymes? They are (1)
- A. all proteins in their molecular nature
 - B. ✓ **functional under wide range of pH and temperature**
 - C. not changed during the reaction process
 - D. specific in the type of substrate they act on

Answer: B

Enzymes are highly sensitive biological catalysts that operate efficiently only within a narrow range of temperature and pH; they denature outside of these optimal ranges.

55. Which homeostasis process of humans is directly related with the vaporization property of water? (1)
- A. Waste excretion
 - B. Balancing of fat
 - C. Control of sugar level
 - D. ✓ **Temperature regulation**

Answer: D

The high heat of vaporization of water allows humans to regulate body temperature (thermoregulation) through sweat evaporation, which absorbs and removes excess heat from the skin.

56. Water has high surface tension that results from the (1)
- A. low density of water as a liquid than it is as a solid
 - B. ✓ **pulling force of hydrogen bonds is strongest at the surface**
 - C. low viscosity of water at its surface
 - D. hydrogen bonding of water molecules from all directions

Answer: B

Water's high surface tension is caused by cohesive hydrogen bonds pulling water molecules inward at the surface, creating a net downward and sideways tension because there are no water molecules above to pull them upward.

57. Which one of the following monosaccharides can be formed when maltose is hydrolysed? (1)
- A. $C_6H_{12}O_6$ and $C_3H_6O_3$
 - B. $C_5H_{10}O_5$ and $C_3H_6O_3$
 - C. ✓ **$2C_6H_{12}O_6$**
 - D. $2C_5H_{10}O_5$

Answer: C

Maltose is a disaccharide composed of two glucose units. Hydrolysis of one mole of maltose splits it into two moles of the monosaccharide glucose ($2 \times C_6H_{12}O_6$).

58. Science is a method of acquiring knowledge and understanding nature through (1)
- A. religion and belief
 - B. ✓ **conducting experiments**
 - C. formulating opinions
 - D. reasonable guessing

Answer: B

Science relies on empirical evidence obtained through systematic observation and conducting experiments to understand the natural world.

59. This item is based on the following observations, hypothesis and procedures written on a student note book. I. (1)
Some plants in a maize farm showed wilting. II. Two groups of maize plants were set aside; one was treated with fungicide and another left untreated. III. The wilt might be caused by fungal infection. IV. Treated plants recovered from the wilt while untreated ones didn't. According to the steps of the scientific method, which of the above notes is correctly ordered?

A. III, II, I, IV
B. IV, I, II, III
C. II, I, III, IV
D. ✓ I, III, II, IV

Answer: D

The scientific method follows a logical order: observation (I), formulating a hypothesis (III), designing and conducting an experiment (II), and analyzing results (IV).

60. Assume you wanted to test the effectiveness of three types of soil fertilizers using plants which are separately (1)
grown in a pot. Which one of the following treatments can be considered the correct application of the scientific method?

A. ✓ **Adding the same amount of each fertilizer in separate pots**
B. Adding different amounts of all fertilizers and adding to each pot
C. Adding different amounts of each fertilizer in separate pots
D. Mixing the same amounts of all fertilizers and adding to each pot

Answer: A

To test the effectiveness of different fertilizers, the type of fertilizer should be the only independent variable, meaning the same amount of each must be added to separate pots containing identical plants.

61. Which of the following are commonly used tools in a biology laboratory? (1)

A. Caliper and resistor
B. Ruler and protractor
C. ✓ **Balance and centrifuge**
D. Photometer and electrode

Answer: C

Balances (for weighing substances) and centrifuges (for separating components based on density) are standard, commonly used tools in biological laboratories.

62. Which biological tool uses satellite signals to record the location of a given area? (1)

A. Flow meter
B. ✓ **Global positioning system**
C. Theodolite
D. Data logger

Answer: B

The Global Positioning System (GPS) uses signals from satellite networks to determine and record geographic coordinates of a location.

63. Which of the following is correct about feedback regulation of enzyme activity? The first enzyme is inhibited by (1)
the final product

A. which binds on the active site
B. ✓ **which binds to the allosteric site**
C. irrespective of product concentration
D. that alters the charge in the active site

Answer: B

In feedback inhibition, the final product of a metabolic pathway regulates the pathway by binding to an allosteric site of the first enzyme, changing its shape and inhibiting its activity.

64. Significant change in pH affects enzymatic activity by (1)
- A. decreasing the number of substrates in the reaction process
 - B. altering the charge on amino acids away from the active sites
 - C. strengthening ionic bonds that hold the tertiary structure in place
 - D. ✓ **altering the charge on some of the amino acids that form the active sites**

Answer: D

Extreme changes in pH alter the ionization and charge of amino acid residues, especially those in the active site, which disrupts substrate binding and catalytic function.

65. A student was attempting to demonstrate the effect of substrate concentration on the rate of reaction using the enzyme catalase and its substrate hydrogen peroxide. She increased the substrate concentration in a stepwise manner while maintaining enzyme concentration constant and recorded the rate. Accordingly, what pattern of reaction rate is expected to be observed? (1)
- A. **Sharp increase at the beginning and a constant maximum rate when substrate concentration becomes excess**
 - ✓
 - B. Sharp increase at the beginning and a decline when the substrate concentration becomes excess
 - C. Constant rate at all points of substrate concentration
 - D. Constant rate at the beginning and a sharp increase when substrate concentration becomes excess

Answer: A

As substrate concentration increases, the reaction rate rises sharply until all enzyme active sites are saturated, at which point the rate reaches a plateau (V_{max}) and remains constant.

66. Which one of the following statements is NOT a part of the cell theory? (1)
- A. All cells come from pre-existing cells
 - B. ✓ **All cells have basically different chemical composition**
 - C. Organisms are made of one or more cells
 - D. The cell is the basic structural unit of all organisms

Answer: B

Cell theory states that all organisms are composed of cells, cells are the basic units of life, and all cells arise from pre-existing cells; however, cells share a fundamentally similar, not different, chemical composition.

67. The structural characteristics of photosystems is known to be suitable for their function, because they are found closely associated with the (1)
- A. outer membrane
 - B. ✓ **electron transport chain**
 - C. inner membrane
 - D. stroma

Answer: B

Photosystems are pigment-protein complexes embedded in the thylakoid membrane where they are closely linked structurally and functionally with the electron transport chain to drive light reactions.

68. Which of the following is correct about the Calvin cycle and glucose production by the light independent reactions? (1)
- A. GP reacts with CO_2 to produce TP
 - B. ✓ **Two TP are used to produce one glucose**
 - C. RuBP is reduced by NADPH
 - D. GP is produced before CO_2 fixation

Answer: B

Triose phosphate (TP) is a 3-carbon sugar produced in the Calvin cycle; two molecules of TP are combined during gluconeogenesis to synthesize one 6-carbon glucose molecule.

69. If the initial reaction with RuBP of the Calvin cycle is negatively affected, which factor might be taken as a direct cause of this? (1)
- A. Dehydration
 - B. Temperature
 - C. ✓ **CO₂ concentration**
 - D. Light intensity

Answer: C

The initial reaction of the Calvin cycle is the carbon fixation step where CO₂ is added to RuBP by the enzyme RuBisCO. Thus, the concentration of CO₂ directly affects the rate of this initial reaction.

70. Which one of the following is INCORRECT about photorespiration? It is a phenomena that (1)
- A. ✓ **occurs due to cold temperature conditions**
 - B. results from reaction of O₂ with RuBP
 - C. is common in hot and dry environments
 - D. occurs due to shortage of CO₂

Answer: A

Photorespiration is a wasteful pathway that occurs under hot, dry conditions when stomata close and CO₂ levels drop while O₂ levels rise, not under cold temperature conditions.

71. Traditional fermentation products such as 'Tella' and 'Injera', and modern industrial products such as detergents and textiles generally would not have been possible without the use of (1)
- A. metallic cofactors
 - B. inorganic catalysts
 - C. organic acids
 - D. ✓ **enzymes**

Answer: D

Both traditional fermentation (using yeasts and bacteria) and modern industrial processes like textile and detergent manufacturing rely on enzymes to catalyze chemical reactions.

72. Cellular respiration takes place through completion of several reaction steps that involve transfer of hydrogen and oxygen atoms or electrons from one substrate to another. Which groups of enzymes must be involved to catalyze these reactions? (1)
- A. Hydrolases
 - B. Lysases
 - C. ✓ **Oxidoreductases**
 - D. Transferases

Answer: C

Cellular respiration relies heavily on redox reactions involving the transfer of electrons and hydrogen atoms, which are catalyzed by oxidoreductases (such as dehydrogenases).

73. Which one of the following statements is correct about the mechanism of action of enzymes? The (1)
- A. ✓ **induced-fit model explains how activation energy is reduced by formation of the transition state**
 - B. lock-and-key model is less specific in terms of the range of substrates that can bind to an enzyme
 - C. lock-and-key model proposes the binding of substrate molecules produce change of shape in the active site
 - D. induced-fit model doesn't explain how the activation energy is reduced

Answer: A

The induced-fit model describes how an enzyme changes shape upon binding the substrate, which strains bonds to form the transition state and lowers the activation energy of the reaction.

74. Which of the following is correct about apoenzymes and cofactors? (1)
- A. Most apoenzymes end up being incorporated in the product molecule
 - B. ✓ **Enzymes that have cofactors can function only if they exist as holoenzymes**
 - C. The cofactor is usually a protein with low molecular weight
 - D. Apoenzymes function without their cofactors but with a lower rate

Answer: B

An apoenzyme is the inactive protein component of an enzyme that requires a cofactor to function; the active, fully assembled enzyme is called a holoenzyme.

75. Which one of the following matches of a stage of cellular respiration and its location in the cell is correctly paired? (1)
- A. Krebs cycle - inner mitochondrial membrane
 - B. Link reaction - cytoplasm
 - C. Chemiosmosis - mitochondrial matrix
 - D. ✓ **Glycolysis - cytoplasm**

Answer: D

Glycolysis is the first stage of cellular respiration and occurs entirely within the cytoplasm of the cell, unlike the other stages which occur inside the mitochondria.

76. Use of acetyl-CoA, production of ATP by substrate level phosphorylation and formation of reduced NAD are characteristics of which stage of aerobic respiration? (1)
- A. Glycolysis
 - B. ✓ **Krebs cycle**
 - C. Link reaction
 - D. Chemiosmosis

Answer: B

The Krebs cycle (or citric acid cycle) begins with the entry of acetyl-CoA, generates ATP/GTP via substrate-level phosphorylation, and reduces NAD⁺ to NADH.

77. What is the main significance of lactate fermentation during short distance race? To (1)
- A. ✓ **produce ATP quickly over a short period of time**
 - B. metabolizes glucose as energy source in the blood
 - C. convert glucose into lactic acid in the muscle
 - D. allow aerobic respiration to produce the ATP at its lower rate

Answer: A

During short-distance sprints, oxygen cannot be supplied fast enough to muscles, so lactate fermentation quickly regenerates NAD⁺ to allow glycolysis to continue producing ATP at a rapid rate anaerobically.

78. Suppose 7NADH and 6FADH₂ oxidized by NADH dehydrogenase complex and ubiquinone respectively to pump proton down into mitochondrial inner membrane space. Then, how many ATP molecules are generated? (1)
- A. 26
 - B. ✓ **33**
 - C. 13
 - D. 46

Answer: B

Using the classic biological conversion factors where 1 NADH yields 3 ATP and 1 FADH₂ yields 2 ATP: $(7 \text{ NADH} \times 3) + (6 \text{ FADH}_2 \times 2) = 21 + 12 = 33$ ATP molecules.

79. The light-independent reactions of photosynthesis take place in which part of chloroplasts? (1)

- A. Outer membrane
B. Inner membrane
C. ✓ **Stroma**
D. Thylakoid

Answer: C

The light-independent reactions (or Calvin cycle) of photosynthesis take place in the stroma of the chloroplast, where the necessary enzymes are located, whereas the light-dependent reactions occur in the thylakoid membranes.

80. The structure of specimens can be studied after they are freshly collected using a (1)

- A. ✓ field microscope
B. data logger
C. flow meter
D. theodolite

Answer: A

A field microscope is a portable microscope designed for use outdoors, allowing biologists to examine the microscopic structure of freshly collected specimens directly at the field site.

81. Grade 11 students were reading chapters of a biology text book on plant adaptation in water, decomposition in bacteria, the causes of breast cancer and biotechnology. These chapters respectively represent the relevance and promises of biology in (1)

- A. agricultural production, health, cures for genetic diseases and environmental protection
- B. agricultural production, health, environmental protection and cures for genetic diseases
- C. agricultural production, health, cures for genetic diseases and environmental protection
- D. ✓ **agricultural production, environmental protection, health, and cures for genetic diseases**

Answer: D

Plant adaptation in water, bacterial decomposition, causes of breast cancer, and biotechnology correspond respectively to agricultural production, environmental protection, health, and cures for genetic diseases.

82. Which one of the following may NOT be directly linked to application of biology in the fight against HIV/AIDS? (1)

The effort to

- A. design the mechanisms of protection B. understand the mechanism of invasion
C. discover a vaccine or a cure D. ✓ **provide moral support to patients**

Answer: D

Providing moral support to HIV/AIDS patients is a social and ethical responsibility, whereas understanding the virus, designing protection, and discovering vaccines are direct biological applications.

83. Which one of the following practices is a part of a responsible HIV/AIDS engagement in the fight against it? (1)

- B. ✓ Maintaining a monogamous relationship**

Answer: B

Maintaining a monogamous relationship prevents the transmission of HIV, whereas sharing needles (even with friends) is highly risky, and washing hands is unnecessary as HIV is not transmitted via casual skin contact.

84. What is the best practice for youngsters to avoid HIV infection? (1)

- A. Having few sexual partners
- B. Polygamous relationship
- C. ✓ **Abstinence from sex**
- D. Use of condoms

Answer: C

For youngsters, complete abstinence from sexual intercourse is the most reliable and 100% effective method to avoid sexually transmitted HIV infections.

85. Identify the lowest level of organization from the following options? (1)

- A. Circulatory system
- B. Cardiac muscles
- C. ✓ **Blood cells**
- D. Heart

Answer: C

Blood cells represent the cellular level of organization, which is lower than tissues (cardiac muscles), organs (the heart), and organ systems (the circulatory system).

86. Assume you wanted to estimate the size of cheek cell samples. At the required level of magnification, the field of view was determined using a ruler which was equal to 3 mm. If 10 cheek cells were counted under similar magnification, what is the estimated size of the cells? (1)

- A. 330 μm
- B. 3.3 μm
- C. ✓ **300 μm**
- D. 30 μm

Answer: C

The field of view is 3 mm, which equals 3,000 micrometers (μm). Dividing this by the 10 cells that span across the field of view gives an estimated size of 300 μm per cell.

87. Which one of the following cellular structures is common to both eukaryotic and prokaryotic cells? (1)

- A. ✓ **Ribosome**
- B. Nucleus
- C. Chloroplast
- D. Mitochondria

Answer: A

Ribosomes are non-membrane-bound organelles responsible for protein synthesis and are present in both prokaryotic and eukaryotic cells, whereas nuclei, chloroplasts, and mitochondria are membrane-bound and unique to eukaryotes.

88. One of the main functions of the plasma membrane is regulation of (1)

- A. cell support
- B. ✓ **material transport**
- C. cell division
- D. protein synthesis

Answer: B

The primary function of the plasma membrane is selectively regulating the transport of materials entering and exiting the cell.

89. What is the role of bacteria in recombinant DNA technology? To (1)

- A. serve as a source of nuclear donor
- B. isolate desired genes of interest
- C. ✓ **receive recombinant DNA**
- D. create recombinant plasmids

Answer: C

In recombinant DNA technology, host bacteria are used to receive the recombinant DNA (transformation) so that they can replicate it and express the desired protein product.

90. What are the two main structural components of a virus? (1)

- A. ✓ **Capsid and genetic material**
- B. Genetic material and lipid membrane
- C. Protein shell and lipid membrane
- D. Capsid and lipid membrane

Answer: A

The basic structure of all viruses consists of nucleic acid (genetic material) enclosed within a protective protein coat called a capsid. While some viruses also possess an outer lipid membrane (envelope), it is not a universal component of all viruses.

91. Herpes simplex is a type of (1)

- A. bacteriophage
- B. RNA virus
- C. retrovirus
- D. ✓ **DNA virus**

Answer: D

Herpes simplex virus (HSV) is a double-stranded DNA virus belonging to the Herpesviridae family, meaning its genetic material is DNA rather than RNA.

92. Which class of HIV anti-retroviral drugs binds to T-cells in order to inhibit joining of the virus with its receptor? (1)

- A. Non-nucleotide reverse transcriptase inhibitors
- B. Nucleotide reverse transcriptase inhibitors
- C. ✓ **Entry inhibitors**
- D. Protease inhibitors

Answer: C

Entry inhibitors (such as CCR5 antagonists) block HIV from entering host T-cells by binding to receptors on the T-cell surface, thereby preventing the viral envelope from attaching to its target.

93. The only common characteristics viruses have with free-living cells is the possession of (1)

- A. nucleus
- B. ✓ **genetic material**
- C. plasma membrane
- D. ribosomes

Answer: B

Viruses are non-cellular entities that lack organelles like ribosomes, a nucleus, or a true plasma membrane; their only shared characteristic with living cells is that they contain genetic material (DNA or RNA) to direct their replication.

— END OF MARKING KEY —

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