

Biology, 2014 EC, natural science, entrance exam, round 1

Grade 12 · Biology · 2014 E.C.

MARKING KEY — CONFIDENTIAL

Time allowed: 120 minutes

Questions: 95

Total marks: 95

1. Bacterial cell wall is unique due to its (1)
- A. ✓ **chemical composition.** B. freely permeability.
C. selective permeability. D. mechanical support.

Answer: A

The bacterial cell wall is unique because it is composed of peptidoglycan (murein), a complex polymer of sugars and amino acids not found in archaea or eukaryotes.

2. Which genus of bacteria oxidize hydrogen sulphide to sulphate and make sulphate ions available to be taken by plant roots from the soil? (1)
- A. Klebsiella B. Desulfovibrio
C. Azotobacter D. ✓ **Thiobacillus**

Answer: D

Thiobacillus species are chemolithotrophic bacteria that obtain energy by oxidizing sulfur and hydrogen sulfide into sulfate, making it available for uptake by plant roots.

3. Which one of the following diseases is caused by food poisoning bacteria? (1)
- A. Candidiasis B. ✓ **Salmonellosis**
C. Tuberculosis D. Pneumonia

Answer: B

Salmonellosis is a symptomatic infection caused by bacteria of the genus Salmonella, which is a very common cause of bacterial food poisoning.

4. Which one of the following is correct concerning the reproductive cycles of viruses? (1)
- A. Both lytic and lysogenic life cycles release new viruses without the genetic alteration of the host cell.
B. ✓ **In lysogenic life cycle the DNA of the virus integrates with the host cell's DNA.**
C. Both lytic and lysogenic life cycles undergo the same life cycle but ending with different results.
D. In lytic life cycle, viruses are released without killing the host cell.

Answer: B

In the lysogenic cycle, the viral genome integrates into the host bacterium's DNA as a prophage, replicate together with it, and does not immediately lyse the host cell.

5. Unlike free living cells, viruses are completely (1)
- A. pathogenic to a living cell. B. mutual to a living cell.
C. ✓ **parasitic to a living cell.** D. harmful to a living cell.

Answer: C

Viruses are obligate intracellular parasites, meaning they are completely dependent on a host cell's machinery to replicate and survive.

6. Why are vaccines important? Because they help to (1)
- A. ✓ **trigger the immune system.** B. kill pathogens.
C. prevent functional diseases. D. heal wounds.

Answer: A

Vaccines work by introducing weakened or inactive parts of a pathogen to stimulate and trigger the body's primary immune response, creating immunological memory.

7. Assume you wanted to demonstrate compatibility of blood groups. You took four test tubes labeled O, A, B, and AB based on the blood group that each test tube contains. Then you added unknown blood sample into each test tube and no agglutination was observed in each test tube. From this, you can conclude that the unknown blood sample was (1)
- A. blood group B. B. ✓ **blood group O.**
C. blood group A. D. blood group AB.

Answer: B

Blood group O red blood cells contain neither A nor B antigens on their surface. Consequently, when mixed with blood of any other group containing antibodies, no agglutination occurs.

8. Which one of the following diseases increases the likelihood of contracting HIV? (1)
- A. ✓ **Syphilis** B. Chancroid
C. Tuberculosis D. Gonorrhoea

Answer: A

Syphilis is a sexually transmitted infection that causes genital ulcers, which break the skin barrier and greatly facilitate the transmission and contraction of HIV.

9. Even though pasteurization is a technique used to heat milk, beer and other foods, it cannot kill pathogenic microorganisms because it (1)
- A. cannot kill all pathogenic microorganisms.
B. reduces the nutritional content of the food.
C. is conducted in containers that are not properly sealed.
D. ✓ **uses mild temperature that kills most but not all bacteria.**

Answer: D

Pasteurization is not sterilization; it uses a relatively mild heat treatment that is sufficient to destroy common heat-sensitive pathogens but leaves thermophilic bacteria and bacterial spores intact.

10. Which one of the following statements is correct about the binomial nomenclature? (1)
- A. The genus name is written in full while the species name is abbreviated.
B. Both genus and species names are capitalized and italicized when printed.
C. ✓ **The first letter of genus name is capitalized while the species name is written in small letters.**
D. The genus name is written in English while the species name is written in Latin.

Answer: C

In binomial nomenclature, the genus name always begins with a capital letter, while the specific epithet (species name) is written entirely in lowercase.

11. During gas exchange between the alveoli and blood capillaries, oxygen is absorbed by the blood while carbon dioxide is removed. This opposite direction of gas exchange occurs due to (1)
- A. ✓ **difference in the concentration gradient of oxygen and carbon dioxide.**
 - B. difference in the molecular size of oxygen and carbon dioxide.
 - C. thicker layer of the capillaries.
 - D. the small surface area of the alveoli.

Answer: A

Gas exchange across the respiratory membrane occurs via passive diffusion, which is driven entirely by the partial pressure (concentration) gradients of oxygen and carbon dioxide.

12. Identify the correct statement about the effect of exercise on breathing rate. (1)
- A. The vital capacity of the lungs decrease during heavy exercise.
 - B. The tidal volume of air at rest is greater than the tidal volume of air during exercise.
 - C. Fast and deep breathing are the result of demanding less oxygen.
 - D. ✓ **Exercise and getting fit makes the lungs efficient.**

Answer: D

Regular physical exercise and improved fitness strengthen the respiratory muscles and optimize cardiovascular function, leading to more efficient gas exchange and oxygen delivery.

13. The following is a list of functions of the components of blood: Transport of oxygen Fight against diseases Cause blood clotting Which one of the following is a correct order of blood components responsible for the above functions respectively? (1)
- A. White blood cells, platelets, red blood cells
 - B. Platelets, white blood cells, red blood cells
 - C. ✓ **Red blood cells, white blood cells, platelets**
 - D. Red blood cells, platelets, white blood cells

Answer: C

Red blood cells contain hemoglobin for oxygen transport, white blood cells are key to the immune defense, and platelets trigger blood clotting at wound sites.

14. What is the cause of the back flow of blood into the atria from the ventricles? It could be damage of the (1)
- A. aorta.
 - B. pulmonary artery.
 - C. ✓ **valves.**
 - D. pulmonary vein.

Answer: C

The atrioventricular valves (mitral and tricuspid) normally prevent the backward flow of blood from the ventricles into the atria; damage to these valves leads to regurgitation (backflow).

15. The capillaries are blood vessels that have thin wall and large surface area since their function is (1)
- A. transport of oxygenated blood.
 - B. ✓ **exchange of substances.**
 - C. to return blood to the heart.
 - D. transport of deoxygenated blood.

Answer: B

Capillaries have walls that are only one cell thick and present a vast total surface area to maximize the rate of diffusion and exchange of gases, nutrients, and wastes between the blood and tissues.

16. During image formation, light is refracted twice before it is focused on the retina. This phenomenon happens at the (1)
- A. aqueous humour and lens.
 - B. iris and lens.
 - C. lens and vitreous humour.
 - D. ✓ **cornea and lens.**

Answer: D

Light is refracted first and most significantly when it passes through the cornea, and is refracted a second time by the lens to focus precisely on the retina.

17. Three students designed the following experimental settings to understand the actual taste of a food. Student 1: Blind folded two students, one of them tightly holding the nose while the other without holding the nose and tasting the food. Student 2: Blind folded one student and the other left with open eyes, both holding their nose tightly while tasting the food. Student 3: None of the participants blind folded and only one of them holding her nose tightly while tasting the food. Student 4: None of the participants blind folded and both of them taste the food without holding the nose. Which student designed the most appropriate experiment? (1)
- A. ✓ **Student 1**
 - B. Student 2
 - C. Student 4
 - D. Student 3

Answer: A

Student 1's design is the best because blindfolding both participants controls for visual cues, while having one hold their nose and the other not isolates the sense of smell as the independent variable affecting taste perception.

18. Short-sightedness is corrected by a concave lens because the problem arises due to a (1)
- A. weak eye lens that converges light slightly.
 - B. powerful eye lens that diverges light.
 - C. weak eye lens that diverges light.
 - D. ✓ **strong eye lens that converges light too soon.**

Answer: D

Short-sightedness (myopia) is caused by an eyeball that is too long or a lens system that is too strong, focusing light rays in front of the retina rather than directly on it; a concave lens diverges light to correct this.

19. A patient exhibited symptoms of weight loss, sweating, and irritability and the doctor suspected an endocrine malfunction that can be related to the (1)
- A. pancreas.
 - B. adrenal gland.
 - C. ✓ **thyroid gland.**
 - D. gonads.

Answer: C

Weight loss, excessive sweating, heat intolerance, and irritability are classic clinical signs of hyperthyroidism, which is characterized by overactivity of the thyroid gland.

20. Secretions of endocrine glands require receptors on cell membrane to be picked by their targets while exocrine secretions do not. This is because (1)
- A. exocrine glands secrete hormone directly to the blood stream.
 - B. endocrine glands are controlled by the nervous system.
 - C. ✓ **endocrine glands are ductless.**
 - D. endocrine glands produce protein-based hormones.

Answer: C

Because endocrine glands are ductless, they secrete hormones directly into the bloodstream to circulate throughout the body; target cells must express specific receptors to detect and respond to these systemic signals.

21. Which of the following diseases is caused by a DNA virus? (1)

- A. ✓ **Cold sore**
- B. AIDS
- C. Swine flu
- D. Corona

Answer: A

Cold sores are caused by the Herpes Simplex Virus (HSV), which is a double-stranded DNA virus, whereas AIDS (HIV), swine flu (influenza), and Corona (SARS-CoV-2) are all caused by RNA viruses.

22. Currently, natural resources are being depleted at increasing rate and waste materials are accumulated and discharged freely into water bodies. What is the best strategy to overcome these problems? (1)

- A. Decomposition
- B. Succession
- C. Fossilization
- D. ✓ **Recycling**

Answer: D

Recycling reduces the demand for raw natural resource extraction and diverts waste materials from landfill and water body dumping back into productive use.

23. Which stage of the nitrogen cycle needs the role of Rhizobium? (1)

- A. Decomposition
- B. Denitrification
- C. ✓ **Nitrogen fixation**
- D. Nitrification

Answer: C

Rhizobium is a symbiotic, nitrogen-fixing bacterium that associates with the roots of leguminous plants to convert atmospheric nitrogen gas into ammonia.

24. A key aspect in the process of recovery of an ecosystem through succession is that (1)

- A. ✓ **pioneer species always make the environment better.**
- B. higher organisms colonize the environment first.
- C. a climax community of lichens and mosses is established at the end.
- D. pioneer species always tend to be lower animals.

Answer: A

A key mechanism of ecological succession is facilitation, where pioneer species modify the abiotic environment (e.g., forming soil) in ways that make it more suitable for later-successional species.

25. What are the common plants of the boreal forest? (1)

- A. Deciduous trees
- B. ✓ **Conifers**
- C. Mosses
- D. Epiphytes

Answer: B

The boreal forest (or taiga) is characterized by cold climates and is globally dominated by cone-bearing evergreen trees, also known as conifers.

26. Which one of the following may NOT be regulated by a plant hormone? (1)

- A. ✓ **Seed dispersal**
- B. Cell division
- C. Fruit ripening
- D. Cell elongation

Answer: A

Seed dispersal is typically an ecological or mechanical process mediated by wind, water, or animals, and is not directly regulated by plant hormones, whereas cell division (cytokinins), fruit ripening (ethylene), and cell elongation (auxins) are hormone-regulated.

27. Bushing of a plant results from (1)
- A. cancellation of the positive effect of apical dominance.
 - B. ✓ **removal of the inhibitory effect of auxin.**
 - C. decreased production of auxin by side shoots.
 - D. increased production of auxin by the main shoot.

Answer: B

Apical dominance is maintained by auxin produced at the shoot tip, which inhibits the growth of lateral buds. Removing this tip removes the inhibitory effect of auxin, allowing lateral buds to grow and make the plant bushy.

28. Actions such as protection of individual species, reduction of pollution, and biodiversity conservation can collectively be taken as methods of (1)
- A. agricultural expansion.
 - B. ✓ **biodiversity conservation.**
 - C. fighting global warming.
 - D. fighting soil erosion.

Answer: B

The protection of individual species, reduction of habitat-destroying pollution, and other preservation actions collectively fall under the methods used for biodiversity conservation.

29. Which one of the following plants is NOT endemic to Ethiopia? (1)
- A. ✓ **Mango**
 - B. Zigba
 - C. Noug
 - D. Enset

Answer: A

Mango (*Mangifera indica*) is native to South and Southeast Asia, whereas Enset, Noug, and Zigba are either endemic, domesticated, or native to Ethiopia and the Horn of Africa.

30. Which one of the following national parks is characterized by the presence of wildlife such as elephant, lion, cheetah and giraffe? (1)
- A. Bale mountains national park
 - B. Awash national park
 - C. ✓ **Mago national park**
 - D. Simien mountains national park

Answer: C

Mago National Park, located in southern Ethiopia, is characterized by semi-arid savanna environments that support large mammals like elephants, giraffes, lions, and cheetahs.

31. In kingdom animalia, which phylum poisons its prey by tentacles that contain stinging cells? (1)
- A. Nematoda
 - B. ✓ **Coelenterata**
 - C. Annelida
 - D. Porifera

Answer: B

Members of the phylum Coelenterata (also known as Cnidaria), such as jellyfish and sea anemones, possess specialized stinging cells called cnidocytes on their tentacles to paralyze or kill prey.

32. Mosses are grouped under division bryophyta because they (1)
- A. ✓ **lack true roots system and vascular tissue.**
 - B. have true leaves, stems and roots.
 - C. have flat and broad leaves.
 - D. are evergreen and photosynthesize all year round.

Answer: A

Mosses are bryophytes, which are characterized as non-vascular plants because they lack specialized vascular tissues (xylem and phloem) as well as true roots, stems, and leaves.

33. If you are asked to draw a pyramid of biomass of an aquatic habitat that contains zooplanktons, herrings, sea lions and phytoplankton, which organisms should be placed at the top of the pyramid? (1)
- A. Phytoplankton
 - B. Zooplanktons
 - C. Herrings
 - D. ✓ **Sea lions**

Answer: D

In an aquatic food chain, phytoplankton (producers) are eaten by zooplankton (primary consumers), which are eaten by herrings (secondary consumers), which are eaten by sea lions (tertiary consumers/top predators), placing sea lions at the top of the biomass pyramid.

34. Which one of the following is an adaptation to reduce water loss in plants? (1)
- A. a single layered epidermis in leaves
 - B. thin broad leaves
 - C. large and wide stomata
 - D. ✓ **leaves covered with waxy cuticle**

Answer: D

A thick, waxy cuticle covering the leaves acts as a physical barrier that prevents water from evaporating from the leaf surface, thereby reducing water loss through transpiration.

35. Why are arctic animals such as seals, walruses and whales large in body size? To (1)
- A. ✓ **reduce heat loss**
 - B. move in the water bodies easily
 - C. capture their prey without challenges
 - D. increase their surface area

Answer: A

According to Bergmann's rule, larger bodies have a smaller surface-area-to-volume ratio, which reduces the rate of heat loss and helps large arctic animals maintain their body temperature in cold waters.

36. The institute of biodiversity conservation is one of the biological research institutes of Ethiopia attempting to conserve the genetic resources of the country. As such, the institute's major research efforts focus on all of the following EXCEPT (1)
- A. microorganism conservation
 - B. animal conservation
 - C. ✓ **soil conservation**
 - D. plant conservation

Answer: C

The Ethiopian Institute of Biodiversity (EIB) focuses on the conservation of biotic genetic resources (plants, animals, and microorganisms), whereas soil conservation is an abiotic environmental management activity handled by agricultural bodies.

37. The importance of stains in microscopic investigations is explained by their effect in (1)
- A. increasing resolution.
 - B. ✓ **creating contrast.**
 - C. increasing magnification.
 - D. decreasing air bubbles.

Answer: B

Stains bind to specific cell structures, coloring them and creating contrast against the background or other organelles, which makes them visible under a microscope.

38. One of the following problems can occur if the liver does NOT properly carry out its digestive functions. (1)
- A. Increased alkalinity of the intestine
 - B. Incomplete digestion of polysaccharides
 - C. Partial absorption of digested foods
 - D. ✓ **Partial digestion of fats**

Answer: D

The liver produces bile, which is stored in the gallbladder and released into the small intestine to emulsify fats. Without proper liver function, fat emulsification is impaired, leading to partial digestion and absorption of fats.

39. Which of the following is the correct order of food substance, enzyme, and breakdown product of the digestive process in the stomach respectively? (1)
- A. Starch, lipase, glucose
 - B. Fat, trypsin, glycerol
 - C. ✓ **Protein, pepsin, amino acid**
 - D. Lipid, amylase, fatty acid

Answer: C

In the stomach, the inactive pepsinogen is activated to pepsin, which digests proteins into smaller peptides (simplified in many curricula as breaking down to amino acids). No other option correctly pairs a stomach enzyme with its correct substrate.

40. Assume you are trying to demonstrate breathing movements using artificial lung and you pulled down the rubber sheet. This action of pulling represents which step of the actual breathing process? (1)
- A. Exhalation and contraction of the diaphragm
 - B. Inhalation and relaxation of the diaphragm
 - C. ✓ **Inhalation and contraction of the diaphragm**
 - D. Exhalation and relaxation of the diaphragm

Answer: C

In a bell jar model, pulling down the rubber sheet increases the volume inside and decreases pressure, causing air to rush into the balloons. This mimics inhalation, which is driven by the contraction (downward movement) of the diaphragm.

41. When three fatty acid molecules and a glycerol molecule undergo condensation reaction, they form (1)
- A. peptide bond and protein.
 - B. ✓ **ester bond and triglyceride.**
 - C. glycoside bond and polysaccharide.
 - D. phosphate bond and phospholipid.

Answer: B

A condensation reaction between one glycerol molecule and three fatty acids results in the formation of three ester bonds, producing a triglyceride molecule and three water molecules.

42. In water, phospholipids become organized into a bilayer. In this configuration, which part of the bilayer faces towards the water? (1)
- A. Hydrocarbon tail
 - B. Fatty acid tail
 - C. ✓ **Phosphate head**
 - D. Glycerol head

Answer: C

Phospholipids are amphipathic; their hydrophilic (water-loving) phosphate heads face outward toward the aqueous environments inside and outside the cell, while their hydrophobic fatty acid tails face inward, away from water.

43. Four students wanted to conduct chemical tests on unknown food particles and used the following chemicals and materials. Student A: Test tubes and burnet solution Student B: Test tubes, ethanol, water, filter paper Student C: Test tubes, benedict's solution, water bath Student D: Test tubes and iodine solution Which of the above students planned a test for lipids? (1)

A. ✓ Student B

B. Student D

C. Student C

D. Student A

Answer: A

Student B planned the emulsion test, which utilizes ethanol and water to extract and identify lipids by the formation of a cloudy white emulsion.

- 44.** Niacin is used to make the coenzyme (1)

A. FAD.

B. ADP.

C. ✓ NAD.

D. AMP.

Answer: C

Niacin (vitamin B3) is the precursor molecule required for the synthesis of the coenzyme nicotinamide adenine dinucleotide (NAD).

- 45.** The following are reaction types catalyzed by different classes of enzymes: 1. Transferring hydrogen and oxygen atoms 2. Changing of the molecular form of the substrate 3. Joining of two molecules by the formation of new bonds Which classes of enzymes catalyze the above reactions according to their consecutive order? (1)

A. Transferases, hydrolases, lyases

B. ✓ Oxidoreductases, isomerases, ligases

C. Oxidoreductases, hydrolases, lyases

D. Transferases, isomerases, ligases

Answer: B

Oxidoreductases catalyze oxidation-reduction reactions (transfer of oxygen/hydrogen), isomerases catalyze structural rearrangements within a molecule, and ligases catalyze the joining of two molecules using energy (bonds).

- 46.** The hydrogen ions that used to turn the rotor of ATP synthase come from (1)

A. phosphorylation of ADP.

B. ✓ oxidation of NADH and FADH₂.

C. hydrolysis of ATP.

D. reduction of NADH and FADH₂.

Answer: B

The protons (H⁺ ions) pumped into the intermembrane space to create the gradient that drives ATP synthase are released during the oxidation of NADH and FADH₂ in the electron transport chain.

- 47.** What triggers fermentation during exercise? (1)

A. ✓ Shortage of oxygen

B. Over activity of respiratory enzymes

C. Production of ATP beyond the cells demand

D. Presence of excess glucose

Answer: A

During strenuous exercise, oxygen supply to muscle tissues cannot keep up with the high demand, leading to a shortage of oxygen and triggering lactic acid fermentation to regenerate NAD^+ and sustain glycolysis.

48. Which of the following processes explains lactate production during anaerobic respiration in animal cells? (1)
- A. Oxidation of pyruvate
 - B. Decarboxylation of pyruvate
 - C. Phosphorylation of pyruvate
 - D. ✓ **Reduction of pyruvate**

Answer: D

Lactate is produced during anaerobic respiration in animal cells by the reduction of pyruvate using electrons from NADH, a reaction catalyzed by lactate dehydrogenase.

49. Which one of the following descriptions holds true for the link reaction of respiration? (1)
- A. ✓ **Pyruvate reacts with coenzyme A to form acetyl coenzyme A.**
 - B. Glucose is converted to pyruvate through a chain of reactions.
 - C. Hydrogen ion and ATP are synthesized.
 - D. Reduced NAD and reduced FAD are produced.

Answer: A

The link reaction connects glycolysis to the Krebs cycle, during which pyruvate undergoes decarboxylation and oxidation to form an acetyl group that reacts with coenzyme A to produce acetyl-CoA.

50. Which one of the following is the neo-Darwinian idea of evolution? (1)
- A. inheritance of acquired characteristics.
 - B. ✓ **natural selection through genetics and behavior.**
 - C. use and disuse of anatomical structures.
 - D. competitions between living organisms.

Answer: B

Neo-Darwinism (the Modern Synthesis) combines Darwin's theory of natural selection with Mendelian genetics and population genetics to explain how evolutionary changes and behaviors are inherited.

51. What is the significance of Australopithecus afarensis in the study of human evolution? To confirm (1)
- A. ✓ **evolution of bipedalism before large brains**
 - B. divergent evolution from Homo habilis
 - C. true common ancestor of chimpanzees and humans
 - D. convergent evolution of Homo neanderthalensis and Homo erectus

Answer: A

The fossil of Australopithecus afarensis (such as Lucy) demonstrated that bipedalism (walking upright) evolved before the development of a large brain in human ancestors.

52. Instinctive behavior (1)
- A. ✓ **is common to all members of a species.**
 - B. varies from individual to individual.
 - C. may be modified by new experiences.
 - D. develops through trial and error.

Answer: A

Instinctive or innate behavior is genetically programmed, meaning it is inherited and relatively consistent among all members of a species.

53. Which one of the following statements is an example of latent learning? (1)
- A. The random movement of woodlice in response to changes in light intensity and humidity.
 - B. ✓ **Knowledge of a mice about the immediate environment of its burrow may help it escape from predator.**
 - C. Foraging bees returning from successful trip dance on the honey comb to recruit others to harvest a new.
 - D. Female baboon turns its buttock toward the dominant male to signify readiness to mate.

Answer: B

Latent learning occurs without immediate reinforcement or reward; for example, a mouse learns the spatial layout of its environment and uses this knowledge later to escape a predator.

54. Which one of the following is correct about the action of apoenzymes and coenzymes? (1)
- A. Coenzymes bind with cofactors to form an active enzyme.
 - B. Apoenzymes bind with enzymes to give catalytic activity.
 - C. Both apoenzymes and coenzymes combine with cofactors to form a non-active enzyme.
 - D. ✓ **Coenzymes bind with enzymes to give catalytic activity.**

Answer: D

In active enzyme systems, coenzymes (non-protein organic molecules) bind to inactive apoenzymes (often referred to generally as enzymes) to form the active holoenzyme and enable catalytic activity.

55. Consider the following statements. I. Genetically determined and common to all members of a species. II. The behavior may be modified by new experiences. III. Behavior is fully functional at the first attempt. IV. Generally there is no modification of the behavior. Which numbers describe innate and learned behaviors? (1)
- A. Innate: III, IV and Learned: I, II
 - B. Innate: I, II and learned: III, IV
 - C. Innate: II, III, IV and Learned: I
 - D. ✓ **Innate: I, III, IV and Learned: II**

Answer: D

Innate behavior is genetically determined (I), fully functional at the first attempt (III), and not easily modified (IV). Learned behavior, on the other hand, is flexible and modified by new experiences (II).

56. Which one of the following is an example of social behavior? (1)
- A. Exaggeration of size by fluffing up of feathers
 - B. Singing of frogs on spring nights
 - C. Marking a territory with urine
 - D. ✓ **Caring for offspring that are not one's own**

Answer: D

Social behavior involves cooperative interactions between members of the same species, such as altruism, exemplified here by individuals caring for offspring that are not their own.

57. Consider the following reaction: Reactant A + Reactant B → Enzyme → Intermediate → Product AB + Enzyme? At which point are the chemical bonds weakened? (1)
- A. ✓ **intermediate**
 - B. reactant A
 - C. reactant B
 - D. product AB

Answer: A

During an enzyme-catalyzed reaction, the chemical bonds of the substrates are weakened and strained while in the intermediate enzyme-substrate complex, reducing the activation energy required for the reaction.

58. How do enzymes bind and act on their substrates? By using the (1)
- A. lock-and-key model and reducing energy of the substrate
 - B. induced-fit model and providing extra energy for the substrate
 - C. lock-and-key model and changing themselves into products
 - D. ✓ **induced-fit model and putting the substrates under tension**

Answer: D

The induced-fit model describes how the binding of a substrate induces a conformational change in the enzyme, which puts the substrate's chemical bonds under physical tension to facilitate the reaction.

59. Which of the following external factors influence the turnover rate of enzymes by completely damaging their tertiary structure? (1)
- A. Competitive inhibitors
 - B. Substrate concentration
 - C. Reversible inhibitors
 - D. ✓ **Temperature and pH**

Answer: D

Extremes in temperature and pH cause the denaturation of enzymes by disrupting the non-covalent bonds (such as hydrogen and ionic bonds) that maintain their tertiary structure, permanently destroying their activity.

60. During baking of injera, the CO₂ produced by yeast is used to (1)
- A. kill contaminants that spoil injera.
 - B. ✓ **give injera its typical texture.**
 - C. bake injera with low temperature.
 - D. increase the shelf life of injera.

Answer: B

Carbon dioxide gas released by yeast during the fermentation of teff dough gets trapped in the batter, creating the characteristic spongy, porous texture (eyes) of injera during baking.

61. The nerve impulse is transmitted from one neuron to another by a neurotransmitter at the (1)
- A. axon.
 - B. cell body.
 - C. ✓ **synapse.**
 - D. myelin sheath.

Answer: C

The synapse is the specialized junction where a nerve impulse is transmitted from the axon terminal of one neuron to the dendrite or cell body of another neuron via neurotransmitters.

62. What happens if the axon is stimulated? Formation of (1)
- A. negative charge in both sides of the axon
 - B. negative charge inside the axon
 - C. ✓ **positive charge inside the axon**
 - D. positive charge outside of the axon

Answer: C

When an axon is stimulated, sodium channels open and sodium ions (Na^+) rush inward, causing depolarization and the generation of a positive charge inside the axon.

63. Assume you wanted to demonstrate a simple reflex action using the knee jerk reflex. You asked a friend to sit with one leg crossed over the other. Which one of the following indicates the correct demonstration? (1)
- A. Pulling down your friend's leg that is followed by downward movement
 - B. Hitting your friend on the toes followed by sudden upward movement of the leg
 - C. Bending up your friend's leg followed by downward movement of the leg
 - D. ✓ **Hitting your friend below the knee cap followed by a sudden upward movement**

Answer: D

The knee-jerk reflex is demonstrated by tapping the patellar tendon just below the kneecap, which stretches the quadriceps muscle and triggers a reflex contraction that kicks the lower leg upward.

64. A finch with an average length beak was not able to obtain insects out of the cracks in the bark of trees as well as one with a longer beak. It was also not able to crush seeds as well as one with a shorter beak. Over time, those with the longer beaks and those with average length beaks decreased in number, while those with shorter beaks increased in number. Which type of selection has been operated in this scenario? (1)
- A. Disruptive
 - B. ✓ **Directional**
 - C. Stabilising
 - D. Behavioral

Answer: B

Directional selection occurs when environmental changes favor individuals at one extreme of a phenotypic distribution (in this case, shorter beaks), leading to a shift in the population's average trait over time.

65. The cell theory states that cells (1)
- A. contain different organelles with no specialization.
 - B. have basically different composition.
 - C. ✓ **come from pre-existing cells by division.**
 - D. come from non-living objects.

Answer: C

A central tenet of the cell theory, formulated by Rudolf Virchow, states that all living cells arise only from pre-existing cells through the process of cell division.

66. Which theory of the origin of life states that life has no beginning or ending? (1)
- A. Cosmozoan theory
 - B. Special creationism
 - C. ✓ **Eternity theory**
 - D. Biochemical theory

Answer: C

The Eternity of Life theory (or steady-state theory) suggests that life has no beginning or end, having always existed and continuing to exist infinitely in the universe.

67. Which one of the following is paleontological evidence of evolution? (1)
- A. The presence of homologous structures in living organisms
 - B. ✓ **Traces of organisms from the remote past**
 - C. Similarities in the DNA base sequences of different organisms
 - D. Similarities in the development of embryos in different organisms

Answer: B

Paleontology is the study of ancient life through fossils, which are the preserved remains, prints, or traces of organisms from the remote geological past.

68. A colour blind daughter can be born when the (1)
- A. mother is normal and the father is colour blind.
 - B. father is colour blind and the mother is normal.
 - C. ✓ **mother is carrier and the father is colour blind.**
 - D. father is normal and the mother is carrier.

Answer: C

Red-green color blindness is an X-linked recessive disorder. For a daughter to be affected (X^bX^b), she must inherit an affected X^b chromosome from both a carrier or affected mother ($X^B X^b$ or $X^b X^b$) and an affected, color-blind father ($X^b Y$).

69. A farmer cut off several regions of a stem near to the buds of a plant. He removed some of the leaves and (1)
- dipped the cuts end in some hormones rooting powder and planted the cuttings in a compost. He kept the well watered and within a few weeks they developed their own root system and became new independent plants. Which one of the following is correct about this experiment?
- A. phenotypically and genotypically different from the parent plant and from each other
 - B. ✓ **genetically and phenotypically identical to the parent plant and to each other**
 - C. genotypically identical but phenotypically different from the parent
 - D. phenotypically identical but genotypically different from each other.

Answer: B

Vegetative propagation via stem cuttings is a form of asexual reproduction, meaning the offspring are genetic clones of the parent plant and of each other, resulting in identical genotypes and phenotypes under identical environmental conditions.

70. With four different bases to work with, there are 64 possible triplet codes, but only 20 amino acids are used to (1)
- make all the different proteins. This is because the DNA code is
- A. ✓ **degenerate code.**
 - B. non-overlapping code.
 - C. semi conservative code.
 - D. universal code.

Answer: A

The genetic code is described as degenerate (or redundant) because multiple distinct codons (out of the 64 possible triplets) can code for the same amino acid among the 20 standard ones.

71. If mRNA brings the code "UGA" into the ribosome (1)
- A. ✓ **translation ceases and protein synthesis terminates.**
 - B. rRNA will bring the amino acid methionine.
 - C. ribosome will initiate protein synthesis.
 - D. tRNA will bring "UGA" anticodon.

Answer: A

UGA is a stop codon. When a ribosome encounters UGA, translation is terminated, releasing the newly synthesized polypeptide chain.

72. Breakdown of the thick spongy wall of the uterus at the end of the menstrual cycle is associated with the (1)
- A. formation of the corpus luteum.
 - B. maturation of the follicle.
 - C. ✓ **decrease in progesterone and estrogen concentration.**
 - D. increase in estrogen and progesterone concentration.

Answer: C

At the end of the menstrual cycle, the degeneration of the corpus luteum leads to a sharp decline in the levels of progesterone and estrogen, which triggers the breakdown of the endometrium (menstruation).

73. The first incubation period of HIV is characterized by a duration of (1)
- A. 20 years before all the symptoms appear in well-nourished people.
 - B. 2 weeks to produce enough antibodies.
 - C. ✓ **3-12 weeks when mild symptoms are manifested.**
 - D. 2-3 years for the progress of infection to AIDS.

Answer: C

The initial stage of HIV infection (incubation or window period) typically lasts 3 to 12 weeks, during which the individual may experience mild, flu-like symptoms while the body begins to produce detectable antibodies.

74. Which one of the following is a behavioral method of temperature regulation in homoiotherms? (1)
- A. Piloerection
 - B. ✓ **Licking**
 - C. Aestivation
 - D. Vasodilation

Answer: B

Licking body parts (e.g., in cats and kangaroos) is a behavioral mechanism that aids in cooling the body through evaporation, unlike piloerection and vasodilation which are physiological responses.

75. What will happen if the water content of the blood is too high? (1)
- A. The second coiled tubule of the kidney becomes more permeable.
 - B. ✓ **Antidiuretic hormone secretion decreases.**
 - C. Osmoreceptors stimulate pituitary gland to release ADH.
 - D. The kidney reabsorbs more water back into the blood.

Answer: B

When water content in the blood is high, osmoreceptors in the hypothalamus detect the low osmotic pressure and signal the pituitary gland to secrete less antidiuretic hormone (ADH), leading to less water reabsorption and more dilute urine.

76. The movement of water from the roots up to the top leaves of tall trees is carried out by (1)
- A. ✓ **loss of water by transpiration and its replacement by osmosis.**
 - B. active transport in the roots and osmosis in the leaves.
 - C. the low cohesive and adhesive forces of water in the xylem.
 - D. active transport in both the roots and leaves.

Answer: A

The upward movement of water in tall trees is driven by transpiration pull (evaporation from leaves) and the subsequent movement of water from the soil into root cells by osmosis.

77. From the following options, which one contains the steps of writing a scientific report in the correct order? (1)
- A. Title → Prediction → Hypothesis → Procedure → Evaluation → Acknowledgement
 - B. **Title → Hypothesis → Prediction → Procedure → Results → Conclusion → Evaluation → Acknowledgement**
 - C. Title → Hypothesis → Procedure → Conclusion → Acknowledgement → Prediction → Evaluation → Results
 - D. Title → Hypothesis → Procedure → Prediction → Results → Conclusion → Evaluation → Acknowledgement

Answer: B

In a standard scientific report, the hypothesis is formulated first, a prediction is made based on that hypothesis, and then the procedure is carried out to test the prediction, followed by results, conclusion, evaluation, and acknowledgements.

78. What type of force is responsible if a stool solution is placed in a centrifuge, spins the tube at high speed and the solid particles are forced to settle down? (1)
- A. Cohesive force
 - B. Adhesive force
 - C. **Centrifugal force**
 - D. Gravitational force

Answer: C

Centrifugation utilizes centrifugal force generated by high-speed spinning to separate particles in a suspension based on their size and density.

79. Ten percent of attendants of a wedding ceremony were sick just after having lunch at the ceremony. What should a student do first to prove scientifically that the sickness was actually linked to the food eaten at the ceremony? (1)
- A. give drugs to the sick individuals before they contaminate others
 - B. take food samples from the laboratory and analyze the presence of toxin.
 - C. **ask herself why ten percent of the attendants were sick**
 - D. take stool sample of the sick individuals and analyze the presence of toxins

Answer: C

The very first step of any scientific investigation is making an observation and asking a question about it, which in this case is asking why the guests became ill.

80. Which one of the following importance of water is directly related with its ideal viscosity? (1)
- A. **Transport medium**
 - B. Habitat for aquatic animals
 - C. Reactant in photosynthesis
 - D. Reaction medium

Answer: A

Water has a relatively low viscosity, allowing it to flow easily through narrow tubes like blood vessels and xylem, making it an ideal transport medium.

81. Which property of water prevents ponds from drying during the long dry season? (1)
- A. viscosity property
 - B. **latent heat of vaporization**
 - C. transparent ability
 - D. surface tension

Answer: B

Water has a high latent heat of vaporization, meaning it requires a significant amount of heat energy to evaporate; this prevents bodies of water from drying out rapidly during dry seasons.

82. Which one of the following is NOT the function of the plasma membrane in eukaryotic cells? (1)
- A. Isolating the cell from the external environment
 - B. ✓ **Transferring chemical energy from carbohydrates to ATP**
 - C. Responding to external signals
 - D. Exchanging materials and information

Answer: B

The transfer of chemical energy from carbohydrates to ATP is cellular respiration, which is the function of the mitochondria, not the plasma membrane.

83. Which one of the following is correct with respect to the structural components of the plasma membrane? (1)
- A. ✓ **Integral proteins are found in the lipid bilayer.**
 - B. Peripheral proteins are located outside the lipid bilayer.
 - C. Channel proteins cover the outer layer of the cell membrane.
 - D. Glycoproteins are found on the cytoplasmic side of the cell membrane.

Answer: A

Integral proteins are embedded within the hydrophobic core of the lipid bilayer, whereas peripheral proteins are loosely attached to the outer or inner surfaces of the membrane.

84. Suppose three potato cylinders were kept in 25%, 15% and 5% sucrose solution respectively and a fourth cylinder was placed in distilled water. Which of the cylinders will be more flaccid? The cylinder in (1)
- A. 5% solution
 - B. 15% solution
 - C. distilled water
 - D. ✓ **25% solution**

Answer: D

The 25% sucrose solution has the highest solute concentration and lowest water potential, causing the most water to leave the potato cells by osmosis, making the cylinder highly flaccid.

85. Consider the following table which shows a result of an experiment where red blood cells were placed in three different solutions X, Y and Z. Solutions Changes observed on RBCs X Shrink Y Burst Z No change The three different solutions in which the blood cells were placed in order of X, Y, Z were (1)
- A. isotonic, hypertonic, hypotonic.
 - B. hypotonic, isotonic, hypertonic.
 - C. hypotonic, hypertonic, isotonic.
 - D. ✓ **hypertonic, hypotonic, isotonic.**

Answer: D

RBCs shrink in hypertonic solutions due to water loss, burst in hypotonic solutions due to water gain, and remain unchanged in isotonic solutions.

86. A more comprehensive definition of biodiversity can be given as the (1)
- A. ✓ **richness, ecological and genetic variability of species.**
 - B. number of individuals of a species in a given area.
 - C. diversity of plants and animals in a given area.
 - D. number of individuals of a given animal species.

Answer: A

Biodiversity is most comprehensively defined as the variety of life at all levels of biological organization, which includes genetic, species (richness), and ecological diversity.

87. At which stage of the population growth curve is the rate of natality and the rate of mortality expected to be equal? (1)
- A. Lag phase
 - B. Decline phase
 - C. Log phase
 - D. ✓ **Stationary phase**

Answer: D

In the stationary phase of a population growth curve, the carrying capacity is reached, and the rate of natality (births) equals the rate of mortality (deaths), resulting in a stable population size.

88. Identify the correct statement about intra-specific competition? It is a (1)
- A. competition between individuals with different adaptations
 - B. ✓ **for all types of requirements**
 - C. of two species inhabiting the same ecological area
 - D. that leads to local extinction of the species

Answer: B

Intraspecific competition occurs between members of the same species who share the exact same ecological niche, meaning they compete intensely for all types of survival and reproductive requirements.

89. Why *Drosophila melanogaster* are considered ideal for genetic experiments? (1)
- A. contain chromosomes with several genes
 - B. have the highest number of chromosomes
 - C. ✓ **breed and keep in large numbers easily**
 - D. complete their life cycle within one month

Answer: C

Drosophila melanogaster is a classic model organism because they are small, easy and inexpensive to culture, and breed rapidly in large numbers in laboratory conditions.

90. Which one of the following statements best describes the mechanisms by which meiosis brings about variation? (1)
- Variation in meiosis is because of
- A. ✓ **independent assortment and crossing over**
 - B. frequent spontaneous mutations
 - C. variations in the content of the cytoplasm between the cells
 - D. reduction division that leads to haploid cell formation

Answer: A

Meiosis generates genetic variation through two primary mechanisms: crossing over (recombination) during prophase I and independent assortment of maternal and paternal chromosomes during metaphase I.

91. In the tropical regions, where there is higher temperature, which one of the following is most likely to take place in the C3 plant's? Rubisco binds with (1)
- A. CO₂ to produce glucose and water
 - B. ✓ **O₂ to produce GP and phosphoglycolate**
 - C. GP to produce lipid
 - D. H₂O to produce TP

Answer: B

At high temperatures, C3 plants close their stomata and undergo photorespiration, where Rubisco binds O₂ instead of CO₂, producing glycerate 3-phosphate (GP) and phosphoglycolate.

92. During the light-independent reactions of photosynthesis

(1)

- A. glucose is directly produced from GP
- B. RuBP reacts with CO₂ to directly form TP
- C. some of the GP is used to regenerate RuBP
- D. ✓ **GP is reduced to TP by reduced NADP**

Answer: D

During the reduction phase of the Calvin cycle, glycerate 3-phosphate (GP) is reduced to triose phosphate (TP) using energy from ATP and reducing power from NADPH (reduced NADP).

93. The suitability of the structural arrangement of a chloroplast in relation to its function can be indicated by the fact that

(1)

- A. all pigments of the stroma are floating around the solution
- B. ✓ **all pigments in the photosystem are linked to the electron transport chain**
- C. carotenoids are used as a reaction center from which electrons are excited
- D. the different pigments absorb the same wavelength of light

Answer: B

Photosystems embedded in the thylakoid membranes contain light-harvesting complex pigments that efficiently transfer captured energy to reaction centers linked directly to the electron transport chain.

94. Which one of the following events occurs during the day time in the CAM photosynthetic pathway?

(1)

- A. CO₂ reacts with malate
- B. The stomata open to allow CO₂
- C. ✓ **CO₂ enters into Calvin cycle**
- D. Oxaloacetate is formed

Answer: C

During the day, CAM plants keep their stomata closed to prevent water loss; stored malate is broken down to release CO₂ inside the cells, which then enters the Calvin cycle.

95. How many turns of the light independent reaction cycle are required to make one molecule of triose phosphate?

(1)

- A. ✓ **3**
- B. 2
- C. 6
- D. 4

Answer: A

Since each turn of the Calvin cycle fixes one molecule of CO₂, three turns of the cycle are required to fix the three carbon atoms needed to produce one net molecule of triose phosphate (TP).

— END OF MARKING KEY —

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