

Biology, 2017 EC, natural science, entrance exam

Grade 12 · Biology · 2017 E.C.

MARKING KEY — CONFIDENTIAL**Time allowed:** 120 minutes**Questions:** 100**Total marks:** 100

1. Which one of the following Ethiopian biological research institutes is known for housing a major gene bank in Africa? (1)
- A. Addis Ababa University Biology Department
 - B. ✓ **Institute of Biodiversity Conservation**
 - C. Akiliu Lemma Institute of Pathobiology
 - D. Armauer Hansen Research Institute

Answer: B

The Institute of Biodiversity Conservation (today called the Ethiopian Biodiversity Institute) keeps one of the largest gene banks in Africa. A gene bank stores seeds and other genetic material so that Ethiopia's crop varieties and wild species are not lost. The other choices are a university department and medical research institutes; storing genetic resources is not their job.

Textbook: Biology Grade 12, Unit 1 Application of Biology, section 1.1 Application in conservation of natural resources (page 8).

2. Consider the following structure of the human heart. In the above diagram, which part is used for forcing oxygenated blood out of the heart and around the body? (1)

 Question Diagram

- A. I
- B. II
- C. ✓ **III**
- D. IV

Answer: C

Label III points to the left ventricle. This chamber has the thickest muscular wall because it pumps oxygenated blood into the aorta with enough force to reach the whole body. Label IV is the left atrium; it only receives blood from the lungs and passes it down to the left ventricle. The chambers on the right side (I and II) handle deoxygenated blood going to the lungs.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.2 The circulatory and lymphatic system.

3. A grade 12 student marked two dots close to each other using a pen on a piece of paper and observed them under a microscope. The two dots appeared well separated under the microscope. This was due to (1)
- A. ✓ **resolution**
 - B. magnification
 - C. staining
 - D. mounting.

Answer: A

Resolution is the power of a microscope to show two points that lie close together as two separate points. The dots looked well separated because of this resolving power. Magnification only makes an image larger; a big but poorly resolved image would still show the two dots as one blurred spot.

Textbook: Biology Grade 9, Unit 1 Introduction to Biology, section 1.5 Handling and using a light microscope.

4. From the following alternatives select the common features that are found both in animal and plant cells. (1)
- A. Cell membrane, nucleus, cytoplasm, lysosome and Golgi apparatus
 - B. ✓ **Cell membrane, nucleus, cytoplasm, mitochondria and endoplasmic reticulum**
 - C. Cell membrane, nucleus, cytoplasm, chloroplast and Golgi apparatus
 - D. Cell membrane, nucleus, cytoplasm, large vacuole and Golgi apparatus

Answer: B

Animal and plant cells are both eukaryotic, so they share the cell membrane, nucleus, cytoplasm, mitochondria and endoplasmic reticulum. The wrong options each smuggle in a structure that belongs to only one cell type: chloroplasts and the single large vacuole are found in plant cells, while lysosomes are typical of animal cells.

Textbook: Biology Grade 9, Unit 3 Cells, section 3.5 Animal and plant cells.

5. A biology teacher grouped his students in to two groups and ordered group I to place a slice of potato in hypertonic solution and group II in hypotonic solution. What will happen to the potato slice in group I and group II? For group I, the potato slice will be (1)
- A. turgid while for group II it will be flaccid.
 - B. haemolyzed while for group II it will be flaccid.
 - C. ✓ **flaccid while for group II it will be turgid.**
 - D. turgid while for group II there will be no change.

Answer: C

In the hypertonic solution (group I) the solution is more concentrated than the potato cells, so water leaves the cells by osmosis and the slice becomes flaccid (soft). In the hypotonic solution (group II) water enters the cells, so the slice becomes turgid (firm). Haemolysis happens only to red blood cells, which burst because they have no cell wall; potato cells are protected by their walls.

Textbook: Biology Grade 9, Unit 3 Cells, section 3.7 The cell and its environment.

6. A man eats only vegetables, beans, banana and orange for one week continuously in his lunch and dinner. For this man, what nutrients are most likely missed in his meal to be a balanced diet? (1)
- A. Carbohydrates
 - B. ✓ **Lipids**
 - C. Proteins
 - D. Minerals

Answer: B

Check each nutrient against the foods. Vegetables, banana and orange give plenty of carbohydrates, vitamins and minerals, and beans are a good plant source of protein. None of these foods contains much fat or oil, so lipids are the nutrient most likely missing from his diet.

Textbook: Biology Grade 9, Unit 5 Human health, nutrition and diseases.

7. Which of the following is correct about the process of digestion or absorption of food in the small intestine? (1)
- A. Proteins are converted into amino acids by the action of hydrochloric acid and amylase.
 - B. ✓ **Bile emulsifies fats to increase the surface area to make it easier for lipase.**
 - C. Water is reabsorbed into the small intestine and metabolic wastes are excreted.
 - D. Glucose and non-hydrolyzed starch molecules are absorbed through the lacteal

Answer: B

Bile is made in the liver and released into the small intestine. It emulsifies fats, meaning it breaks large fat drops into many tiny droplets. This gives the fat a much larger surface area, so the enzyme lipase can digest it faster. Option A is wrong because proteins are digested by protease enzymes such as pepsin and trypsin, not by hydrochloric acid and amylase; most water is reabsorbed in the large intestine, and starch must be fully digested to glucose before it can be absorbed.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.1 The digestive system.

8. This item is based on the following diagram of simple food chain. (1)

Leaves → Grasshoppers → Rodents → Leopards

What will happen if the number of rodents significantly decrease? There will be

- A. an increase in the number of leopards.
- B. fewer grasshoppers in the chain.
- C. no change in the number of leopard.
- D. ✓ **an increase in the number of grasshoppers.**

Answer: D

In this chain, rodents eat grasshoppers. If the rodents decrease, fewer grasshoppers are eaten, so the grasshopper population grows. The leopards would suffer, not increase, because their food (rodents) has become scarce.

Textbook: Biology Grade 10, Unit 6 Ecological Interactions.

9. In an experiment, students wanted to prove that enzymatic digestion begins in the mouth using certain chewed food coated with their own saliva. In order to get a positive result for their experiment, what type of food sample and testing solution should the students use? (1)

- A. ✓ **Potato and iodine solution**
- B. Meat and Benedict's solution
- C. Fish and sodium hydroxide solution
- D. Bread and copper sulphate solution

Answer: A

Saliva contains the enzyme amylase, which starts to digest starch in the mouth. To show this, the students need a starchy food and a test for starch. Potato is rich in starch, and iodine solution is the standard starch test: it turns blue black when starch is present. After chewing, the amylase breaks the starch down, so the iodine result changes and proves digestion began in the mouth. Benedict's solution tests for reducing sugars, and meat or fish contain protein, not starch.

Textbook: Biology Grade 9, Unit 5 Human health, nutrition and diseases.

10. Consider the following diagram of pyramid of biomass. (1)

Which one of the following statements is correct about the above pyramid of biomass?

 Question Diagram

- A. The whole organisms at first trophic level is eaten by the organisms above.
- B. When organisms in stage II eat the producers, most of the producer's materials are turned into new secondary consumers.
- C. ✓ **Much of the biomass from stage II is used by stage III to release energy for living.**
- D. At each stage of trophic level, the amount of biomass, which is passed on, supports a large amount of organism in the stage above.

Answer: C

Biomass gets smaller at each step up the pyramid because most of the food an organism eats is broken down in respiration to release energy for living, and only a small part becomes new body mass. That is exactly what option C says about stage III feeding on stage II. Option A is wrong because not all producers are eaten; option B is wrong because most of the eaten material is lost, not turned into new consumers; option D is wrong because the small biomass passed on can only support fewer organisms above, not more.

Textbook: Biology Grade 10, Unit 6 Ecological Interactions.

11. A student made a collection of plants having flowers and seeds from his locality and compared their embryo, leaves and stems using hand lens. He found that all his collections contain a single seed leaf embryo, long and thin with parallel veins of leaves and stem contains scattered vascular bundles. Which option contains plants that can be categorized under his collection? (1)
- A. Grasses, orchids, teff and roses
B. Grasses, orchids, teff and beans
C. Grasses, sunflowers, teff and maize
D. ✓ **Grasses, orchids, teff and maize**

Answer: D

One seed leaf (cotyledon), long narrow leaves with parallel veins and scattered vascular bundles in the stem are the marks of monocot plants. Grasses, orchids, teff and maize are all monocots, so option D fits the whole collection. The other options fail because roses, beans and sunflowers are dicots: they have two seed leaves, net shaped veins and vascular bundles arranged in a ring.

Textbook: Biology Grade 10, Unit 2 Plants, section 2.5 Seeds (monocots, dicots).

12. Compared to the inhaled air what are the percentage of nitrogen, oxygen and carbon dioxide gases in exhaled air, respectively? (1)
- A. ✓ **80%, 16% and 4%**
B. 80%, 4% and 16%
C. 16%, 4% and 80%
D. 4%, 16% and 80%

Answer: A

Nitrogen is not used by the body, so it stays at about 80 percent in both inhaled and exhaled air. Oxygen falls from about 21 percent to about 16 percent because some of it is absorbed in the lungs, and carbon dioxide rises from about 0.04 percent to about 4 percent because it is a waste product of respiration. So the order nitrogen, oxygen, carbon dioxide in exhaled air is 80 percent, 16 percent and 4 percent.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.3 The breathing system.

13. Identify the typical examples for division Gymnospermae and Angiospermae, respectively? (1)
- A. Mosses and ferns
B. Liverworts and palm trees
C. Grasses and legumes
D. ✓ **Juniper and roses**

Answer: D

Gymnosperms are seed plants whose seeds are naked, meaning not enclosed in a fruit; conifers such as juniper are the classic example. Angiosperms are flowering plants whose seeds develop inside a fruit; roses belong here. Mosses, liverworts and ferns produce no seeds at all, and grasses and legumes are both angiosperms, so those pairs cannot represent the two divisions.

Textbook: Biology Grade 10, Unit 2 Plants, section 2.2 Flowering and non-flowering plants.

14. A biology teacher provided common names of three organisms; human being, dog and housefly to his students to write the correct scientific names of each organism. In which of the following ways should the students write the correct scientific names, respectively? (1)
- A. Homo Sapiens, Canis Familiaris and Musca Domestica
B. ✓ **Homo sapiens, Canis familiaris and Musca domestica**
C. homo sapiens, Canis familiaris and Musca domestica
D. Homo sapiens, Canis familiaris and musca domestica

Answer: B

In binomial nomenclature every scientific name has two parts. The genus name starts with a capital letter and the species name is written all in small letters, and both are italicized or underlined. Only option B follows this rule for all three organisms: Homo sapiens, Canis familiaris and Musca domestica. The other options either capitalize the species name or leave the genus name in small letters.

Textbook: Biology Grade 9, Unit 2 Characteristics and classification of organisms, section 2.4 Linnaean system of nomenclature.

15. Three students carried out different experiments in exhaled air as indicated below. (1)

Student I - uses cold glass and blue cobalt chloride paper

Student II - uses ice cubes

Student III - uses tube containing lime solution and straw

Based on their setup of their preparation, which student plan to demonstrate the presence of water vapour and carbon dioxide, respectively?

- A. II and III
B. I and II
C. II and I
D. ✓ I and III

Answer: D

Student I breathes onto a cold glass so the water vapour in exhaled air condenses into droplets, and blue cobalt chloride paper turns pink when it touches water. This setup tests for water vapour. Student III blows through a straw into lime solution; carbon dioxide turns limewater milky, so this setup tests for carbon dioxide. Ice cubes alone (student II) do not test exhaled air for either gas.

Textbook: Biology Grade 10, Unit 5 Human Biology, section 5.3 The breathing system.

16. If your body cannot make enough red blood cells, which one of the following mineral rich foods can correct this problem? (1)

- A. ✓ Iron-rich food
B. Iodine-rich food
C. Calcium-rich food
D. Sodium-rich food

Answer: A

Red blood cells carry oxygen using haemoglobin, and iron is the mineral at the centre of every haemoglobin molecule. When the body lacks iron it cannot make enough healthy red blood cells, a condition called anaemia, so iron rich foods correct the problem. Iodine is needed by the thyroid gland, calcium builds bones and teeth, and sodium balances body fluids; none of them builds red blood cells.

Textbook: Biology Grade 9, Unit 5 Human health, nutrition and diseases.

17. Which of the following is NOT a key process involved in carbon cycle? (1)

- A. ✓ Evaporation
B. Cellular respiration
C. Photosynthesis
D. Decomposition

Answer: A

Evaporation moves water, not carbon, so it belongs to the water cycle. The carbon cycle runs on photosynthesis, which takes carbon dioxide out of the air, and on cellular respiration and decomposition, which return carbon dioxide to the air.

Textbook: Biology Grade 10, Unit 6 Ecological Interactions.

18. Which of the following is correct about mitosis? It is a division of (1)

- A. somatic cells to make daughter cells with half chromosome.
B. sex cells to make identical daughter cells with doubled chromosome.
C. ✓ . somatic cells to make identical daughter cells.
D. sex cells to make different daughter cells.

Answer: C

Mitosis is the division of somatic (body) cells. It produces two daughter cells that are genetically identical to each other and to the parent cell, with the full chromosome number kept. The options that mention sex cells or halving the chromosome number describe meiosis, not mitosis.

Textbook: Biology Grade 10, Unit 4 Cell Division, section 4.2.1 Mitosis.

19. Which one of the following statements is correct about the catalytic activities of enzymes? They (1)
- A. change the overall nature of the products.
 - B. ✓ **allow reactions in cells to take place quickly.**
 - C. alter themselves at the end of biochemical reactions.
 - D. increase the energy required to start a reaction.

Answer: B

Enzymes are biological catalysts. They lower the activation energy of a reaction, so reactions in cells happen fast enough to keep the organism alive. They come out of the reaction unchanged, they do not change what the products are, and they lower rather than raise the energy needed to start the reaction, which is why the other options are wrong.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.2 Properties and functions of enzymes (page 82).

20. Which one of the following features is common for mitosis and meiosis? They both involve (1)
- A. ✓ **replication of DNA and the formation of daughter cells.**
 - B. production of daughter cells identical to the parent cell
 - C. formation of cells with the same chromosome number as parent cell.
 - D. spermatogenesis and oogenesis processes in males and females

Answer: A

Before both mitosis and meiosis, the cell copies its DNA during interphase, and both processes end with the formation of daughter cells. The other options describe only one of the two: identical daughter cells with the same chromosome number come from mitosis alone, while spermatogenesis and oogenesis use meiosis alone.

Textbook: Biology Grade 10, Unit 4 Cell Division.

21. Four students draw four different big protein structure posters. The contents of each of their structure are displayed in the following table. Based on the above information, which student draw secondary and quaternary structures, respectively? (1)
- | | |
|-----------------------|---------------|
| A. I and IV | B. II and III |
| C. ✓ I and III | D. II and IV |

Answer: C

Secondary structure is the local folding of a polypeptide chain into an alpha helix or a beta pleated sheet, held together by hydrogen bonds; that is the poster of student I. Quaternary structure exists only when two or more folded polypeptide subunits join into one working protein, such as haemoglobin; that is the poster of student III. So the pair asked for is I and III.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.3 Protein structures (page 88).

22. How does the induced-fit model explain enzyme specificity? They (1)
- A. ✓ **change the shape of active site slightly to fit substrates precisely.**
 - B. have a rigid active site that can just bind to single substrate.
 - C. have multiple active sites that can fit to different substrates.
 - D. bind to whatever the shape of substrate that fits to allosteric site.

Answer: A

In the induced fit model the active site is not rigid. When the right substrate arrives, the active site changes its shape slightly and moulds itself around the substrate, so enzyme and substrate fit precisely. Option B describes the older lock and key model, and the allosteric site is a separate regulatory site, not where the substrate binds.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.4 Enzyme substrate models (page 92).

23. What happens to the substrate molecule when competitive inhibitor binds with an enzyme? It (1)
- A. undergoes conformational change.
 - B. ✓ **cannot bind with the active site.**
 - C. binds to the allosteric site temporarily.
 - D. easily binds with the active site.

Answer: B

A competitive inhibitor has a shape similar to the substrate, so it enters and occupies the active site itself. While the inhibitor sits there, the real substrate cannot bind to the active site, and the reaction slows down. Binding at the allosteric site is how non-competitive inhibitors work, not competitive ones.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.5 Enzyme regulation (page 94).

24. Which tissues of plant leaves are involved in waterproofing, major photosynthetic and major gas exchange activities, respectively? (1)
- A. Guard cells, palisade mesophyll and epidermis
 - B. Guard cells, palisade mesophyll and spongy mesophyll
 - C. ✓ **Waxy cuticle, palisade mesophyll and spongy mesophyll**
 - D. Waxy cuticle, palisade mesophyll and epidermis

Answer: C

The waxy cuticle covers the leaf surface and stops water escaping, so it does the waterproofing. The palisade mesophyll lies just under the upper epidermis and is packed with chloroplasts, making it the main site of photosynthesis. The spongy mesophyll has large air spaces between its cells, so it is where most gas exchange happens inside the leaf. Guard cells only open and close the stomata; they are not the waterproof layer.

Textbook: Biology Grade 10, Unit 2 Plants, section 2.3.1 The internal structure of a leaf.

25. What will happen to the reaction if you add a certain inhibitor or activator to the substrate having allosteric enzyme set up? (1)
- A. Inhibitor binds to active site to speed up the reaction.
 - B. Inhibitor binds to regulatory site to increase rate of reaction.
 - C. Activator binds to active site to initiate the reaction.
 - D. ✓ **Activator binds to regulatory site to activate the reaction.**

Answer: D

An allosteric enzyme has two kinds of sites: the active site for the substrate and a separate regulatory (allosteric) site. An activator binds to the regulatory site and changes the enzyme into its active shape, which switches the reaction on. Inhibitors also bind at the regulatory site, but they slow the reaction down instead of speeding it up, so options A, B and C all mix up the sites or the effects.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.5 Enzyme regulation (page 94).

26. Which of the following is correct about the movement of water in plants? It moves (1)
- A. against a water potential gradient.
 - B. across the phloem tissue by diffusion.
 - C. ✓ **across the tissues of a plant by osmosis**
 - D. by using energy until it reaches to the xylem.

Answer: C

Water crosses plant tissues, from the soil into root hairs and from cell to cell, by osmosis. It always moves down a water potential gradient, from a place of higher water potential to a lower one, and this movement needs no energy from the plant. Water travels up the plant in the xylem, not the phloem, so the other options are wrong.

Textbook: Biology Grade 10, Unit 2 Plants, section 2.8 Transport in plants.

27. What will happen to the growth of the plant when you remove indole-acetic acid from the main shoot part of the plant? (1)

- A. ✓ **The plant will bush out.**
- B. It stimulates dropping of leaves
- C. The main shoot of the plant elongates
- D. The growth of side shoots will slow down.

Answer: A

Indole-acetic acid (IAA) is an auxin made at the shoot tip. While it flows down the stem it holds back the growth of the side buds; this is called apical dominance. Remove the source of IAA and the side buds are freed, so many side shoots grow and the plant bushes out. The main shoot cannot elongate faster without its growth hormone, so option C is the opposite of what happens.

Textbook: Biology Grade 10, Unit 2 Plants, section 2.9 Response in plants.

28. Which one of the following classes of enzyme and type of reactions they catalyze is correctly matched? (1)

- A. Oxidoreductases - transfer functional groups from donor to acceptor
- B. Transferases - transfer of electrons from one molecule to another
- C. ✓ **Ligases - cleave bonds by other means rather than hydrolysis**
- D. Lysses - catalyze the hydrolysis of various bonds

Answer: C

The intended correct match is option C, read as lyases: enzymes that break bonds by means other than hydrolysis or oxidation, for example by removing a group to form a double bond. The other pairs are swapped: oxidoreductases transfer electrons (what option A calls transferases), transferases move functional groups from a donor to an acceptor (what option B gives to oxidoreductases), and hydrolysis of bonds is the work of hydrolases. Note that a true ligase joins two molecules together using energy from ATP, so the word printed in option C is a spelling error for lyase.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.6 Types of enzymes (page 97).

29. In which one of the following alternatives the whole list contains characteristics of animals? (1)

- A. Respire, excrete, autotrophic and reproduce
- B. . Unicellular, excrete, heterotrophic and motility
- C. ✓ **Heterotrophic, excrete, motility and grow**
- D. Respire, multicellular, autotrophic and reproduce

Answer: C

All animals are heterotrophic (they eat other organisms), they excrete wastes, they can move at some stage of life, and they grow. Option C lists only these true animal features. Options A and D fail because no animal is autotrophic; making food from sunlight is what plants do. Option B fails because animals are multicellular, not unicellular.

Textbook: Biology Grade 11, Unit 2 Animals, section 2.1 Characteristics of animals (page 27).

30. A grade 11 student observed and identified some animals group having closed circulatory system, centralized nervous system with brain and sensory organs. Based on their identification select one of the following animals that can belong to this group? (1)

- A. Snails
- B. Earthworm
- C. ✓ Squid
- D. Snake

Answer: C

The description fits the cephalopod molluscs, the most advanced invertebrates. A squid has a closed circulatory system, a centralized nervous system with a true brain, and well developed sense organs such as its large eyes. A snail is also a mollusc but has an open circulatory system, and an earthworm has only simple ganglia and no complex sense organs. A snake matches the description too, but it is a vertebrate, not a member of the invertebrate group the student was studying.

Textbook: Biology Grade 11, Unit 2 Animals, section 2.2 Invertebrates and Vertebrates (page 29).

31. What does it mean if an animal is poikilothermic? It (1)

- A. ✓ changes its body temperature with environmental condition.
- B. increases its metabolic rate during cold and hot conditions.
- C. keeps its body temperature constant regardless of external changes.
- D. . produces heat when temperature falls by activating the hypothalamus

Answer: A

A poikilothermic (cold blooded) animal cannot keep its body temperature steady. Its body temperature rises and falls with the temperature of its surroundings, which is why fish and reptiles bask in the sun to warm up. Keeping a constant temperature by raising metabolic rate or activating the hypothalamus describes homeothermic (warm blooded) animals such as birds and mammals.

Textbook: Biology Grade 11, Unit 2 Animals, section 2.6.1 Thermoregulation (page 62).

32. If a given enzyme works only at temperature range of 20 and 45°C and the potential of hydrogen ions that ranges from 4 to 9 . Which one of the following works best during the optimization of these two factors for the enzyme activity? (1)

- A. Adjusting the temperature below 20°C makes the enzyme more active, hence the temperature at this value is optimal.
- B. Adjusting the pH above 9 can increase the probability of collisions between the enzyme and the substrate.
- C. ✓ Adjusting the temperature between 20°C and 45°C results little denaturation and increased number of collisions.
- D. The optimum pH under which this enzyme is most active is found below 4.

Answer: C

The enzyme only works between 20 and 45 degrees Celsius and between pH 4 and 9, so the best conditions must sit inside those ranges. Warming the mixture within that range makes molecules move faster, so enzyme and substrate collide more often while the enzyme suffers little denaturation. Options A, B and D all push the temperature or pH outside the working range, where the enzyme slows down or is destroyed.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.7 Factors affecting enzyme action (page 100).

33. All of the following features define a chromosome EXCEPT

(1)

- A. contains hundreds to thousands of genes.
- B. exists in pairs in diploid organisms.
- C. made up of DNA and protein.
- D. ✓ **functional unit of inheritance.**

Answer: D

The functional unit of inheritance is the gene, not the chromosome. A chromosome is a much larger structure made of DNA wound around proteins, it carries hundreds to thousands of genes, and in diploid organisms chromosomes come in homologous pairs. So statements A, B and C describe a chromosome, while D describes a gene.

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.1 The genetic materials (page 114).

34. Which structural and functional difference is observed between DNA and RNA?

(1)

- A. Both DNA and RNA have the same nitrogenous bases but differ in pentose sugar.
- B. RNA produces DNA through the process of transcription.
- C. RNA stores the genetic material while DNA involves in protein synthesis.
- D. ✓ **DNA is very stable molecule while RNA is degraded quickly.**

Answer: D

DNA is a double stranded molecule and is chemically very stable, which suits its job of storing genetic information for a lifetime. RNA is single stranded and is broken down quickly after it has done its work. Option A is wrong because the bases also differ (DNA has thymine, RNA has uracil), option B is backwards because transcription makes RNA from DNA, and option C swaps the roles of the two molecules.

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.2 The structure and function of DNA and RNA (page 115).

35. All of the following events occur during telophase I of meiosis I cell division EXCEPT

(1)

- A. ✓ **crossing over takes place.**
- B. each of the spindle fibers disappears.
- C. set of chromosomes come together.
- D. nuclear envelope reforms.

Answer: A

Crossing over happens in prophase I, when homologous chromosomes pair up and exchange pieces; it does not happen in telophase I. In telophase I the events are the ones in the other options: the spindle fibres disappear, each set of chromosomes gathers at its pole, and nuclear envelopes form again around the two new nuclei.

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.3 The process of cell division (page 124).

36. Suppose there was a cross between pea plants with flower positions axial (AA) and terminal (aa) and produced F1 generation. What will be the most probable number of heterozygous dominant individuals obtained if 1000 offspring were produced by self-crossing of F1 generation?

(1)

- A. 200
- B. 750
- C. ✓ **500**
- D. 250

Answer: C

Crossing AA with aa gives an F1 that is all Aa. Self crossing the F1 (Aa with Aa) gives offspring in the ratio 1 AA : 2 Aa : 1 aa, so half of the offspring are heterozygous with the dominant axial phenotype. Half of 1000 offspring is 500.

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.5 Mendelian inheritance (page 137).

37. If you have a pea plant of unknown genotype with a green pod color, you obtained all green pod colors of offspring phenotype after a test cross. What was the unknown genotype of the parent? It was (1)
- A. ✓ **homozygous dominant.** B. homozygous recessive.
C. heterozygous dominant. D. incomplete dominant.

Answer: A

A test cross mates the unknown parent with a homozygous recessive plant. If the green pod parent were heterozygous (Gg), about half of the offspring would show the recessive pod colour. Since every single offspring had green pods, the parent must have given a dominant allele to all of them, so its genotype is homozygous dominant (GG).

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.5.4 Test Crosses (page 144).

38. This item is based on the following examples of genetic inheritance patterns. (1)

- 1 Inflated and pinched pod forms will have inflated pod form.
- 2 Red cow and white bull will have a roan calf.
- 3 AA and BB blood type people will have a child with AB blood type.
- 4 Red and white roses will have a pink rose offspring.

From the above patterns of inheritance, which of the following are exemplary for non-Mendelian inheritance?

- A. 1, 2, 3 B. 1, 3, 4
C. 1, 2, 4 D. ✓ **2, 3, 4**

Answer: D

Example 1 is simple Mendelian inheritance: one allele (inflated pod) completely dominates the other. The other three break Mendel's pattern. A roan calf (2) shows codominance, where both coat colours appear together. An AB child from AA and BB parents (3) shows codominance with multiple alleles in the blood group system. A pink rose from red and white parents (4) shows incomplete dominance, where the offspring is a blend. So 2, 3 and 4 are the non-Mendelian examples.

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.7 Non-Mendelian inheritance (page 148).

39. Farmers want to maintain their sheep with long tails for the next generation through similar sheep from their locality in their breeding program. What process do these farmers apply to keep the desired traits in their program? (1)
- A. ✓ **Inbreeding** B. Crossbreeding
C. Genetic engineering D. Cloning

Answer: A

The farmers are mating similar sheep from the same locality, animals that are closely related, so that the long tail trait stays in the flock. Mating closely related individuals to fix a desired trait is called inbreeding. Crossbreeding does the opposite: it mixes different breeds to bring in new traits. Genetic engineering and cloning are laboratory techniques, not a traditional breeding program.

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.12 Breeding (page 167).

40. If progesterone remains high after ovulation, what will be the most likely outcome?

(1)

- A. FSH will be produced rapidly which leads to a new cycle.
- B. Oestrogen will be decreased, closing down the lining of the uterus
- C. ✓ **Uterus lining will be maintained and prepared for pregnancy.**
- D. Corpus luteum will be regenerated, inhibiting hormone production.

Answer: C

After ovulation the corpus luteum secretes progesterone. As long as progesterone stays high, the lining of the uterus is kept thick and ready to receive an embryo, which is what the body needs if pregnancy begins. High progesterone also blocks the release of FSH, so a new cycle does not start; that is why option A is wrong. The lining only breaks down when progesterone falls.

Textbook: Biology Grade 11, Unit 5 The human body systems, section 5.2.2 Positive and negative feedbacks to control the menstrual cycle (page 201).

41. This item is based on the following pedigree diagram for color blindness, X-linked recessive trait. Based on the above diagram, if the family in the second generation has children, what is the probability that they will have carrier female and color blind male, respectively?

(1)

 Question Diagram

- A. ✓ **1/4 and 1/4**
- B. 1/2 and 1/2
- C. 3/4 and 1/4
- D. 1/4 and 1/2

Answer: A

The couple in generation II is a carrier female and a colour blind male. Writing the alleles, the mother is $X^A X^a$ and the father is $X^a Y$. Their children come in four equally likely types: a carrier daughter $X^A X^a$, a colour blind daughter $X^a X^a$, a normal son $X^A Y$ and a colour blind son $X^a Y$. So the chance of a carrier female is 1/4 and the chance of a colour blind male is 1/4.

Textbook: Biology Grade 11, Unit 4 Genetics, section 4.7.3 Sex-linked inheritance in humans (page 153).

42. The most reliable contraceptive method that prevents travelling of ovum from the ovaries through the fallopian tubes, but requires surgery is

(1)

- A. contraceptive injection.
- B. spermicide.
- C. intrauterine device.
- D. ✓ **sterilization**

Answer: D

Sterilization of a woman (tubal ligation) is a surgical operation in which the fallopian tubes are cut or tied. The egg can then never travel from the ovary through the tube to meet a sperm, which makes it the most reliable method. An intrauterine device also works inside the body but needs no surgery, and injections and spermicides work with hormones or chemicals, not by blocking the tubes.

Textbook: Biology Grade 11, Unit 5 The human body systems, section 5.2.4 Mechanism of action of contraceptives (page 204).

43. Select the option that the whole lists contain renewable natural resources.

(1)

- A. Coal, oil, natural gas and minerals
- B. Coal, wind, hydro power and biomass
- C. ✓ **Sunlight, wind, hydro power and biomass**
- D. Sunlight, wind, hydro power and natural gas

Answer: C

Renewable resources are replaced by nature within a short time. Sunlight, wind, flowing water (hydro power) and biomass all renew themselves, so option C is the only list with no exception. Coal, oil, natural gas and minerals took millions of years to form and are used up faster than they can ever be replaced, so any list containing one of them fails.

Textbook: Biology Grade 11, Unit 6 Population and natural resources, section 6.2 Natural resources (page 254).

44. This item is based on the following list of activities.

(1)

- I. Establishing national parks
- II. Wild sanctuaries
- III. Preparing wild life reserves
- IV. Practicing overgrazing

Which of the above activities CANNOT be used for the conservation of wild life?

- | | |
|--------|---------|
| A. II | B. I |
| C. III | D. ✓ IV |

Answer: D

National parks, wildlife sanctuaries and wildlife reserves all protect animals and their habitats, so activities I, II and III conserve wildlife. Overgrazing (IV) does the opposite: too many livestock strip the vegetation, degrade the land and destroy the habitat wild animals depend on.

Textbook: Biology Grade 11, Unit 6 Population and natural resources, section 6.3 Conservation of natural resources in Ethiopia (page 256).

45. Among the following, which one increases the risk to be infected by sexually transmitted infections

(1)

- A. Have no history of sexually transmitted infections
- B. ✓ **Misuse of drugs that inhibit your judgment**
- C. Protective sexual contact and medical treatment
- D. Consistent use of condoms during intercourse

Answer: B

Drugs and alcohol cloud a person's judgment. Under their influence people more easily agree to unprotected or risky sexual contact, which raises the chance of catching a sexually transmitted infection. The other options describe protective behaviour: having no history of infection, seeking medical treatment and using condoms consistently all lower the risk.

Textbook: Biology Grade 11, Unit 5 The human body systems, section 5.2.6 The major sexually transmitted infections (STIs) in Ethiopia (page 212).

46. Among the following options, identify the air pollutants that can cause acid rain and its effects, respectively. (1)
- A. Carbon dioxide and methane - melting of ice caps and rising of oceans
 - B. ✓ **Sulphur dioxides and nitrogen dioxides - damaging plants and water**
 - C. Perfluorocarbons - causing skin cancer and cataracts
 - D. Chlorofluorocarbons - increasing UV rays and respiratory disease

Answer: B

Acid rain forms when sulphur dioxide and nitrogen dioxides from burning fuel react with water in the air to make sulphuric and nitric acids. The acidic rain then damages plants, soils, lakes and buildings. Carbon dioxide and methane cause global warming, and CFCs damage the ozone layer, so those pairs describe different environmental problems.

Textbook: Biology Grade 11, Unit 6 Population and natural resources, section 6.5.5 Acid rain (page 273).

47. Which of the following is the cause and effect of global warming, respectively? (1)
- A. Greenhouse gases and dropping of sea levels
 - B. ✓ **Greenhouse gases and loss of biodiversity**
 - C. Burning of fossil fuels and increase in species diversity
 - D. Burning of fossil fuels and dropping of sea level

Answer: B

Global warming is caused by greenhouse gases such as carbon dioxide and methane trapping heat in the atmosphere. One of its major effects is the loss of biodiversity, because species cannot survive when their habitats heat up, dry out or flood. The options that mention dropping sea levels or increasing species diversity state the opposite of the real effects: warming raises sea levels and reduces diversity.

Textbook: Biology Grade 11, Unit 6 Population and natural resources, section 6.5.3 Global warming (page 269).

48. Two women were decided not to have pregnancy in the near future and they were offered two different contraceptive options. In woman I, the material fitted in her uterus did not allow the sperm to fertilize the egg. In woman II, the contraceptive prevented hormone production and the releasing of eggs from the ovaries. Which type of contraceptive methods did woman I and II used, respectively? (1)
- A. Sterilization and Injectable contraceptives Depo-Provera
 - B. Post pill and copper-coated intrauterine device
 - C. Contraceptive injection and contraceptive implant
 - D. ✓ **Copper-coated intrauterine device and contraceptive injection**

Answer: D

Woman I has a device fitted inside her uterus that stops sperm from fertilizing the egg; that is the copper coated intrauterine device (IUD), whose copper ions disable sperm. Woman II uses a method that stops hormone production and blocks the release of eggs from the ovaries; that is the hormonal contraceptive injection. Sterilization needs surgery, which was not described for either woman.

Textbook: Biology Grade 11, Unit 5 The human body systems, section 5.2.4 Mechanism of action of contraceptives (page 204).

49. What is the primary purpose of creating transgenic organisms? To

(1)

- A. generate pathogenic organisms that fight against non-pathogenic ones
- B. produce organisms that mimic human beings in every aspect of behaviors
- C. ✓ **promote expression of desired genes that improve nutritional quality of organisms**
- D. produce novel organisms that can affect reproduction across different species

Answer: C

A transgenic organism carries a gene taken from another species. The purpose is to make the organism express a useful new trait, for example rice with extra vitamin A or crops with better protein content, so option C is correct. Transgenic technology is not meant to create pathogens, to copy human behaviour or to interfere with reproduction between species.

Textbook: Biology Grade 12, Unit 1 Application of Biology, section 1.4 Applications in biotechnology (page 15).

50. What is the role of biology in the investigation of a criminal case? To

(1)

- A. detect flavor compounds in food and monitor environmental pollutants
- B. ✓ **examine potential sources of evidences using blood, saliva and hair**
- C. sense pathogens and herbicides using immunochemical detection system
- D. determine the production of complex organic compounds using mold fungus

Answer: B

Forensic biology helps the police solve crimes by examining biological evidence left at the scene. Blood, saliva and hair all carry DNA, so they can identify who was present. The other options describe food science, environmental monitoring and industrial microbiology, which are different applications of biology.

Textbook: Biology Grade 12, Unit 1 Application of Biology (page 6).

51. How does biological washing powder save energy? Because they

(1)

- A. use lipase enzyme without other combination for any stain in clothes.
- B. ✓ **are effective in cleaning clothes at lower temperatures without boiling water.**
- C. are effective in removing dirty ores in clothes without spraying acidic water.
- D. use protease enzyme without other combination for any stain in clothes.

Answer: B

Biological washing powders contain enzymes such as proteases and lipases that digest food and sweat stains. Because the enzymes work well in warm water, clothes come clean without boiling the water, and heating less water saves energy. Options A and D are wrong because one enzyme alone cannot remove every kind of stain; each enzyme digests its own type of substance.

Textbook: Biology Grade 11, Unit 3 Enzymes, section 3.9 Application of enzymes in industries and their benefits (page 104).

52. The finding of the study conducted in two different villages showed that there are harmful practices that affect reproductive health. The common practices in village 1 were forcing underage girls to get married based norms and sexual abuse or harassment. In village 2 abduction to make the girl a wife unwillingly was very common. Which one of the following options is correct about the two villages? (1)

- A. In village 1, gender-based violence, kidnapping and female genital mutilation are common.
- B. ✓ **In village 1, gender-based violence and early marriage are common.**
- C. In village 2, kidnapping and female genital mutilation are common.
- D. In village 2, gender-based violence and female genital mutilation are common.

Answer: B

Match the described practices to their names. In village 1 the report lists forcing underage girls into marriage, which is early marriage, and sexual abuse or harassment, which is gender based violence; option B states exactly these two. Kidnapping was reported only in village 2, and female genital mutilation was not reported in either village, so the other options add practices the study did not find.

Textbook: Biology Grade 11, Unit 5 The human body systems, section 5.3 Harmful traditional practices (page 222).

53. How drinking alcohol can contribute for HIV transmission? By (1)

- A. . improving the decision making ability of a person
- B. ✓ **driving more willingly to participate in risky behaviors**
- C. . impotency or loss of sexual drive both in male and female
- D. . increasing rate of the retrovirus multiplication capacity

Answer: B

Alcohol weakens judgment and self control. A person who has been drinking agrees more easily to risky behaviours, such as unprotected sex, and this is how alcohol contributes to HIV transmission. Option A says the opposite of what alcohol does, and alcohol does not change how fast the virus itself multiplies.

Textbook: Biology Grade 11, Unit 5 The human body systems, section 5.5.1 The effects of alcohol uses (page 225).

54. Sleeping sickness is transmitted by (1)

- A. ✓ **biting of tsetse flies.**
- B. sexual intercourse.
- C. eating contaminated food.
- D. droplet infection.

Answer: A

Sleeping sickness (trypanosomiasis) is caused by the protozoan Trypanosoma. The parasite lives in the tsetse fly, and a person is infected when an infected fly bites them to suck blood. It does not spread through food, sexual contact or coughing.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.4.1 Common diseases caused by protozoa (page 75).

55. Considering the diverse application of microorganisms, which of the following best evaluates their overall importance? They have (1)

- A. ✓ **abundant benefits that are essential for life on Earth.**
- B. a great disadvantage and limited advantage.
- C. limited impact on the environment.
- D. few applications in the areas of biotechnology and medicine.

Answer: A

Microorganisms are essential for life on Earth. They decompose dead matter and recycle nutrients such as carbon and nitrogen, they help us make foods like injera, cheese and yoghurt, and they give us medicines such as antibiotics and many biotechnology products. Only a small fraction cause disease, so judging them as mostly harmful or unimportant would be wrong.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.8 Uses of microorganisms (page 97).

56. What is biological warfare? The use of

(1)

- A. selective genes to produce genetically modified organisms
- B. cloning technique to make exact genetic copies of an organism
- C. bacteria, fungi and viruses as a biological agent to control pests
- D. ✓ **infectious agents with the intent to kill humans, animals or plants**

Answer: D

Biological warfare means deliberately using infectious agents, such as bacteria, viruses or their toxins, as weapons with the intent to kill or harm humans, animals or plants. Option C describes biological pest control, which is a peaceful use, and options A and B describe genetic modification and cloning, which are laboratory techniques, not warfare.

Textbook: Biology Grade 12, Unit 2 Microorganisms (page 40).

57. Suppose a clinical nurse used a needle to treat a person with HIV/AIDS. What would be the most appropriate method of controlling such microbial infection?

(1)

- A. ✓ **Incineration**
- B. Tyndallization
- C. Sanitization
- D. Preservation

Answer: A

A needle used on a patient with HIV is contaminated medical waste. The safest control method is incineration: burning at very high temperature destroys the needle together with every microorganism on it, including viruses. Tyndallization is a gentle repeated heating used for culture media, sanitization only reduces the number of microbes, and preservation is for keeping food, not destroying pathogens.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.9 Controlling microorganisms (page 106).

58. As a clinical microbiologist, suppose you want to collect microbes from a food sample and isolate them via serial dilution. How do you determine the isolated colonies that grow on artificial media? By

(1)

- A. counting the number of strains on the plate
- B. cross checking with other preserved specimens
- C. ✓ **observing their morphological features**
- D. inoculating them into other infected animals

Answer: C

After serial dilution, each isolated colony on the plate grows from a single cell. Colonies of different microbes are told apart by their morphological features: size, shape, colour, margin and surface texture. Counting colonies measures how many microbes there were, not which kinds; inoculating animals or comparing preserved specimens is not how colonies on a plate are first identified.

Textbook: Biology Grade 12, Unit 2 Microorganisms (page 40).

59. Which of the following correctly describes the general features of bacteria? They are unicellular microbes with

(1)

- A. true nucleus and are omnipresent in nature.
- B. ✓ **rigid cell wall and a diverse mode of nutrition.**
- C. mitochondria and a special type of chlorophyll
- D. Golgi bodies and genetic materials of a cell.

Answer: B

Bacteria are unicellular prokaryotes. They have a rigid cell wall made of peptidoglycan, and as a group they feed in many ways: some make their own food and many others feed on living or dead organisms. They have no true nucleus, no mitochondria and no Golgi bodies, because those belong to eukaryotic cells, which rules out the other options.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.1 Eubacteria (page 43).

60. What is the main difference between anabolism and catabolism in cellular metabolic pathways? Anabolism (1)
- A. ✓ **absorbs energy while catabolism releases energy.**
 - B. is destructive while catabolism is constructive process.
 - C. occurs during respiration while catabolism occurs in photosynthesis.
 - D. breaks down macromolecules while catabolism builds them.

Answer: A

Anabolism builds large molecules from smaller ones, and building requires an input of energy, so anabolic reactions absorb energy. Catabolism breaks large molecules down and releases the energy stored in their bonds. Option B and option D describe the two processes the wrong way round, and both types of reaction occur in many pathways, not one each.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.1 Cellular metabolism (page 115).

61. In a hypothetical scenario where photosynthesis ceased to occur on the earth, the longterm consequences on the continuity of life would be (1)
- A. remained unaffected since other sources of energy exist.
 - B. ✓ **collapsed that could lead to mass extinction.**
 - C. balanced between CO₂ and O₂ appropriately.
 - D. disordered although animal life would flourish.

Answer: B

Photosynthesis feeds almost every food chain and keeps oxygen in the atmosphere. If it stopped, producers would die, the animals that eat them would starve, oxygen would no longer be replaced and carbon dioxide would build up. Life on Earth would collapse and a mass extinction would follow. No other energy source can replace the food and oxygen that photosynthesis supplies.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.3 Contributions of photosynthesis for the continuity of life (page 134).

62. What are the roles of grana and stroma in the process of photosynthesis? Grana is a site for (1)
- A. cyclic pathway while stroma is a site for non-cyclic pathway.
 - B. ✓ **photolysis of water while stroma is a site for carbon fixation.**
 - C. generation of sugar while stroma is a site for photolysis of water.
 - D. production of NADPH while stroma is a site for chemiosmosis.

Answer: B

The grana are stacks of thylakoids where the light dependent reactions happen; there, light energy splits water molecules in the process called photolysis, releasing oxygen, protons and electrons. The stroma is the fluid around the grana where the Calvin cycle runs, fixing carbon dioxide into sugar. So grana handle photolysis of water and the stroma handles carbon fixation.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.2 Photosynthesis (page 117).

63. Which one of the following comparisons between cyclic and non-cyclic photophosphorylation is correct? Non-cyclic photophosphorylation (1)
- A. produces ATP, NADPH and O₂, but cyclic produces ATP and NADPH.
 - B. uses oxygen as the final electron acceptor, but cyclic uses cytochrome b₆f complex.
 - C. uses photosystem I as electron donor, but cyclic uses water as an electron donor.
 - D. ✓ involves both photosystems I and II, but cyclic uses only photosystem I.

Answer: D

Non-cyclic photophosphorylation is a one way flow of electrons from water through photosystem II and then photosystem I, producing ATP, NADPH and oxygen. Cyclic photophosphorylation uses only photosystem I; the electrons travel in a circle and come back, so it makes ATP alone, with no NADPH and no oxygen. Option D states this difference correctly, while the others swap what each pathway uses or produces.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.2 Photosynthesis (page 117).

64. Question: Which group of archaea are found in volcanic vents and hot vapors that contain either obligate aerobes, facultative aerobes or obligate anaerobes? (1)
- A. ✓ . Hyperthermophiles
 - B. Acidophiles
 - C. Halophiles
 - D. Psychrophiles

Answer: A

Hyperthermophiles are archaea that love extreme heat. They live in volcanic vents, hot springs and hot vapours, often above 80 degrees Celsius, and among them are obligate aerobes, facultative aerobes and obligate anaerobes. Acidophiles prefer acidic places, halophiles prefer very salty water, and psychrophiles prefer cold environments.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.2 Archaea (page 57).

65. All of the following events happen in the reduction stages of the Calvin cycle EXCEPT (1)
- A. ✓ combining of CO₂ with RuBP.
 - B. utilization of ATP and NADPH molecules.
 - C. conversion of 3-PGA into a sugar molecule.
 - D. donating of electrons to a 3C-intermediates to form G3P.

Answer: A

The Calvin cycle has three stages: carbon fixation, reduction and regeneration of RuBP. The combining of carbon dioxide with RuBP is the fixation stage, the very first step, so it does not belong to the reduction stage. During reduction the cell spends ATP and NADPH, electrons are donated to the three carbon intermediate, and 3-PGA is converted into the sugar G3P, which is what the other options describe.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.2.5 Light-Independent Reactions (Calvin cycle) (page 125).

66. What happens in the mitochondrion during the reactions of photorespiration? (1)
- A. ✓ Glycine is converted to serine with the release of CO₂ and NH₃.
 - B. Glycolate is converted to glyoxylate with the release of H₂O₂.
 - C. Glycerate is converted to GP with the release of ADP.
 - D. Phosphoglycolate is converted to glycolate with the release of Pi.

Answer: A

Photorespiration runs through three organelles: the chloroplast, the peroxisome and the mitochondrion. The step inside the mitochondrion is the conversion of two glycine molecules into one serine, and this releases carbon dioxide and ammonia. The conversion of glycolate to glyoxylate happens in the peroxisome, and the steps involving phosphoglycolate happen in the chloroplast.

Textbook: Biology Grade 12, Unit 3 Energy Transformation (page 114).

67. How does photosynthesis ensure the continuity of life? By (1)
- A. constantly adding carbon dioxide to the atmosphere
 - B. ✓ **maintaining carbon dioxide and oxygen balance in the atmosphere**
 - C. constantly removing oxygen from the atmosphere
 - D. adding natural gas and absorbing methane from the atmosphere

Answer: B

Photosynthesis takes carbon dioxide out of the air to build food and releases oxygen in return, while respiration does the opposite. Together they keep the balance of the two gases in the atmosphere, and that balance is what allows life to continue. Photosynthesis removes carbon dioxide rather than adding it, and it adds oxygen rather than removing it, so the other options reverse its role.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.3 Contributions of photosynthesis for the continuity of life (page 134).

68. From the fungal disease given below, which one is transmitted sexually? (1)
- A. ✓ **. Candidiasis**
 - B. Aspergillosis
 - C. Tineas
 - D. Dermatophytosis

Answer: A

Candidiasis is caused by the yeast *Candida albicans*. When it infects the genitals it can pass between partners during sexual contact, so it is the fungal disease on the list that is transmitted sexually. Tinea and dermatophytosis are skin infections spread by direct contact with infected skin or objects, and aspergillosis is caught by breathing in fungal spores.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.3 Fungi (page 62).

69. Which of the following is the difference between substrate level phosphorylation and oxidative phosphorylation? (1)
- Substrate level phosphorylation
- A. occurs in the inner mitochondrial membrane while oxidative phosphorylation occurs in the cytosol.
 - B. ✓ **occurs during glycolysis and Kreb's cycle while oxidative phosphorylation occurs during electron transport chain.**
 - C. has the same source of energy as oxidative phosphorylation.
 - D. occurs in aerobic respiration while oxidative phosphorylation in anaerobic respiration.

Answer: B

Substrate level phosphorylation makes ATP directly, when an enzyme transfers a phosphate group from a substrate molecule to ADP; this happens during glycolysis and the Krebs cycle. Oxidative phosphorylation makes ATP using the energy of electrons passing along the electron transport chain on the inner mitochondrial membrane. Option A swaps the locations, and both types occur in aerobic respiration, so option D is also wrong.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.4 Cellular Respiration (page 136).

70. Which one of the following is correct about the energy liberation phase of glycolysis pathway? It (1)
- A. hydrolyses two ATP molecules and raises the free energy of glucose.
 - B. breaks six carbon molecules into two glyceraldehyde-3-phosphate molecules.
 - C. releases one water molecule and dihydroxyacetone phosphate molecule.
 - D. ✓ **produces four ATP, two NADH and two molecules of pyruvate.**

Answer: D

Glycolysis has two phases. In the first phase the cell invests two ATP to prepare glucose and split it into two three carbon sugars. The second phase is the energy liberation (payoff) phase: the two glyceraldehyde-3-phosphate molecules are converted into two pyruvate molecules, producing four ATP and two NADH. Options A and B describe the investment phase, not the payoff phase.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.4 Cellular Respiration (page 136).

71. This item is based on the following choices of feeding habit employed by organisms.

(1)

- I. Using nutrients dissolved in the surrounding medium
- II. Manufacturing own nutrients by photosynthesis
- III. Depending on other plants or animals for food

Which method/s the protozoan used to get their nutrition? They employed

- A. I only.
- B. I and II only.
- C. II and III only
- D. ✓ I, II and III.

Answer: D

Protozoa as a group use all three feeding methods. Saprophytic protozoa absorb nutrients dissolved in the water around them (I). Plant like protozoa such as Euglena carry chloroplasts and make food by photosynthesis (II). Holozoic and parasitic protozoa, such as Amoeba and Plasmodium, feed on other organisms (III). Because different members use different methods, the full answer is I, II and III.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.4 Protozoa (page 71).

72. Which one of the following diseases is correctly matched with its symptoms and method of transmission?

(1)

- A. Chickenpox - runny and stuffy nose - respiratory droplets
- B. Measles - paralysis and hydrophobia - bite from infected animals
- C. ✓ **Polio - commonly no sign and symptoms - fecal-oral-route**
- D. Rabies - swollen and painful parotid glands - through infected saliva

Answer: C

Polio spreads by the fecal oral route, usually through contaminated water or food, and most infected people show no signs or symptoms at all, so option C matches disease, symptom and transmission correctly. The other rows are mixed up: paralysis with hydrophobia after an animal bite describes rabies, not measles, and swollen painful parotid glands describe mumps, not rabies.

Textbook: Biology Grade 12, Unit 2 Microorganisms, section 2.7 Modes of disease transmission and ways of prevention (page 95).

73. In order to link a specific microorganism to a specific disease, Koch used mouse as experimental animal... What was his first postulate related with this procedure?

(1)

- A. ✓ **The same microorganisms are present in every case of the diseases.**
- B. The isolated microorganisms can cause the same disease to susceptible animal.
- C. The same pathogens are isolated and re-cultivated from experimental animal.
- D. The microorganisms are isolated from the tissue of a dead animal and pure culture is prepared.

Answer: A

Koch's first postulate states that the same microorganism must be found in every case of the disease. Only after this is shown do the later postulates follow: isolating the microbe and growing it in pure culture, infecting a healthy susceptible animal with it, and re-isolating the same microbe from that animal. Options B, C and D describe those later steps, not the first one.

Textbook: Biology Grade 12, Unit 2 Microorganisms (page 40).

74. Which of the following is NOT a common cause of genetic mutation? (1)

- A. Exposure to ultra-violet radiation
- B. Errors in DNA replication
- C. ✓ **Extensive physical exercise**
- D. Experiences of using chemical substance

Answer: C

Mutations are changes in the DNA sequence. Their common causes are errors made when DNA is copied during replication, and mutagens such as ultraviolet radiation and certain chemicals. Physical exercise works the muscles and heart; it does not alter the DNA sequence, so it is not a cause of mutation.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.6 Mutation (page 208).

75. Which genetic phenomenon is common for both bottleneck and founder effects? (1)

- A. High mutation rate that enhances adaptation
- B. ✓ **Genetic drift that reduces diversity in the population**
- C. Gene flow that increases inbreed and disease's resistance
- D. Natural selection that results from gradual evolutionary changes

Answer: B

In a bottleneck a disaster leaves only a few survivors; in the founder effect a few individuals start a new population. In both cases the small group carries only a chance sample of the original alleles, so allele frequencies change randomly and genetic diversity falls. This random change in a small population is genetic drift, which is why option B is the shared phenomenon.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.7 Genetic Drift (page 215).

76. In a scenario where a male black lion population left its terrestrial territory and joined a white female lion population in an isolated Island to mate, there would be a (1)

- A. decrease in black lion population in the isolated Island.
- B. genetic variation in terrestrial population due to immigration.
- C. ✓ **random introduction of new alleles into the Island population.**
- D. change in allele frequencies of terrestrial population but not in Island.

Answer: C

When the black lions move to the island and mate there, alleles that the island population never had, such as those for black fur, enter its gene pool. Movement of alleles between populations is called gene flow. The island population changes, not only the mainland one, so option D is wrong, and the effect described in option B belongs to the population that receives the migrants.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.8 Gene flow (immigration and emigration) (page 223).

77. Which of the following is an example of anthropogenic driving factor that contributes to species extinction? (1)

- A. Earth quake
- B. Volcanic eruption
- C. ✓ **Expansions of agriculture**
- D. Outbreak of wild-fire

Answer: C

Anthropogenic means caused by human beings. Expanding farmland is a human activity that clears forests and grasslands, destroying the habitats that species need, so it is an anthropogenic driver of extinction. Earthquakes, volcanic eruptions and natural wildfires happen without human action, so they are natural drivers.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.9 Causes of species extinction (page 224).

78. Which one of the following statements describes an event of the process of electron transport system correctly? (1)

- A. ✓ **Oxygen serves as a terminal electron acceptor in the production of ATP.**
- B. Thirteen ATP molecules are invested when electrons are transferred from NADH/FADH₂ to O₂.
- C. More than 90% of the total ATP is produced by substrate-level phosphorylation.
- D. It happens due to the difference in pH as the inside mitochondrial membrane is more acidic.

Answer: A

At the end of the electron transport chain, oxygen accepts the electrons and combines with protons to form water. Because oxygen is the terminal electron acceptor, the chain can keep pumping protons and the enzyme ATP synthase can keep producing ATP. The other statements are false: most ATP (around 90 percent) comes from oxidative phosphorylation, not substrate level phosphorylation, and it is the intermembrane space, not the matrix side, that becomes more acidic.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.4 Cellular Respiration (page 136).

79. Which one of the following statements is correct about nervous system? It (1)

- A. takes air into and out of the body to supply oxygen and remove carbon dioxide.
- B. uses blood vessels to transport blood around the body through the heart.
- C. consist of cells that produce and secrete chemicals into the blood stream via duct.
- D. ✓ **receives and processes sensory information from internal and external parts of the body.**

Answer: D

The nervous system receives information from sense organs inside and outside the body, processes it in the brain and spinal cord, and sends out responses. Option A describes the respiratory system, option B the circulatory system, and option C is closest to glands, though endocrine glands actually release their hormones without ducts.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.1 The Nervous System (page 238).

80. What is the best justification for the role of voltage-gated ion channels in nerve impulse transmission? They (1)

- A. ✓ **actively respond to membrane potential changes, leading to depolarization.**
- B. block the ions movement across the membrane to sustain neuron.
- C. allow potassium ions diffuse to the inside of the membrane, forming repolarization.
- D. produce energy when the sodium ions move to the inside of the axon.

Answer: A

Voltage gated ion channels open and close in response to changes in the electrical charge across the neuron membrane. When the membrane reaches threshold, voltage gated sodium channels open, sodium ions rush in and the membrane depolarizes; this is the rising phase of the nerve impulse. They do not block ion movement, and during repolarization potassium ions flow out of the axon, not in, so options B and C are wrong.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.1.2 The Nerve Impulse and transmission (page 246).

81. Which one of the following ions are used to facilitate the release of neurotransmitters to the synaptic cleft before binding to postsynaptic receptor? (1)

- A. ✓ **Calcium ions**
- B. Magnesium ions
- C. Potassium ions
- D. Sodium ions

Answer: A

When a nerve impulse arrives at the end of the presynaptic neuron, voltage gated calcium channels open and calcium ions flow in. The calcium makes the synaptic vesicles fuse with the membrane and empty their neurotransmitter into the synaptic cleft, where it can bind to receptors on the next neuron. Sodium and potassium ions carry the impulse along the axon, but calcium triggers the release at the synapse.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.1.3 Neurotransmitters (page 252).

82. Find the correct path way of reflex arc that prevents you from physical damage upon the sudden touching of hot plate. (1)
- A. Interneuron → receptor → motor neuron → effector
 - B. Sensory neuron → motor neuron → spinal cord → effector
 - C. ✓ **Sensory neuron → spinal cord → motor neuron → effector**
 - D. Interneuron → spinal cord → motor neuron → effector

Answer: C

In the withdrawal reflex, pain receptors in the skin fire and the sensory neuron carries the impulse to the spinal cord. Inside the spinal cord a relay neuron passes the signal straight to a motor neuron, and the motor neuron makes the effector (the arm muscle) contract and pull the hand away. The impulse must start with the sensory neuron and pass through the spinal cord before the motor neuron, which is the order in option C.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.1.6 Reflex action (page 262).

83. In a complete oxidation of glucose molecule, how many net ATP molecules are produced by substrate level phosphorylation? (1)
- A. 2
 - B. ✓ **4**
 - C. 8
 - D. 10

Answer: B

Substrate level phosphorylation makes ATP directly, without the electron transport chain. In the complete oxidation of one glucose it happens twice: glycolysis gives a net gain of 2 ATP, and the Krebs cycle gives 2 more (one GTP per turn, two turns per glucose). The total from substrate level phosphorylation is therefore 4 ATP; all the rest of the ATP comes from oxidative phosphorylation.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.4 Cellular Respiration (page 136).

84. This item is based on the following diagram of anatomy of human eye. Which labeled part is responsible for controlling the diameter of the pupil according to the light source? (1)

 Question Diagram

- A. I
- B. II
- C. III
- D. ✓ **IV**

Answer: D

The pupil is only a hole; its size is controlled by the iris, the coloured ring of muscle shown at label IV in front of the lens. In bright light the circular muscles of the iris contract and the pupil narrows; in dim light the radial muscles contract and the pupil widens. The other labels point to the outer structures at the front of the eye, such as the cornea, which bends light but cannot change the pupil.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.4 The Eye (page 281).

85. Select the option that contains the correct match of human ear structure and its function. (1)
- A. ✓ **Eustachian tube - balancing air pressure of the middle ear and throat**
 - B. Semicircular canals - concerned with production of nerve impulse
 - C. Ear ossicles - concerned with the detection of motion
 - D. Cochlea - transmits sound from the incus to the auditory nerve

Answer: A

The Eustachian tube connects the middle ear to the throat, and its job is to keep the air pressure equal on both sides of the eardrum, so option A is the correct match. The other pairs are mixed up: the semicircular canals detect motion for balance, the ear ossicles transmit and amplify vibrations, and the cochlea is where vibrations become nerve impulses that travel along the auditory nerve.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.5 The Ear (page 291).

86. What is the difference between aerobic and anaerobic respirations? (1)
- A. Aerobic respiration ends with different products while the same product results in anaerobic respiration.
 - B. Proteins are the main respiratory substrate for both aerobic and anaerobic respiration.
 - C. ✓ **Aerobic respiration produces much more energy than anaerobic respiration.**
 - D. Glycolysis is the first pathway for aerobic while Krebs's cycle is for anaerobic respiration.

Answer: C

The big difference is the amount of energy released. Aerobic respiration uses oxygen to break glucose down completely, giving up to about 36 to 38 ATP per glucose. Anaerobic respiration works without oxygen, breaks glucose down only partly, and gives just 2 ATP. Glycolysis is the first step of both types, so option D is wrong, and carbohydrates, not proteins, are the main respiratory substrate.

Textbook: Biology Grade 12, Unit 3 Energy Transformation, section 3.4 Cellular Respiration (page 136).

87. Which one of the following statements disproves spontaneous generation theory based on a step wise experimental work? (1)
- A. Life is an inherent property of the universe and everlasting.
 - B. Different life forms on the Earth were created by a supreme being within six days.
 - C. ✓ **Both macro and micro-organisms could arise from pre-existing organisms**
 - D. Life has reached to the Earth in the form of spores with falling meteorite.

Answer: C

Spontaneous generation claimed that living things arise from non-living matter. Redi and later Pasteur tested this step by step with controlled experiments: when flies or microbes were kept out, no life appeared, and organisms only came from other organisms. So the statement that both macroorganisms and microorganisms arise from pre-existing organisms (biogenesis) is the one proved by experiment. The other options are beliefs about the origin of life, not results of a step wise experiment.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.2 Theories of evolution (page 171).

88. This item is based on the following list of events that happen during hearing. (1)
- I. Transmission of amplified sound waves to the ear ossicles
 - II. Movement of sensory hair as a result of vibration of the fluid in the cochlea
 - III. Transmission of nerve impulse into the brain and response to the sound stimulus
 - IV. The pinna directs sound waves into the eardrum

Based on the above lists, which alternative shows the correct steps of the events of hearing?

- A. IV → III → II → I
- B. I → II → III → IV
- C. I → IV → II → III
- D. ✓ **IV → I → II → III**

Answer: D

Follow the sound through the ear. First the pinna collects the sound waves and directs them to the eardrum (IV). The vibrations then pass to the ear ossicles, which amplify and transmit them (I). The ossicles shake the fluid in the cochlea, and the moving fluid bends the sensory hairs (II). Finally the impulse travels along the auditory nerve to the brain, which responds to the sound (III). So the order is IV, I, II, III.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.5 The Ear (page 291).

- 89.** Suppose low metabolic rate, cretinism and retarded mental and physical development are common problems of infants and childhood in a small village. Which condition in the endocrine system results in these problems? (1)
- A. ✓ **Extreme hypothyroidism**
- B. Malfunction of adrenal cortex
- C. Over production of parathyroid hormone
- D. Lack of adrenalin production

Answer: A

The thyroid gland controls the body's metabolic rate through the hormone thyroxine, which needs iodine. When infants produce far too little thyroid hormone, the result is cretinism: a low metabolic rate with stunted physical growth and delayed mental development, exactly the problems described in the village. The adrenal glands and the parathyroid gland control stress responses and calcium levels, not this pattern of symptoms.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.6 The endocrine system (page 295).

90. If a woman is admitted to hospital for giving birth, which hormone is helping her in the delivery of her baby and releasing of milk? (1)
- A. Vasopressin
B. Aldosterone
C. ✓ **Oxytocin**
D. Progesterone

Answer: C

Oxytocin, released from the posterior pituitary, does both jobs in the question: it makes the muscles of the uterus contract strongly during labour, and after birth it squeezes milk out of the mammary glands when the baby suckles. Vasopressin (ADH) controls water balance, aldosterone controls salt balance, and progesterone maintains pregnancy and actually keeps the uterus calm.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.2.6 The endocrine system (page 295).

- 91.** Based on comparative anatomy, chimpanzee is the closest relative to humans because of the similarities in their (1)
- A. haemoglobin sequence. B. fossil remains.
C. ✓ **DNA sequence.** D. pentadactyl limb.

Answer: C

The evidence that places chimpanzees closest to humans is the similarity of their DNA: the two species share roughly 98 to 99 percent of their DNA sequence. The pentadactyl (five fingered) limb cannot be the reason, because frogs, lizards, birds and all other tetrapods share it too, so it does not single out the chimpanzee. Fossils and haemoglobin comparisons support evolution in general, but DNA comparison gives the most precise measure of relatedness.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.3 The evidence for evolution (page 177).

92. How ultrafiltration takes place in the human kidney? By (1)
- A. increasing the concentration of urine in the muscular sac using a collecting duct
 - B. ✓ **building the pressure of the knot of blood vessels in the Bowman's capsule**
 - C. diffusing of glucose molecules into the first coiled tubule of microvilli
 - D. reabsorbing of water into the blood in the second coiled tubule using ADH

Answer: B

Ultrafiltration happens in the glomerulus, the knot of capillaries sitting inside the Bowman's capsule. Blood enters through a wide vessel and leaves through a narrower one, so pressure builds up inside the knot. This pressure forces water, glucose, salts and urea out of the blood into the capsule, while blood cells and proteins stay behind because they are too large. Reabsorption in the tubules, described in the other options, happens after filtration, not during it.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.3.1 The structure and function of the human kidney (page 317).

93. Assume a patient with type II diabetes gets an advice to practice regular exercise to raise the number of insulin receptors. Then, how does insulin regulate the blood glucose level if it is high in this patient? It stimulates (1)
- A. glycolysis, which converts glucose into pyruvate.
 - B. ✓ **glycogenesis, which converts glucose into glycogen.**
 - C. lipolysis that converts fatty acid into glucose.
 - D. gluconeogenesis that creates glucose from amino acids.

Answer: B

When blood glucose rises, insulin lowers it mainly by stimulating glycogenesis: the liver and muscles take up glucose and join it into glycogen for storage. Lipolysis and gluconeogenesis do the opposite job, because they raise blood glucose or release stored energy, and they are switched on by other hormones such as glucagon when glucose is low.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.3 Homeostasis in the human body (page 317).

94. Imagine the water content of the blood is low when you take in much salt with your food. What would happen in your kidney to regulate this situation? Osmoreceptor stimulates the (1)
- A. adrenal gland to release adrenalin that increases conversion of glycogen to glucose in the blood.
 - B. hypothalamus that release aldosterone and sodium ions to reabsorb back into the blood.
 - C. ✓ **pituitary gland to release ADH to reabsorb water back into the blood.**
 - D. ADH to release cortisone that promotes resistance to water stress.

Answer: C

Too much salt makes the blood concentrated, and osmoreceptors in the hypothalamus detect this. They stimulate the pituitary gland to release ADH (antidiuretic hormone). ADH makes the kidney's collecting ducts more permeable, so more water is reabsorbed back into the blood and the balance is restored. Option B fails because aldosterone comes from the adrenal cortex, not from the hypothalamus, and adrenalin (option A) controls the stress response, not water balance.

Textbook: Biology Grade 12, Unit 5 Human Body System, section 5.3.1 The structure and function of the human kidney (page 317).

95. Which one of the following causes of variation allows infertile hybrids to become fertile in plant evolution? (1)
- A. Reproductive isolation
 - B. Sympatric speciation
 - C. ✓ **Polyploidy cell**
 - D. Geographical separation

Answer: C

A hybrid between two plant species is often sterile because its chromosomes have no matching partners to pair with during meiosis. If the hybrid's chromosome number doubles, a condition called polyploidy, every chromosome suddenly has a partner, meiosis works, and the plant becomes fertile. Reproductive isolation and geographical separation keep populations apart; they do not make a sterile hybrid fertile.

Textbook: Biology Grade 12, Unit 4 Evolution (page 161).

96. Several current studies point out that very large quantity of greenhouse gases have been added into Earth's atmosphere due to human activities. What would be the most likely responsible gas and its major sources, respectively? (1)

- A. Methane - aluminum smelting and semiconductor manufacturing
- B. ✓ **Carbon dioxide - fossil fuel combustion, deforestation, oil and gas usage**
- C. Sulphur hexafluoride - landfills, rice paddies, digestive tracts of cattle
- D. Perfluorocarbons - electric transmission, magnesium and aluminum production

Answer: B

Carbon dioxide is the greenhouse gas that human activity adds to the atmosphere in by far the largest quantity. Its main sources are burning fossil fuels for energy and transport, deforestation, and the use of oil and gas. The other options attach the wrong sources to each gas: landfills, rice paddies and cattle digestion release methane, not sulphur hexafluoride.

Textbook: Biology Grade 12, Unit 6 Climate Change, section 6.1.2 Causes of climate change (page 334).

97. The effect of increased climate change on agricultural productivity is associated with (1)

- A. land use change and expansion of monoculture farming that yields high productivity.
- B. agroforestry system that increases the mixture of multipurpose trees and crops.
- C. drought that triggers wild fire, which can consume millions of acres of forest.
- D. ✓ **reduction of available water that leads to decrease in biological resources.**

Answer: D

Climate change alters rainfall and brings more frequent drought, so less water is available for crops and livestock. With less water, plants grow poorly and biological resources shrink, and farm productivity falls. Options A and B describe farming practices rather than effects of the climate, and option C describes an effect on forests, not on agricultural productivity.

Textbook: Biology Grade 12, Unit 6 Climate Change, section 6.2.2 Effects of climate change on Agriculture (page 341).

98. Which one of the following local community practices in Ethiopia is considered as an environmental action that addresses climate change mitigation? Culture of (1)

- A. respecting humanity that promotes eco-tourism industry
- B. negotiating mechanism that is led by elders to reduce social unrest
- C. ✓ **planting millions of seedlings following the green legacy initiative**
- D. treating different diseases with herbal remedies by traditional healers

Answer: C

Mitigation means acting to reduce the causes of climate change, mainly by cutting or absorbing greenhouse gases. Planting millions of seedlings under the Green Legacy initiative does exactly that, because growing trees absorb carbon dioxide from the air and store the carbon. Eco-tourism, conflict resolution by elders and herbal medicine are valuable practices, but they do not remove greenhouse gases.

Textbook: Biology Grade 12, Unit 6 Climate Change (page 333).

99. This item is based on the following diagram, which illustrates the occurrence of mutation in a certain sequence of nucleotides. The type of mutation that occurred in the above sequence of nucleotides is



- A. deletion.
- B. inversion.
- C. addition.
- D. ✓ substitution.

Answer: D

Compare the two sequences codon by codon. Only the third codon changed: ATT became ATG, so one base (T) was replaced by another base (G), and the amino acid changed from isoleucine to methionine. A change where one nucleotide is swapped for another, with the sequence staying the same length, is a substitution mutation. Deletion or addition would shorten or lengthen the sequence, and inversion would reverse a segment.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.6 Mutation (page 208).

100. This item is based on the following course of human evolution. (1)

1. Use of fire and other tools
2. Increase in brain size
3. Emergence of Homo sapiens
4. Bipedal walking and arboreal life

Which of the following is the correct order of the above evolutionary time line markers?

- A. 2, 1, 3, 4
B. 1, 3, 4, 2
C. 3, 2, 4, 1
D. ✓ 4, 2, 1, 3

Answer: D

Walking upright on two legs (bipedalism) appeared first in human evolution, in early ancestors that were leaving arboreal (tree) life. Brain size then increased gradually over millions of years. With bigger brains, species such as *Homo erectus* began using fire and better tools. The emergence of our own species, *Homo sapiens*, came last. So the timeline is 4, 2, 1, 3.

Textbook: Biology Grade 12, Unit 4 Evolution, section 4.1.5 Human evolution (page 200).

— END OF MARKING KEY —