



Provincial Department of Education, Northern Province
General Certificate of Education (Adv. Level) Pilot Examination - September 2023



Biology I

09

E

I

Two Hours

Instructions

- Answer **all** questions.
- Write your index number in the space provided in the answer sheet.
- Instructions are given on the back of the answer sheet. Follow those carefully.
- In each of the questions 1 to 50, pick one of the alternative from (1), (2), (3), (4), (5) which is **correct** or **most appropriate** and **mark your response on the answer sheet with a cross (x)** on the number of the correct option in accordance with the instructions given on the back of the answer sheet.

01) Which of the following is correct regarding the characteristic features of living?

- (1) The sum of all chemical activities taking place in an organism is its anabolism.
- (2) Irreversible changes that occur during the lifespan of an organism is adaptation.
- (3) The ability to respond to stimuli from both internal and external environment is co-ordination.
- (4) Ability of organisms to change over time as a result of genetic modification is evolution.
- (5) A peculiarity of structure, physiology or behavior that promotes the likelihood of an organism's survival and reproduction in a particular environment is development.

02) Which of the following statements regarding water and its properties is correct?

- (1) Solubility of solutes depend on their ionic nature.
- (2) Water has the maximum density at 4 K and hence, ice floats on the surface of water bodies
- (3) Water can absorb or release a relatively high amount of heat energy by a slight change in its own temperature.
- (4) Due to the high heat of vaporization, water will function as a thermal buffer.
- (5) High surface tension is due to the adhesion between water molecules and other substances

03) Select the suitable pair out of the following.

A

- (1) R group of amino acids
- (2) Phosphate group
- (3) m-RNA
- (4) Galacturonic acid
- (5) Hydrocarbon tails of phospholipids

B

- Acts as the backbone of amino acids
It gives acidic nature to the nucleic acid
Most abundant type of RNA in cells
Monomer of chitin
Hydrophilic

04) X is an organelle which is abundant in secretory cells and it produces another organelle Y is an Organelle.

Z contains oxidizing enzymes and is present in both plants and animals.

Which of the following could be the organelles X, Y and Z respectively?

- (1) Golgi apparatus, lysosomes, chloroplast.
- (2) Golgi apparatus, peroxisomes, lysosomes.
- (3) Smooth endoplasmic reticulum, lysosomes, mitochondria.
- (4) Rough endoplasmic reticulum, peroxisomes, mitochondria.
- (5) Golgi apparatus, lysosomes, peroxisomes.

05) The four daughter cells produced at the end of meiosis II when compared to the parent diploid cell will have

- (1) same amount of DNA and the same number of chromosomes.
- (2) same amount of DNA and half the number of chromosomes.
- (3) half amount of DNA and half the number of chromosomes.
- (4) half amount of DNA and the same number of chromosomes.
- (5) double amount of DNA and half the number of chromosomes.

06) Which of the following statements is correct regarding the electron flow of light reactions of photosynthesis?

- (1) The excitation of PS I and PS II embedded in thylakoid membrane synthesizes ATP and NADH.
- (2) Electrons released as a result of splitting of water may neutralize the excited P700.
- (3) Splitting of water due to non-enzyme catalyzed reaction produces O_2 , H^+ ions and electrons.
- (4) NADP⁺ reductase enzyme catalyzes the reduction of NADP⁺.
- (5) Cyclic electron flow synthesizes ATP, NADPH and O_2 .

07) Select the correct statement regarding reactions in cellular respiration.

- (1) The volume of O_2 consumed is equal to the volume of CO_2 evolved, when protein is used as the respiratory substrate.
- (2) The amount of usable energy in a NADH molecule is less than that in a $FADH_2$ molecule.
- (3) The electron transport chain is composed of protein molecules only.
- (4) Glycerol is converted to Glyceraldehyde 3-Phosphate and participate in glycolysis.
- (5) All ATP molecules produced during aerobic respiration are produced within mitochondria.

08) Which of the following responses gives a matching pair when time periods are considered?

- (1) Direct evidence for life on early earth – 3.5 million years ago
- (2) Fossils of the oldest known protists – 2.7 billion years ago
- (3) The divergence of human lineage from other primates – 195,000 years ago
- (4) Origin of ancestors of arthropods, chordates and other animal phyla – 700 million years ago
- (5) The formation of earth and the other planets of the solar system – 4600 million years ago

09) The person who introduced the taxon phylum in classification of organisms,

- 1) introduced binomial nomenclature of species.
- 2) introduced a third kingdom- Protista.
- 3) introduced five kingdom system.
- 4) introduced three domain system.
- 5) was the first to classify organisms scientifically.

10) A student found a plant with the following features in a field study.

- Small leaves are found in upright stem
- Ground hugging stem produces dichotomously branching roots

Which of the following is the common feature to the phylum that the above plant belongs?

- | | | |
|-----------------------------|---------------------------------------|--------------------|
| (1) Having strobilus | (2) All are heterosporous | (3) Having rhizome |
| (4) Highly dissected leaves | (5) The dominant plant is gametophyte | |

11) Which of the following features is also found in the phylum which contains animals having tentacles, radial symmetry and mostly marine habitat?

- (1) Radula (2) Gastrovascular cavity (3) Tube feet
(4) Pseudocoelom (5) Mesoderm

12) Which of the following statements is correct regarding secondary growth of plants?

- (1) It occurs in all dicot species but doesn't occur in monocot species.
(2) Elongated initials in vascular cambium are oriented perpendicular to the axis of stem or root.
(3) The cork cambium arises in the outer layer of cortex in stems.
(4) Secondary phloem is not a main component of bark.
(5) Xylem vessels are present in both hard wood and soft wood.

13) Consider two plant cells named A and B. Water potential of A is -200 MPa and for B it is -400 MPa. The solute potential of cell A is -500 MPa. After the two cells are placed in contact with each other, what will be the pressure potential of cell A?

- (1) +200 MPa (2) -200 MPa (3) +300 MPa (4) -300 MPa (5) +500 MPa

14) Which of the following is correct regarding phloem translocation?

- (1) Translocation occurs by bulk flow under negative pressure.
(2) Phloem sap moves from source to sink at a rate about 10 m/hr.
(3) Concentration of free sugar in sink is always more than that in the sieve tube element.
(4) In some plant species, the entry of sugar from mesophyll cells to sieve tube elements occurs via symplast, passing through plasmodesmata.
(5) Translocation of phloem sap is unidirectional and does not depend on the locations of sugar source and sugar sink.

15) Identify the element matching the following description and select the answer which consists of the correct form of intake of that element.

- It is a macronutrient required by plants
- A component of nucleic acids
- Deficiency symptoms include purpling of veins and poor flowering and fruiting

- (1) HPO_4^{2-} (2) NH_4^+ (3) PO_4^{3-} (4) CO_2 (5) H_2O

16) Which of the following responses indicate a haploid, diploid and triploid structure respectively?

- (1) *Nephrolepis* archegonium, Angiosperm ovule, *Cycas* endosperm.
(2) *Selaginella* megaspore, *Pogonatum* rhizoid, *Pinus* root.
(3) *Pogonatum* sporophyte, *Pogonatum* sperm, *Cycas* ovule.
(4) *Cycas* endosperm, *Selaginella* strobilus, *Nephrolepis* embryo.
(5) *Nephrolepis* gametophyte, *Selaginella* megasporangium, Angiosperm endosperm.

17) Which of the following statements regarding plant growth substances is correct?

- (1) Auxin and cytokinin stimulate seed germination
(2) Auxin and ethylene show opposite response to each other in leaf abscission
(3) Cytokinin regulates sex determination and transition from juvenile to adult phase
(4) Absciscic acid helps in delaying leaf senescence
(5) Gibberellins promote movement of nutrients into sink tissues

18) Select the correct response about animal tissues.

- (1) Epithelial tissue helps to connect organs and tissues together structurally and functionally.
- (2) Osteoblasts are mature bone cells that maintain bone tissue.
- (3) Smooth muscle tissue is responsible for churning of stomach and constriction of arteries.
- (4) The matrix of cartilage composed of chondroitin sulphate which is a rubbery lipo-protein complex.
- (5) Neuroglial cells are supportive cells of neurons which always modulate neuron functions.

19) Select the correct statement out of the following regarding human digestive system.

- (1) Digestion of fats starts in the stomach converting fats into fatty acids, glycerol and mono glycerides.
- (2) Secretin stimulates the release of bile from gall bladder.
- (3) Amino acids like leucine and methionine can be synthesized within the body.
- (4) During absorption in the small intestine, all glucose molecules are actively transported into the epithelial cells.
- (5) Pancreatic carboxy peptidases catalyze the conversion of smaller polypeptides into small peptides and amino acids.

20) A few deficiency symptoms of vitamins and minerals are given below.

- | | |
|-----------------------------------|----------------------------|
| (a) disturbance in nervous system | (b) reduced heart function |
| (c) delayed wound healing | (d) heart failure |

Which nutrient deficiencies cause the above symptoms respectively?

- (1) Magnesium, Thiamine, Ascorbic acid, Potassium
- (2) Sodium, Niacin, Ascorbic acid, Potassium
- (3) Magnesium, Riboflavin, Cobalamin, Fluorine
- (4) Iron, Biotin, Ascorbic acid, Potassium
- (5) Sodium, Folic acid, Ascorbic acid, Fluorine

21) Select the correct statement regarding human cardiac cycle and its stages

- (1) Ventricular systole lasts for 0.4 seconds.
- (2) Atrioventricular valves are closed during complete cardiac diastole.
- (3) When blood flows into the atrium, AV node is stimulated.
- (4) Semilunar valves open during the ventricular systole.
- (5) Some blood flows actively through to the ventricles during complete cardiac diastole.

22) Which of the following statements is correct regarding the composition and major functions of human blood?

- (1) Protein concentration in blood plasma is lower than in interstitial fluid
- (2) Generally, a micro liter of blood contains 4-6 million red blood cells.
- (3) Red blood cells are small, biconvex disk-like cells which transport O_2 and CO_2 molecules
- (4) pH of human blood is around 7.2.
- (5) Serum differs from blood plasma due to absence of antibodies.

23) Select the correct statement regarding the immune system of animals.

- (1) Natural killer cells are involved in adaptive immunity of man.
- (2) Sebaceous glands contribute to innate immunity of man.
- (3) T lymphocytes are involved in acquired immunity of mollusks.
- (4) B lymphocytes are involved in inflammatory response of animals.
- (5) Histamine is mainly produced by neutrophils present in the connective tissues of man.

24) Select the correct statement regarding the human nephron.

- (1) Majority of nephrons are juxta-medullary nephrons.
- (2) The closed end of the nephron joins with the collecting duct.
- (3) Proximal convoluted tubule is comparatively longer and wider than the distal convoluted tubule.
- (4) Lining of descending limb of loop of Henle is impermeable to water.
- (5) The efferent arteriole has a larger diameter than the afferent arteriole.

25) Medulla oblongata,

- (1) contains only a reflex centre and a respiratory centre.
- (2) extends from the pons varolii and is continuous with the spinal cord.
- (3) transfers information between PNS and the hind brain and the fore brain.
- (4) controls voluntary reflexes through reflex centres.
- (5) forms the middle part of the brain stem.

26) The correct statement regarding the human eye is,

- (1) Each ganglion cell in retina gathers inputs from one bipolar cell.
- (2) When seeing a distant object, convexity of the lens is reduced by contraction of ciliary muscles.
- (3) Cones are present in large numbers in the retina than rods.
- (4) Iris contains two layers of smooth muscles which are arranged as circular and longitudinal bundles.
- (5) Aqueous fluid is a clear watery substance which supplies nutrients and removes wastes from the cornea, lens and lens capsule which have no blood supply.

27) Select the correct sequence of the functions of the structures P, Q, R and S related to human endocrine system.

P – Hypothalamus

a – secretion of noradrenaline

Q – Anterior pituitary

b – secretion of GnRH

R – Thyroid gland

c – secretion of prolactin

S – Adrenal medulla

d – secretion of calcitonin

(1) a, b, c, d

(2) b, c, a, d

(3) c, a, b, d

(4) b, c, d, a

(5) b, d, c, a

28) A – E represents different stages of human spermatogenesis. Select the correct sequence of cells in spermatogenesis.

A – Sperms

B – Spermatogonia

C – Primary spermatocyte

D – Secondary spermatocyte

E – Spermatids

(1) B, D, C, E, A

(2) B, C, D, E, A

(3) C, D, B, E, A

(4) D, B, C, A, E

(5) B, C, D, A, E

29) Which of the following structure – function relationship is correct?

- (1) Fallopian tube – connects external and internal organs of reproduction
- (2) Vagina – conveys the ovum to uterus
- (3) Uterus – provides the site where sperm is deposited
- (4) Support cells – protect and nourish the oocyte during its development
- (5) Corpus luteum – secretes estradiol, progesterone and FSH

30) Which of the following bone – process combination is correct?

- (1) Atlas vertebra – Bifid spinous process
- (2) Temporal bone – Condylod process
- (3) Sternum – Xiphoid process
- (4) Mandible – Styloid process
- (5) lumbar vertebrae – Odontoid process

31) In an experiment two pea plants which contain yellow colour seeds were crossed together. In the progeny obtained, 75% had yellow colour seeds while 25% had green colour seeds. After that a yellow seeded plant was crossed with a green seeded plant. As a result, both yellow seeded plants and green seeded plants were obtained in equal amounts. According to the above observations, which of the following statements is true?

- (1) The pea plants involved in the first cross were homozygous.
- (2) 50% of the products obtained from first cross were heterozygous.
- (3) 50% of the products obtained from first cross were homozygous dominant.
- (4) The yellow seeded plants obtained from second cross were homozygous.
- (5) The yellow seeded plant crossed with a green seeded plant in the second cross was homozygous.

32) There are 500 flowers in a specific population. This population follows the Hardy-Weinberg equilibrium. If the recessive allele frequency of this population is 0.2, how many flowers of this population contain the dominant trait?

- (1) 150
- (2) 160
- (3) 320
- (4) 400
- (5) 480

33) Which of the following is correct regarding the human genetic disorders caused by mutations?

- (1) In females, at heterozygous condition presence of a defective allele in one X chromosome causes colour blindness.
- (2) Klinefelter syndrome is caused by monosomy condition of X chromosome.
- (3) In condition leading to sickle cell anaemia, the mutation substitutes glutamic acid by valine mutant
- (4) Down syndrome is due to aneuploidy conditions in sex chromosomes.
- (5) Persons with down syndrome have a higher risk of blood pressure, arteriosclerosis, strokes and many types of solid tumors.

34) Select the correct sequence of genetically modified organisms (GMO) that are used to produce the following substances.

- (a) Amylomaltase (an enzyme) (b) Chymosin (an enzyme) (c) Aspartame (a sweetener)
- (1) recombinant yeast, GM *Streptococcus* sp., GM *Bacillus* sp.
- (2) GM *E. coli*, recombinant yeast, GM *Bacillus* sp.
- (3) GM *E. coli*, GM *Bacillus* sp., recombinant yeast
- (4) GM *Bacillus* sp., recombinant yeast, GM *E. coli*
- (5) GM *Streptococcus* sp., GM *Clostridium* sp., recombinant yeast

35) Given below are some features of ecosystems in Sri Lanka

- The vegetation is filled with a network of woody lianas that reach to the canopy layer
- Common on hill slopes of the dry or intermediate zone
- Characterized by stunted or creeping vegetation on large masses of sand
- The vegetation is dominant with grasses and sedges

The ecosystems in the correct order are,

- (1) Tropical thorn scrubs, wet patana, sea shore, salt marshes
- (2) Tropical wet lowland rainforests, dry patana, sea grass beds, savanna
- (3) Tropical montane forests, dry patana, villus, mangroves
- (4) Tropical dry monsoon forests, savanna, sea shore, villus
- (5) Tropical wet lowland rainforests, savanna, sand dunes, villus

36) Which of the following is true regarding biomes in the world?

- (1) Tropical forest is the largest biome on earth.
- (2) Average annual precipitation of alpine tundra is less than that of arctic tundra.
- (3) The diversity of shrubs and herbs in northern coniferous forests is greater than that of temperate broadleaf forests.
- (4) A prolonged dry season of 6-7 months is prominent in Savanna.
- (5) There are only few epiphytes can be found in temperate broadleaf forests.

37) Both mycoplasma and phytoplasma

- (1) have cell walls and are included in the domain bacteria.
- (2) reproduce by budding and binary fission.
- (3) can be seen under light microscope.
- (4) are parasites of humans and animals.
- (5) possess only aerobic mode of respiration.

38) Which of the following statements regarding the commercial products made by microorganisms and their processes is correct?

- (1) The acetic acid fermentation process is highly aerobic.
- (2) Fructose is the most widely used fermentation substrate in production of ethanol.
- (3) *Streptococcus* sp. ferment lactose into lactic acid.
- (4) *Aspergillus oryzae* is used in commercial production of citric acid.
- (5) Riboflavin is produced by fermentation by bacteria.

39) Select the correct statement out of the following.

- (1) Botulism caused by *Clostridium tetani* is an example for food intoxication.
- (2) Cause for typhoid fever is an infection of protozoan.
- (3) Enteroviruses cause some food borne illnesses.
- (4) Aflatoxins which cause food intoxication are produced by bacteria.
- (5) Cholera is a food borne infection caused by an endotoxin produced by *Vibrio cholerae*.

40) Select the answer which contains the correct sequence of products of nanotechnology which can be used for below functions.

- Bio imaging enhancements
- Used to replace broken bones and to fill teeth
- Prevents the entry of HIV and HSV during sexual intercourse

- (1) Nano filters, Nano shells, Nanocomposites
- (2) Nano carrier systems, Nanocomposites, Viva gel
- (3) Nano shells, Nanocomposites, Viva gel
- (4) Nano particles, Nano shells, Nano filters
- (5) Nano shells, Nano device sensors, Viva gel

- For each of the questions 41 to 50, one or more of the responses is/are correct. Decide which response/responses is/are correct and then select the correct number.

- If only (A), (B) and (D) are correct (1)
 If only (A), (C) and (D) are correct (2)
 If only (A) and (B) are correct (3)
 If only (C) and (D) are correct (4)
 If any other response or combination of responses is correct (5)

| Directions summarised | | | | |
|---------------------------|---------------------------|----------------------|----------------------|--|
| (1) | (2) | (3) | (4) | (5) |
| (A), (B), (D) correct. | (A), (C), (D) correct. | (A), (B) correct. | (C), (D) correct. | Any other response or combination of responses correct. |

41) Select the correct statement/s regarding enzymes and enzyme cofactors.

- (A) Cofactors that are loosely bound to the enzymes are reversible under certain circumstances.
- (B) Drugs used against microbes bind to enzymes reversibly with weak interactions.
- (C) Enzymes generally have different optimum pH values and same optimum temperature.
- (D) Inorganic cofactors are called coenzymes and they include Cu^{2+} , Zn^{2+} and Fe^{2+} .
- (E) Enzymes are used up during the reactions to decrease the activation energy.

42) Select the correct characteristic/characteristics shown by a group of unicellular protists which have cell walls.

- (A) Pectin and silica as cell wall components
- (B) Heterotrophic mode of nutrition
- (C) Golden brown in colour
- (D) Highly diverse group regarding the shape and markings in the surface
- (E) Thallus is supported by gas filled bulb shaped floats

43) Select the correct statement/s out of the following.

- (A) Positive phototropism strengthen photosynthesis.
- (B) In roots, statoliths are located in all cells of the root cap.
- (C) Photoperiod is the interval in a 24-hour period in which the plant gets exposed to light.
- (D) The high concentration of auxin inhibits cell elongation in roots.
- (E) The directional growth of tendril towards support is called thigmonasty.

44) Which of the following is/are correct about the homeostatic control of breathing.

- (A) Main breathing regulatory center is found at the forebrain.
- (B) The O₂ level has high influences on the breathing control centers.
- (C) There are a pair of breathing control centers found in medulla oblongata.
- (D) Sensors which detect stretching of lung tissues are found in the lungs.
- (E) A positive-feedback mechanism is involved in regulating this process.

45) The correct statement/s out of the following is/are,

- (A) Organ systems are completely developed in the first trimester.
- (B) Although one sperm is required per one oocyte in in-vitro fertilization, in intra cytoplasmic sperm injection, one sperm is not enough.
- (C) Embryonic membranes provide a life support system for further embryonic/fetal development.
- (D) During the first 2-4 weeks of embryonic development, the embryo obtains nourishment directly from the endometrium.
- (E) The secondary oocyte arrested at prophase of meiosis II is released at ovulation, when its follicle breaks open.

46) Select the correct statement/s regarding the sliding filament theory of skeletal muscle contraction. (A) When a skeletal muscle cell contracts, the thick and thin filaments slide past each other in a sarcomere.

- (B) Myosin head can bind with an ATP molecule when it's at low energy state.
- (C) Even though many myosin heads can be found in one thick filament, only one myosin head can form cross bridge with the myosin binding site of actin within one second.
- (D) At higher energy state, the myosin head binds to myosin binding site of actin forming a cross bridge.
- (E) The lengths of actin and myosin filaments in the sarcomere decrease during muscle contraction.

47) Which of the following is/are correct regarding Small Tandem Repeats (STR markers)?

- (A) They can be easily amplified by PCR.
- (B) Highly variable polymorphisms are present.
- (C) They occur very rarely in genome.
- (D) A large number of characterized STRs are available.
- (E) Lengths of small tandem repeats do not vary.

48) Select the correct statement/s regarding ecological pyramids.

- (A) The trophic structure of an ecosystem can be indicated by means of ecological pyramid.
- (B) The energy pyramid describes the overall nature of the ecosystem.
- (C) Energy pyramids are always inverted and vertical.
- (D) Number pyramids can be upright or inverted.
- (E) The higher the steps in the ecological pyramid the higher will be the number of individuals and the smaller their size.

49) Which of the following is/are true about interactions of soil microorganisms relevant to plant growth?

- (A) Bacteria are the most numerous organisms in the rhizosphere.
- (B) Pathogenic fungi do not associate with the rhizosphere.
- (C) Mycorrhizae increase uptake of immobile nutrients such as phosphorous, zinc and copper.
- (D) Fungal filaments and actinomycetes filaments are involved in soil aggregation formation. (E) Mycorrhizae is a kind of symbiotic interaction between plant roots and soil surrounding the root surface for about few millimeters.

50) What other genome projects have already been completed in addition to the Human Genome Project?

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|-------------------------------------|-----------------------------------|-----------------------------|
| (A) <i>Escherichia coli</i> | (B) <i>Arabidopsis thaliana</i> | (C) <i>Salmonella typhi</i> |
| (D) <i>Saccharomyces cerevisiae</i> | (E) <i>Bacillus thuringiensis</i> | |