



SET ZOOLOGY 100 FREE QUESTIONS

- 1) Hypersecretion of adrenal cortex causes
- A) Addison's disease
 - B) Down's syndrome
 - C) Acromegaly
 - D) Cushing's syndrome

Answer: D) Cushing's syndrome

Solution:

- The adrenal cortex produces three hormones:
 - (1) Mineralocorticoids: the most important of which is aldosterone.
 - (2) Glucocorticoids: predominantly cortisol.
 - (3) Adrenal androgens.
- Cushing's syndrome, or hypercortisolism, occurs due to abnormally high levels of the hormone cortisol.
- Addison's disease is caused due to hyposecretion of adrenal hormones. It results from damage to the adrenal cortex.
- Down's syndrome, also known as trisomy 21, is a genetic disorder caused by the presence of a third copy of chromosome 21.
- Acromegaly is a disorder which occurs due to hypersecretion of growth hormone from pituitary gland.
- So, option D is the correct answer. Hypersecretion of adrenal cortex causes Cushing's syndrome.

- 2) The periods of Mesozoic Era are
- A) Triassic, Jurassic, Cretaceous
 - B) Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian
 - C) Triassic, Jurassic, Carboniferous
 - D) Tertiary and Quaternary

Answer: A) Triassic, Jurassic, Cretaceous

Solution:

- The phanerozoic eon is divided into three eras: the Paleozoic, Mesozoic, and Cenozoic eras.
- The Paleozoic Era is divided into the six periods: Cambrian, Ordovician, Silurian, Devonian, Carboniferous, and Permian.
- The Mesozoic Era is divided into three time periods: Triassic, Jurassic and Cretaceous.

- The Cenozoic Era is divided into Tertiary and Quaternary periods.
- So, option A (Triassic, Jurassic, Cretaceous) is the correct answer.

- 3) 'Agenda 21' was adopted in
- A) Kyoto Protocol
 - B) Summit on Sustainable Development
 - C) Earth Summit
 - D) Basel Convention

Answer: C) Earth Summit

Solution:

- Agenda 21 was adopted in Earth summit held in Rio de Janeiro, Brazil, 3 to 14 June 1992.
- The United Nations Conference on Environment and Development (UNCED) is also known as the 'Earth Summit'.
- It is a comprehensive plan of action to be taken globally, nationally, and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment.

- 4) Disease caused by mercury poisoning is
- A) Itai-itai disease
 - B) Osteosclerosis
 - C) Bright's disease
 - D) Minamata disease

Answer: D) Minamata disease

Solution:

- Minamata disease is a neurological disease caused by severe mercury poisoning.
- Mercury gets changed to water soluble dimethyl mercury which undergoes biomagnifications.

- Minamata disease was first reported in 1952 due to eating of fish captured from Hg-contaminated Minamata Bay of Japan.
- Disease is characterized by diarrhoea, haemolysis, impairment of various senses, numbness of lips, tongue, limbs, deafness, blurring of vision, mental derangement, meningitis, and death.
- Itai-itai disease was caused by cadmium poisoning due to mining in Toyama Prefecture.
- Osteosclerosis is an abnormal increase in the density of bone tissue.
- Bright's disease (glomerulonephritis) is a condition that causes inflammation in the kidneys.

- 5) The insulin hormone of pancreas is secreted by
- A) Alpha cells
 - B) Beta cells
 - C) Delta cells
 - D) Gamma cells

Answer: B) Beta cells

Solution:

- The endocrine pancreas consists of Islets of Langerhans.
- Islets of Langerhans are irregularly shaped patches of endocrine tissue located within the pancreas.
- Islets of Langerhans consist of four types of cells:
 - (1) α cells (Alpha cells or A cells) which secrete glucagon.
 - (2) β cells (Beta cells or B cells) which secrete insulin.
 - (3) δ cells (Delta cells or D cells) which secrete somatostatin.
 - (4) F cells (PP cells) which secrete pancreatic polypeptide.
- So, option B is the correct answer. The insulin hormone of pancreas is secreted by beta cells.

- 6) Interaction which is harmful to one partner and neutral to the other is
- A) Ammensalism
 - B) Commensalism

- C) Mutualism
- D) Predation

Answer: A) Ammensalism

Solution:

- Ammensalism is a type of biological interaction where one species causes harm to another organism without any cost or benefits to itself. i.e., harmful to one partner and neutral to the other.
- Commensalism is an interaction between two organisms in which one benefits and the other derives neither benefit nor harm. i.e., beneficial to one partner and neutral to the other.
- Mutualism is an interaction beneficial to both partners.
- Predation is an interaction beneficial to one partner and harmful to the other. The predator is benefited, and the prey is harmed.
- So, option A (Ammensalism) is the correct answer.

7) Heterochromatin is

- A) Loosely packed and transcriptionally active
- B) Densely packed and transcriptionally inactive
- C) Loosely packed and transcriptionally inactive
- D) Densely packed and transcriptionally active

Answer: B) Densely packed and transcriptionally inactive

Solution:

- There are two forms of chromatin: euchromatin and heterochromatin.
- Heterochromatin is densely packed and deeply stained region of chromatin.
- Heterochromatin is highly condensed and typically cannot be transcribed (transcriptionally inactive).
- Loosely packed and lightly stained region of chromatin are called as euchromatin.
- Euchromatin is less condensed and can be transcribed (transcriptionally active).
- So, option B is the correct answer. Heterochromatin is densely packed and transcriptionally inactive.

- 8) The enzyme that converts fumarate to malate in Krebs cycle is
- A) Aconitase
 - B) Malate dehydrogenase
 - C) Fumarase
 - D) Fumarate reductase

Answer: C) Fumarase

Solution:

- Citric acid cycle is also known as Krebs cycle or TCA (tricarboxylic acid) cycle.
- The seventh step of citric acid cycle is the hydration of fumarate to malate.
- The enzyme fumarase catalyses the hydration of fumarate to malate.
- Aconitase catalyses the isomerization of citrate to isocitrate.
- Malate dehydrogenase catalyses the oxidation of malate to oxaloacetate.
- Fumarate reductase is the enzyme that converts fumarate to succinate and is important in microbial metabolism as a part of anaerobic respiration.

- 9) Urea cycle is also known as
- A) Krebs-Henseleit cycle
 - B) Lactic acid cycle
 - C) Krebs Cycle
 - D) Citric acid cycle

Answer: A) Krebs-Henseleit cycle

Solution:

- The urea cycle is a cycle of biochemical reactions that produces urea from ammonia, formed during protein metabolism.
- Urea cycle was the first metabolic cycle discovered and was elucidated by Hans Krebs and Henseleit (1932), hence it is also known as Krebs-Henseleit cycle.
- The Cori cycle is also known as the lactic acid cycle.

- The TCA (tricarboxylic acid) cycle is also known as the Krebs Cycle (named for its discoverer, Hans Adolf Krebs) and the citric acid cycle.

- 10) Colorimeter was invented by
- A) Rene Laennec
 - B) Johann Heinrich Lambert
 - C) August Beer
 - D) Louis Jules Duboscq

Answer: D) Louis Jules Duboscq

Solution:

- Colorimeter is a device that measures the absorbance of particular wavelengths of light by a specific solution.
- This device is most commonly used to determine the concentration of a known solute in a given solution with the help of Beer-Lambert law.
- The colorimeter was invented in the year 1870 by Louis Jules Duboscq.
- So, option D (Louis Jules Duboscq) is the correct answer.

- 11) Allopatric speciation is also known as
- A) Reproductive speciation
 - B) Geographic speciation
 - C) Polypatric speciation
 - D) None of the above

Answer: B) Geographic speciation

Solution:

- Allopatric speciation is the speciation that occurs when biological populations of the same species become isolated due to geographical barriers.
- The first stage of allopatric speciation begins as a result of geographic separation between populations.

- Since geographical isolation plays an important part in this process, it is also known as geographic speciation.

- 12) Number of linkage group is equal to
- A) Number of X chromosome
 - B) Number of Y chromosome
 - C) Number of barr bodies
 - D) Haploid number of chromosomes

Answer: D) Haploid number of chromosomes

Solution:

- The genes present on the same chromosome and inherited together are called linkage group.
- The number of linkage groups of an organism corresponds to its haploid number of chromosomes.
- The number of linkage groups in an organism = Haploid number of chromosomes of that organism.
- So, option D (Haploid number of chromosomes) is the correct answer.

- 13) Pulmonary vein carries
- A) Oxygenated blood from lungs to left atrium
 - B) Deoxygenated blood from right ventricle to lungs
 - C) Oxygenated blood from lungs to right atrium
 - D) Deoxygenated blood from left ventricle to lungs

Answer: A) Oxygenated blood from lungs to left atrium

Solution:

- Pulmonary vein carries oxygenated blood from lungs to left atrium of the heart.
- Deoxygenated blood is pumped from right ventricle to lungs through pulmonary artery.
- Exchange of gases occurs between blood and alveoli of the lungs.
- Oxygenated blood returns to left atrium through pulmonary veins.
- So, option A is the correct answer.

- 14) If the heart rate is 72 beats/min, the duration of cardiac cycle is
- A) 0.8 second
 - B) 0.5 second
 - C) 0.12 second
 - D) 0.3 second

Answer: A) 0.8 second

Solution:

- The cardiac cycle is defined as a sequence of alternating contraction and relaxation of the atria and ventricles in order to pump blood throughout the body.
- Cardiac cycle consists of systole (contraction) and diastole (relaxation) of both the atria and ventricles.
- When the heart beats at a normal rate of 72 beats/minute, duration of each cardiac cycle is about 0.8 seconds.
- So, option A (0.8 second) is the correct answer.

- 15) Teichoic acid is present in the cell wall of
- A) Gram positive bacteria
 - B) Both Gram positive and Gram negative bacteria
 - C) Gram negative bacteria
 - D) Bacteriophage

Answer: A) Gram positive bacteria

Solution:

- Teichoic acid is an acidic polymer consisting of carbohydrate, phosphate, and alcohol.
- They are polymers of glycerol and ribitol joined by phosphate groups.
- Teichoic acid is found in cell walls of Gram positive bacteria.
- Teichoic acid is not present in Gram negative bacteria.
- So, option A is the correct answer.

16) Which of the following muscles are involuntary muscles?

- (i) Cardiac muscle
 - (ii) Smooth muscle
 - (iii) Skeletal muscle
- A) i only
 - B) i and ii
 - C) ii and iii
 - D) iii only

Answer: B) i and ii

Solution:

- Based on structure, contractile properties and control mechanisms, muscles are classified into three:
 - (1) Skeletal muscles - associated with the skeletal components of the body.
 - (2) Smooth muscles - located in the inner wall of hollow visceral organs.
 - (3) Cardiac muscles - muscles of heart.
- The activities of voluntary muscles are under the voluntary control of the nervous system. Skeletal muscles are voluntary muscles.
- The activities of involuntary muscles are not under the voluntary control of the nervous system. Cardiac muscles and smooth muscles are involuntary muscles.

17) Primary lymphoid organs are the organs where

- A) Immature lymphocytes mature and become committed to a particular antigenic specificity
- B) Immature lymphocytes mature and encounter antigen
- C) Immature lymphocytes reside and encounter antigen
- D) Mature lymphocytes interact with antigen

Answer: A) Immature lymphocytes mature and become committed to a particular antigenic specificity

Solution:

- Immature lymphocytes generated in hematopoiesis, mature and become committed to a particular antigenic specificity in primary lymphoid organs.
- Primary lymphoid organs (central lymphoid organs) are those organs in which the maturation of lymphocytes takes place. Thymus, bone marrow and bursa of Fabricius of birds are primary lymphoid organs.
- A lymphocyte becomes immunocompetent only after it has matured within a primary lymphoid organ.
- The organs in which mature lymphocytes reside and in which they counter antigen are called secondary lymphoid organs. Lymph nodes, spleen, mucosal associated lymphoid tissue (MALT) etc are secondary lymphoid organs.

18) An integral membrane protein is a type of membrane protein that is permanently attached to the biological membrane. Integral membrane proteins are

- A) Hydrophobic in nature
- B) Hydrophilic in nature
- C) Amphipathic in nature
- D) Monopathic in nature

Answer: C) Amphipathic in nature

Solution:

- Integral membrane proteins penetrate the plasma membrane. They are transmembrane proteins which has the ability to pass through the lipid bilayer.
- Integral membrane proteins are amphipathic, having both hydrophilic and hydrophobic portions.
- The region of integral membrane protein that reside within the lipid bilayer (transmembrane domain) is hydrophobic in nature.
- The portions of integral membrane proteins exposed to the cytoplasm or extracellular fluid tend to be hydrophilic.
- So, option C (Amphipathic in nature) is the correct answer.

- 19) Choose the incorrect statement regarding punctuated equilibrium model:
- A) The concept of punctuated equilibrium was proposed by Niles Eldredge and Stephen Gould
 - B) Prominent episodes of evolution in the history of life are associated with the splitting of lineages
 - C) Rates of evolution are rapidly accelerated by rapidly convergent speciation
 - D) Conspicuous or prominent evolutionary changes are concentrated in brief periods or punctuations

Answer: C) Rates of evolution are rapidly accelerated by rapidly convergent speciation

Solution:

- Statement C is incorrect regarding punctuated equilibrium model. According to punctuational hypothesis, rates of evolution are accelerated by rapidly divergent speciation.
- Statements A, B and D are correct.
- The concept of punctuated equilibrium was proposed by Niles Eldredge and Stephen Gould in 1972.
- Punctuated equilibrium model advocates that prominent episodes of evolution in the history of life are associated with the splitting of lineages.
- According to the model, most evolutionary changes have consisted of rapid bursts of speciation (punctuation) alternating with long periods in which the individual species remain virtually unmodified (equilibria).
- Conspicuous or prominent evolutionary changes are concentrated in brief periods (punctuation) when the lineages actually split.

- 20) Superficial blastula is the characteristic of
- A) Birds
 - B) Reptiles
 - C) Echinoderms
 - D) Insects

Answer: D) Insects

Solution:

- Periblastula (superficial blastula) is the characteristic type of blastula of insects.
- It consists of a layer of peripheral blastomeres surrounding a central large yolk mass.
- It results from meroblastic superficial cleavage of macrolecithal (large amount of yolk) and centrolecithal (yolk concentrated at the center of egg) eggs.

21) In negative phase contrast

- A) Background is darker and specimen appears brighter
- B) Background is brighter and specimen appears darker
- C) Background and specimen appears brighter
- D) Background and specimen appears darker

Answer: A) Background is darker and specimen appears brighter

Solution:

- Phase-contrast microscopy is an optical microscopy technique that converts phase shifts in the light passing through a transparent specimen to brightness changes in the image.
- To produce phase contrast, phase contrast microscope utilizes two devices: an annular diaphragm and a phase plate.
- Depending upon the configuration and properties of the phase ring, specimens can be observed either in positive or negative phase contrast.
- In positive phase contrast, background is brighter and the specimen appears darker.
- In negative phase contrast, background is darker and the specimen appears brighter.

22) Match the following:

(a) Ramsar convention	(i) Convention on persistent organic pollutants
(b) Stockholm Convention	(ii) Convention for the protection of ozone layer
(c) Vienna Convention	(iii) Convention on the control of transboundary movements of hazardous wastes
(d) Basel Convention	(iv) Convention on wetlands

- A) a-iv, b-ii, c-iii, d-i
- B) a-iv, b-i, c-ii, d-iii
- C) a-i, b-ii, c-iii, d-iv
- D) a-iv, b-ii, c-i, d-iii

Answer: B) a-iv, b-i, c-ii, d-iii

Solution:

- Ramsar convention is called the convention on wetlands.
It is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands.
- Stockholm convention is a convention on Persistent Organic Pollutants (POPs).
It is a global treaty that aims to protect human health and the environment from the effects of persistent organic pollutants (POPs).
- Vienna convention is related to the protection of ozone layer.
It is the first international agreement dedicated to the protection of the ozone layer.
- Basel convention is related to the control of transboundary movements of hazardous wastes and their disposal.
The Basel Convention regulates the transboundary movements of hazardous wastes and other wastes and obliges its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner.
- So, option B (a-iv, b-i, c-ii, d-iii) is the correct answer.

- 23) Diversity within a particular area or community or ecosystem which is usually expressed by the number of species in that ecosystem is
- A) Alpha diversity
 - B) Beta diversity
 - C) Gamma diversity
 - D) None of the above

Answer: A) Alpha diversity

Solution:

- Whittaker (1972) described three terms for measuring biodiversity over spatial scales: alpha, beta, and gamma diversity.
- Alpha diversity refers to the diversity within a particular area or community or ecosystem, and is usually expressed by the number of species (i.e., species richness) in that ecosystem.
- Beta diversity describes the species diversity between two communities or ecosystems. It measures the change in species diversity between two ecosystems.
- Gamma diversity is a measure of the overall diversity for the different ecosystems within a region.
- So, option A (Alpha diversity) is the correct answer.

- 24) Choose the option with in-situ conservation strategies only:
- A) Zoological parks, Museum, DNA bank
 - B) Biosphere reserves, National parks, Wildlife sanctuaries
 - C) National parks, Museum, Biosphere reserves
 - D) Zoological parks, Gene Bank, Biosphere reserves

Answer: B) Biosphere reserves, National parks, Wildlife sanctuaries

Solution:

- The process of protecting plant or animal species in its natural habitat is known as in-situ conservation.
- Biosphere reserves, national parks, wildlife sanctuaries etc are in-situ conservation strategies.
- The process of relocation of endangered or rare species from their natural habitats to protected areas equipped for their protection and preservation is known as ex-situ conservation.

- Zoological parks, botanical gardens, museum, Gene bank, DNA bank etc are ex-situ conservation strategies.
- So, option B (Biosphere reserves, National parks, Wildlife sanctuaries) is the correct answer.

- 25) Under normal conditions, oxygen-hemoglobin dissociation curve is:
- A) Hyperbolic
 - B) Sigmoid
 - C) Linear
 - D) Parabolic

Answer: B) Sigmoid

Solution:

- Oxygen-hemoglobin dissociation curve is also called oxyhemoglobin dissociation curve or oxygen dissociation curve.
- It is the curve that demonstrates the relationship between partial pressure of oxygen and the percentage saturation of hemoglobin with oxygen.
- It explains hemoglobin's affinity for oxygen.
- Under normal conditions, oxygen-hemoglobin dissociation curve is 'S' shaped or sigmoid.
- So, option B (Sigmoid) is the correct answer.

- 26) Counter current mechanism of urine formation occurs in
- A) Loop of Henle
 - B) Glomerulus
 - C) Bowman's capsule
 - D) Efferent arteriole

Answer: A) Loop of Henle

Solution:

- Counter current mechanism is used to concentrate urine.

- Loop of Henle functions as counter current multiplier and vasa recta functions as counter current exchanger.
- The flow of filtrate in the two limbs of Loop of Henle is in opposite direction (counter current pattern). The flow of blood through the two limbs of vasa recta is also in a counter current pattern.
- The transport of substances and subsequent concentration of urine is facilitated by the special arrangement of Loop of Henle and vasa recta.
- So, option A (Loop of Henle) is the correct answer.

- 27) Vitamin H is also known as
- A) Tocopherol
 - B) Biotin
 - C) Ascorbic acid
 - D) Niacin

Answer: B) Biotin

Solution:

- Biotin is also known as vitamin B7 or vitamin H.
- It is a water-soluble vitamin that serves as an essential cofactor for carboxylase enzymes in multiple metabolic pathways, that catalyse critical steps in the metabolism of fatty acids, glucose, and amino acids.
- Vitamin E is also known as tocopherol or alpha-tocopherol.
- Vitamin C is also known as ascorbic acid.
- Vitamin B3 is also known as niacin.

- 28) The enzyme that converts angiotensinogen to angiotensin I is
- A) Renin
 - B) ACE
 - C) ANP
 - D) ADH

Answer: A) Renin

Solution:

- Angiotensinogen is produced in the liver and is continuously circulating in the plasma.
- Renin acts to cleave angiotensinogen into angiotensin I.
- Angiotensin I is physiologically inactive and act as the precursor for angiotensin II.
- Angiotensin II causes increases in blood pressure, influences renal tubules to retain sodium and water, and stimulates aldosterone release from adrenal gland.
- So, option A (Renin) is the correct answer.

29) In uncompetitive inhibition:

- A) Inhibitors combine with enzyme only
- B) Inhibitors combine with enzyme substrate complex only
- C) Inhibitors may combine with both free enzyme and enzyme substrate complex
- D) Inhibitors do not combine with free enzyme and enzyme substrate complex

Answer: B) Inhibitors combine with enzyme substrate complex only

Solution:

- Reversible enzyme inhibition can be of three types: competitive inhibition, non-competitive inhibition and uncompetitive inhibition.
- In competitive inhibition, both substrate and inhibitor compete for the active site of the enzyme with formation of enzyme-inhibitor (EI) complex rather than enzyme-substrate-inhibitor (ESI) complex.
- In non-competitive inhibition, inhibitors may combine with both free enzyme and ES (enzyme substrate) complex producing inhibition.
- In uncompetitive inhibition, the inhibitors bind with enzyme substrate complex only and do not with the free enzyme.
- So, option B is the correct answer.

30) Bacterial resistance to antibiotics is an example of

- A) Microevolution
- B) Macroevolution

- C) Quantum evolution
- D) Megaevolution

Answer: A) Microevolution

Solution:

- Microevolution is the change in allele frequencies that occur over time within a population.
- It is a change in gene frequency within a population over time.
- Pesticide resistance, herbicide resistance, bacterial resistance to antibiotics, progressive replacement of light-coloured moths by dark coloured moths in industrial region of England (industrial melanism) etc are examples of microevolution.
- So, option A (Microevolution) is the correct answer.

- 31) Scintillation counter is used for:
- A) Measuring ionizing radiations
 - B) Measuring mass of molecule
 - C) Detecting chemical structure of molecule
 - D) Measuring sodium in a sample

Answer: A) Measuring ionizing radiations

Solution:

- A scintillation counter is an instrument that is used for measuring ionizing radiation.
- It is used to detect gamma rays and the presence of a particle.
- It can also measure the radiation in the scintillating medium, the energy loss, or the energy gain. The medium can either be gaseous, liquid, or solid.
- So, option A (Measuring ionizing radiations) is the correct answer.

- 32) Velvet worms or walking worms belongs to phylum:
- A) Coelenterata

- B) Onychophora
- C) Mollusca
- D) Echinodermata

Answer: B) Onychophora

Solution:

- Onychophora is a small phylum of animals often referred to as 'velvet worms' or 'walking worms'.
- They are terrestrial, bilaterally symmetrical and vermiform.
- The outer covering is a cuticle, which is wrinkled with small projections known as papillae.
- These papillae give onychophorans their velvet texture.

33) The relationship between mean, median and mode is

- A) $\text{Mode} = \text{median} - 2 \text{ mean}$
- B) $\text{Mode} = 2 \text{ median} - \text{mean}$
- C) $\text{Mode} = 2 \text{ median} - 3 \text{ mean}$
- D) $\text{Mode} = 3 \text{ median} - 2 \text{ mean}$

Answer: D) $\text{Mode} = 3 \text{ median} - 2 \text{ mean}$

Solution:

- A distribution in which the values of mean, median and mode coincide (i.e., $\text{mean} = \text{median} = \text{mode}$) is known as a symmetrical distribution.
- When values of mean, median and mode are not equal, the distribution is known as asymmetrical or skewed distribution.
- In moderately skewed or asymmetrical distribution, the relation between mean, median and mode that means the three measures of central tendency is given the formula: $\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$.
- So, option D ($3 \text{ median} - 2 \text{ mean}$) is the correct answer.

34) Technique used for the detection of specific DNA fragments

- A) Southern blotting

- B) Micro-injection
- C) Northern blotting
- D) Western blotting

Answer: A) Southern blotting

Solution:

- Southern blotting technique is used for the detection of specific DNA fragments.
- The technique of southern blotting was developed by Edwin Southern in 1975.
- Northern blotting is used for the detection of mRNA and western blotting is used for the detection of proteins.
- Microinjection is a technique mainly used to introduce DNA and other molecules into cells such as oocytes, eggs and the cells of early embryos.

35) Choose the correct match between vitamins and its deficiency diseases:

Vitamin	Deficiency disease
(a) Vitamin B1	(i) Cerebral folate deficiency
(b) Vitamin B12	(ii) Beriberi
(c) Vitamin B3	(iii) Pellagra
(d) Vitamin B9	(iv) Pernicious anaemia

- A) a-ii, b-iii, c-iv, d-i
- B) a-ii, b-iv, c-iii, d-i
- C) a-iv, b-ii, c-i, d-iii
- D) a-i, b-iv, c-iii, d-ii

Answer: B) a-ii, b-iv, c-iii, d-i

Solution:

- The deficiency of vitamin B1 (thiamine) causes beriberi.
- Vitamin B12 (cobalamin) deficiency causes pernicious anaemia.
- Deficiency of vitamin B3 (niacin) causes a condition known as pellagra.
- The deficiency of vitamin B9 (folate) causes cerebral folate deficiency.
- So, option B (a-ii, b-iv, c-iii, d-i) is the correct answer.

- 36) Morphogenetic movement that occurs only in the prospective ectodermal blastomeres during gastrulation to cover the entire embryo is
- A) Epiboly
 - B) Invagination
 - C) Delamination
 - D) Concrescence

Answer: A) Epiboly

Solution:

- All kinds of morphogenetic movements during gastrulation can be broadly classified into epiboly and emboly.
- **Epiboly:**
It is the morphogenetic movement that occurs only in the prospective ectodermal blastomeres during gastrulation to cover the entire embryo.
- **Emboly:**
Concerned with inward migration of prospective chordamesodermal and endodermal blastomeres from the external surface of the blastula and their extension along antero-posterior axis of the developing embryo. Embolic movements include invagination, involution, delamination, infiltration, ingression, concrescence, convergence, divergence and extension.

- 37) DDBJ is located in:
- A) National Institute of Genetics (NIG)
 - B) National Center for Biotechnology Information (NCBI)
 - C) European Bioinformatics Institute (EBI)
 - D) Swiss Institute of Bioinformatics (SIB)

Answer: A) National Institute of Genetics (NIG)

Solution:

- The DNA Data Bank of Japan (DDBJ) is a biological database that collects DNA sequences.
- It is located at the National Institute of Genetics (NIG) in the Shizuoka prefecture of Japan.
- DDBJ Center collects nucleotide sequence data as a member of INSDC (International Nucleotide Sequence Database Collaboration) and provides freely available nucleotide sequence data.

38) Philadelphia chromosome results from the reciprocal translocation between

- A) Chromosome 9 and chromosome 17
- B) Chromosome 9 and chromosome 14
- C) Chromosome 5 and chromosome 17
- D) Chromosome 9 and chromosome 22

Answer: D) Chromosome 9 and chromosome 22

Solution:

- The Philadelphia chromosome forms when chromosome 9 and chromosome 22 break and exchange portions.
- It results from the reciprocal translocation between chromosome numbers 9 and 22.
- Philadelphia chromosome is a genetic mutation that causes leukemia.
- So, option D (Chromosome 9 and chromosome 22) is the correct answer.

39) Glucose transporter expressed in muscles is

- A) GLUT 2
- B) GLUT 4
- C) GLUT 5
- D) GLUT 6

Answer: B) GLUT 4

Solution:

- The GLUTs transport glucose across the plasma membrane by means of a facilitated diffusion mechanism.
- Glucose transporter expressed in muscles is GLUT 4.
- GLUT4 exists in skeletal muscle cells, adipocytes, and cardiomyocytes.
- GLUT2 is expressed mainly in beta cells of the pancreas, liver and kidney.
- GLUT5 is primarily a fructose transporter located on cells of the small intestine, testes and kidney.
- GLUT6 is mainly expressed in brain and spleen cells and in peripheral leukocytes.

40) Formation of synaptonemal complex occurs during

- A) Zygotene
- B) Diplotene
- C) Leptotene
- D) Diakinesis

Answer: A) Zygotene

Solution:

- Prophase I is subdivided into five phases: Leptotene, Zygotene, Pachytene, Diplotene and Diakinesis.
- Zygotene is the second stage of prophase I.
- Synapsis or pairing of homologous chromosomes takes place during zygotene.
- Synapsis is accompanied by the formation of a complex structure called synaptonemal complex.
- So, formation of synaptonemal complex occurs during zygotene.

41) RT-PCR uses:

- A) mRNA as a template to form cDNA

- B) cDNA as a template to form ssRNA
- C) DNA as a template to form mRNA
- D) mRNA as template to form proteins

Answer: A) mRNA as a template to form cDNA

Solution:

- RT-PCR stands for Reverse Transcription Polymerase Chain Reaction.
- RT-PCR uses mRNA rather than DNA as the starting template.
- The enzyme reverse transcriptase uses the mRNA template to produce a complementary DNA strand called cDNA in a process known as reverse transcription.
- The cDNA serves later as a template for exponential amplification using PCR.
- So, option A (mRNA as a template to form cDNA) is the correct answer.

42) Choose the correct match:

(a) Down's syndrome	(i) Trisomy 18
(b) Edward's syndrome	(ii) Deletion of short arm of chromosome number 5
(c) Patau syndrome	(iii) Trisomy 21
(d) Cri-du-chat syndrome	(iv) Trisomy 13

- A) a-iv, b-ii, c-iii, d-i
- B) a-iii, b-i, c-ii, d-iv
- C) a-i, b-iii, c-ii, d-iv
- D) a-iii, b-i, c-iv, d-ii

Answer: D) a-iii, b-i, c-iv, d-ii

Solution:

- Down's syndrome is caused due to the autosomal trisomy of chromosome number 21 (trisomy 21).
- Edward's syndrome is due to the autosomal trisomy of chromosome number 18 (trisomy 18).
- Patau syndrome is caused due to the autosomal trisomy of chromosome number 13 (trisomy 13).
- Cri-du-chat syndrome is caused due to the deletion of short arm of chromosome number 5.
- So, option D (a-iii, b-i, c-iv, d-ii) is the correct answer.

- 43) Second quadrant of Ramachandran plot contains allowed regions for:
- A) Left-handed alpha helices and right-handed alpha helices
 - B) Parallel beta sheets and left-handed alpha helices
 - C) Right-handed alpha helices and collagen triple helices
 - D) Antiparallel beta sheets and collagen triple helices

Answer: D) Antiparallel beta sheets and collagen triple helices

Solution:

- The Ramachandran plot helps with determination of secondary structures of proteins.
- Quadrant I - this is where rare left-handed alpha helices lie.
- Quadrant II - region has the most favourable conformations of atoms. It shows the sterically allowed conformations for beta strands (parallel beta sheets and antiparallel beta sheets). Collagen triple helix allowed region is also present in this quadrant.
- Quadrant III - this is where right-handed alpha helices lie.
- Quadrant IV - this conformation (Ψ around -180 to 0 degrees, Φ around 0 to 180 degrees) is disfavoured due to steric clash.

- 44) Site of EMP pathway:
- A) Cytoplasm
 - B) Mitochondria
 - C) Lysosome
 - D) Endoplasmic reticulum

Answer: A) Cytoplasm

Solution:

- Glycolysis is also known as EMP pathway.
- The scheme of glycolysis was given by Gustav Embden, Otto Meyerhof and J. Parnas. So, glycolysis is also referred to as EMP (Embden-Meyerhof-Parnas) pathway.
- It is a series of reactions that extract energy from glucose by splitting it into two three-carbon compounds called pyruvic acid.
- Glycolysis occurs in the cytoplasm of the cell and is present in all living organisms.
- So, option A (Cytoplasm) is the correct answer.

45) A DNA microarray is

- A) Collection of microscopic DNA spots attached to a solid surface
- B) Solution of microscopic DNA suspended in a buffer
- C) Collection of cDNA and mRNA
- D) Collection of microscopic DNA loaded into pre-cast wells in the gel

Answer: A) Collection of microscopic DNA spots attached to a solid surface

Solution:

- A DNA microarray is a collection of microscopic DNA spots attached to a solid surface.
- It is commonly known as DNA chip or biochip.
- Each DNA spot contains picomoles (10 moles) of a specific DNA sequence, known as probes.
- So, option A is the correct answer.

46) Type IV hypersensitivity is mediated by

- A) IgM
- B) Complement system
- C) T-lymphocytes
- D) IgE

Answer: C) T-lymphocytes

Solution:

- The four types of hypersensitivity are:
 - (1) Type I Hypersensitivity: mediated by IgE antibodies.
 - (2) Type II Hypersensitivity: mediated by IgM and IgG antibodies. IgM and IgG bind to target cells and by the activation of the complement system destroy them.
 - (3) Type III Hypersensitivity: mediated by immune complexes.
 - (4) Type IV hypersensitivity (cell mediated hypersensitivity or delayed hypersensitivity): mediated by T-lymphocytes.

47) In thelytoky:

- A) Haploid egg develops into haploid embryo
- B) Haploid egg develops into diploid embryo
- C) Diploid egg develops into diploid embryo
- D) Diploid egg develops into haploid embryo

Answer: C) Diploid egg develops into diploid embryo

Solution:

- Thelytoky is also known as diploid parthenogenesis.
- In thelytoky, all ova produced are diploid and diploid eggs develop into diploid embryos without fertilization.
- The diploid condition of egg is maintained either by omitting the reduction division or by fusion of one of the polar bodies with haploid egg.
- In arrhenotoky (haploid parthenogenesis), haploid egg develops into haploid embryo without fertilization.
- So, option C (Diploid egg develops into diploid embryo) is the correct answer.

48) Which of the following provide myelination around the nerve fibers in central nervous system (CNS)?

- A) Astrocytes
- B) Schwann cells
- C) Oligodendrocytes
- D) Microglia

Answer: C) Oligodendrocytes

Solution:

- Astrocytes, oligodendrocytes and microglia are the three types of neuroglial cells in central nervous system (CNS).
- Oligodendrocytes produce myelin sheath around the nerve fibers in CNS where Schwann cells are absent.
- Schwann cells are neuroglial cells found in peripheral nervous system (PNS).
- Schwann cells provide myelination around the nerve fibers in PNS.

- 49) In scientific nomenclature, homonyms are
- A) Different scientific names used for a single taxon
 - B) Same scientific name used for two or more taxons
 - C) Scientific names in which same word is used for both genus and species
 - D) None of the above

Answer: B) Same scientific name used for two or more taxons

Solution:

- In scientific nomenclature, homonyms are same scientific name used for two or more taxons.
- The rule in the International Code of Zoological Nomenclature is that the first such name to be published is the senior homonym and is to be used; any others are junior homonyms and must be replaced with new names.
- Synonyms are different scientific names used for a single taxon.
- Tautonym is a scientific name in which the same word is used for both genus and species.
- So, option B is the correct answer.

- 50) Arboreal adaptations are seen in
- A) Fast running mammals
 - B) Tree dwelling mammals
 - C) Burrowing mammals
 - D) Flying mammals

Answer: B) Tree dwelling mammals

Solution:

- Arboreal adaptations are seen in tree dwelling mammals like squirrels and primates.
- Their adaptations are small and slender body, presence of powerful claws with which they cling to the branches, elongated feet and hand, presence of opposable toes, prehensile tail and the development of parachuting mechanism.
- Cursorial adaptations are seen in fast running mammals.
- Fossorial adaptations are seen in burrowing mammals.
- Volant adaptations are seen in flying mammals such as flying squirrels, flying lemurs etc.

- 51) Choose the correct match:

(a) Golden age of reptiles	(i) Cenozoic era
(b) Golden age of mammals	(ii) Paleozoic era
(c) Golden age of fishes	(iii) Mesozoic era

- A) a-i, b-ii, c-iii
- B) a-iii, b-ii, c-i
- C) a-ii, b-iii, c-i
- D) a-iii, b-i, c-ii

Answer: D) a-iii, b-i, c-ii

Solution:

- The Devonian period of Paleozoic era is known as the golden age of fishes. There are 6 periods in Paleozoic era: Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian.
- The mesozoic era is known as the golden age of reptiles. The Mesozoic era is divided into 3 periods: Triassic, Jurassic and Cretaceous.
- Cenozoic era is the golden age of mammals. The 3 periods of Cenozoic era are Paleogene, Neogene and Quaternary.
- So, option D (a-iii, b-i, c-ii) is the correct answer.

52) Annelids are best described as

- A) Diploblastic, acoelomate animals
- B) Triploblastic, pseudocoelomate animals
- C) Triploblastic, coelomate animals
- D) Diploblastic, coelomate animals

Answer: C) Triploblastic, coelomate animals

Solution:

- Annelids are animals belonging to the phylum of Annelida.
- They are triploblastic animals (Pertaining to a condition in which there are three primary germ layers, such as ectoderm, mesoderm and endoderm).
- They are coelomate animals (True coelom or body cavity is present).
- So, option C is the correct answer. Annelids are triploblastic, coelomate animals.

53) Which of the following cleaves the pri-miRNA to pre-miRNA?

- A) Drosha
- B) Dicer
- C) RISC
- D) Argonaute

Answer: A) Drosha

Solution:

- Drosha is a Class 2 ribonuclease III enzyme.
- Drosha cleaves primary microRNAs (pri-miRNAs) to yield precursor microRNA (pre-miRNA). It occurs in nucleus.
- The pre-miRNA is exported to the cytoplasm in an Exportin5/RanGTP-dependent manner.
- In the cytoplasm, pre-miRNA is cleaved by Dicer to produce mature miRNA.
- RISC (RNA induced silencing complex) is a multiprotein complex that incorporates one strand of a small interfering RNA (siRNA) or micro-RNA (miRNA).
- Argonaute is one of the proteins in RISC.
- RISC uses the siRNA or miRNA as a template for recognizing complementary mRNA. When it finds a complementary strand, Argonaute activates and cleaves the mRNA.

- 54) Backbone of peptidoglycan is composed of:
- A) N-acetylglucosamine and N-acetylmuramic acid
 - B) Glucose and N-acetylglucosamine
 - C) N-acetylglucosamine and N-acetylmannose
 - D) N-acetylmuramic acid and galactose

Answer: A) N-acetylglucosamine and N-acetylmuramic acid

Solution:

- The cell walls of bacteria are made up of peptidoglycan (also called murein).
- Peptidoglycan is composed of a peptide part (amino acids linked by peptide bond) and a glycan part (sugar part).
- The glycan part forms the backbone of peptidoglycan and is composed of alternating units of N-acetylglucosamine (NAG) and N-acetylmuramic acid (NAM) linked by β -1,4 linkages.

- 55) Choose the incorrect statement regarding facilitated diffusion:
- A) Requires special membrane proteins
 - B) Requires energy in the form of ATP
 - C) It is very specific
 - D) Cannot cause net transport of molecules from a low to high concentration

Answer: B) Requires energy in the form of ATP

Solution:

- Statement B is incorrect.
- In facilitated diffusion, no energy expenditure takes place.
- Statements A, C and D are correct.
- In facilitated diffusion special membrane proteins help to move substances across membrane without expenditure of ATP energy.
- Facilitated diffusion is very specific.
- As the net transport of molecules from low to high concentration requires energy, facilitated diffusion cannot cause net transport of molecules from a low to high concentration.

- 56) Shuttle vectors:
- A) Can propagate in two different host species
 - B) Can be used in eukaryotes only
 - C) Cannot propagate in-vitro
 - D) Can be used in prokaryotes only

Answer: A) Can propagate in two different host species

Solution:

- A shuttle vector is a vector that can propagate in two different host species.
- Shuttle vectors can be used in both eukaryotes and prokaryotes.
- Shuttle vectors are frequently used to quickly make multiple copies of the gene in *E. coli* (amplification). They can also be used for in vitro experiments and modifications such as mutagenesis and PCR.
- One of the most common types of shuttle vectors is the yeast shuttle vector that contains components allowing for the replication and selection in both *E. coli* cells and yeast cells.

- 57) In lac operon, the binding of CAP-cAMP complex to CAP binding site
- A) Increases transcription
 - B) Stops transcription
 - C) Decreases transcription
 - D) Has no effect on transcription

Answer: A) Increases transcription

Solution:

- In the absence of glucose, cAMP levels inside the cell increase and it binds to CAP (catabolite activator protein), to form CAP-cAMP complex. This complex is capable of binding to the CAP binding site near the lac promoter.
Binding of CAP-cAMP complex causes a bend in the DNA that enhances the ability of RNA polymerase to bind to the promoter.
In this way, the rate of transcription is increased.
- When glucose is present, it inhibits the activity of adenylyl cyclase (enzyme that catalyzes the conversion of ATP to cAMP), causing a decline in the level of cAMP in the cell.
CAP cannot form the CAP-cAMP complex thereby diminishing transcription.
- So, option A is the correct answer. The binding of CAP-cAMP complex to CAP binding site increases transcription.

- 58) Gene that triggers X- chromosome inactivation in dosage compensation:
- A) Xist
 - B) XIC
 - C) XX
 - D) Yist

Answer: A) Xist

Solution:

- Dosage compensation is the process by which organisms equalize the expression of genes between members of different biological sexes.
- Xist is X-inactive specific transcript.
- It is a non-coding RNA on the X chromosome of the placental mammals that acts as a major effector of the X-inactivation process.
- It is a component of the Xic – X-chromosome inactivation centre – along with two other RNA genes (Jpx and Ftx) and two protein genes (Tsx and Cnbp2).

59) Theory of imprinting was given by:

- A) Jane Goodall
- B) Konrad Lorenz
- C) Karl von Frisch
- D) Ivan Pavlov

Answer: B) Konrad Lorenz

Solution:

- Konrad Zacharias Lorenz was an Austrian zoologist, ethologist, and ornithologist.
- Konrad Lorenz developed the theory of imprinting or childhood learning during the critical period.
- Imprinting is a kind of learning that occurs very early in life and provides the basis for the animal's attachment to its mother.
- So, option B (Konrad Lorenz) is the correct answer.

60) Hugo de Vries proposed

- A) Mutation theory
- B) Use and disuse theory
- C) Germplasm theory
- D) Theory of pangenesis

Answer: A) Mutation theory

Solution:

- Hugo de Vries was the first to propose the mutation theory to explain the evolution of new species.
- He postulated this theory based on his careful observations of an ornamental plant called evening primrose, *Oenothera lamarckiana*.
- The theory of use and disuse was proposed by Lamarck.
- Germplasm theory was proposed by August Weismann.
- Theory of pangenesis was proposed by Darwin to explain the mechanism of heredity and variation.

61) The inactive precursor of an enzyme:

- A) Ribozyme
- B) Isozyme
- C) Zymogen
- D) Inactive protein

Answer: C) Zymogen

Solution:

- The inactive precursor of the enzyme is called as zymogen.
- Another term used for zymogens is proenzyme.
- Zymogen is cleaved to form the active enzyme.
- A zymogen requires a biochemical change such as a hydrolysis reaction revealing the active site, or changing the configuration to reveal the active site for it to become an active enzyme.
- Ribozymes are autocatalytic RNA molecules with sequence specific cleavage activity.
- Isoenzymes or isozymes are the molecular variants or the polymorphic forms of an enzyme.

62) Deficiency of blood clotting factor XI causes:

- A) Purpura
- B) Haemophilia B
- C) Haemophilia A
- D) Haemophilia C

Answer: D) Haemophilia C

Solution:

- Individuals affected with haemophilia are not able to produce certain essential blood clotting factors.
- Haemophilia is classified into three types based on the deficiency of factor involved.
- Deficiency of blood clotting factor XI causes Haemophilia C.
- Haemophilia B is caused by the deficiency of factor IX.
- Haemophilia A is caused by the deficiency of factor VIII.

- 63) The theory of abiogenesis stated that
- A) Life originated from biotic sources spontaneously
 - B) Life arose from living forms only
 - C) Life originated from abiotic sources
 - D) Life can arise from both living and non-living forms

Answer: C) Life originated from abiotic sources

Solution:

- Theory of abiogenesis is also known as theory of spontaneous generation.
- According to this theory, organisms arose de novo (from nowhere) or from abiotic sources.
- Life originated from abiotic sources spontaneously.
- Aristotle, Epicurus, Thales, Anaximander, Plato, Paracelsus and Anaxagoras believed in abiogenesis.

- 64) Hematopoietic stem cells are
- A) Pluripotent
 - B) Totipotent
 - C) Multipotent
 - D) Unipotent

Answer: C) Multipotent

Solution:

- Multipotent cells can develop into more than one cell type, but are more limited than pluripotent cells.
- HSCs (Hematopoietic stem cells) are a type of multipotent adult stem cell.
- They are characterized by their ability to self-renew and differentiate into erythrocyte (red blood cell) and leukocyte (white blood cell) cell lineages.
- Pluripotent cells can give rise to all of the cell types that make up the body. Embryonic stem cells are pluripotent.
- Totipotent cells can differentiate into embryonic and extraembryonic cell types. Cells produced by the first few divisions of the fertilized egg are totipotent.
- Unipotent cells can produce only one cell type but have the property of self-renewal. Eg: germ line stem cell.

65) Type of wave detected by EEG during mental tension:

- A) Alpha
- B) Beta
- C) Delta
- D) Theta

Answer: B) Beta

Solution:

- There are four basic EEG frequency patterns: Beta, Alpha, Theta and Delta.
- Alpha waves are obtained in inattentive brain or mind as in light sleep or narcosis with closed eyes.
- Beta waves are desynchronized waves recorded during mental tension, mental activity or arousal state.
- Delta waves are recorded during deep sleep in adults.
- Theta waves are obtained generally in children below 5 years of age.

66) The small subunit of prokaryotic ribosome contains:

- A) 16S rRNA
- B) 5S rRNA, 23S rRNA
- C) 28S rRNA, 5S rRNA, 5.8S rRNA
- D) 5S rRNA, 23S rRNA

Answer: A) 16S rRNA

Solution:

- Prokaryotes have 70S ribosomes.
- Prokaryotic ribosome is made up of two subunits: 50S (large subunit) and 30S (small subunit).
- The large subunit (50S) is composed of a 5S rRNA subunit, 23S rRNA subunit and approximately 31 proteins.
- The small subunit is composed of 16S rRNA and 21 proteins.
- Eukaryotes have 80S ribosomes: 60S (large subunit) and 40S (small subunit).
- The large subunit (60S) is composed of 28S rRNA, 5S rRNA, 5.8S rRNA and approximately 49 proteins. The small subunit (40S) is composed of 18S rRNA and approximately 33 proteins.
- So, option A (16S rRNA) is the correct answer.

67) Site of beta oxidation in eukaryotes:

- A) RER
- B) Cytosol
- C) Mitochondria
- D) Ribosome

Answer: C) Mitochondria

Solution:

- Beta-oxidation is the catabolic process by which fatty acid molecules are broken down to generate acetyl-CoA, which enters the citric acid cycle, and NADH and FADH₂, which are co-enzymes used in the electron transport chain.
- Fatty acid breakdown brings about the oxidation of long chain fatty acids (oxidation takes place at beta carbon atom).
- It occurs in the cytosol of prokaryotes and in the mitochondrial matrix of eukaryotes.

- So, option C (Mitochondria) is the correct answer.

- 68) Teichoic acid is present in:
- A) Cell walls of Gram positive bacteria and Gram negative bacteria
 - B) Cell walls of Gram positive bacteria
 - C) Cell walls of Gram negative bacteria
 - D) Cell walls of Gram negative bacteria and bacteriophages

Answer: B) Cell walls of Gram positive bacteria

Solution:

- Teichoic acid is an acidic polymer consisting of carbohydrate, phosphate and alcohol.
- They are polymers of glycerol and ribitol joined by phosphate groups.
- Teichoic acid is found in cell walls of Gram positive bacteria.
- Teichoic acid is not present in Gram negative bacteria.

- 69) Class II MHC molecules present processed antigenic peptides to:
- A) CD4+ T helper cells
 - B) CD8+ T cytotoxic cells
 - C) Both A and B
 - D) T suppressor cells

Answer: A) CD4+ T helper cells

Solution:

- Class II MHC (Major histocompatibility complex) molecules are expressed primarily on antigen-presenting cells (macrophages, dendritic cells and B cells).
- They present processed antigenic peptides to CD4+ T helper cells.
- Class I MHC molecules present antigenic peptides to CD8+ T cytotoxic cells.

- 70) Which of the following are secondary pollutants?
- A) Sulphur dioxide and PAN
 - B) Carbon dioxide and carbon monoxide
 - C) PAN and ozone
 - D) Carbon monoxide and ozone

Answer: C) PAN and ozone

Solution:

- A primary pollutant is an air pollutant emitted directly from a source.
- A secondary pollutant is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere.
- Sulphur dioxide (SO₂), carbon dioxide (CO₂) and carbon monoxide (CO) are primary pollutants.
- Ozone (O₃) and PAN (peroxyacetyl nitrate) are secondary pollutants.
- Ozone is formed when hydrocarbons (HC) and nitrogen oxides (NO_x) combine in the presence of sunlight.
- PAN is a component of photochemical smog, produced in the atmosphere when oxidized volatile organic compounds combine with nitrogen dioxide.

- 71) The number of linkage groups in humans is:
- A) 22
 - B) 23
 - C) 44
 - D) 46

Answer: B) 23

Solution:

- The genes present on the same chromosome and inherited together are called linkage group.
- The number of linkage groups of an organism corresponds to its haploid number of chromosomes.
- The number of linkage groups in an organism = Haploid number of chromosomes of that organism.

- The haploid chromosome number in humans is 23.
- So, option B (23) is the correct answer.

- 72) Which of the following does not come under superclass tetrapoda?
- A) Amphibia
 - B) Osteichthyes
 - C) Aves
 - D) Mammalia

Answer: B) Osteichthyes

Solution:

- The superclass Tetrapoda of subphylum Vertebrata includes vertebrates with two pairs of limbs (a pair of forelimbs and a pair of hindlimb).
- The four classes coming under this superclass are Amphibia, Reptilia, Aves and Mammalia.
- Osteichthyes are commonly called as bony fishes. The class Osteichthyes comes under the superclass Pisces.

- 73) The water (prevention and control of pollution) act was enacted in:
- A) 1974
 - B) 1977
 - C) 1986
 - D) 1981

Answer: A) 1974

Solution:

- The water (prevention and control of pollution) act was enacted in 1974.
- It was enacted for the prevention and control of water pollution.
- This act provides for establishing, functioning and powers and duties of Central and State pollution boards in great detail.
- The water (prevention and control of pollution) act was amended in 1988.

- The water (prevention and control of pollution) Cess act was enacted in 1977.

- 74) Pheromone used in recruitment of worker honeybees is:
- A) Nasonov pheromone
 - B) Bombykol
 - C) Drone Mandibular Pheromone
 - D) None of the above

Answer: A) Nasonov pheromone

Solution:

- Nasonov's gland produces a pheromone (Nasonov pheromone) used in recruitment of worker honeybees.
- Nasonov pheromone (also called the 'come hither' scent) is released by worker bees to orient returning forager bees back to the colony.
- Bombykol is released by the female silkworm moth to attract mates. It is released from the pheromone gland located between the eighth and ninth abdominal segments.
- Drone Mandibular Pheromone attracts other flying drones to suitable sites for mating with virgin queens.
- So, option A (Nasonov pheromone) is the correct answer.

- 75) Choose the correct statement regarding chemical sequencing method:
- A) It is also known as Sanger sequencing
 - B) A primer that corresponds to one end of the sequence is added
 - C) It is widely used because of its methodical simplicity
 - D) It involves the radioactive labelling of the 5'-P ends of DNA

Answer: D) It involves the radioactive labelling of the 5'-P ends of DNA

Solution:

- Statements A, B and C are incorrect.

- Maxam-Gilbert method is known as chemical sequencing method. Sanger sequencing is also known as chain termination method.
- No primer is added in Maxam-Gilbert method. Addition of primer is involved in Sanger sequencing.
- Chemical sequencing method is no longer in widespread use because of its methodical complication, widespread application of dangerous elements and difficulties with scale-up.

76) Which of the following complex of electron transport chain is not a proton pump?

- A) NADH dehydrogenase
- B) Cytochrome bc1 complex
- C) Cytochrome c oxidase
- D) Succinate dehydrogenase

Answer: D) Succinate dehydrogenase

Solution:

- The four protein complexes of electron transport chain which are involved in moving the electrons from NADH and FADH₂ to molecular oxygen are:
 - (i) Complex I (NADH dehydrogenase)
 - (ii) Complex II (succinate dehydrogenase)
 - (iii) Complex III (cytochrome bc1 complex)
 - (iv) Complex IV (cytochrome c oxidase)
- Complex II (succinate dehydrogenase) does not pump protons.
- Complex I pumps four protons from the mitochondrial matrix into intermembrane space for every electron pair passing through the complex.
- Four protons per electron pair are pumped out of the matrix by complex III using a mechanism called Q cycle.
- Complex IV pumps two protons out of the matrix per electron pair.

77) Insect pest causing damage to paddy is:

- A) *Dicladispa armigera*

- B) *Tribolium castaneum*
- C) *Rhynchophorus ferrugineus*
- D) *Opisina arenosella*

Answer: A) *Dicladispa armigera*

Solution:

- *Dicladispa armigera* is commonly called the rice hispa.
- Its adults and grubs are destructive to paddy plants.
- *Tribolium castaneum* (red flour beetle) is a pest of stored grains.
- *Rhynchophorus ferrugineus* (red palm weevil) and *Opisina arenosella* (black-headed coconut caterpillar) are pests of coconut.

- 78) The concept of punctuated equilibrium was proposed by:
- A) Richard Dawkins and Bernhard Rensch
 - B) Sewall Wright and Ledyard Stebbins
 - C) Ernst Mayr and Richard Goldschmidt
 - D) Niles Eldredge and Stephen Gould

Answer: D) Niles Eldredge and Stephen Gould

Solution:

- The concept of punctuated equilibrium was proposed by Niles Eldredge and Stephen Gould in 1972.
- According to the hypothesis, most evolutionary changes have consisted of rapid bursts of speciation alternating with long periods in which the individual species remain virtually unmodified.
- Conspicuous or prominent evolutionary changes are concentrated in brief periods (punctuation) when the lineages actually split.
- Most lineages display limited morphological changes for long interval of geological time as to remain in stasis (equilibria).

- 79) The intermediate developmental stages in the ecological succession is called

- A) Sere
- B) Ecesis
- C) Climax
- D) Nudation

Answer: A) Sere

Solution:

- A seral community (or sere) is an intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.
- In ecological succession, the first community to begin with is called pioneer community.
- The intermediate stages that are replaced one after another are called seral stages.
- The final stable community in ecological succession is called as climax community.
- Ecesis is the successful establishment of a plant or animal species in a new habitat.
- Nudation is the development of a bare site uninhabited by any organisms.
- So, option A (Sere) is the correct answer.

- 80) In anion exchange chromatography, the stationary phase is
- A) Negatively charged
 - B) Positively charged
 - C) Zwitter ionic
 - D) Neutral in charge

Answer: B) Positively charged

Solution:

- Anion-exchange chromatography is a process that separates substances based on their charges using an ion-exchange resin containing positively charged groups, such as diethyl-aminoethyl groups (DEAE).
- In anion-exchange chromatography, the stationary phase is positively charged. It will attract negatively charged anions.
- It uses a positively charged ion exchange resin with an affinity for molecules having net negative surface charges.
- So, option B (Positively charged) is the correct answer.

- 81) Kinesins are (+) end-directed microtubule associated motor proteins. One exception is:
- A) Kinesin-14
 - B) Kinesin-1
 - C) Kinesin-2
 - D) Kinesin-5

Answer: A) Kinesin-14

Solution:

- Dynein and kinesin are microtubule associated motor proteins. Both are ATP-dependent motor proteins.
- Dynein is (-) end-directed motor protein. i.e., dynein move towards negative end.
- Kinesin is (+) end-directed motor protein. i.e., kinesin move towards plus end. One exception is kinesin-14.
- Kinesin-14 motors are specific minus-end-directed motors. Kinesin-14 move toward the (-) end of the microtubule.

- 82) 5S rRNA is synthesized by
- A) RNA Polymerase I
 - B) RNA polymerase II
 - C) RNA polymerase III
 - D) RNA polymerase V

Answer: C) RNA polymerase III

Solution:

- In eukaryotes, there are 5 types of RNA polymerases: RNA Polymerase I, II, III, IV and V.
- RNA Polymerase IV and V are found only in plants.
 - (1) RNA Polymerase I- found in all eukaryotes - transcribes rRNA except 5S rRNA.
 - (2) RNA Polymerase II - found in all eukaryotes- transcribes mRNA,

siRNA, snRNA except U6snRNA, miRNA.

(3) RNA Polymerase III - found in all eukaryotes - transcribes tRNA, 5S rRNA, U6snRNA.

(4) RNA Polymerase IV - found only in plants - transcribes siRNA in plants.

(5) RNA Polymerase V - found only in plants - transcribes RNA molecules participating heterochromatin formation.

- 83) Domains according to three domain system introduced by Carl Woese are
- A) Archaea, Bacteria and Eukarya
 - B) Archaea, Prokarya and Eukarya
 - C) Archaea, Bacteria and Fungi
 - D) Archaea, Fungi and Eukarya

Answer: A) Archaea, Bacteria and Eukarya

Solution:

- Three domain system of classification was proposed by Carl Woese, Otto Kandler and Mark Wheelis.
- The classification divided life forms into three domains: Archaea, Bacteria and Eukarya.
- The prokaryotes were divided into two groups: Archaea and Bacteria.
- The domain Eukarya contains eukaryotic organisms. It includes the kingdoms Protista, Fungi, Plantae and Animalia.

- 84) Analogous organs arise due to:
- A) Divergent evolution
 - B) Genetic shift
 - C) Artificial selection
 - D) Convergent evolution

Answer: D) Convergent evolution

Solution:

- The organs which have similar functions but are different in their structural details and origin are called analogous organs.
- The analogous structures are the results of convergent evolution.
- For example, the wings of an insect are analogous to wings of a bird. They are not anatomically similar structures though they perform similar functions.

85) Which of the following is a denitrifying bacteria?

- A) *Pseudomonas*
- B) *Nitrosomonas*
- C) *Nitrobacter*
- D) *Azotobacter*

Answer: A) *Pseudomonas*

Solution:

- Denitrifying bacteria are microorganisms that convert nitrates in soil into free atmospheric nitrogen.
- *Micrococcus denitrificans*, *Thiobacillus denitrificans*, *Paracoccus denitrificans*, *Pseudomonas aeruginosa* etc are examples of denitrifying bacteria.
- *Nitrosomonas* and *Nitrobacter* are nitrifying bacteria. They convert ammonia to nitrite and then to nitrate.
- *Azotobacter* is an aerobic, non-symbiotic, free-living nitrogen fixing bacteria.
- so, option A (*Pseudomonas*) is the correct answer.

86) Classical conditioning is also known as:

- A) Pavlovian conditioning
- B) Instrumental learning
- C) Operant conditioning
- D) Latent learning

Answer: A) Pavlovian conditioning

Solution:

- Classical conditioning is also called Pavlovian or respondent conditioning.
- Classical conditioning is a behavioural procedure in which a biologically potent stimulus (e.g., food) is paired with a previously neutral stimulus (e.g., a bell).
- Classical conditioning got its name from the fact that it is a kind of learning that was demonstrated in the early 'classical' experiments of Ivan Petrovich Pavlov.
- Operant conditioning is also known as instrumental conditioning or instrumental learning.
- Latent learning is a phenomenon where learning occurs without any obvious reinforcement or reward.

87) The excretory organs of Molluscs are:

- A) Green glands
- B) Metanephridia
- C) Flame cells
- D) Malpighian tubules

Answer: B) Metanephridia

Solution:

- The excretory organs of Molluscs are metanephridia.
- A metanephridium is a type of excretory gland found in many types of invertebrates such as annelids, arthropods and molluscs.
- Antennal glands or green glands perform the excretory function in crustaceans like prawns.
- Flame cells are excretory structures in flatworms.
- Malpighian tubules are excretory organs of insects.

88) Leukocytes:

- A) Possess hemoglobin and lacks nucleus
- B) Possess hemoglobin and nucleus

- C) Lacks hemoglobin and nucleus
- D) Possess nucleus and lacks hemoglobin

Answer: D) Possess nucleus and lacks hemoglobin

Solution:

- White blood cells (WBCs) or leukocytes are the colourless and nucleated formed elements of blood.
- It lacks hemoglobin.
- Hemoglobin is the protein that carries oxygen and exists within each red blood cell (erythrocytes)
- WBCs are classified into two as granulocytes and agranulocytes.
- Neutrophils, basophils and eosinophils are granulocytes. Monocytes and lymphocytes are agranulocytes.
- So, option D is the correct answer. Leukocytes possess nucleus and lacks hemoglobin.

- 89) Bence-Jones proteins are
- A) Light chains of immunoglobulins
 - B) Neurotransmitters
 - C) Heavy chain of immunoglobulins
 - D) Channel proteins

Answer: A) Light chains of immunoglobulins

Solution:

- Bence-Jones protein is a monoclonal globulin protein or immunoglobulin light chain.
- The proteins are immunoglobulin light chains (paraproteins) and are produced by neoplastic plasma cells.
- It is found in the urine of most people with multiple myeloma.
- Bence-Jones protein urine test is one of several tests used to diagnose a type of blood cancer known as multiple myeloma.

- 90) Larvae of echinoderms
- A) Bipinnaria
 - B) Trocophore
 - C) Mysis
 - D) Nauplius

Answer: A) Bipinnaria

Solution:

- Bipinnaria larva is characteristic of the class Asteroidea in the phylum Echinodermata.
- It possesses pre-oral and post-oral ciliated bands.
- It is a free-swimming larva and the anterior end of the archenteron develops as mouth and blastopore becomes the anus.
- Trocophore larvae is found in phylum Mollusca.
- Mysis and nauplius are the larval stages found in phylum Arthropoda.

- 91) The transition area between two biological communities is known as
- A) Ecotone
 - B) Niche
 - C) Pioneer community
 - D) Ecotype

Answer: A) Ecotone

Solution:

- An ecotone is the transition area between two biological communities.
- Ecotone is the zone where two communities meet and integrate.
- An ecological niche is the role and position a species has in its environment.
- The first biotic community to emerge in a bare area is called as pioneer community.
- An ecotype is a population (subspecies or race) that is adapted to local environmental conditions.

- 92) Gonadotropins are:
- A) LH and FSH
 - B) MSH and ACTH
 - C) GH and TSH
 - D) PTH and ADH

Answer: A) LH and FSH

Solution:

- Gonadotropins are hormones secreted from anterior pituitary and they stimulate gonadal activity.
- Luteinizing hormone (LH) and follicle stimulating hormone (FSH) are the main gonadotropins.
- Melanocyte stimulating hormone (MSH), adrenocorticotrophic hormone (ACTH), growth hormone (GH) and thyroid stimulating hormone (TSH) are also secreted from anterior pituitary. MSH acts on melanocytes, ACTH acts on adrenal cortex, GH stimulates growth and TSH acts on thyroid gland.
- Parathyroid hormone (PTH) is secreted from parathyroid gland and it increases the calcium level in the blood.
- Vasopressin (anti-diuretic hormone or ADH) is produced in hypothalamus, stored and secreted by posterior pituitary. ADH acts on kidneys.

- 93) Primary spermatocyte of human contains:
- A) 22 autosomes and 2 sex chromosomes
 - B) 22 pairs of autosomes and X or Y chromosome
 - C) 22 autosomes and X or Y chromosome
 - D) 22 pairs of autosomes and 2 sex chromosomes

Answer: D) 22 pairs of autosomes and 2 sex chromosomes

Solution:

- Primary spermatocyte is a diploid cell that has been derived from spermatogonium.
- Primary spermatocytes are diploid (2n) and contains 46 chromosomes (23 pairs of chromosomes).

- The 23 pairs include 22 pairs of autosomal chromosomes and one pair of sex chromosomes. i.e., 44 autosomal chromosomes and 2 sex chromosomes.
- Sex chromosomes are one X chromosome and one Y chromosome.

- 94) Which of the following is a multiple sequence alignment tool?
- A) BLAST
 - B) ClustalW
 - C) SWISS-PROT
 - D) BLOCKS

Answer: B) ClustalW

Solution:

- ClustalW is a tool for aligning multiple protein or nucleotide sequences.
- It is a general purpose multiple alignment program for DNA or proteins.
- BLAST (Basic Local Alignment Search Tool) is a local alignment tool.
- SWISS-PROT is a curated protein sequence database.
- BLOCKS is a secondary biological database. It is a collection of blocks representing known protein families that can be used to compare a protein or DNA sequence with documented families of proteins.
- So, option B is the correct answer. ClustalW is a multiple sequence alignment tool.

- 95) Total lung capacity =
- A) Vital capacity + Residual volume
 - B) Expiratory reserve volume + Tidal volume + Inspiratory reserve volume
 - C) Expiratory reserve volume + Residual volume
 - D) Tidal volume + Inspiratory reserve volume

Answer: A) Vital capacity + Residual volume

Solution:

- Total lung capacity (TLC) is the volume of air present in lungs after a deep inspiration.
- TLC includes tidal volume, residual volume, inspiratory reserve volume and expiratory reserve volume.
- $\text{Total lung capacity (TLC)} = \text{Tidal volume (TV)} + \text{Residual volume (RV)} + \text{Inspiratory reserve volume (IRV)} + \text{Expiratory reserve volume (ERV)}$.
- Since, $\text{Expiratory reserve volume (ERV)} + \text{Tidal volume (TV)} + \text{Inspiratory reserve volume (IRV)} = \text{VC (Vital capacity)}$
- $\text{Total lung capacity (TLC)} = \text{Vital capacity (VC)} + \text{Residual volume (RV)}$.
- The total lung capacity of an adult human is 5000-6000ml.
- $\text{Expiratory reserve volume (ERV)} + \text{Residual volume (RV)} = \text{Functional residual capacity (FRC)}$.
- $\text{Tidal volume (TV)} + \text{Inspiratory reserve volume (IRV)} = \text{Inspiratory capacity (IC)}$.

96) In lac operon, repressor protein binds to:

- A) Structural genes
- B) Promoter
- C) Regulator
- D) Operator

Answer: D) Operator

Solution:

- Operator is a sequence of DNA which lies adjacent to promoter. It serves as the binding site for the repressor protein.
- Structural genes (lac Z, lac Y and lac A) code for enzymes.
- Promoter is the site where the RNA polymerase binds to the DNA to initiate transcription.
- Regulatory genes encodes regulatory proteins.
- So, option D (Operator) is the correct answer.

97) mRNA capping enzyme is recruited to the transcription complex by

- A) Phosphorylation of carboxy terminal domain of RNA Pol II
- B) Acetylation of carboxy terminal domain of RNA Pol II

- C) Acetylation of amino terminal domain of RNA Pol II
- D) Phosphorylation of amino terminal domain of RNA Pol II

Answer: A) Phosphorylation of carboxy terminal domain of RNA Pol II

Solution:

- The large subunit of Pol II has a carboxy terminal domain (CTD) which is referred to as the tail.
- The CTD contains a series of repeats of heptapeptide sequence (Tyr-Ser-Pro-Thr-Ser-Pro-Ser).
- mRNA capping enzyme is recruited to the transcription complex by phosphorylation of the RNA polymerase II carboxy-terminal domain.
- So, option A is the correct answer.

- 98) The number of Barr bodies in a normal male is
- A) 1
 - B) 2
 - C) 0
 - D) 4

Answer: C) 0

Solution:

- The Barr body (sex chromatin) is an inactivated X chromosome.
- It is attached to the inner surface of the nuclear membrane and contains large amount of heterochromatin and lesser amount of euchromatin.
- The number of barr bodies is always one less than the number of X chromosomes.
- A genotypical female (XX) has one Barr body per somatic cell nucleus, while a genotypical male (XY) has none.

- 99) LNG-20 is a
- A) Hormone-releasing IUD
 - B) Condom

- C) Oral pill
- D) Copper releasing IUD

Answer: A) Hormone-releasing IUD

Solution:

- Hormone releasing intrauterine devices (hormone-releasing IUDs) release a synthetic form of the hormone progesterone.
- During pregnancy, progesterone is released by both the woman's body and the placenta, which halts the menstrual cycle and ovulation while the fetus develops.
- IUDs release hormone progesterone slowly over a long period of time and thus prevent conception.
- Examples for hormone-releasing IUDs include progestasert, LNG-20 etc.

- 100) Water soluble vitamins are:
- A) Vitamin A and Vitamin B
 - B) Vitamin B and Vitamin C
 - C) Vitamin D and Vitamin K
 - D) Vitamin C and Vitamin D

Answer: B) Vitamin B and Vitamin C

Solution:

- Vitamins that can dissolve in water are called water-soluble vitamins.
- Water soluble vitamins cannot be stored in the body for a long time. These vitamins are excreted out in the urine by the excretory system.
- Major water soluble vitamins are vitamin B and vitamin C.
- A, D, E, and K vitamins are fat soluble vitamins. They are soluble in fats.
- So, option B (Vitamin B and Vitamin C) is the correct answer.

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THANK YOU

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