Sri Lankan Biology Olympiad 2014

Instructions:

This paper contains two parts, **A** and **B**.
Part A: 40 multiple choice questions; Total Marks 40.
Part B: 20 short answer questions; Total Marks 60.

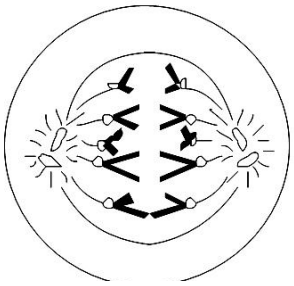
Answer All Questions Time: 2 hours

Part A – Multiple Choice Questions

Mark the correct answer with an X on the answer sheet provided

1. Which of the following statements is incorrect?
   (1) Amylose contains only α–glucose.
   (2) Cellulose contains only β-glucose.
   (3) Lactose contains only β-galactose.
   (4) Proteins contain only α– aminoacids.
   (5) All true lipids contain glycerol.

2. The diagram given below shows a stage of cell division. Which of the following statements is incorrect regarding the cell shown?



   (1) The cell cannot be a diploid one.
   (2) This cannot be a stage of meiosis.
   (3) The cell cannot be a plant cell.
   (4) The nuclear membrane of the cell has fully disappeared.
   (5) Chromosomes are fully condensed with histone proteins.

3. Which of the following statements is incorrect?
   (1) Ribosomes make the primary structure of a protein.
   (2) All proteins enter sacs of endoplasmic reticulum immediately after synthesis.
   (3) Covalent bonds between different aminoacids of a protein are often necessary for the formation of tertiary structure.
   (4) Non-protein parts are joined into proteins inside sacs of endoplasmic reticulum.
   (5) Some proteins are transported into nucleus after the synthesis.

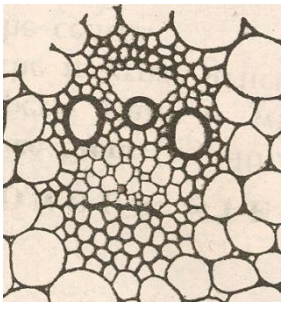
4. Which of the following statements is incorrect?
   Prokaryotes are different from eukaryotes because in prokaryotes,
   (1) flagellae do not have microtubules.
   (2) ribosomes are 70S particles.
   (3) chromosomesdo not have chromatin structure.
   (4) cytoplasm does not have internal membranes.
   (5) cell walls have peptide compounds.

5. Which of the following statements is incorrect?
   When a leaf of a sugar cane plant is exposed to sunlight,
   (1) PSII light reactions occur in mesophyll cells.
   (2) PSI and PSII light reactions occur in bundle sheath cells.
   (3) mesophyll cells produce malate.
   (4) bundle sheath cells produce pyruvate.
   (5) malate and pyruvate are transported through plasmodesmata.

6. Which of the following statements is incorrect?
   (1) Some bacteria can carryout oxidative phosphorylation although they do not have mitochondria.
   (2) Some bacteria can carryout photophosphorylation although they do not have chloroplasts.
   (3) Bacteria as well as eukaryotes carryout substrate level phosphorylation.
   (4) All phosphorylation reactions take place with the participation of protonpumps.
   (5) In most phosphorylation reactions chemical energy is stored in P-P bonds.

7. Which of the following statements is incorrect?
   (1) In humid nights water potential inside xylem of herbaceous plants increases.
   (2) Under water deficit conditions mesophyll cells of plants synthesize abscisic acid.
   (3) Casparian strips of endodermal cells forms a barrier for free intake of mineral ions.
   (4) When plant leaves are exposed to light guard cells of stomata accumulate starch.
   (5) Companion cells of phloem use ATP in order to transport sucrose through plasma membrane.

8. Which of the following statements regarding the structure shown in the following diagram is correct?



   (1) This structure is usually found in water plants.
   (2) It may be seen in Maize plants.
   (3) All the cells shown in it are dead.
   (4) Some cells shown are storage cells.
   (5) Some cells shown are still undifferentiated.

9. Which of the following statements is incorrect?
   (1) When indole acetic acid is applied to moist paddy seeds they will germinate quickly.
   (2) Germination of some seeds gets delayed because of abscisic acid present in their tissues.
   (3) Pineapple cultivators use carbide to induce uniform flowering in plants.
   (4) Cut flowers can be kept freshly for a longer period if cytokinin is applied.
   (5)Cabbage plants will grow with longer internodes if gibberelic acid is applied.

10. Which of the following statements is incorrect?
   (1) A seed of *Cycas* has tissues belonging to three generations.
   (2) A seed of an Angiosperm has tissues of two generations.
   (3) In *Selaginella* development of a megaspore begins even before it is released from the mother plant.
   (4) In *Pogonatum* sporophyte is fully parasitic on gametophyte.
   (5) Evolution of seeds has resulted in making the gametophytes fully parasitic on sporophytes.

11. When a plant of the genotype AaBb is crossed with a plant of the genotype aabb the next generation had the following composition

Genotype	**frequency**
AABB	40%
aabb	40%
Aabb	9%
aaBb	11%

   If a cross of the type AaBb x AaBb was done what would have been the percentage of plants with the genotype AABB in the next generation.
   (1) 40% (2) 36% (3) 20% (4) 16% (5)8%

12. Which of the following statements is incorrect?
   (1)Downs syndrome is caused due to an abnormality occurring at meiosis.
   (2) Huntington's disease is caused by a dominant mutation of an autosomal gene.
   (3) Two sex chromosomes are necessary for the normal development of a human being.
   (4) Hemophilia is caused by a recessive mutation of a single gene in X chromosome.
   (5)Mutations of genes do not take place without the influence of an external agent.

13. In a plant species RR genotype of a gene determines dark red flowers, Rr genotype determines light red flowers and rr genotype determines white flowers.
   In an artificially established population there were 60 dark red flowered plants 20 light red flowered plants and 20 white flowered plants. If fully random mating occurred to produce the next generation what will be the percentage of light red flowered plants in the population?
   (1) 60% (2) 49% (3) 42% (4) 21% (5) 9%

14. In order to verify the parentage of a lost child DNA finger printing can be used to compare DNA samples taken from the child and the two parents. Which of the following features of DNA is really compared in such a test?
   (1) Nucleotide composition
   (2) Sequence of bases of some selected genes
   (3) Presence of some selected genes
   (4) Lengths of some homologous sections of DNA
   (5) Lengths of homologous chromosomes

15. Which of the following statements is incorrect?
    (1) All Archaebacteria are unicellular aerobes.
    (2) Prions are heat stable proteins causing diseases of animals.
    (3) Some viruses have cores containing proteins.
    (4) Cyanobacteria do not have flagellae.
    (5) Gram +ve as well as Gram-ve bacteria produce exotoxins.

16. Which of the following statements is incorrect?
    (1)*Escherichia coli* is an opportunistic pathogen inhabiting human body.
    (2)*Clostridium tetani* produce toxins that affect oxygen transport in blood.
    (3)*Shigella* causing dysentery spreads through water.
    (4)*Lactobacillus* inhabiting human body can bring resistance to pathogenic organisms.
    (5)*Streptococcus pneumoneae* can live harmlessly in human body.

17. Which of the following statements is incorrect?
    (1) Addition of hops prevent bacterial growth in brewing of beer.
    (2) Lactic acid produced by bacteria preventsgrowth of yeasts in milk curds.
    (3)Genes taken from bacteria in transgenic corn plants prevents insect damages.
    (4) Promotion of bacterial growth can reduce pollution caused by oil spills in sea water.
    (5) Naturally acquired passive immunity protects infants from infectious diseases.

18. Which of the following statements is incorrect?
    (1) Gram's test is done on bacteria to identify its species.
    (2)Coliform test is done with water to assess its suitability for drinking.
    (3) Pasteurization of milk is done to kill some pathogenic bacteria.
    (4)Vaccination against tuberculosis is done with live cells of the pathogen.
    (5)In activated sludge system of purification of water part of the sludge is reused to increase the microbial activity.

19. Extinction of dinosaurs occurred
    (1) at the same time of the extinction of trilobites
    (2) before the origin of flowering plants
    (3) after the extinction of ammonites
    (4) before the origin of conifers
    (5) after the origin of mammals

20. Which of the following statements regarding the human influence on ecosystems is incorrect?
    (1) Agricultural activities prevent the cycling of nutrient elements in biogeochemical cycles.
    (2) Due to removal of nutrients from agricultural ecosystems, large supplements of nutrients are needed.
    (3) Nitrogen fixation by industrial processes is necessary.
    (4) Nutrients in fertilizer pollute ground water.
    (5) Excess nutrients result in algal blooms.

21. Which of the following animals is a flagship species?
    (1) Indian pitta (2) Bengal tiger (3) Dodo (4) Loggerhead turtle (5)Lion
22. Which one of the following is the greatest threat to biodiversity?
    (1) Pollution of air (2) Invasive species (3) Global warming
    (4) Habitat loss (5) Ozone depletion

23. A person whose gall bladder has been surgically removed should restrict eating
(1) fruits. (2) bread. (3) sweets. (4) oily foods. (5) proteins.

24. Respiration control center in man is located in
(1) Hypothalamus. (2) red nuclei.
(3) Pons Varolii. (4) cerebellum.
(5) medulla oblongata.

25. Which of the following is not a response to an increase in osmotic pressure of blood?
(1) Secretion of ADH
(2) Increased permeability of the collecting duct to water
(3) Stimulation of thirst center
(4) Increased production of renin.
(5) Reduction in reabsorption of sodium ions

26. Release of which of the following hormones is regulated by the nervous system?
(1) Calcitonin (2) Parathormone (3) Thyroxin (4) Oestrogen (5) Oxytocin

27. Which of the followinganimals spends most of energy for homoeostasis?
(1) A snake in the Sinharaja forest
(2) A bird in Horton plains
(3) A shark in the ocean
(4) A butterfly in a dry mixed forest
(5) A jellyfish in an estuary

28. Neurotransmitter receptors are located on
(1) nodes of Ranvier.
(2) postsynaptic membrane.
(3) presynaptic membrane.
(4) membrane of Schwann cell.
(5) membrane of synaptic vesicle.

29. Which of the following may be the reason for production of large amount of dilute urine?
(1) Low production of aldosterone
(2) Low production of ADH
(3) High production of adrenaline
(4) High production of ACTH
(5) High production of aldosterone

30. Which of the following processes that take place in the kidney is least selective?
(1) Filtration of blood
(2) Reabsorption of water
(3) Reabsorption of amino acids
(4) Active transport of sodium ions
(5) Secretion of potassium ions

31. The movable bone in the skull
(1) has several processes.
(2) participates in the formation of secondary palate.
(3) participates in the formation of zygomatic arch.
(4) articulates with atlas. (5) contains sinuses.

32. Which of the following bones in the human skull contributes least to the resonance of voice?
(1) Frontals (2) Parietals (3) Sphenoid (4) Ethmoid (5) Maxillary

33. In a 7.5 cm long healthy normal human fetus, which of the following structures is least likely to be developed?
(1) Nails (2) External ear lobes (3) Nose (4) Eye lashes (5) Aorta

34. In human females, peaks in FSH and LH production occur at the
(1) beginning of menstruation.
(2) beginning of the proliferation phase.
(3) end of the follicular phase.
(4) beginning of the secretory phase.
(5) end of the luteal phase.

35. Which of the following statements regarding semen of man is incorrect?
(1) It usually contains about 20,000 sperms per mm^3.
(2) It has a pH value more or less similar to that of normal water.
(3) It contains secretions of epididymis.
(4) It contains sugar.
(5) It lubricates urethra.

36. Which of the following groups of animals developed a blood circulatory system first?
(1) Ammonites (2) Trilobites (3) Annelids (4) Echinoderms (5) Nematodes

37. Which of the following animals does not have a respiratory pigment in blood?
(1) Grasshopper (2) Prawn (3) Earthworm (4) Spider (5) Squid

38. A cartilaginous fish can be distinguished from a bony fish due to
(1) presence of paired fins
(2) presence of 10 pairs of cranial nerves
(3) absence of eye lids
(4) presence of lateral lines
(5) presence of heterocercal tail fin

39. Which of the following can beseen in all annelids?
(1) Setae (2) Gills (3) Parapodia (4) Clitellum (5) Hydrostatic skeleton

40. Which of the following is common to land snail, a clam and an octopus?
(1) Cephalization (2) Mantle (3) Radula (4) Gills (5) Shell

Index Number:

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Answer Sheet for Part A and Part B

Please handover this part to the Invigilator.
Only Part A is allowed to move out of the examination hall.

Answer Sheet for Part A
Mark the correct answer with a X

:01*	1	2	3	4	5	:21*		1	2	3	4	5
:02*	1	2	3	4	5		:22*	1	2	3	4	5
:03*	1	2	3	4	5		:23*	1	2	3	4	5
:04*	1	2	3	4	5		:24*	1	2	3	4	5
:05*	1	2	3	4	5		:25*	1	2	3	4	5
:06*	1	2	3	4	5		:26*	1	2	3	4	5
:07*	1	2	3	4	5		:27*	1	2	3	4	5
:08*	1	2	3	4	5		:28*	1	2	3	4	5
:09*	1	2	3	4	5		:29*	1	2	3	4	5
:10*	1	2	3	4	5		:30*	1	2	3	4	5
:11*	1	2	3	4	5		:31*	1	2	3	4	5
:12*	1	2	3	4	5		:32*	1	2	3	4	5
:13*	1	2	3	4	5		:33*	1	2	3	4	5
:14*	1	2	3	4	5		:34*	1	2	3	4	5
:15*	1	2	3	4	5		:35*	1	2	3	4	5
:16*	1	2	3	4	5		:36*	1	2	3	4	5
:17*	1	2	3	4	5		:37*	1	2	3	4	5
:18*	1	2	3	4	5		:38*	1	2	3	4	5
:19*	1	2	3	4	5		:39*	1	2	3	4	5
:20*	1	2	3	4	5		:40*	1	2	3	4	5

Part B – Short Answer Questions

Please answer in the spaces provided. Please use given letters, numbers or symbols (√ or X) only.

1. Some structures found in eukaryotic cells are listed (A) to (I) below.
   (A) Plasma membrane (B) Ribosome (C) Chloroplast (D) Mitochondrion(E) Lysosome (F) Cytoplasm (G) Golgi body (H) Rough endoplasmic reticulum (I) Smooth endoplasmic reticulum

   Indicate the structure/structures in whicheach of the following processes take place.

   (1) Synthesis of lipids ……..

   (2) Synthesis of glycoproteins ……..

   (3) Synthesis of NADH ……..

   (4) Synthesis of ATP ……..

   (5) Hydrolysis of Proteins ……..

   (6) Oxidation of carbohydrates ……..

2. Sequence of stages of cell cycle of a eukaryotic cell is given as G1-S-G2-M-C
   Indicate the stage/stages in which each of the following takes place

   1. Mitochondria divide ……..
   2. Centrioles are synthesized ……..
   3. Chromosomes are replicated ……..
   4. Proteins are synthesized ……..
   5. Microtubules are well organized ……..
   6. Plasma membrane growsrapidly …….

3. Some substances used in the metabolism of a photosynthetic plant cell is given below.

   (A) NADPH (B)O_2 (C)ATP (D) Acetyl CoA (E) CO_2 (F) NADH (G) Glucose

   Indicate the substancethat fits each of the blanks shown in the following metabolic reactions

   (1) Fructose + …… ⇨ Sucrose

   (2) RuBP + …… ⇨ PGA + Phosphoglycolate

   (3) PEP + …… ⇨ Oxaloacetate

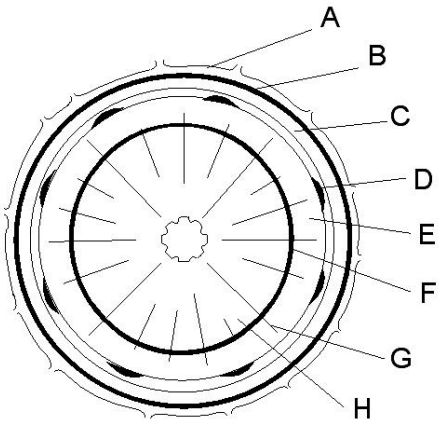
   (4) Oxaloacetate +…… ⇨ Citrate

   (5) Oxaloacetate +…… ⇨ Malate

   (6) Pyruvate +…… ⇨ Lactate

4. Some mineral elements absorbed by plants and used in their metabolic reactions are given below.
   (A) Mg (B) Ca (C) Fe (D) K (E) Mo (F) Cl
   Indicate the element/elements of the given list that are used by plants in each of the following processes
   1. N- fixation ……..
   2. Chlorophyll synthesis ……..
   3. Respiratory chain reactions ……..
   4. Enzyme activation ……..
   5. Geotrophic response ……..
   6. Stomatal movement …….

5. The diagram given below represents a cross section of a stem with secondary growth.Several tissues have been labeled A-H. Indicate the tissues which fit each of the descriptions given below.

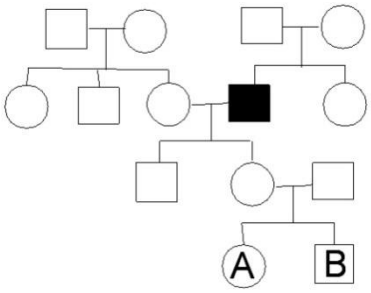


   1. Tissues with dividing cells ……..
   2. Tissues which contain only dead cells ……..
   3. Tissues containing live cells and dead cells……..
   4. Tissues with suberinised cells ……..
   5. Tissues of the bark ……..
   6. Tissues performing horizontal conduction of nutrients ……..

6. In a plant species flowers can be pink, red, blue or white. When a pure line red flowered plant is crossed with a pure line blue flowered plant all plants of the F1 generation produced pink flowers. When these F1 plants were crossed to each other F2 generation produced pink flowered plants, red flowered plants, blue flowered plants and white flowered plants in 9:3:3:1 ratio.
   Indicate whether each of the following statements is correct (√) or incorrect (X).

1. If all the blue flowered plants of the F2 generation are crossed with white flowered plants blue flowered and white flowered plants will be produced in 1:1 ratio.	
2. If all pink flowered plants of the F2 generation are crossed with white flowered plants next generation will have plants of all the four colours .	
3. If all the red flowered plants of the F2 generation are crossed with white flowered plants red flowered and white flowered plants will be produced in 2:1 ratio.	
4. Red colour and blue colour of the flowers are produced by codominant alleles.	
5. White colour of the flower is due to double recessive alleles of two genes.	
6. In the F2 generation 4/9 of the plants are double heterozygotes.	

7. The diagram below shows a human pedigree in which one male member has a rare genetic disease.



   Indicate whether each of the following statements is correct (√) or incorrect (X).

1. If the disease is a sex linked recessive character the diseased person should have inherited it from his mother.	
2. If the disease is a sex linked recessive character daughter of the diseased person should be a carrier.	
3. If the disease is a sex linked recessive character A must be a carrier.	
4. If the disease is caused by an autosomal recessive allele probability of B being a carrier is less than 0.25.	
5. If the disease was caused by a dominant mutation which occurred in him it should be on his Y chromosome.	
6. If the disease was caused by an autosomal dominant mutation which occurred in him none of his descendants will inherit the disease.	

8. Some microorganisms inhabiting soil are listed below.
   (A) *Streptomyces* (B) *Aspergillus* (C) *Thiobacillus* (D) *Clostridium*(E) *Fusarium* (F) *Agrobacterium* (G) *Pseudomonas*
   Indicate the microorganism/microorganisms involved in each of the following processes.
   1. N- fixation ……..
   2. Amonification ……..
   3. Plant root diseases ……..
   4. Plant wilt diseases ……..

5. Oxidation of metal ions ……..
6. Producing antibiotics …….

9. Some microorganisms used in food and beverage industries are listed below.
(A) *Gluconobacter* (B) *Aspergillus* (C) *Saccharomyces* (D) *Streptococcus* (E) *Lentinus* (F) *Acetobacter* (G) *Mucor* (H) *Lactobacillus*
Indicate the microorganism /microorganisms involved in each of the following.

1. Preparation of fruit juices ……..
2. Production of cheese ……..
3. Production of acetic acid ……..
4. Cultivation as a food item ……..
5. Production of milk curd ……..
6. Source of vitamin rich food …….

10. This question is based on the following animals
A) Horse B) Cat C) Shrew D) Elephant E) Dog
Arrange the above animals in increasing order of energy expenditure per unit mass ……..

11. Indicate whether each of the following statements regarding the nervous system of animals is correct (√) or incorrect (X).

1.	Synapses first appeared in Platyhelminthes	
2.	Nematodes have longitudinal nerve cords arising from a pair of anterior ganglia	
3.	Annelids differ from arthropods by having a double ventral nerve cord	
4.	Nerve rings are present in Platyhelminthes and echinoderms	
5.	Paired dorsal cerebral ganglia are present in annelids and arthropods	

12. Four vitamins, their main dietary sources and major functions of those are given in the following Table

	Vitamins	**Main dietary sources**	**Main functions**
A)	Vitamin A	a) Vegetables	i. Maintenance of a healthy skin
B)	Vitamin B_2	b) Tea	ii. Synthesis of FAD
C)	Vitamin C	c) Eggs	iii. Growth of bone
D)	Vitamin D	d) Wheat flour	iv. Synthesis of hemoglobin

Write 8 correct "Vitamin – a main dietary source – a main function" combinations.

1……. 2…… 3…… 4…….

5……. 6…… 7…… 8…….

13. Indicate whether each of the following statements regarding the human eye is correct (√) or incorrect (X).

1.	Cornea is an extension of sclera	
2.	Fovea does not contain rods	
3.	Ciliary muscles are involved in the control of diameter of pupil	

4. Vitreous humor controls the amount of light that enters the eye
5. Retina lies just inside sclera and contains photoreceptor cells

14. Some hormones of man and their functions are given below. Indicate whether each of these "hormone – function" combinations is correct (√) or incorrect (X).

1. Calcitonin – Increase in blood calcium level
2. Adrenalin – Dilation of dermal blood vessels
3. Thymosin – Maturation of lymphocytes
4. Parathormone – Excretion of phosphate ions
5. Cortisol – Breakdown of proteins

15. Indicate whether each of the following statements regarding the cardiac muscle fibers is correct (√) or incorrect (X).

1. They are connected to each other by intercalated discs.
2. They do not have A bands.
3. They need a nervous stimulation to initiate contraction.
4. They are innervated by peripheral nervous system.
5. They are cylindrical.

16. Indicate whether each of the following reactions prevail (√) in the red blood corpuscles of the capillaries of the iliac artery or not (X). (Hb = Haemoglobin)

1. $Hb + 4CO_2 \longrightarrow Hb(CO_2)_4$
2. $H_2CO_3 \longrightarrow H^+ + HCO_3^-$
3. $CO_2 + H_2O \longrightarrow H_2CO_3$
4. $Hb + 4O_2 \longrightarrow Hb(O_2)_4$
5. $Hb(O_2)_4Hb + 4O_2 \longrightarrow$

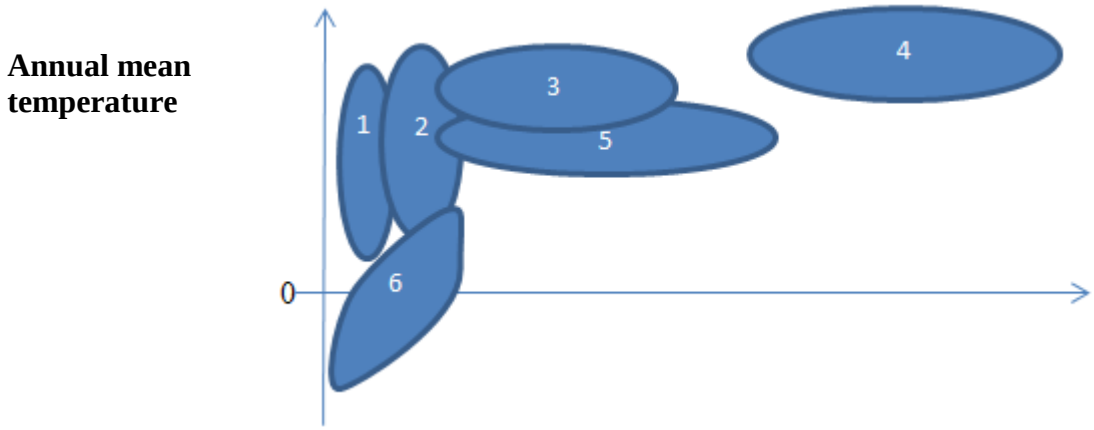
17. Indicate whether each of the following pairs of male and female structures are alike in function (√) or not (X).

1. Spermatogonia – Primary oocytes
2. Primary spermatocytes – Secondary oocytes
3. Vas deferens – Fallopian tube
4. Urethra – Vagina
5. Leydig cells – Follicle cells

18. Indicate whether each of the following statements regarding the purposes of treating a Rh^- mother with anti Rh antibodies after giving birth to a Rh^+ baby is correct (√) or incorrect (X).

1. To protect her from Rh^+ antigens of her next baby
2. To prevent the generation of anti Rh antibodies in her body
3. To protect her next baby
4. To induce immune responses to anti Rh antibodies
5. To prevent the generation of anti Rh antibodies in her next baby

19. The distribution of six biomes numbered from 1 to 6 in a plot of annual mean precipitation and annual mean temperature is shown in the following figure.



Annual mean rainfall and snowfall

The above biomes are listed below. Identify each of these biomes using the correct number.

Tropical rain forests	
Deserts	
Tundra	
Taiga	
Temperate broad leaf forests	
Temperate grasslands	

20. Indicate whether each of the following statements regarding oceans is correct (√) or incorrect (X)

1.	They contribute for a large amount of atmospheric oxygen	
2.	They help to control the increase in global temperature	
3.	They play a major role in maintaining a constant pH in the atmosphere	
4.	They are the major source of snowfall	
5.	They help to reduce the impact of acid rains	