KVPY-2018 (Biology)-Stream-(SA)

PART-I

1. Which ONE of the following molecules is a secondary metabolite?
   a. Ethanol
   b. Lactate
   c. Penicillin
   d. Citric acid

2. Lecithin is a
   a. carbohydrate
   b. phospholipid
   c. nucleoside
   d. protein

3. The water potential (p) ψ of pure water at standard temperature and atmospheric pressure is
   a. 0
   b. 0.5
   c. 1.0
   d. 2.0

4. Action potential in neurons is generated by a rapid influx of
   a. chloride ions
   b. potassium ions
   c. calcium ions
   d. sodium ions

5. Erythropoietin is produced by
   a. heart
   b. kidney
   c. bone marrow
   d. adrenal gland

6. Tendrils are modifications of
   a. stem or leaf
   b. stem only
   c. leaf only
   d. aerial roots only

7. Which ONE of the following combinations of biomolecules is present in the ribosomes?
   a. RNA, DNA and protein
   b. RNA, lipids and DNA
   c. RNA and protein
   d. RNA and DNA

8. Which ONE of the following proteins does NOT play a role in skeletal muscle contraction?
   a. Actin
   b. Myosin
   c. Troponin
   d. Microtubule

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9. Which ONE of the following reactions is catalyzed by high-energy ultraviolet radiation in the stratosphere?
   a. $O_2 + O \rightarrow O_3$
   b. $O_2 \rightarrow O + O$
   c. $O_3 + O_3 \rightarrow 3O_2$
   d. $O + O \rightarrow O_2$

10. Which ONE of the following statements is TRUE about trypsinogen?
   a. It is activated by enterokinae
   b. It is activated by renin
   c. It is activated by pepsin
   d. It does not need activation

11. Which ONE of the following organisms respire through the skin?
   a. Blue whale
   b. Salamander
   c. Platypus
   d. Peacock

12. Which ONE of the following human's cells lacks a nucleus?
   a. Neutrophil
   b. Neuron
   c. Mature erythrocyte
   d. Keratinocyte

13. The first enzyme that the food encounters in human digestive system is
   a. pepsin
   b. trypsin
   c. chymotrypsin
   d. amylase

14. Glycoproteins are formed in which ONE of the following organelles?
   a. Peroxisome
   b. Lysosome
   c. Golgi apparatus
   d. Mitochondria

15. An example of nastic movement (external stimulus-dependent movement) in plants is
   a. folding-up of the leaves of *Mimosa pudica*
   b. climbing of tendrils
   c. growth of roots from seeds
   d. growth of pollen tube towards the ovule

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PART-II

16. If the genotypes determining the blood groups of a couple are IAIO and IAIB, then the probability of their first child having type O blood is
    a. 0
    b. 0.25
    c. 0.50
    d. 0.75

17. A cross was carried out between two individuals heterozygous for two pairs of genes. Assuming segregation and independent assortment, the number of different genotypes and phenotypes obtained respectively would be
    a. 4 and 9
    b. 6 and 3
    c. 9 and 4
    d. 11 and 4

18. If the H^+ concentration of an aqueous solutions is 0.001 M, then the pOH of the solution would be
    a. 0.001
    b. 0.999
    c. 3
    d. 11

19. Consider the following vision defects listed in Column I & II and the corrective measures in Column III. Choose the correct combination.

Column I	**Column II**	**Column III**
P. Hypermetropia	i. near-sightedness	a. convex lens
Q. Myopia	ii. Far-sightedness	b. concave lens

    a. P-ii-b
    b. Q-i-b
    c. P-i-a
    d. Q-i-a

20. Which ONE of the following properties causes the plant tendrils to coil around a bamboo stick?
    a. Tendril has spines
    b. The base of the tendril grows faster than the tip
    c. Part of the tendril in contact with the bamboo stick grows at a slower rate than the part away from it
    d. The tip of the tendril grows faster than the base

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ANSWER KEY

1. (c)	2. (b)	3. (a)	4. (d)	5. (b)	6. (a)	7. (c)	8. (d)	9. (b)	10. (a)
11. (b)	12. (c)	13. (d)	14. (c)	15. (a)	16. (a)	17. (c)	18. (d)	19. (b)	20. (c)

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SOLUTIONS

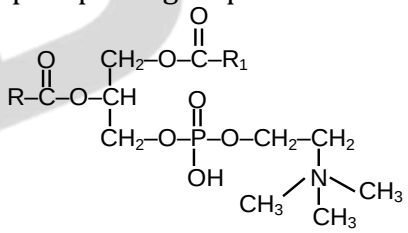
PART - I

1. (c)

Secondary metabolites are compounds that are not required for the growth or reproduction of an organism but are produced to confer a selective advantage to the organism. For example, they may inhibit the growth of organisms with which they compete and, as such, they often inhibit biologically important processes.
The most well-known secondary metabolite produced by Penicillium is the antibiotic penicillin, which was discovered by Fleming
Some secondary metabolites:---

Pigments	Carotenoids, Anthocyanins etc.
Alkaloids	Morphine, Codeine, etc.
Terpenoids	Monoterpenes, Diterpenesetc
Essential oils	Lemson grass oil, etc
Toxins	Abrin, Ricin
Lectins	Concanavalin A
Drugs	Vinblastin, curcumin, etc.
Polymeric substances	Rubber, gums, cellulose

2. (b)
Some lipids have phosphorus and a phosphorylated organic compound in them. These are phospholipids. Lecithin is a phospholipid which consists of glycerol, two fatty acids, a phosphate group and choline. They are found in cell membrane



Phospholipid (Lecithin)

3. (a)
The free energy of water is water potential. Water potential of pure water is maximum, it is considered zero at standard temperature & atmospheric pressure because there is no solute in pure water
$\psi w = \psi s + \psi p$
ψs = solute potential (pure water ψs is zero)
ψp = pressure potential (pure water ψp is zero)

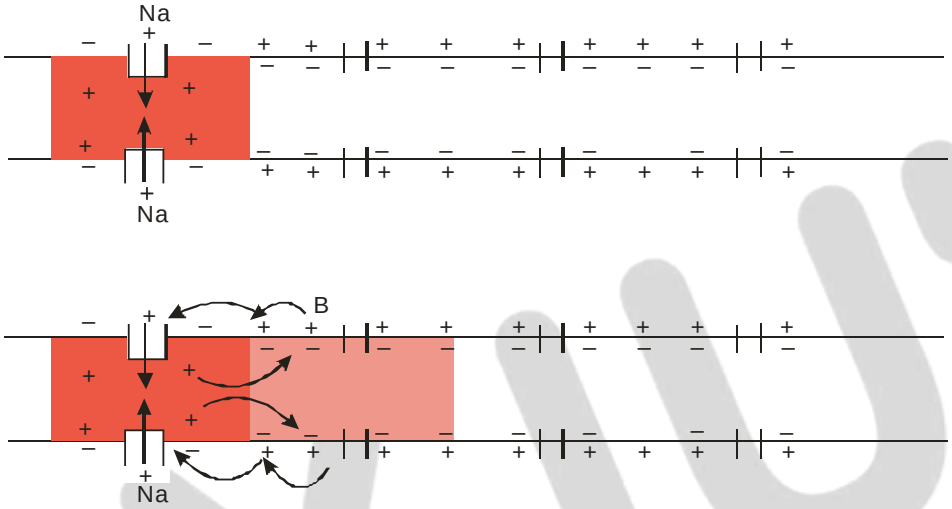
$\psi w = 0 + 0$

$\psi w = 0$

4. (d)

An action potential (AP) is the mode through which a neuron transports electrical signals. It is defined as a brief change in the voltage across the membrane due to the flow of sodium (Na+) ion into the neuron.

When an action potential happens, the sodium (Na+) ion channels on the axon open and the Na+ rushes in. Since the Na+ is positively charged, it makes the inside of the axon a little more positively charged. The sodium keeps rushing in until the inside is positive relative to the outside.



5. (b)

The hormone erythropoietin (Epo) maintains red blood cell mass by promoting the survival, proliferation and differentiation of erythrocytic progenitors. Circulating erythropoietin originates mainly from Juxta glomerular cells of kidney. It acts on red blood cells to protect them against destruction. At the same time it stimulates stem cells of the bone marrow to increase the production of red blood cells(Erythropoiesis).

6. (a)

Tendril is modification of stem and leaves, develop from bud and long, thin, wiry, spirally coiled structure which helps in climbing

Examples: ----

(A) In pea terminal leaflets modified into tendrils that are a slender wiry and coiled structure made for support known as leaf tendrils.

(B) In cucumber auxiliary bud of stem get modified to form stem tendrils.

(C) In grapevine apical buds modify to form stem tendrils

7. (c)

Ribosomes are made up of ribosomal proteins and ribosomal RNA (rRNA). In prokaryotes, ribosomes are roughly 40 percent protein and 60 percent rRNA. In eukaryotes, ribosomes are about half protein and half rRNA

8. (d)
Skeletal muscle is composed of muscle fibers which have smaller units called myofibrils. There are three types of proteins that make up each myofibril; they are contractile (actin, myosin), regulatory protein (troponin, tropomyosin) and structural proteins

9. (b)
Ozone is naturally produced in the stratosphere in a two-step process. In the first step, ultraviolet sunlight breaks apart an oxygen molecule to form two separate oxygen atoms. In the second step, each atom then undergoes a binding collision with another oxygen molecule to form an ozone molecule.

$$O^2 \xrightarrow{\text{UV rad}} O + O$$
$$O_2 + O \longrightarrow O_3$$

10. (a)
Enterokinase(produced from intestinal gland in small intestine)converts trypsinogen (an inactive enzyme produced from pancreatic juice) into active trypsin, it hydrolyses some peptide bonds of food proteins and activates a number of pancreatic zymogens. For this reasonenterokinase is a key enzyme in the digestion of dietary proteins and its absence may result in gross protein malabsorption.

11. (b)
the arboreal salamander and the California slender salamander, don't have lungs or gills as adults. Commonly called lungless salamanders, they breathe through their skin and the thin membranes in the mouth and throat.

12. (c)
Mature red blood cells (RBCs) do not possess nucleus along with other cell organelles such as mitochondria, Golgi apparatus and endoplasmic reticulum in order to accommodate greater amount of haemoglobin in the cells.
Exception- red blood cells of camel have a nucleus

13. (d)
The first enzyme that the food encounters in human digestive system isamylase (salivary amylase). Amylase is an enzyme that catalyses the hydrolysis of starch into sugars. Amylase is present in the saliva of humans and some other mammals and it begins the chemical process of digestion of food in mouth.

14. (c)
A Golgi body, also known as a Golgi apparatus, is a cell organelle that helps process and package proteins and lipid molecules, It forms glycoprotein (protein from RER) and glycolipids (lipid from SER) called glycosylation due to glycosyltransferase enzyme

15. (a)
Nastic movements are plant movements that occur in response to environmental stimuli. For example, speed of the nastic response generated by Mimosa pudica depends on the magnitude in which we touch it. If we gently graze the leaves, the movement will propagate slowly from the tip of the plant, to the stem
Examples of nastic movements are:
1. In the Mimosa pudica plant, when we touch the leaves of the plant they fold up. Here the stimulus is touch.
2. In a dandelion flower, the opening up of the petals of this flower in the morning in bright light and closing in the evening when light fades. Here, the stimulus is light.

PART - II

16. (a)
No 'O' blood group probability

		I^AI^O
	I^A	I^O
I^AI^B I^A	I^AI^A A	I^OI^A A
I^B	I^AI^B AB	I^OI^B B

17. (c)
To find out the No. of possible genotype = 3^n
Where n = No. of heterozygous pair in question No. of heterozygous pair is given = 2
possible genotype in given question is = $3^2 = 3 \times 3 = 9$
To find out the No. of possible phenotype = 2^n
Where n = No. of heterozygous pair in questions No. of heterozygous pair = 2
Possible phenotype in given question = $2^2 = 2 \times 2 = 4$

18. (d)
$[H^+] = 10^{-3}M$
$pH = -\log_{10}[H^+]$
$= -\log_{10}[10^{-3}]$
pH = 3
pH + POH = 14
POH = 14 – 3 = 11

19. (b)
Near-sightedness (myopia) is a common vision condition in which can see objects near to clearly, but objects farther away are blurry. It occurs when the shape of eye causes light rays to bend (refract) incorrectly, focusing images in front of retina instead of on retina.
Lenses used to correct near-sightedness are concave in shape.
Q. Myopia -- i. near-sightedness -- b. concave lens

20. (c)
The part of the tendril in contact with the support doesn't grow as fast as the other part of plants, it coils around the support with the help of plant hormone called Auxin. This causes the tendril to coil around the support.