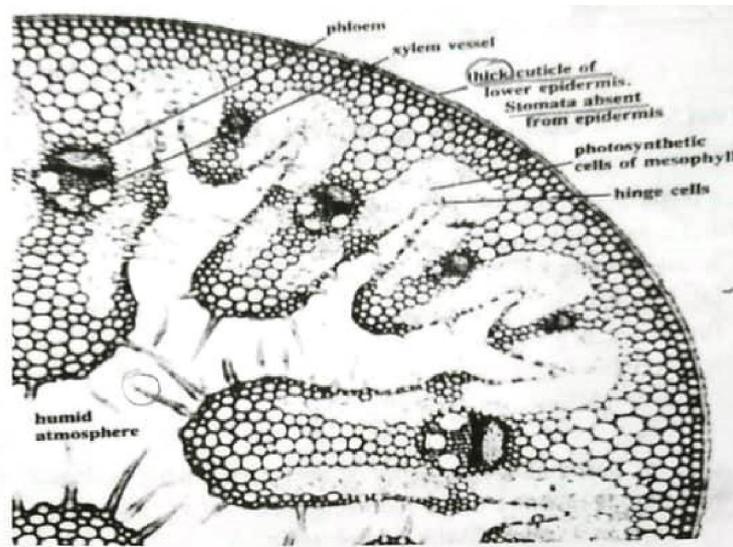


INDIAN OLYMPIAD QUALIFIER IN BIOLOGY (IOQB)-2020-21
(Held On Sunday 07th FEBRUARY , 2021)**Time allowed : 60 Minutes****Max. Marks : 120****TEST PAPER (LEVEL-1)****Attempt All The Thirty Two Questions****A-1****◆ ONLY ONE OUT OF FOUR OPTIONS IS CORRECT BUBBLE THE CORRECT OPTION.**

1. A mixture of samples containing DNA fragments a, b, c and d with molecular weights $a + b = c$, $a > b$ and $d > c$, was subjected to agarose gel electrophoresis. What would be the sequence of bands from anode to cathode :-
(a) b, a, c, d
(b) d, c, a, b
(c) a, b, d, c
(d) c, d, b, a
2. Lack of permeability to water is very rare among biological membranes but is critical to the functioning of which of the following regions of a nephron ?
(a) Descending limb of the loop of Henle.
(b) Ascending limb of the loop of Henle.
(c) Distal tube.
(d) Collecting duct.
3. This fruit is a rich source of lycopene, contains 92% water by weight and pH of its pulp varies between 5 to 7. This fruit is likely to be :
(a) Lime
(b) tomato
(c) apple
(d) watermelon
4. Shingle beaches (or pebble beaches) have low animal biodiversity mainly because of:
(a) very high wave effects.
(b) high salinity.
(c) unstable substratum.
(d) steep slope.
5. In flowering plants, self-pollination is often prevented through self-incompatibility. It is controlled by multiple alleles. Assuming that there are three alleles S_1 , S_2 and S_3 for this and that self-incompatibility occurs if the pollen and tissue of stigma-style have an allele in common, what proportion of pollen produced by S_1S_2 plant would germinate on plants with genotype S_2S_3 ?
(a) 0%
(b) 25%
(c) 50%
(d) 75%

6. The accompanying diagram represents a cross section of leaf blade of a grass, The anatomical features suggest it to be a:

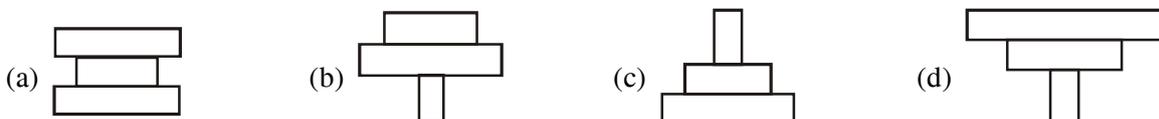


- (a) xerophyte (b) hydrophyte (c) hygrophyte (d) mesophyte
7. A comparison of certain cell structures in three types of cells P, Q and R are tabulated below.

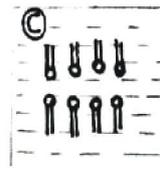
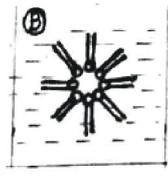
	Cell wall	ER	Nucleus	Mitochondria
P	Absent	Present	Present	Present
Q	Present	Absent	Absent	Absent
R	Present	Present	Present	Present

P, Q and R could respectively represent:

- (a) Onion cell, *E. coli*, Mushroom cell (b) Mouse cell, *E. coli*, Amoeba
 (c) *E. Coli*, Mushroom cell, Onion cell (4) Amoeba, *E. coli*. Onion cell
8. Consider the following situations.
 I: Over several generations, *Drosophila* flies are attracted to lower light intensities than higher light intensities.
 II: Duck eggs of intermediate weight have the highest hatching success.
 The processes of selection underway in I and II respectively are:
 (a) Disruptive and Stabilizing (b) Stabilizing and Directional
 (c) Directional and Disruptive (d) Directional and Stabilizing
9. If a cell has solute potential of -2000 kPa and water potential of -1600 kPa, what will be the pressure potential of the cell?
 (a) - 400 kPa (b) 400 kPa (c) - 3600 kPa (d) 3600 kPa
10. For an ecosystem comprising of a tree, birds and parasites, the biomass pyramid will take the shape of:



15. Which of the following structures represents a stable lipid-water interaction in protoplasm?



- (a) Structure A (b) Structure B
(c) Structure C (d) Structure D

16. A group of hens was observed for 300 minutes and the aggressive pecking behavior was recorded. The numbers indicate the frequency with which the hen in the row pecks the hen in the column.

		P	Q	R	S
Row 1	P	-	0	0	0
Row 2	Q	59	-	17	92
Row 3	R	8	0	-	7
Row 4	S	6	0	0	-

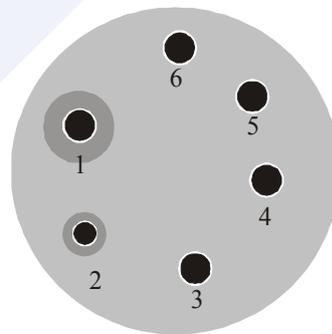
The data obtained indicates the correct pecking order as :

- (a) $P > S > R > Q$ (b) $Q > S > R > P$ (c) $Q > R > S > P$ (d) $S > Q > R > P$

17. In order to study the digestive activity, samples from different parts of the gastro-intestinal tract were placed on an agar containing crab shell powder. The clearance zones numbered 1, 2, 3 and 4 indicate effect of liquids from stomach, duodenum, ileum and colon respectively of an animal X. Distilled water was added to positions 5 and 6 as control.

The results indicate that the animal X is:

- (a) a ruminant X
(b) a non-ruminant
(c) a hindgut fermenter
(d) an insectivore



18. In 1914, McCollum and his co-workers showed that a factor isolated from butter fat (X) Was non-saponifiable and when added to diet, could cure xerophthalmia in young rats and bone deformities in puppies. These conditions could not be cured by yeast suspension (Y) or orange juice (Z) and also by heated butter fat. The likely factors present in X, Y and Z are respectively:

- (a) Vitamin (A and D), B, C. (b) Vitamin A, D, E.
(c) Vitamin B₁, B₂, B₁₂ (d) Vitamin A, C, D

19. The recombination frequencies of q, r, s and t genes on a chromosome were- $t \& q = 30\%$, $r \& s = 7\%$, $s \& t = 25\%$ and $r \& q = 12\%$. Arrangement of these genes on the chromosome would be :

- (a) q, r,s,t (b) s,q,r,t (c) q, s, r, t (d) t, s, q, r

20. Flagellum of which of the following has organization different from others ?

- (a) *Chlamydomonas reinhardtii* (b) *Vibrio cholerae*
(c) *Trypanosoma aruzi* (d) Gametes of *Ulothrix*

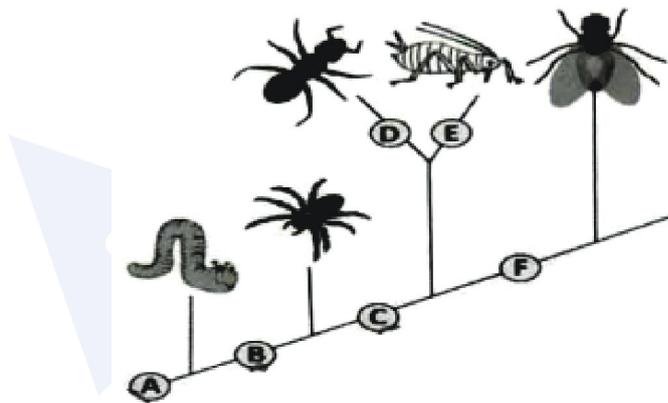
21. Which of the following polypeptide chain is translated from the following sense strand of 5' ATG AGA GTT GAG GAT TTA TCT 3' ?
Ser – UCU; Leu – UUA; Glu – GAG; Met – AUG; Arg – AGA; Asp – GAU; Val – GUU
(a) COOH–Met–Arg–Val–Glu–Asp–Leu–Ser–H₂N
(b) COOH–Met–Glu–Leu–Arg–Asp–Val–Ser–H₂N
(c) H₂N–Met–Arg–Val–Glu–Asp–Leu–Ser–COOH
(d) H₂N–Met–Glu–Leu–Arg–Asp–Val–Ser–COOH
22. Abundance of trees bearing buttress roots indicates that the soil is:
(a) shallow and nutrient-poor. (b) shallow and dry.
(c) deep and nutrient rich. (d) deep and clayey.
23. The identification tags on the cell membranes for cell-to-cell recognition are:
(a) Glycoproteins. (b) Lipoproteins.
(c) Glycolipids. (d) Nucleoproteins.
24. Independent assortment has the possibility of producing different gametes. How many different gametes could possibly be produced in humans?
(a) 2⁴⁶ (b) 23² (c) 46² (d) 2²³

Any Number of Options 4, 3, 2 OR 1 May Be Correct

A-2

- ♦ MARKS WILL BE AWARDED ONLY IF ALL CORRECT OPTION ARE BUBBLED AND NO WRONG OPTION.

25. Based on the cladogram given below, match the following derived characteristics listed in the table with the alphabets A–D and choose the correct option/s.



Number	Characteristic
1	Legs
2	Cerci
3	Segmented Body
4	6 legs
5	Wings
6	Crushing Mouthparts

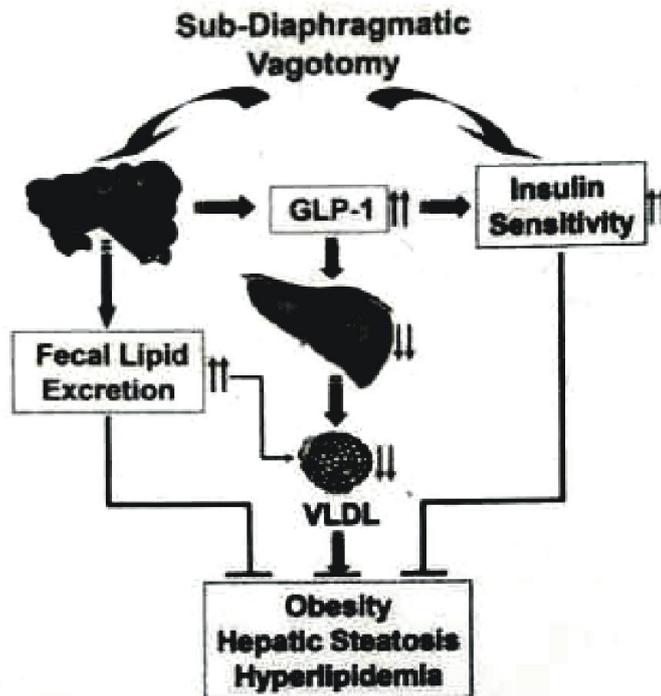
- (a) A: 6; C: 5; F: 2 (b) B: 2; D: 4; E: 6
(c) B: 1; E: 2; F: 5 (d) A:3; C: 4; D: 6

29. In nature, species interact with its abiotic as well as biotic components. Biological interactions can be classified into different categories based on whether they are beneficial (+), harmful (–) or neutral (0) to each of the participating member. Interactions of two species are depicted at positions P and Q in the table.

Interaction	+	–	0
+			
–	P	Q	
0			

P and Q respectively indicate:

- (a) Competition, parasitism
(b) Predation, parasitism
(c) Predation, competition
(d) parasitism, competition
30. The diagram depicts the regulatory mechanism mediated through Glucagon like Peptide 1 (GLP-1) in a mouse in which the vagus connection to hepatic–gut region has been severed.



Which of the following can be correctly deduced from the diagram?

- (a) GLP-1 antagonists can increase steatorrhea (excretion of abnormal quantities of fat with the feces).
(b) GLP-1 agonists can reduce post-prandial hyperglycemia.
(c) GLP-1 agonists can reduce VLDL in the plasma,
(d) GLP-1 antagonists can decrease fasting blood sugar.

31. Birdwatchers often take the count of different birds in the area to comment upon its biodiversity. The accompanying table gives such a data for three regions 1,2 and 3. Assume that the three regions match in terms of environmental factors and equal time is spent for watching for all the three plots.

	Plot 1	Plot 2	Plot 3
Magpie Robin	2	2	2
Indian Robin	3	2	4
Ring Dove	2	2	2
Drongo	3	1	2
Sparrow	4	25	6
Crow	1	18	3
Oriole	0	1	2
Minivet	0	1	1
Flycatcher	0	1	1

Which of the following statements is correct?

- (a) Greater variety of resources is available in plot 2 than plot 3.
 - (b) Biodiversity of plots 2 and 3 is the same.
 - (c) Resource utilization is more even in plot 3 than plot 2.
 - (d) More reliable data can be obtained if observations are made during nesting season of the birds.
32. Within a population's geographic range, local densities may differ substantially creating contrast patterns of dispersion. Which of the following examples represent clumped dispersion?
- (a) Mushrooms growing on rotting log.
 - (b) Birds nesting on small islands exhibiting territoriality.
 - (c) Mayfly adult populations which survive only for a day or two.
 - (d) Growth of dandelion plants from wind-blown seeds.