

Date: 07/02/2021

Test Booklet Code

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# Questions & Answers

*for*

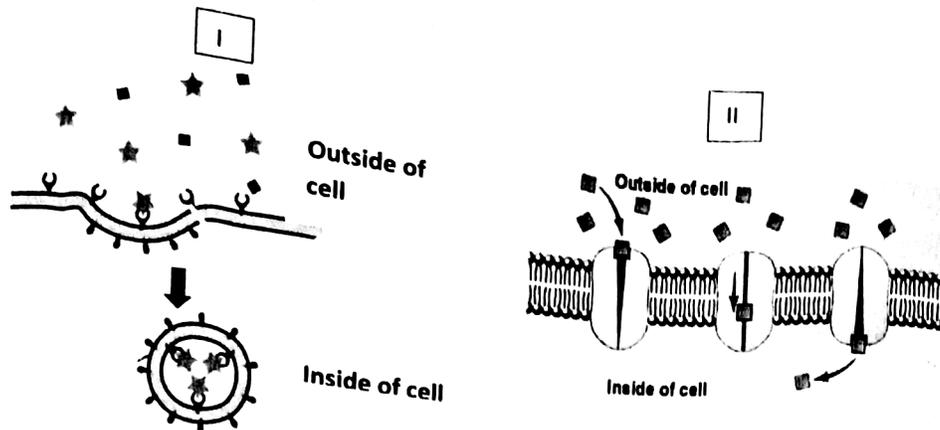
## Indian Olympiad Qualifiers (Part I) Biology (IOQB) 2020-21

### INSTRUCTIONS TO CANDIDATES

- (1) There are 32 objective type questions. Out of 32 questions, 24 questions in **Part A1** and 8 questions in **Part A2**. All questions are compulsory.
- (2) In **Part A1**, each question has four alternatives out of which only one is correct.
- (3) In **Part A2**, each question has four alternatives out of which any number of alternative(s) (a, b, c or d) may be correct.
- (4) For **Part A1**, each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer.
- (5) For **Part A2**, each correct answer carries 6 marks if all correct answers are marked and no incorrect. No negative marking for this part.



7. Two processes of transport (I and II) are depicted. These processes respectively represent:



- (a) Active transport and passive transport  
 (b) Active transport for both  
 (c) Passive transport for both  
 (d) Passive and active transport

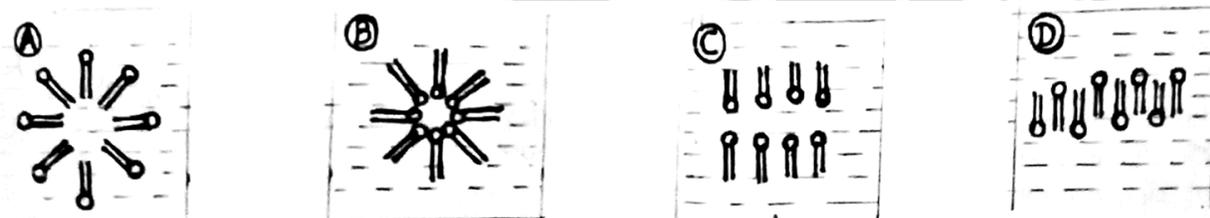
**Answer (a)**

8. The Eastern meadow lark and Western meadow lark are distinct biological species with similar body shape and coloration but different breeding songs which prevents members of these species from mating. This is an example of:

- (a) Pre-zygotic isolation  
 (b) Reduced hybrid viability  
 (c) Hybrid breakdown  
 (d) Temporal isolation

**Answer (a)**

9. 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

**Answer (a)**

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

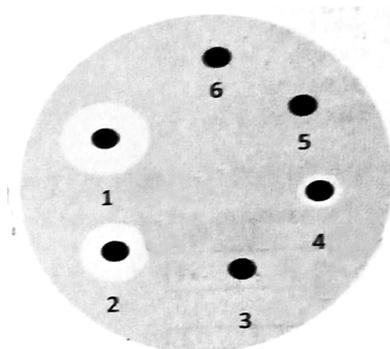
		P	Q	R	S
Row 1	P	-	0	0	0
Row 2	Q	59	-	17	92
Row 3	R	8	0	-	7
Row 4	S	6	0	0	-

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)  $S > Q > R > P$

**Answer (c)**

11. 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 (b) A non-ruminant  
(c) A hindgut fermenter (d) An insectivore

**Answer (d)**

12. 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 B<sub>1</sub>, B<sub>2</sub>, B<sub>12</sub> (d) Vitamin A, C, D

**Answer (a)**

13. A comparison of certain cell structures in three types of cells P, Q and R are tabulated below.

	Cell wall	ER	Nucleus	Mitochondria
<b>P</b>	Absent	Present	Present	Present
<b>Q</b>	Present	Absent	Absent	Absent
<b>R</b>	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 (d) Amoeba, E. coli, Onion cell

**Answer (d)**

14. 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

**Answer (d)**

15. 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

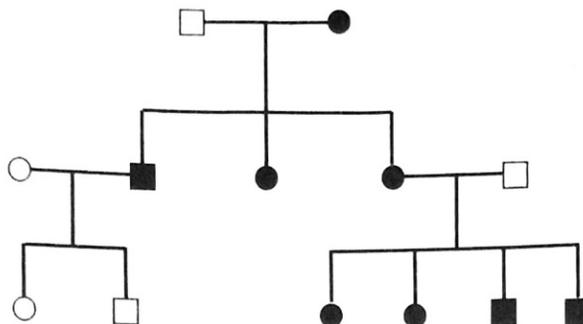
**Answer (b)**

16. For an ecosystem comprising of a tree, birds and parasites, the biomass pyramid will take the shape of :



**Answer (c)**

17. Inheritance of a disease trait observed in a family is represented below. It most likely indicates:



- (a) Autosomal dominance. (b) Mitochondrial inheritance.  
(c) Autosomal recessive trait. (d) X-linked recessive trait.

**Answer (b)**

18. The drug cytochalasin B blocks the function of actin. Which of the following aspects of the cell cycle would be more disrupted by cytochalasin B?
- (a) Spindle attachments to kinetochores. (b) DNA synthesis.  
(c) Cell elongation during anaphase (d) Cleavage furrow formation.

**Answer (d)**

19. 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

**Answer (a)**

20. 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

**Answer (b)**

21. 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

**Answer (d)**

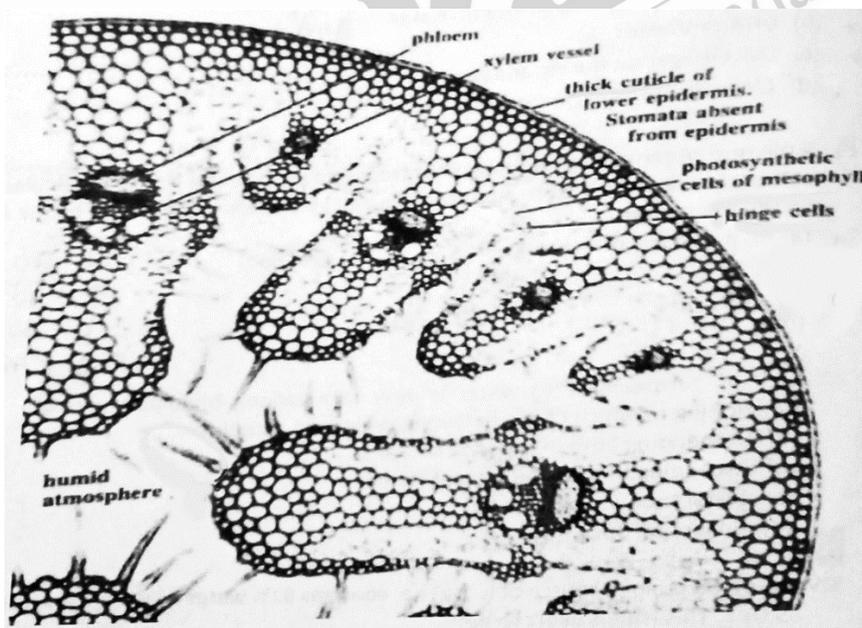
22. Shingle beaches (or pebble beaches) have low animal biodiversity mainly because of
- (a) Very high wave effects    (b) High salinity  
(c) Unstable substratum    (d) Steep slope

**Answer (a)**

23. 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%

**Answer (c)**

24. 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

**Answer (a)**

## PART-A2

25. 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.

**Answer (c, d)**

26. 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.

**Answer (a, c)**

27. 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.

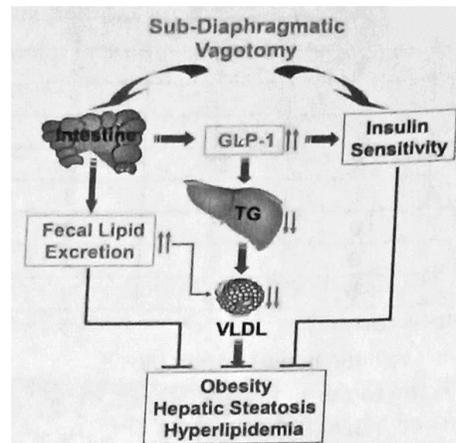
Interaction	+	–	0
+			
–	P	Q	
0			

P and Q respectively indicate:

- (a) Competition, parasitism
- (b) Predation, parasitism
- (c) Predation, competition
- (d) Parasitism, competition

**Answer (c, d)**

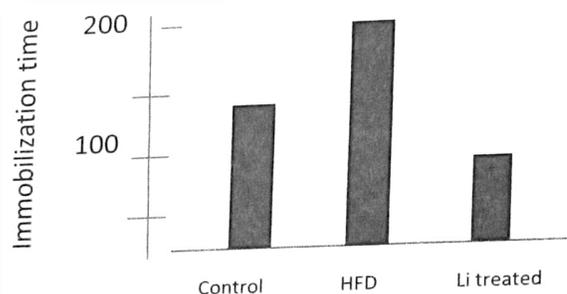
28. The diagram depicts the regulatory mechanism mediated through Glucagon like Peptide 1 (GLP-1) in a mouse in which the vagus connection to hepatic – gut region has been served. Which of the following can be correctly deduced from the diagram?



- (a) GLP-1 antagonists can increase steatorrhea (excretion of abnormal quantities of fat with the faeces).
- (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.

**Answer (b, c)**

29. The tail suspension test (TST) is developed to study the effect of drugs or chemicals on the behaviour of rats. The test involves suspending mice above the ground by their tails for a period of 6 minutes. The time spent by the mouse to show any escape related activity is measured. It is subtracted from the total time to get immobilization time. It is based on the assumption that an animal will actively try to escape an aversive stimulus. If escape is impossible, the animal will eventually stop trying (“give up”). When rats fed with high fat diet (HFD) and those fed with lithium were tested using TST, the following results were obtained.

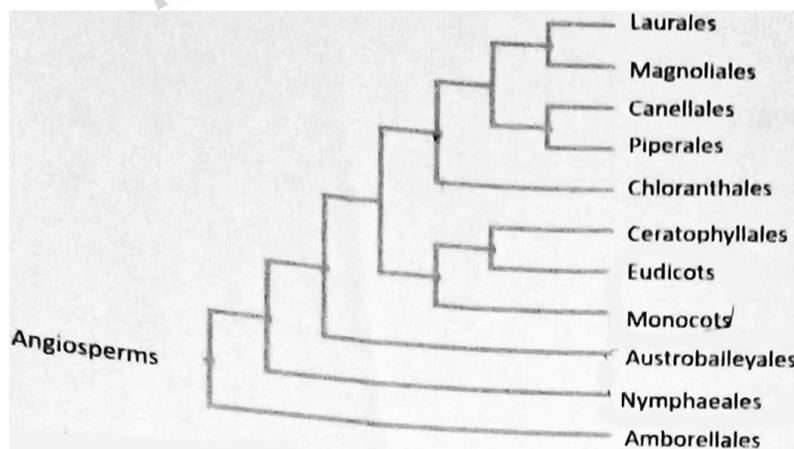


Which of the following statements are true?

- (a) High caloric value of HFD provided more energy to the mice.
- (b) Li proves toxic to brain tissues and increases stress of mice.
- (c) High fat content in the diet led to less agility and lesser efforts to escape the aversive situation.
- (d) Li has improved the stress overcoming efforts of the mice.

**Answer (a, b)**

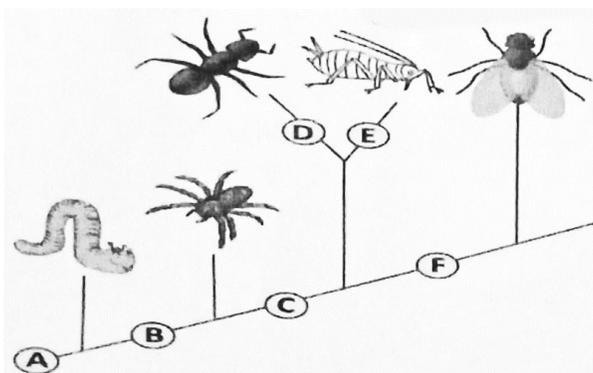
30. Study the given cladogram and state which of the following statements is/are true.



- (a) Laurales cannot be considered as an outgroup.  
 (b) Austrobaileyales and Nymphaeales are polyphyletic groups.  
 (c) Eudicots and Monocots are paraphyletic orders.  
 (d) Chloranthales are more closely related to Piperales than to Canellales.

**Answer (a, b, c)**

31. 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

**Answer (c, d)**

32. Which of the following are the possible agents of change in allele frequency?  
 (a) Random mating. (b) Gene flow.  
 (c) Genetic drift. (d) Assortative mating.

**Answer (b, c, d)**
