

Time: 02:30 PM to 03:30 PM

Question Paper Code: 21

Student's Roll No:															
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Write the question paper code (mentioned above) on YOUR OMR Answer Sheet (in the space provided), otherwise your Answer Sheet will NOT be evaluated. Note that the same Question Paper Code appears on each page of the question paper.

Instructions to Candidates:

1. Use of mobile phone, smart watch and iPad during examination is **STRICTLY PROHIBITED**.
2. In addition to this question paper, you are given OMR Answer Sheet along with candidate's copy.
3. On the OMR Sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.
Incomplete/ incorrect/ carelessly filled information may disqualify your candidature.
4. On the OMR Answer Sheet, use only **BLUE or BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Your **fourteen -digit roll number and date of birth** entered on the OMR Answer Sheet shall remain your login credentials means login id and password respectively for accessing your performance /result in Indian Olympiad Qualifier in Biology 2020 – 21 (Part I)
6. Question paper has two parts. In part A1 (Q. No.1 to 24) each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.

Q.No.12



In part A2 (Q. No. 25 to 32) each question has four alternatives out of which any number of alternative (s) (1, 2, 3, or 4) may be correct. You have to choose **all** correct alternative(s) and fill the appropriate bubble(s), as shown

Q.No.30



7. For **Part A1**, each correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer. In **Part A2**, you get 6 marks if all the correct alternatives are marked and no incorrect. No negative marks in this part.
8. Rough work should be done only in the space provided. There are **12** printed pages in this paper.
9. Use of **non-programmable** scientific calculator is allowed.
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting answer paper, take away the question paper & candidate's copy of OMR for your reference.

Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the OMR answer sheet.

OMR answer sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED. Scratching or overwriting may result in a wrong score.

DO NOT WRITE ON THE BACK SIDE OF THE OMR ANSWER SHEET.

Instructions to Candidates (Continued) –

You may read the following instructions after submitting the Answer Sheet.

12. **Comments/Inquiries/Grievances regarding this question paper, if any, can be shared on the Inquiry/Grievance column on www.iaptexam.in on the specified format till February 12, 2021.**
13. **The answers / solutions to this question paper will be available on the website www.iapt.org.in by February 13, 2021.**
14. **CERTIFICATES and AWARDS –**
Following certificates are awarded by IAPT/ATBS to the students successful in the Indian Olympiad Qualifier In Biology 2020 – 21 (Part I)
- (i) “CENTRE TOP 10 %”
 - (ii) “STATE TOP 1 %”
 - (iii) “NATIONAL TOP 1%”
 - (iv) “GOLD MEDAL & MERIT CERTIFICATE” to all students who attend OCSC – 2021 at HBCSE Mumbai.
15. All these certificates (except gold medal) will be downloadable from IAPT website www.iapt.org.in after March 15, 2021.
16. List of students (with centre number and roll number only) having score above MAS will be displayed on the website: www.iapt.org.in by **February 25, 2021**. See the **Minimum Admissible score Clause** on the Student’s brochure on the web.
17. List of students eligible for evaluation of IOQB 2020-21 (Part II) shall be displayed on www.iapt.org.in by March 1, 2021.

Question Paper Code: 21

Time: 60 Minutes

Max. Marks: 120

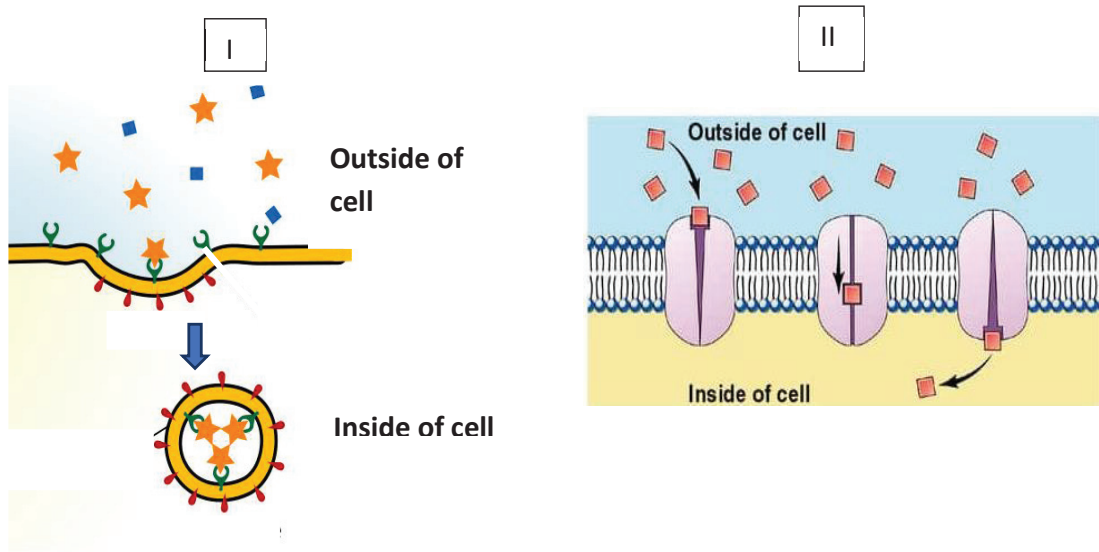
*Attempt All The Thirty two Questions***A – 1****ONLY ONE OUT OF FOUR OPTIONS IS CORRECT. BUBBLE THE CORRECT OPTION**

- 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:
 - q, r, s, t
 - s, q, r, t
 - q, s, r, t
 - t, s, q, r
- Flagellum of which of the following has organization different from others?
 - Chlamydomonas reinhardtii*
 - Vibrio cholerae*
 - Trypanosoma aruzi*
 - Gametes of *Ulothrix*
- 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

 - COOH – Met – Arg – Val – Glu – Asp – Leu – Ser – H₂N
 - COOH – Met – Glu – Leu – Arg – Asp – Val – Ser – H₂N
 - H₂N – Met – Arg – Val – Glu – Asp – Leu – Ser – COOH
 - H₂N – Met – Glu – Leu – Arg – Asp – Val – Ser – COOH
- Abundance of trees bearing buttress roots indicates that the soil is:
 - shallow and nutrient-poor.
 - shallow and dry.
 - deep and nutrient rich.
 - deep and clayey.
- The identification tags on the cell membranes for cell- to-cell recognition are:
 - Glycoproteins.
 - Lipoproteins.
 - Glycolipids.
 - Nucleoproteins.
- Independent assortment has the possibility of producing different gametes. How many different gametes could possibly be produced in humans?
 - 2^{46}
 - 23^2
 - 46^2
 - 2^{23}

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

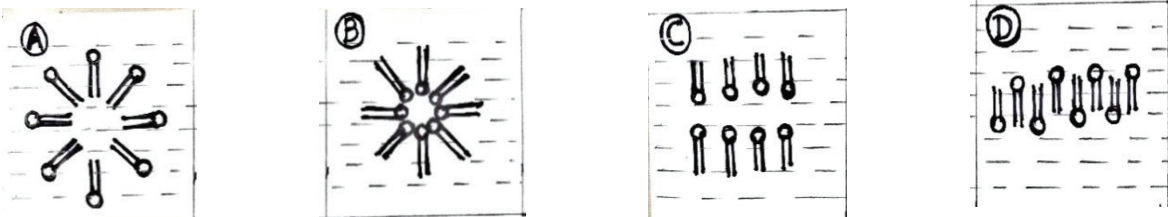


- (a) Active transport and passive transport.
- (b) Active transport for both.
- (c) Passive transport for both.
- (d) Passive and active transport.

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.

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

10. 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.

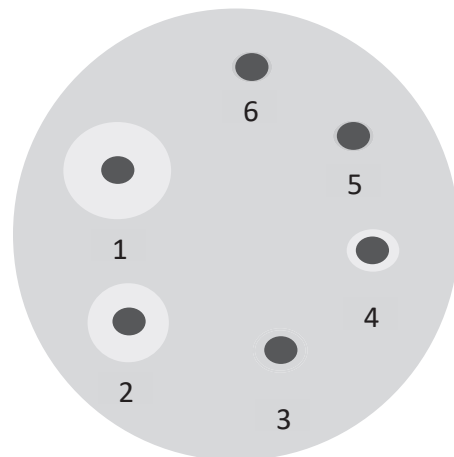
		P	Q	R	S
Row 1	P	-	0	0	0
Row 2	Q	59	-	17	92
Row 3	R	8	0	-	7
Row 4	S	6	0	0	-

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) $S > Q > R > P$
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



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 B₁, B₂, B₁₂.
 (d) Vitamin A, C, D.
13. 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
- (d) *Amoeba*, *E. coli*, Onion cell

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.

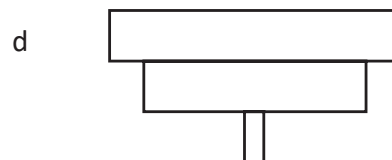
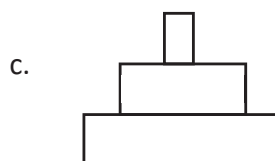
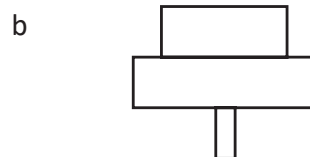
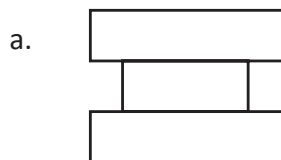
The processes of selection underway in I and II respectively are:

- (a) Disruptive and Stabilizing
- (b) Stabilizing and Directional
- (c) Directional and Disruptive
- (d) Directional and Stabilizing

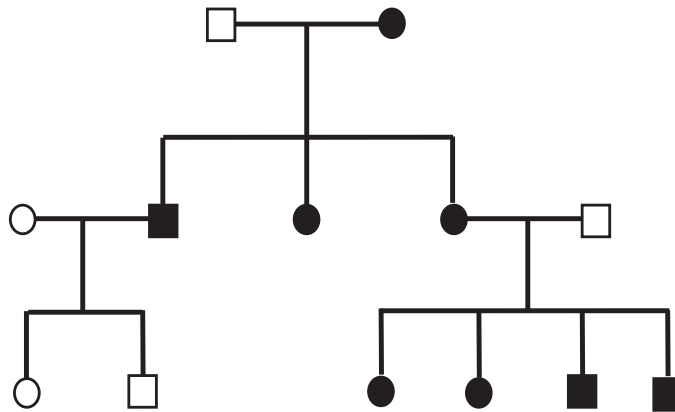
15. If a cell has solute potential of -2000 kPa and water potential of -1600 kPa, what will be the pressure potential of the cell?

- (a) -400 kPa
- (b) 400 kPa
- (c) -3600 kPa
- (d) 3600 kPa

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

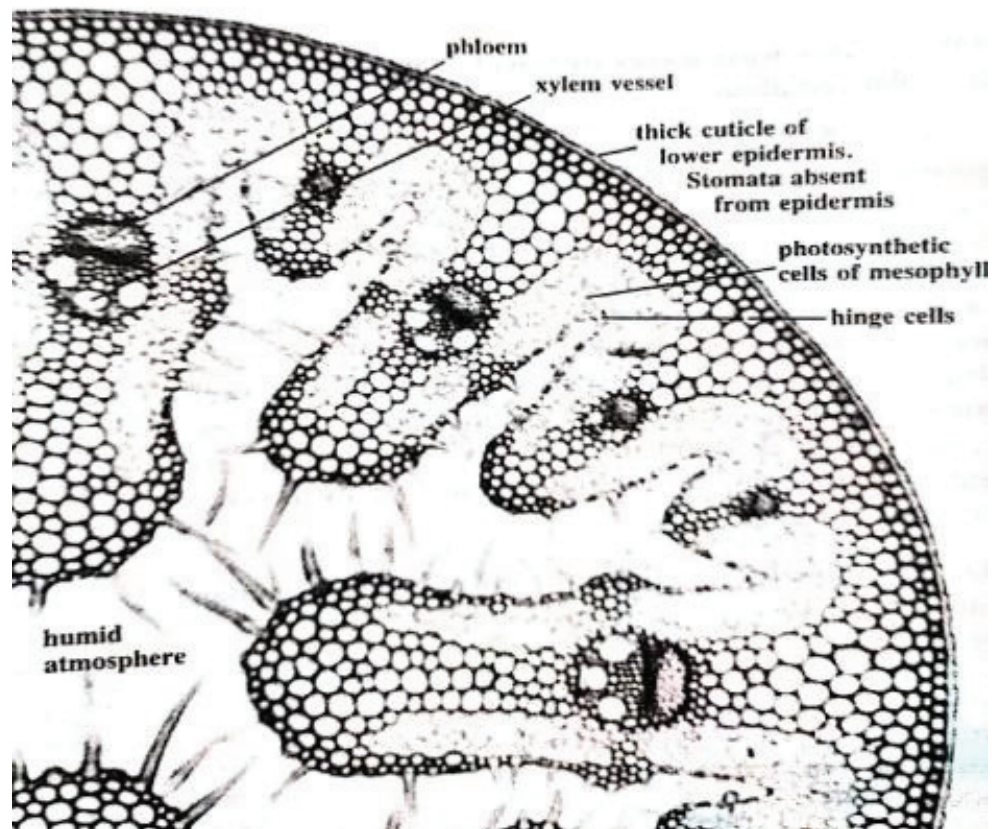


17. Inheritance of a disease trait observed in a family is represented below. It most likely indicates:



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

22. Shingle beaches (or pebble beaches) have low animal biodiversity mainly because of:
- very high wave effects.
 - high salinity.
 - unstable substratum.
 - steep slope.
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 ?
- 0%
 - 25%
 - 50%
 - 75%
24. The accompanying diagram represents a cross section of leaf blade of a grass. The anatomical features suggest it to be a:



- xerophyte
- hydrophyte
- hygrophyte
- mesophyte

A - 2

ANY NUMBER OF OPTIONS 4, 3, 2 OR 1 MAY BE CORRECT
MARKS WILL BE AWARDED ONLY IF ALL CORRECT OPTION(S) ARE BUBBLED, AND NO WRONG OPTION

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?

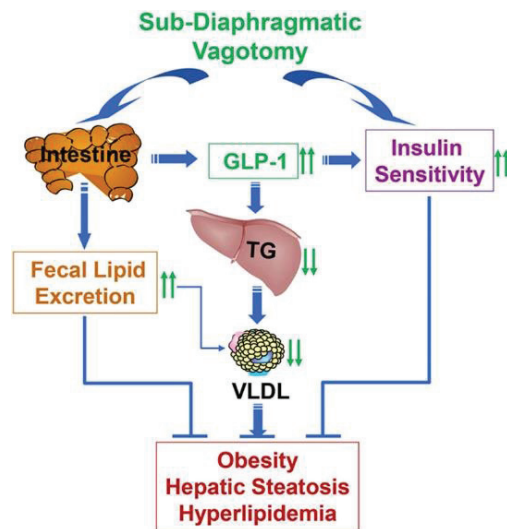
- (a) Greater variety of resources is available in plot 2 than plot 3.
 (b) Biodiversity of plots 2 and 3 is the same.
 (c) Resource utilization is more even in plot 3 than plot 2.
 (d) More reliable data can be obtained if observations are made during nesting season of the birds.
26. Within a population's 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.
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:

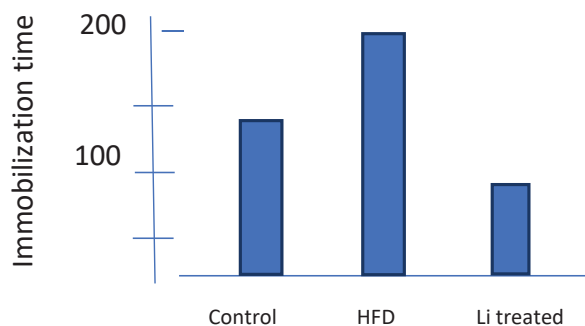
- (a) Competition, parasitism
- (b) Predation, parasitism
- (c) Predation, competition
- (d) Parasitism, competition

28. The diagram depicts the regulatory mechanism mediated through Glucagon like Peptide1 (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?

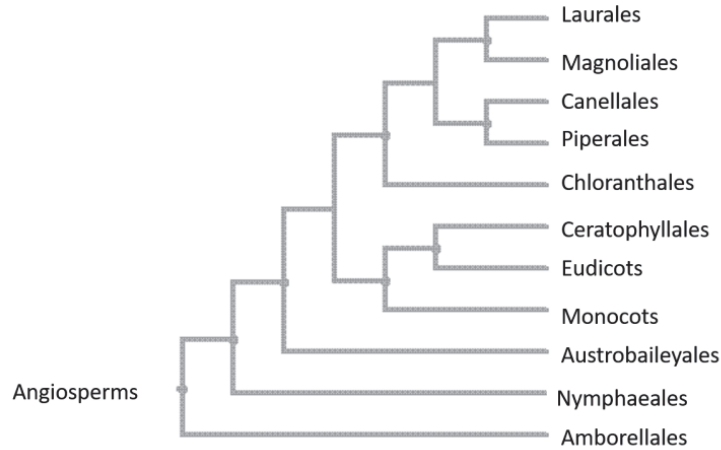
- (a) GLP-1 antagonists can increase steatorrhea (excretion of abnormal quantities of fat with the feces).
 - (b) GLP-1 agonists can reduce post-prandial hyperglycemia.
 - (c) GLP-1 agonists can reduce VLDL in the plasma.
 - (d) GLP-1 antagonists can decrease fasting blood sugar.
29. The *tail suspension test* (TST) is developed to study the effect of drugs or chemicals on the behavior 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?

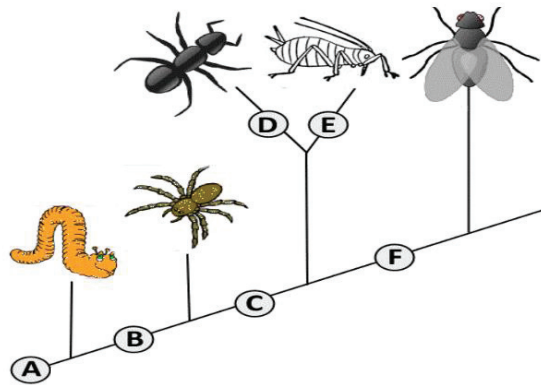
- (a) High caloric value of HFD provided more energy to the mice.
- (b) Li proves toxic to brain tissues and increases stress of mice.
- (c) High fat content in the diet led to less agility and lesser efforts to escape the aversive situation.
- (d) Li has improved the stress overcoming efforts of the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

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.

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

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.

ROUGH WORK

Rough Work

Rough Work

Rough Work