CAREERS 360
PREPARATION Series

GATE 2025

Ecology & Evolution (EY)
Question Paper & Answer Key

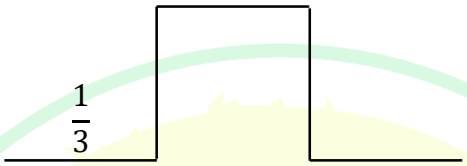
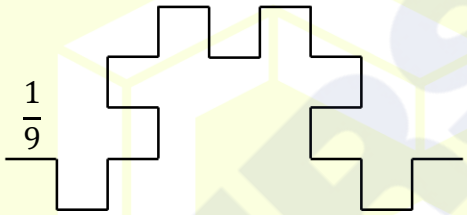
General Aptitude

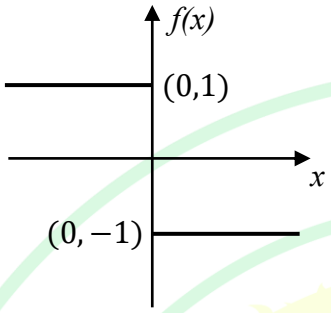
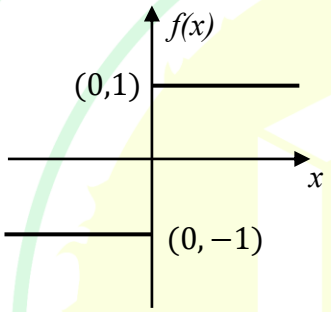
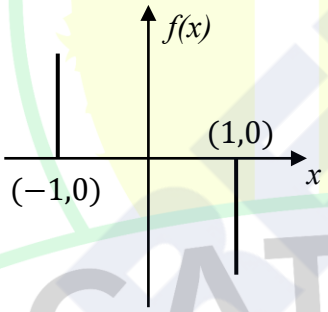
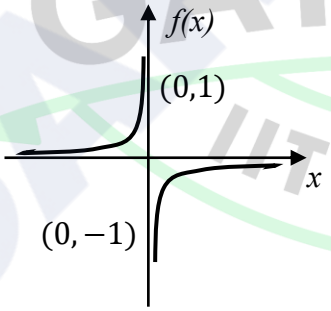
Q.1 – Q.5 Carry ONE mark Each

Q.1	Here are two analogous groups, Group-I and Group-II, that list words in their decreasing order of intensity. Identify the missing word in Group-II. Group-I: Abuse → Insult → Ridicule Group-II: _____ → Praise → Appreciate
(A)	Extol
(B)	Prize
(C)	Appropriate
(D)	Espouse

Q.2	Had I learnt acting as a child, I _____ a famous film star. Select the most appropriate option to complete the above sentence.
(A)	will be
(B)	can be
(C)	am going to be
(D)	could have been

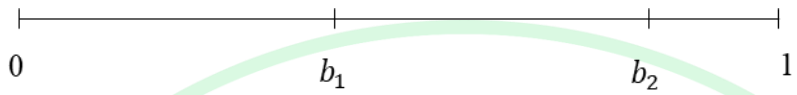
Q.3	The 12 musical notes are given as $C, C^{\#}, D, D^{\#}, E, F, F^{\#}, G, G^{\#}, A, A^{\#}$, and B. Frequency of each note is $\sqrt[12]{2}$ times the frequency of the previous note. If the frequency of the note C is 130.8 Hz, then the ratio of frequencies of notes $F^{\#}$ and C is:
(A)	$\sqrt[6]{2}$
(B)	$\sqrt{2}$
(C)	$\sqrt[4]{2}$
(D)	2

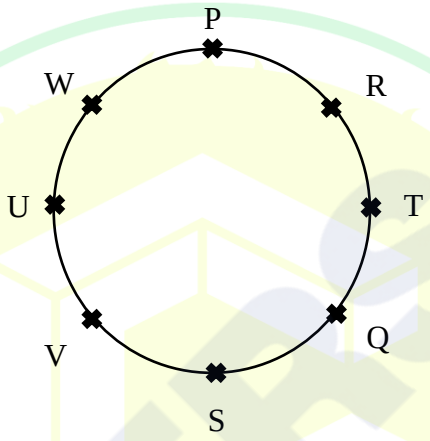
Q.4	The following figures show three curves generated using an iterative algorithm. The total length of the curve generated after 'Iteration n' is: Note: The figures shown are representative.
	Iteration 0:  Iteration 1:  Length of each segment: $\frac{1}{3}$ Iteration 2:  Length of each segment: $\frac{1}{9}$
(A)	$\left(\frac{5}{3}\right)^{\frac{n}{2}}$
(B)	$\left(\frac{5}{3}\right)^{n}$
(C)	$\left(\frac{5}{3}\right)^{2n}$
(D)	$\left(\frac{5}{3}\right)^{n(2n-1)}$

Q.5	Which one of the following plots represents $f(x) = -\frac{\lvert x \rvert}{x}$, where x is a non-zero real number? Note: The figures shown are representative.
(A)	
(B)	
(C)	
(D)	

Q.6 – Q.10 Carry TWO marks Each

Q.6	Identify the option that has the most appropriate sequence such that a coherent paragraph is formed: P. Over time, such adaptations lead to significant evolutionary changes with the potential to shape the development of new species. Q. In natural world, organisms constantly adapt to their environments in response to challenges and opportunities. R. This process of adaptation is driven by the principle of natural selection, where favorable traits increase an organism's chances of survival and reproduction. S. As environments change, organisms that can adapt their behavior, structure and physiology to such changes are more likely to survive.
(A)	P → Q → R → S
(B)	Q → S → R → P
(C)	R → S → Q → P
(D)	S → P → R → Q

Q.7	A stick of length one meter is broken at two locations at distances of b_1 and b_2 from the origin (0), as shown in the figure. Note that $0 < b_1 < b_2 < 1$. Which one of the following is NOT a necessary condition for forming a triangle using the three pieces? Note: All lengths are in meter. The figure shown is representative.
	
(A)	$b_1 < 0.5$
(B)	$b_2 > 0.5$
(C)	$b_2 < b_1 + 0.5$
(D)	$b_1 + b_2 < 1$

Q.8	Eight students (P, Q, R, S, T, U, V, and W) are playing musical chairs. The figure indicates their order of position at the start of the game. They play the game by moving forward in a circle in the clockwise direction. After the 1st round, 4th student behind P leaves the game. After 2nd round, 5th student behind Q leaves the game. After 3rd round, 3rd student behind V leaves the game. After 4th round, 4th student behind U leaves the game. Who all are left in the game after the 4th round? Note: The figure shown is representative.
	
(A)	P; T; Q; S
(B)	V; P; T; Q
(C)	W; R; Q; V
(D)	Q; T; V; W

Q.9 The table lists the top 5 nations according to the number of gold medals won in a tournament; also included are the number of silver and the bronze medals won by them. Based only on the data provided in the table, which one of the following statements is INCORRECT?

Nation	Gold	Silver	Bronze
USA	40	44	41
Canada	39	27	24
Japan	20	12	13
Australia	17	19	16
France	16	26	22

(A) France will occupy the third place if the list were made on the basis of the total number of medals won.

(B) The order of the top two nations will not change even if the list is made on the basis of the total number of medals won.

(C) USA and Canada together have less than 50% of the medals awarded to the nations in the above table.

(D) Canada has won twice as many total medals as Japan.

Q.10	An organization allows its employees to work independently on consultancy projects but charges an overhead on the consulting fee. The overhead is 20% of the consulting fee, if the fee is up to ₹ 5,00,000. For higher fees, the overhead is ₹ 1,00,000 plus 10% of the amount by which the fee exceeds ₹ 5,00,000. The government charges a Goods and Services Tax of 18% on the total amount (the consulting fee plus the overhead). An employee of the organization charges this entire amount, i.e., the consulting fee, overhead, and tax, to the client. If the client cannot pay more than ₹ 10,00,000, what is the maximum consulting fee that the employee can charge?
(A)	₹ 7,01,438
(B)	₹ 7,24,961
(C)	₹ 7,51,232
(D)	₹ 7,75,784

Q.11 – Q.35 Carry ONE mark Each

Q. 11	In a linear regression, a line of best fit can be obtained by
(A)	minimizing the sum of squares of the residuals
(B)	minimizing the sum of the residuals
(C)	minimizing the standard deviation from the mean
(D)	minimizing the standard error of the mean

Q.12	Fly larvae of a species feed simultaneously on a shared rotting fruit. If the density of fly larvae is high, then all the larvae grow up to be smaller sized adults than if the larval density were low. Which one of the following processes best describes this observation?
(A)	Scramble competition
(B)	Interspecific competition
(C)	Competitive exclusion
(D)	Apparent competition

Q.13	In primates, males are often larger than females. If sexual dimorphism evolved to enable males to compete for access to multiple females, in which mating system would we expect to see the greatest sexual dimorphism?
(A)	Monogamy
(B)	Polygyny
(C)	Polyandry
(D)	Parthenogamy
Q.14	Hosts of parasites evolve effective immune responses to infection, which in turn results in those parasites evolving increased infectiousness towards the hosts. Which one of the following processes describes this type of interaction between hosts and parasites?
(A)	Co-evolution
(B)	Quorum sensing
(C)	Convergent evolution
(D)	Character displacement

Q.15	Male rhinoceros beetles have horns that they use to fight each other. Despite the competitive advantage of having large horns, horn length never exceeds two thirds of their body length. What form of selection explains why horn length is constrained?
(A)	Directional selection
(B)	Disruptive selection
(C)	Artificial selection
(D)	Stabilizing selection
Q.16	Lizards that produce many eggs often have a shorter lifespan than those who produce fewer eggs. Which one of the terms below describes the relationship between the number of eggs and lifespan?
(A)	Compensatory growth
(B)	Frequency dependent selection
(C)	Biomagnification
(D)	Life-history tradeoff

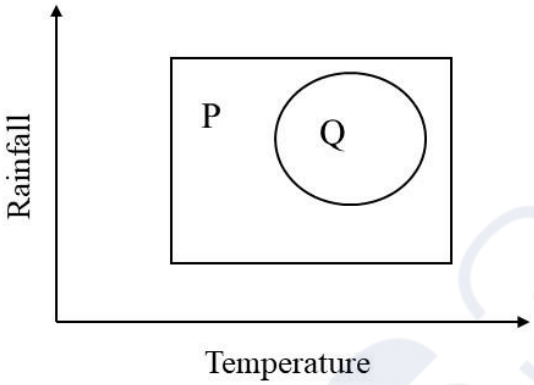
Q.17	A butterfly species in a homogenous forest patch starts exhibiting assortative mating, such that spotted individuals always mate with each other and plain individuals always mate with each other. This trait is heritable, and spotted parents always produce spotted offspring and plain parents always produce plain offspring. Which one of the following forms of speciation could this prezygotic reproductive barrier most likely lead to?
(A)	Sympatric speciation
(B)	Cryptic speciation
(C)	Allopatric speciation
(D)	Peripatric speciation
Q.18	The hippocampus is a region of the brain whose size is positively correlated with navigation and spatial mapping ability in birds and mammals. Which one of the following observations would NOT be consistent with this statement?
(A)	When the size of the hippocampus is surgically reduced in laboratory rats, their ability to find food is reduced in a radial arm maze
(B)	Bird species that hoard food in different parts of their territory have a larger hippocampus than similarly-sized bird species that do not hoard food
(C)	In domestic pigeons, non-homing varieties have a larger hippocampus than homing varieties
(D)	In voles, males have larger home ranges than females, and the hippocampus of males is larger than that of females

Q.19	A bird eats two types of worms, P and Q, picking them randomly. Which one of the following describes the kind of probability distribution of the number of worms of type P eaten by the bird in a day?
(A)	Binomial
(B)	Normal
(C)	Log-normal
(D)	Uniform
Q.20	Which one of the following is an example of a cell type found only in a single phylum?
(A)	Cnidocyte
(B)	Erythrocyte
(C)	Myocyte
(D)	Neurocyte

Q.21	Fossils of most of the modern animal phyla first appeared over a short period of time. In which one of the following geological time periods did this occur?
(A)	Cambrian
(B)	Cretaceous
(C)	Jurassic
(D)	Permian
Q.22	Certain species of ibex and weevils depend on the same food source. A study finds that the removal of ibex results in an increase in the number of weevils, but the removal of weevils does not affect the ibex. Which one of the following options best describes this interaction?
(A)	Amensalism
(B)	Commensalism
(C)	Mutualism
(D)	Parasitism

Q. 23	Across trophic levels, energy flows from producers to primary consumers, and from primary consumers to secondary consumers. Which one of the following options best represents the percentage of energy that is transferred from producers to secondary consumers?
(A)	Between 0.01 and 0.02 %
(B)	Between 0.5 and 1.5 %
(C)	Between 7.5 and 12.5 %
(D)	Between 72.5 and 77.5 %
Q.24	High water temperatures can cause coral bleaching, which often leads to coral death. In coral reefs that experience repeated bleaching, there can be substantial algal growth on dead coral, eventually leading to an algal dominated ecosystem. Such a transformation is known as
(A)	adaptive radiation
(B)	coral transplantation
(C)	coral recruitment
(D)	phase shift

Q. 25	The species richness of trees increases from North to South in the Western Ghats, and from South to North in the Andes. Which one of the following can be an explanation for these patterns?
(A)	Greater incident solar radiation at lower latitudes
(B)	Higher temperature at higher latitudes
(C)	Greater distance from the coast at lower latitudes
(D)	Stronger trade winds at higher latitudes
Q.26	Local communities are comprised of a subset of species from the regional species pool. Which one of the following processes is LEAST likely to cause species composition of local communities to differ from one another?
(A)	Local interspecific competition
(B)	Regionally stable climatic conditions
(C)	Stochastic demographic variation
(D)	Local predator-prey interactions

Q.27	In this figure, the rectangle (P) depicts the range of temperature and rainfall in which a plant species can survive and propagate. The circle (Q) demarcates the range of temperature and rainfall in which this plant species is actually found. Which one of the following statements about P and Q is accurate for this plant species? 
(A)	P is the fundamental niche and Q is the realized niche
(B)	P is the fundamental niche and Q is the habitat
(C)	Q is the fundamental niche and P is the realized niche
(D)	Q is the fundamental niche and P is the habitat

Q.28 Match the following **geographic regions** to the **mammals** that are native to those regions.

Geographic regions	Mammals
(P) Western Ghats	(i) Golden langur
(Q) Western Himalaya	(ii) Malabar giant squirrel
(R) Northeast India	(iii) Pika
(S) Andaman and Nicobar Islands	(iv) Nilgai
	(v) Long-tailed macaque

(A) P-iii; Q-ii; R-i; S-v

(B) P-ii; Q-iii; R-i; S-iv

(C) P-ii; Q-iii; R-i; S-v

(D) P-iii; Q-v; R-ii; S-iv

Q.29	Mayflies lay eggs in water. Their nymphs (immature life stage) are aquatic and adults are terrestrial. Some mayflies perceive dry, paved parking lots as waterbodies and lay eggs there that do not survive. In this situation, which one or more of these statements is/are correct?
(A)	These parking lots are ecological sink habitats, whereas adjacent waterbodies are source habitats
(B)	This is an example of antagonistic coevolution between humans and insects
(C)	Mayflies have an iteroparous life history strategy
(D)	Laying eggs in these parking lots instead of waterbodies would reduce the fitness of individual female mayflies

Q.30	Fish schools in coral reefs can comprise multiple species that swim and forage together. Which one or more of the following options describe(s) potential fitness benefit(s) to individuals in a mixed-species group?
(A)	Individuals of some species draw the attention of predators away from the school, thereby sacrificing themselves for the survival of the group
(B)	Some species join mixed-species groups in order to hybridize
(C)	Larger groups reduce the per capita risk of predation
(D)	Individuals of some species feed on the substrate, while others feed on the invertebrates that are flushed out by the substrate-feeder

Q. 31	During migration, which one or more of the following do birds use for long-distance navigation?
(A)	Celestial cues
(B)	Earth's magnetic field
(C)	Chemical cues
(D)	Polarized light

Q.32	Which one or more of the following functions do insects directly perform in ecosystems?
(A)	Decomposition
(B)	Pollination
(C)	Photosynthesis
(D)	Vernalization

Q.33	In a lake with a large population of fish, there are 4 blue fish for every red fish. Every fish has an equal probability of being caught. If you dip a net into this lake and pick up 4 individuals at random, the probability that you will get 2 fish of each colour is _____ (*Round off to three decimal places*)

Q.34	There are 9 different rock lizard species, each with a unique colour. Lizards of 2 different species sit on a rock at any given time. The number of possible colour combinations of rock lizards seen together on a rock is _____ (*Answer in integer*)

Q.35	In a population of 534 blue sheep, there are two alleles, P and Q, at an autosomal locus. Allele P has a frequency of 30%. The number of sheep with the QQ genotype is 262. Assuming that this population is at Hardy-Weinberg equilibrium, the expected percentage of sheep with the PQ genotype in the population is _____% (*Round off to two decimal places*)

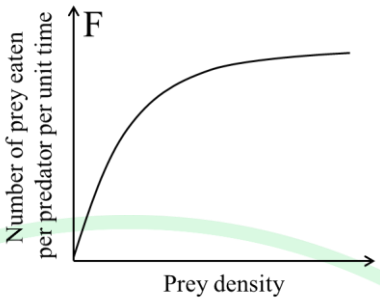
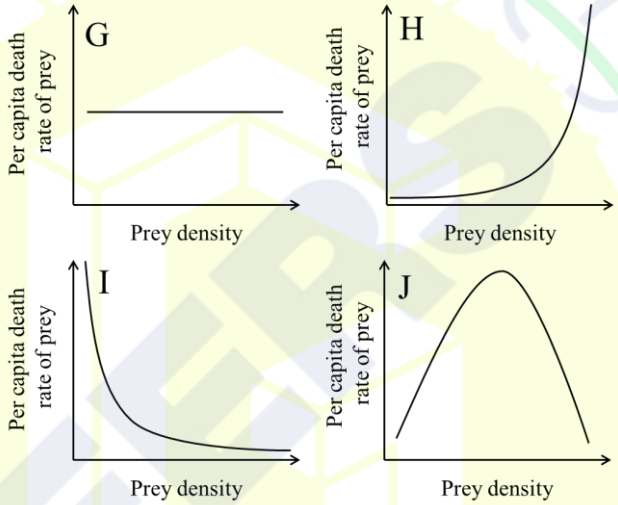
Q.36 – Q.65 Carry TWO marks Each

Q.36	Rotting leaves of mango are composed of 25% of compound P which decomposes exponentially at a rate $k_P = 0.5\ yr^{-1}$ and 75% of compound Q which decomposes exponentially at a rate $k_Q = 0.1\ yr^{-1}$. What percentage of the initial amount of compound Q remains when half of the initial amount of compound P has decomposed? Choose the closest numerical value from the options provided.
(A)	87%
(B)	50%
(C)	75%
(D)	37%

Q.37	The origin and proliferation of which one of the following organisms was responsible for the ‘Great Oxidation Event’?
(A)	Cyanobacteria
(B)	Fungi
(C)	Plants
(D)	Virus

Q.38	Which one of the following mechanisms is expected to generate tightly linked genes?
(A)	Chromosomal inversion
(B)	Deletion of an exon
(C)	Gene duplication
(D)	Insertion of an exon

Q.39	Newts produce tetrodotoxin (TTX), a poison that targets sodium ion channels, for defense against their predators, garter snakes. Several species of garter snakes are resistant to newt TTX due to specific known amino acid substitutions in garter snake sodium channels. Which one of the following is best-suited to identify whether this adaptation in garter snakes has a single origin or multiple independent origins?
(A)	Building a gene phylogeny of sodium ion channel in garter snakes
(B)	Building a species phylogeny of garter snakes
(C)	Building a gene phylogeny of newt sodium ion channels and species phylogeny of newts, and comparing them
(D)	Building a gene phylogeny of garter snake sodium ion channels and a species phylogeny of garter snakes, and comparing them
Q.40	Many insect species carry the endosymbiotic bacteria *Wolbachia*, which are maternally inherited. *Wolbachia* persist over time in these insect hosts by increasing the fitness of the infected host. This increased host fitness can lead to the fixation of *Wolbachia* in the host population, wherein all individuals carry it. Which one of the following statements describes a process that would NOT allow *Wolbachia* to become fixed in the host population?
(A)	*Wolbachia* induce cytoplasmic incompatibility and so, mating between infected and uninfected host individuals produces no viable offspring
(B)	*Wolbachia* increase the fecundity of the host by increasing its longevity
(C)	*Wolbachia* increase the immune response of the host to other infections
(D)	*Wolbachia* induce cytoplasmic compatibility and so, only mating between infected and uninfected host individuals produces viable offspring

Q.41	Figure F shows how predation rate changes with increasing prey density.  Which one of the figures represents the per capita death rate of prey under the conditions of F? 
(A)	G
(B)	H
(C)	I
(D)	J

Q.42	Fungus S infects elm trees and fungus T infects chestnut trees, and both kill their hosts within a year of infection. A forest with equal density of elm and chestnut trees is colonized by both pathogenic fungi. A 100 years later, the elm tree population has declined and the chestnut trees have become extinct. Which one of the following mechanisms would NOT contribute to this outcome?
(A)	Fungus S is dispersed by flightless beetles and fungus T disperses by wind
(B)	Elm trees reproduce much more quickly than chestnut trees
(C)	Elm seeds disperse far away from the parent, while chestnut seeds fall near the parent
(D)	Fungus S reproduces much more quickly than fungus T

Q.43

The table below provides a list of **study questions** (P, Q, R) and **statistical tests** (i, ii, iii).

Study question	Statistical Test
(P) Does flower colour follow Mendelian inheritance?	(i) Student's t-test
(Q) Does increased visitation by pollinators increase the number of viable fruits produced by an individual?	(ii) Chi-square test
(R) Does the quantity of nectar production differ between flowers that were visited by pollinators compared to those that had no pollinator visitation?	(iii) Pearson's correlation analysis

Which one of the following options correctly matches the study question to the most appropriate statistical test?

(A) P-i; Q-ii; R-iii

(B) P-i; Q-iii; R-ii

(C) P-ii; Q-i; R-iii

(D) P-ii; Q-iii; R-i

Q.44	A researcher wants to estimate the number of crickets in an isolated valley. They captured 56 crickets in the first session, and then marked and released them. In the second session, they captured 41 crickets of which 8 were already marked. Assuming that there is no birth, death, immigration or emigration in the cricket population during the study period, what is the estimated number of crickets in this valley?
(A)	97
(B)	247
(C)	287
(D)	334

Q.45

The table below lists potential **environmental conditions** in future climates, related to atmospheric carbon dioxide concentrations (CO_2) and mean annual temperature (MAT).

The table also lists potential **outcomes** with respect to whether conditions will favour grasses with C3 or C4 photosynthetic pathways.

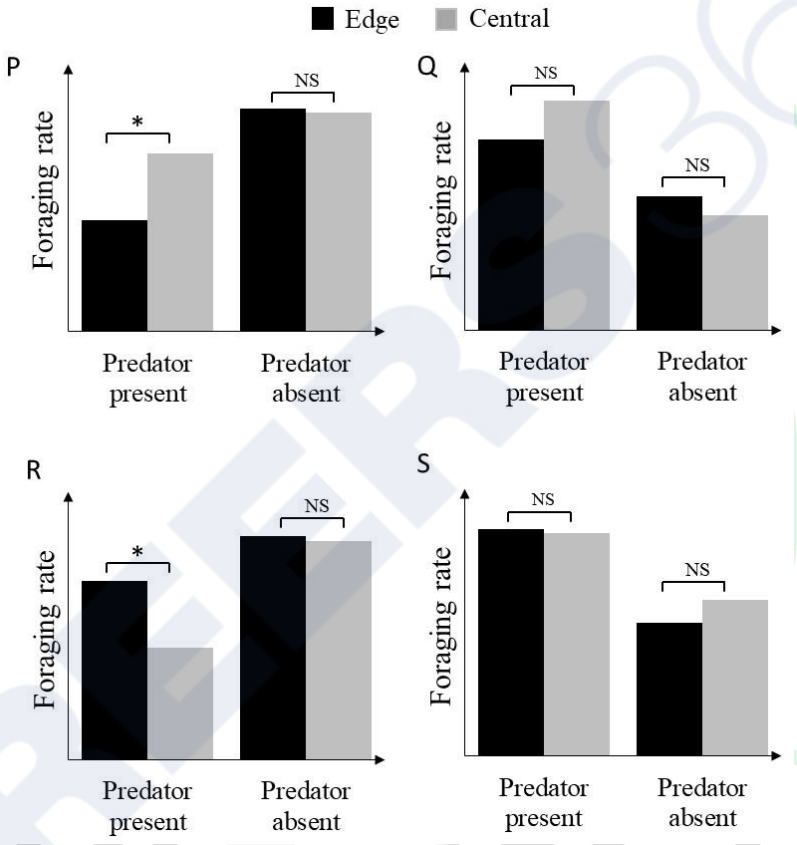
Assuming no other changes in environmental conditions, match the options in the two columns.

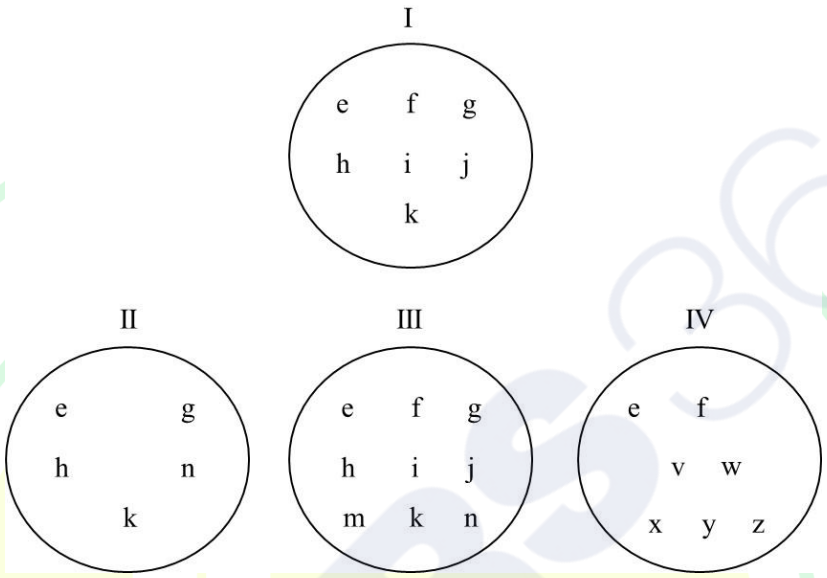
Environmental conditions	**Outcomes**
(P) Increased CO_2, no change in MAT	(i) C3 performs better than C4
(Q) No change in CO_2, increased MAT	(ii) C4 performs better than C3
	(iii) C3 and C4 perform equally

(A)	P-i; Q-iii
(B)	P-i; Q-ii
(C)	P-ii; Q-iii
(D)	P-iii; Q-ii

Q.46	In a grassland (P), there are 8 plant species with a similar number of individuals of each species. In another grassland (Q), there are 12 species with uneven abundances. Which one of the following statements about the Shannon's diversity index of P and Q is correct?
(A)	The diversity index of P is greater than Q
(B)	The diversity index of P is less than Q
(C)	The diversity index of P is equal to Q
(D)	There is not enough information to draw a conclusion
Q.47	Which one of the following statements about genetic drift is accurate?
(A)	Like mutation, drift increases genetic variation within a population
(B)	Drift typically increases genetic differences between populations
(C)	Drift typically reinforces the effects of natural selection in populations
(D)	Drift increases with population size, leading to faster evolution

Q.48	Mean global temperature since pre-industrial times has increased approximately by
(A)	0 to 0.5 ℃
(B)	1 to 1.5 ℃
(C)	2 to 3 ℃
(D)	3 to 5 ℃

Q.49	In a deer species that lives in groups, some individuals act as sentinels and are vigilant for predators but there is a trade-off between foraging and vigilance. A researcher collects data on the foraging rates of edge (black) and central (grey) members of the group in two similar forests, one with and one without predators. Which one of the following figures best supports the hypothesis that members at the edge are acting as sentinels in this deer species? (For comparisons within a forest, * denotes a statistically significant difference, and NS denotes no difference. Comparisons between forests with versus without predators are always statistically significantly different.) 
(A)	P
(B)	Q
(C)	R
(D)	S

Q.50	A patch of forest (I) has been declared as a protected area. Conservationists have surveyed three other patches of forest (II, III and IV) and can only recommend one of them for protection. In the figure below, each letter denotes a different species of frog. The conservationists recommend that Patch IV should be protected. Which one of the following metrics is this decision based on? 
(A)	Species richness
(B)	Complementarity
(C)	Alpha diversity
(D)	Evenness

Q.51	The numbers of rabbits (R) and their predators, foxes (F), in an ecosystem are modelled by the Lotka-Volterra equations as follows: $$\frac{dR}{dt} = 2R - 0.01\,R\,F$$ $$\frac{dF}{dt} = -F + 0.005\,R\,F$$ where the time is measured in months. If there are currently 100 rabbits and 10 foxes, the number of rabbits is changing at the rate of _____ per month and the number of foxes is changing at the rate of _____ foxes per month.
(A)	+190 and -5
(B)	+5 and -190
(C)	-190 and +5
(D)	-10 and +5

Q.52	The number of species found on islands typically increases with the size of the island. Which one or more of the following options explains this relationship between island size and species richness?
(A)	Large islands have more habitat types than small islands
(B)	Large islands are colonized by more species than small islands
(C)	Small islands have higher species extinction rates than large islands
(D)	Small islands are closer to the mainland than large islands
Q.53	Decreasing surface area to volume ratio helps reduce heat loss in colder climates. In which one or more of the following observations does this play a role?
(A)	Related species of mammals are larger in size at higher latitudes
(B)	Birds lay more clutches of eggs at higher latitudes
(C)	Birds and mammals huddle tightly together at higher latitudes
(D)	Mammals have longer limbs and larger ears at higher latitudes

Q.54 The table below describes the number of tree species in a forest whose seeds are dispersed by large or small animals, and whether they are insect or wind pollinated.

In the past, seed dispersers and pollinators were abundant in this forest. Now, there are very few large animal dispersers, but the number of small animal dispersers has not changed. There are also very few insect pollinators in this forest.

Which one or more of the following inferences about trees in the forest can be drawn from these changes in seed dispersers and pollinators?

	Insect pollinated	**Wind pollinated**
Dispersed by large animals	85 tree species	19 tree species
Dispersed by small animals	25 tree species	11 tree species

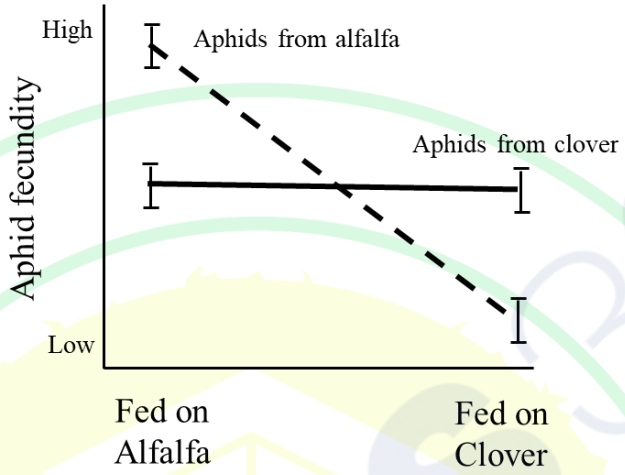
(A) Mortality of all trees in this forest will decrease in the future

(B) Mortality of a large number of trees in this forest will increase in the future

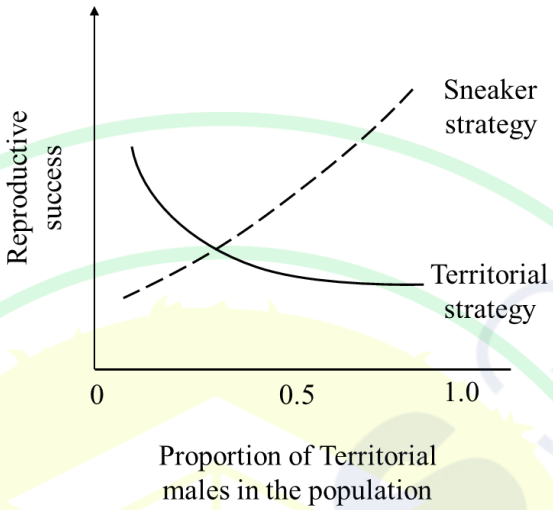
(C) Regeneration of all tree species in this forest will increase in the future

(D) Regeneration of a large number of tree species will decrease in future

Q.55	Which one or more of the following would make a plant community more susceptible to invasion by exotic plants?
(A)	Anthropogenic influx of nutrients
(B)	Decline in density of a dominant species due to disease
(C)	Arrival of a highly competitive exotic species
(D)	Absence of suitable pollinators for an invading species

Q.56	Aphids feed on both alfalfa and clover plants. A researcher collected and reared different genotypes of aphids from separate alfalfa and clover fields. He then measured the fecundity of both aphid groups when fed on each of the two host plants. The figure summarizes the performance of aphid groups originating from alfalfa (dashed) or clover (solid).  Which one or more of the following situations does the figure depict?
(A)	Aphids demonstrate a genotype by environment interaction
(B)	Aphids from clover fields are much less genetically variable than aphids from alfalfa fields
(C)	Aphids from clover fields are locally adapted to their original host
(D)	Aphids from clover fields show high plasticity

Q.57	Which one or more of the following processes has/have resulted in increased greenhouse gases in the atmosphere over the last 100 years?
(A)	Increasing levels of N_2 in the atmosphere due to increased denitrification
(B)	Increased release of CO_2 into the atmosphere due to the burning of fossil fuels
(C)	Increased release of methane into the atmosphere due to livestock
(D)	Increased release of methane from wetlands soil

Q.58	The figure below shows the reproductive success of two alternative mating strategies, with respect to their frequency in the population. Territorial males (solid line) defend territories to get mates, and Sneaker males (dashed line) obtain mating opportunities without having territories.  Which one or more of the following conclusions can be drawn from this figure?
(A)	The reproductive success of Territorial and Sneaker males can never be the same in the population
(B)	The reproductive success of Sneaker males is influenced by the proportion of Territorial males in the population
(C)	The highest possible reproductive success can be obtained by Sneaker males, and not Territorial males
(D)	Territorial males will always have a higher reproductive success than Sneaker males

Q.59 From the table below, choose one or more of the options that match(es) the **evolutionary biologists** with the **organisms** they are well-known to have studied.

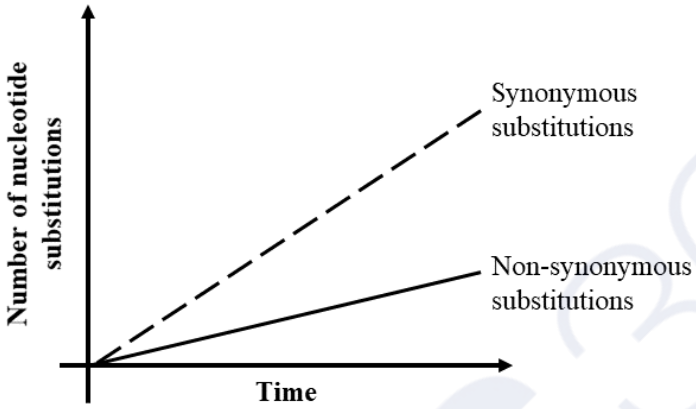
Evolutionary biologist	**Organism**
(P) Charles Darwin	(i) Mountain gorilla
(Q) Gregor Mendel	(ii) Giant tortoise
(R) Dian Fossey	(iii) Finches
(S) Frederick Griffith	(iv) Pea plant
	(v) *Streptococcus pneumoniae*

(A) P–ii; Q–iv; R–i; S–v

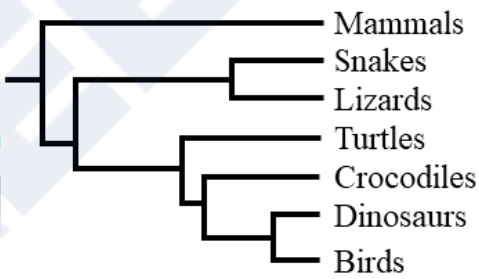
(B) P–ii; Q–iv; R–ii; S–iv

(C) P–iii; Q–iv; R–i; S–v

(D) P–v; Q–i; R–v; S–iii

Q.60	Consider the following figure of sequence divergence over time. The dashed and solid lines represent synonymous and non-synonymous substitutions, respectively. Which one or more of the following does the figure support? 
(A)	Adaptive evolution
(B)	Molecular clock
(C)	Neutral theory of evolution
(D)	Positive selection

Q.61	Modern humans of European descent have a much higher proportion of Neanderthal DNA than modern humans of African descent. Which one or more of the following statements is/are consistent with this information?
(A)	Following the migration of Neanderthals out of Africa into Europe, modern humans, who were already present in Europe, bred with them
(B)	Following the migration of modern humans out of Africa into Europe, Neanderthals, who were already present in Europe, bred with them
(C)	Modern humans and Neanderthals bred in Africa and then migrated out of Africa into Europe
(D)	Modern humans and Neanderthals did not interbreed

Q.62	A phylogenetic tree representing the evolutionary relationship between various vertebrates is shown below.  Given this tree topology, which one or more of the following statements is/are correct?
(A)	Crocodiles are more closely related to turtles than they are to dinosaurs
(B)	Mammals represent the outgroup with respect to reptiles
(C)	Dinosaurs are more closely related to crocodiles than they are to birds
(D)	Reptiles are nested within mammals

Q.63

The population of whirligig beetles in a lake grows or declines exponentially i.e.

$$N(t) = N(0)e^{rt}$$

where $N(t)$ is the population size at time t, $N(0)$ is the initial population size and r is the per capita rate of population change, occurring only due to birth and death.

A researcher tracks population sizes for a year and finds the following:

Time interval	**Number of beetles at start**	**Number of beetles at end**
January – March	1000	150
April – June	150	3013
July – September	3013	100
October – December	100	2009

Assuming that the individual birth rates remain constant throughout the year and only death rates are affected, which one or more of the following statements is/are true?

(*In your calculations, round off the birth and date rates to two decimal places*)

(A) The death rate during April–June is equal to that during October–December

(B) The death rate during July–September is lower than that during January–March

(C) The death rate during July–September is higher than that during January–March

(D) The death rate during April–June is higher than that during October–December

Q.64	Which one or more of the following conditions is/are necessary for the evolution of increased nectar production in an insect-pollinated plant via natural selection?
(A)	Increased nectar production in individual plants results in greater fruit set and number of offspring for these individuals
(B)	The quantity of nectar produced by flowers varies across individuals in the population
(C)	The quantity of nectar produced by a flower increases when more pollinators visit that same flower
(D)	The quantity of nectar produced is heritable, i.e. passed on from parent to offspring

Q.65	The following empirical relationship describes how the number of trees $N(t)$ in a patch changes over time (t) $$N(t) = -2t^2 + 12t + 24$$ where $t = 0$ is when the number of trees were first counted. Given this relationship, the maximum number of trees that occur in the patch is _____ (*Round off to the nearest integer*)

Answer Key for Ecology and Evolution (EY)

Q. No.	Session	Q. Type	Section	Key/Range	Marks
1	6	MCQ	GA	A	1
2	6	MCQ	GA	D	1
3	6	MCQ	GA	B	1
4	6	MCQ	GA	B	1
5	6	MCQ	GA	A	1
6	6	MCQ	GA	B	2
7	6	MCQ	GA	D	2
8	6	MCQ	GA	MTA*	2
9	6	MCQ	GA	C	2
10	6	MCQ	GA	B	2
11	6	MCQ	EY	A	1
12	6	MCQ	EY	A	1
13	6	MCQ	EY	B	1
14	6	MCQ	EY	A	1
15	6	MCQ	EY	D	1
16	6	MCQ	EY	D	1
17	6	MCQ	EY	A	1
18	6	MCQ	EY	C	1
19	6	MCQ	EY	A	1
20	6	MCQ	EY	A	1
21	6	MCQ	EY	A	1
22	6	MCQ	EY	A	1
23	6	MCQ	EY	B	1
24	6	MCQ	EY	D	1
25	6	MCQ	EY	A	1
26	6	MCQ	EY	B	1
27	6	MCQ	EY	A	1
28	6	MSQ	EY	C	1
29	6	MSQ	EY	A;D	1
30	6	MSQ	EY	C;D	1

31	6	MSQ	EY	A;B;D	1
32	6	MSQ	EY	A;B	1
33	6	NAT	EY	0.150 to 0.160	1
34	6	NAT	EY	36 to 36	1
35	6	NAT	EY	41.00 to 43.00	1
36	6	MCQ	EY	A	2
37	6	MCQ	EY	A	2
38	6	MCQ	EY	A	2
39	6	MCQ	EY	D	2
40	6	MCQ	EY	D	2
41	6	MCQ	EY	C	2
42	6	MCQ	EY	D	2
43	6	MCQ	EY	D	2
44	6	MCQ	EY	C	2
45	6	MCQ	EY	B	2
46	6	MCQ	EY	D	2
47	6	MCQ	EY	B	2
48	6	MCQ	EY	B	2
49	6	MCQ	EY	A	2
50	6	MCQ	EY	B	2
51	6	MCQ	EY	A	2
52	6	MSQ	EY	A;B;C	2
53	6	MSQ	EY	A;C	2
54	6	MSQ	EY	D	2
55	6	MSQ	EY	A;B;C	2
56	6	MSQ	EY	A	2
57	6	MSQ	EY	B;C;D	2
58	6	MSQ	EY	B;C	2
59	6	MSQ	EY	A;C	2
60	6	MSQ	EY	B;C	2
61	6	MSQ	EY	B	2
62	6	MSQ	EY	B	2
63	6	MSQ	EY	A;C	2
64	6	MSQ	EY	A;B;D	2
65	6	NAT	EY	42 to 42	2

***MTA= Marks To All**