

Previous Year Question Paper of

G.A.T.E. (EY) 2018 ECOLOGY & EVOLUTION

Examination

(Original Question Paper with Answer Key)
GRADUATE APTITUDE TEST IN ENGINEERING



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Q.	1	_	Q.	5	carry	one	mark	each.
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Q.1	"Going by theall the students in the		s make light work, the	school involved
The words that best fill the blanks in the above sentence are				
	(A) principle, princip (C) principle, princip		(B) principal, princip (D) principal, princip	
Q.2	"Her should need."	d not be confused with	miserliness; she is eve	er willing to assist those in
	The word that best fi	lls the blank in the abo	ove sentence is	
	(A) cleanliness	(B) punctuality	(C) frugality	(D) greatness
Q.3		e 7 minutes to make 7 is e for 100 machines to	dentical toys. At the samake 100 toys?	ame rate, how many
	(A) 1	(B) 7	(C) 100	(D) 700
Q.4		this process, the rectar		reduced by 10 m and 5 m, rea. What is the area of the
	(A) 1125	(B) 2250	(C) 2924	(D) 4500
Q.5		of two digits. The sun e interchanged. What is	_	45 is subtracted from the
	(A) 63	(B) 72	(C) 81	(D) 90
Q. 6 –	Q. 10 carry two mar	ks each.		
Q.6		c , what would be the $ c $ + $ c $ + $ c $ = (num values respectively of
	(A) -3 and 3	(B) -1 and 1	(C) -1 and 3	(D) 1 and 3

GA 1/2

- Given that a and b are integers and $a + a^2 b^3$ is odd, which one of the following 0.7 statements is correct?
 - (A) a and b are both odd

(B) a and b are both even

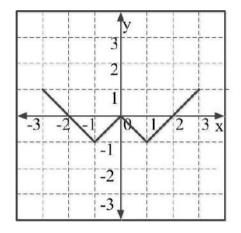
(C) a is even and b is odd

- (D) a is odd and b is even
- From the time the front of a train enters a platform, it takes 25 seconds for the back of the Q.8 train to leave the platform, while travelling at a constant speed of 54 km/h. At the same speed, it takes 14 seconds to pass a man running at 9 km/h in the same direction as the train. What is the length of the train and that of the platform in meters, respectively?
 - (A) 210 and 140

(B) 162.5 and 187.5

(C) 245 and 130

- (D) 175 and 200
- Which of the following functions describe the graph shown in the below figure? Q.9



(A) y = ||x| + 1| - 2(C) y = ||x| + 1| - 1

(B) y = ||x| - 1| - 1

- (D) y = ||x 1| 1|
- Q.10 Consider the following three statements:
 - (i) Some roses are red.
 - (ii) All red flowers fade quickly.
 - (iii) Some roses fade quickly.

Which of the following statements can be logically inferred from the above statements?

- (A) If (i) is true and (ii) is false, then (iii) is false.
- (B) If (i) is true and (ii) is false, then (iii) is true.
- (C) If (i) and (ii) are true, then (iii) is true.
- (D) If (i) and (ii) are false, then (iii) is false.

END OF THE QUESTION PAPER

Q. 1-Q. 25 carry one mark each.

Q.1	During the Ple extinction?	eistocene, which of	the following group	es experienced the larg	est mass
	(A) Large dine(B) Large mar(C) Reptiles(D) Trilobites				
Q.2	In group living	g species, the term	"dilution effect" ref	ers to	
	(B) reduction(C) reduction	in the mobility of i	ndividuals with incre success of individua	ncreasing group size easing group size als with increasing gro with increasing group s	_
Q.3	Which of the habitats?	following diversity	indices best capture	s species turnover acro	oss
	(A) α	(B) β	(C) γ	(D) δ	

EY 1/22

Q.4 A duck egg is removed from its mother's nest and incubated by a barnyard hen. The duckling hatches out in the presence of the barnyard hen and stays in her nest. After a couple of days, the duckling is presented with a choice between its biological mother and the hen that incubated it. The duckling approaches and follows the hen. This set of observations demonstrates the phenomenon of

- (A) habituation
- (B) imprinting
- (C) instinct
- (D) sensitization

Q.5 If both of your ears were located next to each other in the middle of your face, you would have difficulty in resolving the

- (A) direction of a sound
- (B) duration of a sound
- (C) loudness of a sound
- (D) pitch of a sound

Q.6 Forager bees communicate the distance of a food source using a waggle dance upon return to the hive. It is observed that the number of waggles of a dance increases linearly with the distance to the food source. This tells us that the

- (A) number of waggles and distance to food source is negatively correlated
- (B) number of waggles and distance to food source is positively correlated
- (C) number of waggles affects the distance to the food source
- (D) number of waggles and the distance to the food source are uncorrelated

EY 2/22

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Q.7		• •	cing loud acoustic sig	gnals. The use of these mple of
	(A) aposematism(B) deception(C) eavesdropping(D) mimicry			
Q.8		•	snake is brightly colo the same habitat. Th	oured and closely is is most likely a case
	(A) aggressive mim(B) Batesian mimic(C) masquerade(D) Müllerian mimi	ry		
Q.9		sting membrane pote al of which of the fol	ntial of a typical neu llowing ions?	ron is closest to the
	(A) Ca ⁺⁺	(B) K ⁺	(C) Mg ⁺⁺	(D) Na ⁺
Q.10		nd in India produces ving is the most likel		te, fragrant, and tubular.
	(A) Hummingbirds(C) Moths		(B) Lorises (D) Wind	

EY 3/22

Q.11	Which of the followa tropical versus a	_	test differences betw	veen mean tree heights in
	(A) Binomial test(B) Linear regressi(C) Pearson's corre(D) Student's t-test	elation		
Q.12		ming a relatively she etition will result in		evolution, increased
	(A) larger fundame (C) smaller fundam		(B) larger realized (D) smaller realized	
Q.13	In which of the foliation (A) Monoandry (B) Monogamy (C) Polyandry (D) Polygyny	llowing mating syste	ems is sperm compet	ition likely to evolve?
Q.14	Copies of genes the known as	at arrive in a particu	lar genome by horize	ontal gene transfer are
	(A) analogs	(B) homologs	(C) ohnologs	(D) xenologs

EY 4/22

Q.15	In which of the following plants is the dominant stage of the life cycle haploid?				
	(A) Cycads(C) Gymnosperms	(B) Ferns (D) Mosses			
Q.16	Which of the following is NOT typically pioneer plants relative to late succession	•			
	(A) Higher shade tolerance(C) Smaller size at maturity	(B) Smaller seed size(D) Wind dispersed seeds			
Q.17	Natural populations often deviate from I reason for this is	Hardy-Weinberg equilibrium. One possible			
	(A) no migration(C) random mating	(B) no selection(D) small population sizes			
Q.18	Which of the following is NOT an exam	nple of phenotypic plasticity?			
	 (A) Density-dependent swarming behavior in locusts (B) Increase in DDT resistance in mosquitos (C) Seasonal variation in plumage colouration in birds (D) Temperature-dependent sex determination in turtles 				

EY 5/22

Q.19 Which of the following is NOT a characteristic of *r*-selected species?

	(A) Early sexual ma(B) High juvenile m(C) High parental c(D) Large number of	nortality are		
Q.20	confirmation. The c	curator of the museund asks the scientis	t to also provide sam	e to a museum for holotype for the newly uples of the opposite sex.
	(A) allotype	(B) isotype	(C) karyotype	(D) neotype
Q.21	Which of the follow selection?	ving is NOT essenti	al for a behavioural	trait to evolve by natural
	(A) The behavioura(B) The behavioura(C) The behavioura(D) The behavioura	l trait is determined l trait influences re	l at least in part by g productive success	enes

EY 6/22

Q.22	El Niño Southern Oscillation (ENSO) events have occurred approximately every 3-7 years over the last century. The cause of these ENSO events is related to
	 (A) large-scale air-sea interactions in the Pacific Ocean (B) strong monsoon winds in the Indian Ocean (C) the melting of icebergs in the Antarctic Ocean (D) unsustainable overfishing in North Atlantic Ocean
Q.23	If the mean of a sample is 5, and the variance is 25, the PERCENT coefficient of variation is
Q.24	Consider a diploid population at Hardy-Weinberg equilibrium. For a locus with two alleles, the frequency of the A_1A_1 genotype is 0.01. The frequency of heterozygotes A_1A_2 is (answer up to 2 decimal places).
Q.25	In a food chain, the efficiency of transfer of energy from one trophic level to the next is 10%. The PERCENTAGE of energy that is expected to transfer from the second to the fourth level is

EY 7/22

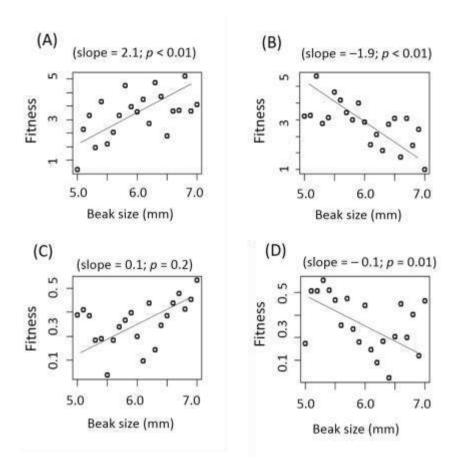
Q. 26 – Q. 55 carry two marks each.

- Q.26 Which of the following is an adaptation for osmoregulation in freshwater teleost fish?
 - (A) Excreting large quantities of dilute urine
 - (B) Excreting large quantities of uric acid
 - (C) Having high concentration of blood urea
 - (D) Excreting large quantities of uracil

- Q.27 The latitudinal diversity gradient is defined as the decrease in the number of species from the equator to the poles. This can result from
 - (A) greater energy input at the poles
 - (B) greater land mass at the poles
 - (C) greater seasonal variation at the poles
 - (D) greater speciation rates at the poles

EY 8/22

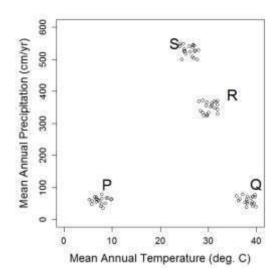
Q.28 Identify the graph in which natural selection on beak size is LEAST likely to be occurring? For each of the graphs, the slope of the regression line and the associated *p*-value is given.



- Q.29 Some species of spiders add additional silk 'decorations' to their webs. It is hypothesized that these decorations serve either to lure flies (prey) or to decrease bird (predator) attacks on the spiders. The appropriate way to test these hypotheses would be to compare numbers of
 - (A) predators and prey approaching decorated webs
 - (B) predators and prey approaching undecorated webs
 - (C) predators approaching decorated webs with prey approaching undecorated webs
 - (D) predators and prey approaching both decorated and undecorated webs

EY 9/22

Q.30 The figure below shows mean annual temperatures (°C) and mean annual precipitation (cm per year) from multiple sites in four regions in India.



From this climatic information, we can infer that P, Q, R, and S are LIKELY to be located in:

- (A) P: Andaman, Q: Meghalaya, R: Ladakh, S: Rajasthan
- (B) P: Ladakh, Q: Rajasthan, R: Andaman, S: Meghalaya
- (C) P: Meghalaya, Q: Ladakh, R: Rajasthan, S: Andaman
- (D) P: Rajasthan, Q: Andaman, R: Meghalaya, S: Ladakh
- Q.31 For a pair of interacting species, increased specialization and decreased niche breadth in both species would result in
 - (A) decreased intraspecific competition and increased interspecific competition
 - (B) decreased intraspecific competition and decreased interspecific competition
 - (C) increased intraspecific competition and increased interspecific competition
 - (D) increased intraspecific competition and decreased interspecific competition

EY 10/22

- Q.32 Males of a bird species provide parental care by feeding nestlings before they fledge. Which of the following is a PROXIMATE explanation for this behaviour?
 - (A) Feeding nestlings increases their survivorship after fledging
 - (B) High prolactin levels cause males to feed their nestlings
 - (C) Males from all species in this genus provide parental care
 - (D) Males that provide parental care have higher fitness

Q.33 The courtship display of a spider species consists of both visual and vibrational signals. Females respond to the display by approaching males. In an experiment, females were presented with 3 treatments: i) only videos of displaying males, ii) only vibrational signals of the display, and iii) both videos of displaying males and vibrational signals. The results are given below:

Treatment	Percent of responding	
	females	
Videos only	55%	
Vibrational signals only	0%	
Videos plus vibrational signals	95%	

Results from this experiment show that

- (A) vibrational signals are necessary to evoke a response
- (B) vibrational signals are sufficient to evoke a response
- (C) visual and vibrational signals are necessary to evoke a response
- (D) visual signals are necessary to evoke a response

EY 11/22

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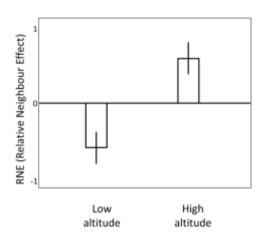


Q.34 Moth ears typically consist of a membranous eardrum backed by an air cavity. Ears in different phylogenetic groups of moths have evolved on different body parts.
Moth ears are thus best described as

- (A) convergent organs
- (B) homologous organs
- (C) maladaptive organs
- (D) vestigeal organs
- Q.35 Increased anthropogenic disturbance has resulted in an overall decrease in densities of trees and an increase in fragmentation of forests. Which of the following types of trees will have the greatest reduction in reproductive success?
 - (A) Dioecious species
 - (B) Monoecious species
 - (C) Self-compatible hermaphrodites
 - (D) Self-incompatible hermaphrodites

EY 12/22

Q.36 A study examined the effect of neighbours on plants when grown at low or high altitudes. The researcher measured Relative Neighbour Effect (RNE), defined as: RNE = Biomass with neighbours – Biomass without neighbours.



The results shown above demonstrate

- (A) competition at both altitudes
- (B) competition at high altitudes, and facilitation at low altitudes
- (C) competition at low altitudes, and facilitation at high altitudes
- (D) facilitation at both altitudes
- Q.37 Match the combination of flora and fauna from the list, to the state where they are found.

Combination	Fauna; Flora
P	Red panda; Rhododendron
Q	Pygmy hog; Elephant grass
R	Tiger; Mangrove
S	Hangul; Chinar

(A) P: Assam; Q: Jammu & Kashmir; R: West Bengal; S: Sikkim

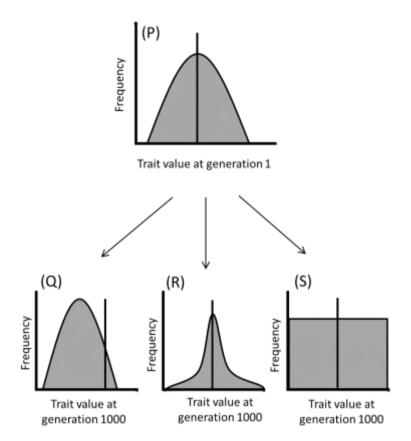
(B) P: Jammu & Kashmir; Q: Assam; R: West Bengal; S: Sikkim

(C) P: Sikkim; Q: Assam; R: West Bengal; S: Jammu & Kashmir

(D) P: Sikkim; Q: West Bengal; R: Assam; S: Jammu & Kashmir

EY 13/22

Q.38 A parent population (P) is split into three daughter populations (Q, R, and S) which grow in three different habitats. After 1000 generations, the equilibrium frequency distribution of a trait in each of the daughter populations is shown in the figure below. For reference, the vertical line represents the mean of the parent population.



From this information, one can infer that the subpopulations experienced the following selection regimes

(A) Q: Directional; R: Stabilizing; S: No selection

(B) Q: Directional; R: Stabilizing; S: Stabilizing

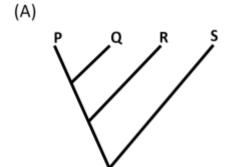
(C) Q: Directional; R: Directional; S: Stabilizing

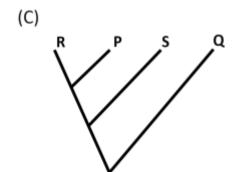
(D) Q: Stabilizing; R: Directional; S: No selection

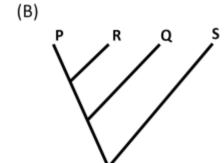
EY 14/22

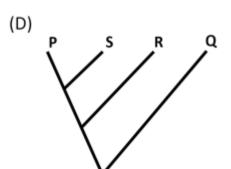
Q.39 The character matrix below lists four taxa (P-S) and their nine characters (i-ix). A character state is designated as '0' if it is ancestral and '1' if it is derived. Which of the following phylogenetic trees is obtained by cladistic analysis of these data?

	P	Q	R	S
i)	0	1	0	0
ii)	1	1	0	0
iii)	1	1	1	0
iv)	1	1	0	0
v)	1	1	1	0
vi)	0	1	0	0
vii)	1	1	1	0
viii)	0	1	0	0
ix)	1	1	1	0









EY 15/22

Q.40 The reactions below (R1 and R2) represent different carbon fixation pathways in photosynthesis.

RuBP represents Ribulose bisphosphate.

Rubisco represents RuBP carboxylase-oxygenase.

PGA represents Phosphoglyceric acid.

PEP represents Phosphoenolpyruvate.

R1.
$$CO_2 + RuBP \xrightarrow{Rubisco} PGA$$

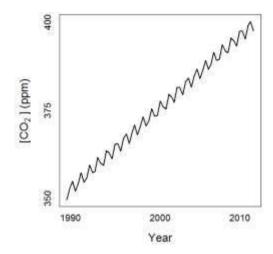
R2.
$$CO_2 + PEP \xrightarrow{PEP-Carboxylase} Malic Acid$$

Which of the following is CORRECT?

- (A) R1 and R2 both occur in C-3 and CAM photosynthesis
- (B) R1 occurs in C-4 photosynthesis; R2 occurs in C-3 photosynthesis
- (C) R1 occurs in C-3 photosynthesis; R2 occurs in C-4 photosynthesis
- (D) R1 occurs in C-4 and CAM photosynthesis; R2 occurs in C-3 photosynthesis
- Q.41 A fish species is sexually dimorphic: males possess ultraviolet (UV) spots on their bodies which are lacking in females. Females prefer males with larger and more intense UV spots as mates. Which of the following statements is a plausible reason for the spots being coloured ultraviolet?
 - (A) Females assess males from long distances
 - (B) Females are not sensitive to UV light
 - (C) Ultraviolet spots are a poor indicator of male quality
 - (D) Ultraviolet spots are more conspicuous to predators

EY 16/22

Q.42 A climate scientist notices a trend in atmospheric CO₂ concentrations (in ppm) at a research station. Although overall CO₂ is rising over decades, there are intra-annual fluctuations, as shown in the figure below.



These fluctuations can be attributed to

- (A) burning of fossil fuels by automobiles and industry
- (B) oscillations due to El Niño and La Niña events
- (C) rising sea levels due to melting of polar ice-caps
- (D) seasonal trends in photosynthesis and respiration

Q.43 Four islands differ in size (small = 10 km^2 , large = 100 km^2) and distance from the mainland (near = 50 km, far = 500 km).

Island P is small and near the mainland;

Island Q is small and far from the mainland;

Island R is large and near the mainland;

Island S is large and far from the mainland

Let N_P, N_Q, N_R and N_S denote the number of species on islands P, Q, R and S, respectively. Which of the following is consistent with the theory of island biogeography?

(A)
$$N_Q > N_S > N_P > N_R$$

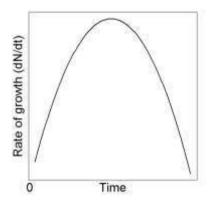
$$(B)\ N_R > N_Q > N_P > N_S$$

(C)
$$N_0 > N_P > N_S > N_R$$

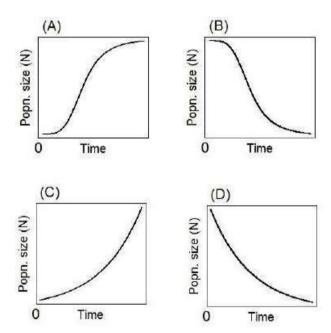
$$(D)\ N_R > N_P > N_S > N_Q$$

EY 17/22

Q.44 The rate of population growth (dN/dt) over time (t) is shown below.

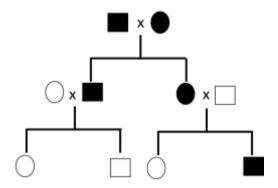


For the above population, which of the following plots of population (Popn.) size (N) vs. time (t) is CORRECT?



EY 18/22

Q.45 The pedigree below details a late onset genetic disease among humans. Males are represented as squares and females as circles. Individuals with the disease are depicted as black, and those without it are depicted as white. Which of the following best describes the pattern of inheritance of the disease-causing gene?



- (A) Mitochondrial
- (B) X-linked dominant
- (C) X-linked recessive
- (D) Y-linked
- Q.46 Match the following scientists with the concepts or theories they are associated with.

(P) WD Hamilton	(i) Neutral Theory of Molecular Evolution
(Q) RA Fisher	(ii) Island Biogeography
(R) M Kimura	(iii) Inclusive Fitness
(S) RH MacArthur	(iv) Runaway Sexual Selection

- (A) P-iii, Q-i, R-iv, S-ii
- (B) P-ii, Q-iii, R-iv, S-i
- (C) P-iii, Q-iv, R-i, S-ii
- (D) P-ii, Q-iii, R-i, S-iv

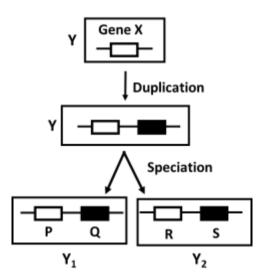
EY 19/22

- Q.47 Which of the following is an example of complete intrinsic post-zygotic reproductive isolation between two species P and Q?
 - (A) P and Q can mate and have fertile offspring
 - (B) P and Q can mate but their offspring are inviable
 - (C) P and Q have breeding seasons during different times of the year
 - (D) P and Q have different courtship behaviour
- Q.48 Match the animals to their locomotor adaptation.

Adaptation	Animal
(P) Volant	(i) Ostrich
(Q) Fossorial	(ii) Slow Loris
(R) Arboreal	(iii) Naked Mole Rat
(S) Cursorial	(iv) Bat

EY 20/22

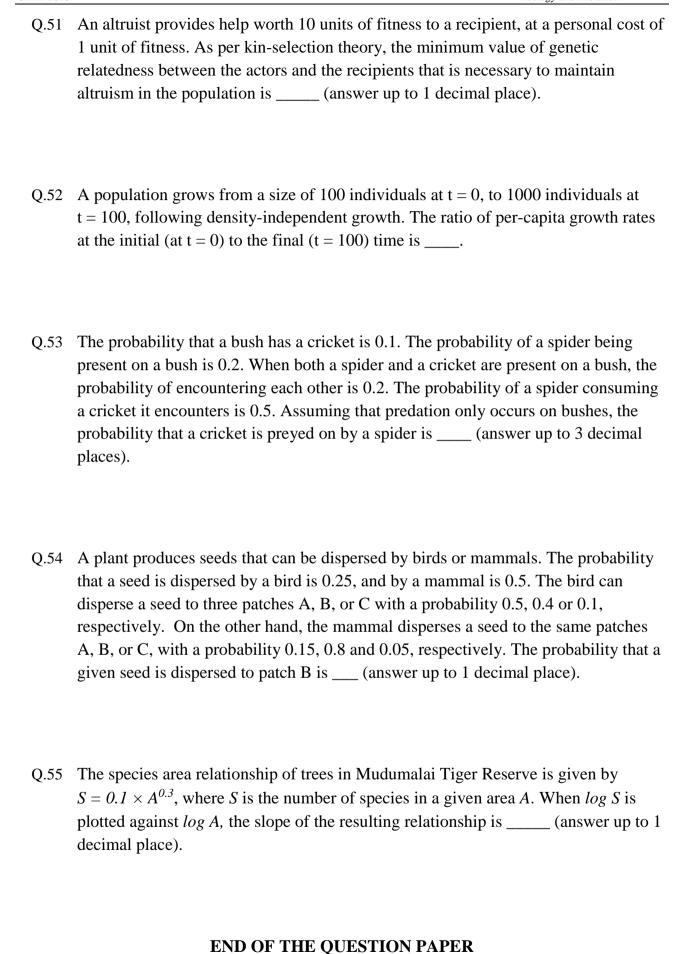
Q.49 Paralogs are genes that are the products of gene duplication events within a species. Orthologs are genes in different species that share a common ancestral gene. The figure below describes the evolutionary history of a hypothetical gene X in organism Y. This gene undergoes a duplication event. Later, Y splits into two species Y₁ and Y₂, and this gives rise to four copies of the gene - P, Q, R and S. Which option best describes the relationships between the four copies of the gene X?



- (A) P & Q are orthologs, Q & R are paralogs
- (B) R & S are orthologs, S & Q are paralogs
- (C) R & S are orthologs, Q & R are paralogs
- (D) P & R are orthologs, R & S are paralogs

Q.50 The frequency distribution of beak sizes of a bird species is symmetric but not normally distributed. If the mean value of beak size is 6 mm, standard deviation is 25 mm and kurtosis is 10, then the median is ____ mm.

EY 21/22



EY 22/22

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Q.No.	Туре	Section	Key/Range	Marks
1	MCQ	GA	А	1
2	MCQ	GA	С	1
3	MCQ	GA	В	1
4	MCQ	GA	В	1
5	MCQ	GA	В	1
6	MCQ	GA	Α	2
7	MCQ	GA	D	2
8	MCQ	GA	D	2
9	MCQ	GA	В	2
10	MCQ	GA	С	2
1	MCQ	EY	В	1
2	MCQ	EY	D	1
3	MCQ	EY	В	1
4	MCQ	EY	В	1
5	MCQ	EY	Α	1
6	MCQ	EY	В	1
7	MCQ	EY	С	1
8	MCQ	EY	В	1
9	MCQ	EY	В	1
10	MCQ	EY	С	1
11	MCQ	EY	D	1
12	MCQ	EY	D	1
13	MCQ	EY	С	1
14	MCQ	EY	D	1

Q.No.	Туре	Section	Key/Range	Marks
15	MCQ	EY	D	1
16	MCQ	EY	Α	1
17	MCQ	EY	D	1
18	MCQ	EY	В	1
19	MCQ	EY	С	1
20	MCQ	EY	Α	1
21	MCQ	EY	D	1
22	MCQ	EY	Α	1
23	NAT	EY	99 to 101	1
24	NAT	EY	0.179 to 0.181	1
25	NAT	EY	0.99 to 1.01	1
26	MCQ	EY	Α	2
27	MCQ	EY	С	2
28	MCQ	EY	С	2
29	MCQ	EY	D	2
30	MCQ	EY	В	2
31	MCQ	EY	D	2
32	MCQ	EY	В	2
33	MCQ	EY	D	2
34	MCQ	EY	Α	2
35	MCQ	EY	Α	2
36	MCQ	EY	С	2
37	MCQ	EY	С	2
38	MCQ	EY	Α	2

Q.No.	Туре	Section	Key/Range	Marks
39	MCQ	EY	А	2
40	MCQ	EY	С	2
41	MCQ	EY	A (or) D	2
42	MCQ	EY	D	2
43	MCQ	EY	D	2
44	MCQ	EY	А	2
45	MCQ	EY	С	2
46	MCQ	EY	С	2
47	MCQ	EY	В	2
48	MCQ	EY	В	2
49	MCQ	EY	D	2
50	NAT	EY	5.9 to 6.1	2
51	NAT	EY	0.09 to 0.11	2
52	NAT	EY	0.99 to 1.01	2
53	NAT	EY	0.0019 to 0.0021	2
54	NAT	EY	0.49 to 0.51	2
55	NAT	EY	0.299 to 0.301	2