

Solved Question Paper

Section II of CUET (UG) is Domain specific. In this section of Biology 40 questions to be attempted out of 50.

Time : 45 minutes

- Which of the following is not an *ex-situ* conservation?
 - Cryopreservation
 - Seed bank
 - Biosphere reserves
 - Botanical garden
- Natality refers to
 - death rate
 - birth rate
 - number of individuals leaving the habitat
 - number of individuals entering a habitat.
- Which of the following is a correct sequence of steps in a PCR (Polymerase Chain Reaction)?
 - Annealing, Denaturation, Extension
 - Denaturation, Annealing, Extension
 - Denaturation, Extension, Annealing
 - Extension, Denaturation, Annealing
- In RNAi, the genes are silenced using
 - ds-RNA (b) ss-DNA
 - ss-RNA (d) ds-DNA.
- Cyclosporin is used as a/an
 - clot buster
 - immunosuppressant
 - prophylactic for viruses
 - prophylactic for marasmus.
- The relative contribution of various greenhouse gases to total global warming is given in the following diagram:
- According to Hugo de Vries, the mechanism of evolution is
 - multiple step mutations
 - saltation
 - phenotypic variations
 - minor mutations.
- A person who has allergy, the type of antibody produced in his body is
 - IgE (b) IgA
 - IgM (d) IgG.
- Which one of the following is the start codon?
 - UAA (b) UAG
 - AUG (d) UGA
- The breakdown of detritus into simpler inorganic substances by bacterial and fungal enzymes is called
 - leaching (b) humification
 - fragmentation (d) catabolism.
- Match the terms in column I with their description in column II and choose the correct option.

	Column I		Column II
A.	Dominance	(i)	Many genes govern a single character
B.	Co-dominance	(ii)	In a heterozygous organism only one allele expresses itself
C.	Pleiotropy	(iii)	In a heterozygous organism both alleles express themselves fully
D.	Polygenic inheritance	(iv)	A single gene influences many characters

Identify the greenhouse gases.

- A = CFCs; B = CO₂; C = CH₄; D = N₂O
- A = CO₂; B = CH₄; C = CFCs; D = N₂O
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- A = CO₂; B = CFCs; C = CH₄; D = N₂O

- | | A | B | C | D |
|-----|------|-------|------|-------|
| (a) | (iv) | (i) | (ii) | (iii) |
| (b) | (iv) | (iii) | (i) | (ii) |
| (c) | (ii) | (i) | (iv) | (iii) |
| (d) | (ii) | (iii) | (iv) | (i) |

12. In sickle cell anaemia, the sequence of amino acids from the first to the seventh position of the β -chain of haemoglobin S(HbS) is
 (a) His, Leu, Thr, Pro, Glu, Val, Val
 (b) Val, His, Leu, Thr, Pro, Glu, Glu
 (c) Thr, His, Pro, Val, Pro, Val, Glu
 (d) Val, His, Leu, Thr, Pro, Val, Glu.
13. What is the site of fertilisation in mammals?
 (a) Cervix (b) Uterus
 (c) Vagina (d) Fallopian tube
14. Dobson units are used to measure thickness of
 (a) troposphere (b) CFCs
 (c) stratosphere (d) ozone.
15. In which method of animal breeding two different species of male and female animals are mated?
 (a) Cross breeding
 (b) Interspecific hybridisation
 (c) Out breeding
 (d) Out crossing
16. Transfer of pollen grains from the anther to the stigma of another flower of the different plant is known as
 (a) autogamy (b) geitonogamy
 (c) xenogamy (d) cleistogamy.
17. Match the column I with column II.
- | Column I | Column II |
|-----------------|-----------|
| A. Parasitism | (i) ++ |
| B. Commensalism | (ii) +- |
| C. Amensalism | (iii) 0+ |
| D. Mutualism | (iv) 0- |
- (a) A-(iii), B-(ii), C-(iv), D-(i)
 (b) A-(i), B-(ii), C-(iii), D-(iv)
 (c) A-(ii), B-(iii), C-(i), D-(iv)
 (d) A-(ii), B-(iii), C-(iv), D-(i)
18. The similarity of bone structure in the forelimbs of many vertebrates is an example of
 (a) homology
 (b) analogy
 (c) convergent evolution
 (d) adaptive radiation.
19. All of the following are part of an operon except
 (a) an operator (b) structural genes
 (c) an enhancer (d) a promoter.
20. Species area relationship curve had been proposed by
 (a) David Tilman (b) Edward Wilson
 (c) Paul Ehrlich (d) von Humboldt.
21. The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the
 (a) methanogens (b) eubacteria
 (c) halophiles (d) thermoacidophiles.
22. The body of the ovule is fused within the funicle at
 (a) hilum (b) micropyle
 (c) nucellus (d) chalaza.
23. The proteins encoded by the genes *cryIAC* and *cryIIAb* control
 (a) cotton bollworms (b) corn borer
 (c) budworms (d) butterflies.
24. Among the RNA polymerases, the RNA polymerase II transcribes
 (a) *r*-RNA
 (b) *t*-RNA
 (c) small nuclear RNAs
 (d) heterogenous nuclear RNA.
25. Increase in concentration of the toxicant at successive trophic levels is known as
 (a) biotransformation
 (b) biogeochemical cycling
 (c) biomagnification
 (d) biodeterioration.
26. Presence of which of the following hormones in the urine confirms pregnancy ?
 (a) Progesterone
 (b) Estrogen
 (c) Human chorionic gonadotropin
 (d) Prolactin
27. Vegetative propagation in water hyacinth takes place by
 (a) rhizome (b) bulbil
 (c) leaf bud (d) offset.
28. The cytokine barrier among these is
 (a) polymorphonuclear neutrophil
 (b) monocyte
 (c) nK cell
 (d) interferon.
29. Sea weeds existed probably evolved around
 (a) 320 mya (b) 350 mya
 (c) 500 mya (d) 50 mya.
30. The isotope used by Meselson and Stahl in their experiment was
 (a) O^{18} (b) C^{14} (c) H^3 (d) N^{15} .

31. *Cuscuta* is an example of
 (a) ectoparasitism (b) brood parasitism
 (c) predation (d) endoparasitism.
32. The process of transfer of genetic information from DNA to RNA is called
 (a) transcription (b) translation
 (c) replication (d) degeneracy.
33. Which of the following ecological pyramids is generally inverted?
 (a) Pyramid of biomass in a sea
 (b) Pyramid of numbers in grassland
 (c) Pyramid of energy
 (d) Pyramid of biomass in a forest
34. Which one of these is not a tool of recombinant DNA technology?
 (a) Restriction enzyme (b) Vector
 (c) Polymerase enzyme (d) Introns
35. The 'sticky ends' on each of the two strands of a DNA generated by treatment with restriction enzyme facilitate the action of enzyme
 (a) DNA ligase (b) endonuclease
 (c) exonuclease (d) DNA polymerase.
36. The first human hormone produced by recombinant DNA technology is
 (a) insulin (b) estrogen
 (c) thyroxin (d) progesterone.
37. Which part of poppy plant is used to obtain the drug "smack"?
 (a) Flowers (b) Latex
 (c) Roots (d) Leaves
38. Agarose extracted from the sea weeds is used in
 (a) PCR amplification
 (b) electroporation
 (c) gel electrophoresis
 (d) cybrid production.
39. Mutation may be defined as
 (a) continuous genetic variation
 (b) phenotypic change
 (c) genetic evolution
 (d) discontinuous genetic variation.
40. Each secondary spermatocyte after second meiotic division produces
 (a) four haploid spermatids
 (b) one haploid spermatid
 (c) two haploid spermatids
 (d) two diploid spermatids.
41. Which of the following are the most species rich among invertebrates?
 (a) Fishes (b) Crustaceans
 (c) Molluscs (d) Insects
42. In water hyacinth and water lily, pollination takes place by
 (a) insects or wind
 (b) water currents only
 (c) wind and water
 (d) insects and water.
43. Microbe used for biocontrol of pest butterfly caterpillars is
 (a) *Saccharomyces cerevisiae*
 (b) *Bacillus thuringiensis*
 (c) *Streptococcus sp.*
 (d) *Trichoderma sp.*
44. Which of the following flowers once in 12 years?
 (a) *Neelakuranji* (b) Jackfruit
 (c) Mango (d) Papaya
45. Pusa Komal variety of cow pea is resistant to disease
 (a) hill bunt (b) white rust
 (c) leaf curl (d) bacterial blight.
46. Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produces _____ in the host cells.
 (a) both sense and anti-sense RNA
 (b) a particular hormone
 (c) an antifeedant
 (d) a toxic protein.
47. The frequency of recombination between gene present on the same chromosome as a measure of the distance between genes was explained by
 (a) Sutton Boveri
 (b) T.H. Morgan
 (c) Gregor J.Mendel
 (d) Alfred Sturtevant.
48. The number of chromosomes in meiocyte (2n) in apple is
 (a) 24 (b) 380
 (c) 34 (d) 20.
49. Non-albuminous seed is produced in
 (a) maize (b) castor
 (c) wheat (d) pea.
50. Energy flow in an ecosystem is
 (a) unidirectional (b) bidirectional
 (c) multidirectional (d) stable.

ANSWER KEYS

1. (c) 2. (b) 3. (b) 4. (a) 5. (b) 6. (b) 7. (b) 8. (a) 9. (c) 10. (d)
11. (d) 12. (d) 13. (d) 14. (d) 15. (b) 16. (c) 17. (d) 18. (a) 19. (c) 20. (d)
21. (a) 22. (a) 23. (a) 24. (d) 25. (c) 26. (c) 27. (d) 28. (d) 29. (a) 30. (d)
31. (a) 32. (a) 33. (a) 34. (d) 35. (a) 36. (a) 37. (b) 38. (c) 39. (d) 40. (c)
41. (d) 42. (a) 43. (b) 44. (a) 45. (d) 46. (a) 47. (d) 48. (c) 49. (d) 50. (a)

Hints &

1. (c) : *In situ* conservation is on-site conservation. It is conservation of threatened plant and animal species in its natural habitat. It involves creation of hot spots and protected areas such as National parks, wildlife sanctuaries, biosphere reserves.

2. (b) : Natality refers to the number of births during a given period in the population that are added to the initial density. Death rate or mortality is the number of deaths in the population during a given time period. Immigration is the number of individuals entering a habitat. Emigration is the number of individuals of the population that left the habitat and had gone elsewhere during a time period.

3. (b) : A single PCR cycle involves three basic steps.

(i) Denaturation (DNA is heated to high temperature, usually 94°-96°C)

(ii) Primer annealing (two oligonucleotide primers anneal to each of the single stranded template DNA, temperature usually 40° - 60°C) and

(iii) Extension (*Taq* DNA polymerase synthesises the DNA region between primers, optimum temperature 72°C).

4. (a) : RNAi or RNA interference is a novel strategy which prevents the infection by nematode *Meloidogyne incognita* in the roots of tobacco plants. RNAi involves silencing of specific mRNA. Using *Agrobacterium* vectors, nematode specific genes are introduced into the host plant (tobacco plant). The introduction of DNA is such that it produces both sense and anti-sense RNA in the host cells. These two RNAs, being complementary to each other form a dsRNA (double stranded RNA), that initiates RNAi by first forming siRNA (small interfering RNAs). The siRNA first unwinds and then binds to specific complementary mRNA molecules of the nematode. These sites are then cut by RISC (RNA-induced silencing complex), thereby destroying mRNA of host. Hence, no toxin proteins are synthesised.

5. (b) : Cyclosporin is used as an immunosuppressant. This drug is derived from a fungus, *Trichoderma polysporum* and is used to prevent rejection of kidney, heart and liver transplants. Cyclosporin inhibits the activity of helper T-cells that acts against foreign bodies.

6. (b)

7. (b) : As per mutation theory given by Hugo de Vries, the evolution is a discontinuous phenomenon or saltatory phenomenon (single step large mutation).

8. (a) : Allergy involves mainly IgE antibodies and chemicals like histamines and serotonin from mast cells.

9. (c) : Polypeptide synthesis is signalled by two initiator codons or start codons *i.e.*, AUG (methionine codon) and rarely by GUG (valine codon).

10. (d)

11. (d)

12. (d)

13. (d) : Fertilisation takes place at ampullary-isthmic junction of the fallopian tube.

14. (d) : The thickness of the ozone in a column of air from the ground to the top of the atmosphere is measured in terms of Dobson Unit (DU).

15. (b) : In interspecific hybridisation, a species is mated with a different related species of the same genus. Interspecific hybrids are generally difficult to produce, but they are important in plant breeding, particularly in breeding for disease resistance. This is also called intragenic hybridisation.

16. (c) : Xenogamy (Gk. *xenos*-strange, *gamos*-marriage) or cross pollination is the transfer of pollen grains from the anther of one flower to the stigma of a genetically different flower or another flower of a different plant. Cross pollination is carried out with the help of an external agency (biotic or abiotic).

17. (d)

18. (a) : Homologous organs are those organs which have the same fundamental structure but are different in functions. Wings of birds and forelimbs of horse show homology because skeletal parts of their forelimbs are similar in structure and arrangement but have different functions.

19. (c) : Operon concept is for prokaryotes that consist of operator gene, promoter gene, regulator gene and structural gene. Structural, operator and regulator genes are also present in eukaryotic gene expression along with enhancer gene but enhancer gene is present only in eukaryotic gene expression. It changes the rate of transcription of structural genes.

20. (d) : German naturalist and geographer Alexander von Humboldt while exploring the wilderness of South American jungles found that within a region the species richness increased with increasing area but upto a certain limit. On this basis, he proposed species area relationship curve. The relationship between species richness and area turned out to be rectangular hyperbola for a wide variety of taxa whether they are birds, bats, freshwater fish or flowering plants. On a logarithmic scale, it is a straight line. It is described by the equation:

$$\log S = \log C + Z \log A$$

Here, S is species richness, Z is slope of line or regression coefficient, C is Y intercept and A is area.

21. (a) : Methanogens are obligate anaerobes found in oxygen deficient environments such as marshes, swamps, sludge (formed during sewage treatment) and digestive systems of ruminants. Mostly they obtain their energy by reducing carbon dioxide and oxidising hydrogen with the production of methane. *E.g., Methanobacillus* and *Methanotherix*.

22. (a) : The hilum is a scar on the seed coat where funicle and body of ovule is attached.

23. (a) : Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into several crop plants such as cotton. Two *cry* genes, *cryIAc* and *cryIIAb* have been incorporated in cotton. The genetically modified crop is called Bt cotton as it contains Bt toxin genes against cotton bollworms.

24. (d) : Eukaryotes have three RNA polymerases. RNA polymerase I is located in the nucleolus and transcribes for rRNAs (28S, 18S and 5.8S), RNA polymerase II is localised to the nucleoplasm and used for hnRNA, mRNA synthesis and RNA polymerase III is localized to the nucleus, possibly the nucleolar-nucleoplasm interface and transcribes for tRNA, 5SrRNA and snRNAs.

25. (c)

26. (c)

27. (d) : In water hyacinth, vegetative reproduction occurs *via* the breaking of offsets. The offsets are easily broken by wind or wave action and are readily transported *via* wind or water movement. These offsets rapidly give rise to a group of individuals at the newly reached place causing extensive growth of population.

28. (d) : Polymorphonuclear neutrophil, monocyte and NK cell represent cellular barrier of innate immunity and interferon is a cytokine barrier. Cytokines are small protein hormones produced by lymphocytes (helper T-cells), fibroblasts endothelial cells and antigen-presenting cells. The immune response requires complex interactions between different cells. The communication required for this is mediated by cytokines which act as chemical messengers of immune cells.

29. (a)

30. (d) : Meselson and Stahl (1958) by growing *Escherichia coli* for many generations in a medium having heavy isotope of nitrogen, in the form of $^{15}\text{NH}_4\text{Cl}$, proved the semi-conservative replication of DNA.

31. (a) : *Cuscuta* is a total stem parasite which is a good example of ectoparasitism. It is commonly found growing on hedge plants. It has lost chlorophyll and leaves in the course of evolution. It attaches and wraps itself around the stem of host plant and produces haustoria that gets inserted into the vascular system of host. The parasitic plant sucks all the nutrients from the host plant with the help of haustoria. *Cuscuta* is known to receive even the flower inducing hormone or florigen from the host.

32. (a) : Transcription is the process of transfer of genetic information from antisense or template strand of DNA to RNA. It is meant for taking the coded information from DNA to the site where it is required for protein synthesis.

33. (a) : Pyramid of biomass in an aquatic ecosystem (*e.g.*, pond, sea) is usually inverted because the biomass of fishes exceeds the biomass of phytoplanktons.

34. (d) : Three types of biological tools are used in the formation of recombinant DNA. These are :

- (i) Enzymes (*e.g.*, restriction enzymes, polymerase enzymes, ligase enzymes etc.)
- (ii) Cloning vector (vehicle DNA) and
- (iii) Competent host (for transformation with recombinant DNA).

35. (a)

- 36. (a) :** The recombinant DNA technological processes have made great impact in the area of health care by mass production of safe and more effective therapeutic drugs. In 1983, Eli Lilly an American company, first prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *Escherichia coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin (humulin).
- 37. (b) :** Smack (Heroin) is chemically diacetylmorphine which is a white, odourless, bitter, crystalline compound. This is obtained by acetylation of morphine, extracted from the latex of poppy plant (*Papaver somniferum*).
- 38. (c) :** Fragments of DNA are separated by a technique called gel electrophoresis. In this technique, charged molecules are separated under the influence of an electrical field through a medium matrix. Most commonly used matrix is agarose which is a polysaccharide extracted from sea weeds. DNA fragments separate according to size.
- 39. (d) :** Mutations are the new sudden genetic discontinuous variations which appear in the organisms due to permanent change in their genotypes.
- 40. (c) :** The spermatogonia (sing. spermatogonium) present on the inside wall of seminiferous tubules multiply by mitotic division and increase in numbers. Each spermatogonium is diploid and contains 46 chromosomes. Some of the spermatogonia called primary spermatocytes periodically undergo meiosis. A primary spermatocyte completes the first meiotic division (reduction division) leading to formation of two equal, haploid cells called secondary spermatocytes, which have only 23 chromosomes each. The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids. Thus each secondary spermatocyte produce two haploid spermatids. The spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis.
- 41. (d)**
- 42. (a) :** In many aquatic plants with emergent flowers, pollination occurs by wind or insects, e.g., lotus, water lily, water hyacinth.
- 43. (b) :** Spores of bacterium *Bacillus thuringiensis* produce the insecticidal cry protein. Therefore, spores of this bacterium kill larvae of insects which eat them.
- 44. (a)**
- 45. (d) :** Pusa Komal Variety of cowpea has been developed by hybridisation of P-85-2 (photoinsensitive) and P-426 (photosensitive) cowpea strains. It is widely adapted, bears good quality pods, resistant to bacterial blight and gives higher pod yield.
- 46. (a) :** RNAi or RNA interference is a novel strategy which prevents the infection by nematode *Meloidogyne incognita* in the roots of tobacco plants. RNAi involves silencing of specific mRNA. Using *Agrobacterium* vectors, nematode specific genes are introduced into the host plant (tobacco plant). The introduction of DNA is such that it produces both sense and anti-sense RNA in the host cells. These two RNAs, being complementary to each other form a dsRNA (double stranded RNA), that initiates RNAi by first forming siRNA (small interfering RNAs). The siRNA first unwinds and then binds to specific complementary mRNA molecules of the nematode. These sites are then cut by RISC (RNA-induced silencing complex), thereby destroying mRNA of host. Hence, no toxin proteins are synthesised.
- 47. (d) :** T.H. Morgan coined the term linkage to describe the physical association of genes on chromosome and term recombination to describe the generation of non-parental gene combinations. Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes.
- 48. (c) :** The number of chromosomes in the meiocyte (2n) of apple is 34, and the number of chromosomes in gamete (n) of apple is 17.
- 49. (d) :** In majority of dicot seeds, including pea, the endosperm is consumed during seed development and the food is stored in cotyledons and other regions. They are called non-endospermic or exalbuminous seeds.
- 50. (a) :** Energy flow in an ecosystem is always unidirectional or one way, i.e., solar radiations → producers → herbivores → carnivores. There is decrease in the content and flow of energy with the rise in trophic level.

