

NTA CUET PAPER (19TH JULY 2024, SHIFT-I)

Instructions

Attempt only 40 questions out of the given 50 questions. Each question carries 5 marks. One mark will be deducted for a wrong answer.

Full Marks: 200

(Time: 45 Minutes)

- Production of seeds without fertilization is known as:
 (a) Parthenogenesis (b) Apomixis
 (c) Polyembryony (d) Syngamy
- Arrange the given stages of Megasporogenesis in chronological order.
 (A) Megaspore tetrad (B) Megaspore dyad
 (C) Megaspore mother cell (D) Female gametophyte
 Choose the **correct** answer from the options given below :
 (a) (D), (A), (B), (C) (b) (A), (D), (C), (B)
 (c) (B), (A), (D), (C) (d) (C), (B), (A), (D)

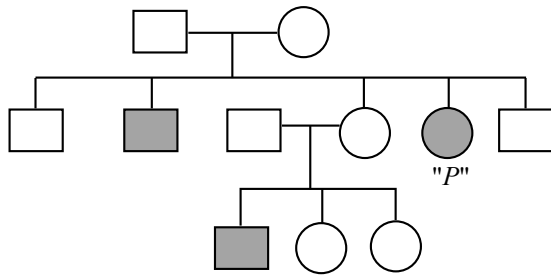
3. Match **List-I** with **List-II**:

List-I Kind of Pollinations		List-II Features	
A.	Autogamy	(i)	Pollination involving flower of two different plants
B.	Geitonogamy	(ii)	Pollination involving water
C.	Xenogamy	(iii)	Pollination involving two flowers of same plant
D.	Hydrophily	(iv)	Pollination involving same flower

Choose the **correct** answer from the options given below :

- A-(ii), B-(i), C-(iii), D-(iv)
- A-(iii), B-(ii), C-(i), D-(iv)
- A-(iv), B-(iii), C-(i), D-(ii)
- A-(i), B-(iii), C-(ii), D-(iv)

- Hormone releasing Intra Uterine Device is :
 (a) Lippes loop (b) LNG - 20
 (c) Multiload 375 (d) Cu 7
- Which of the following is **incorrect** regarding oral contraceptives?
 (a) These are small doses of progestogens or progestogen - estrogen combinations
 (b) They inhibit ovulation and implantation
 (c) They suppress the sperm motility and its fertilizing capacity
 (d) They may contain non-steroidal preparation with few side effects and high contraceptive value
- Choose the statements which are **correct** with respect to the Medical Termination of Pregnancy (MTP) Act, 2017 :
 A. Approximately 20% of the conceived pregnancies undergone MTP globally in a year
 B. MTP is legalized in India upto four months unconditionally
 C. Amniocentesis is mandatory before performing MTP
 D. MTPs are considered relatively safe upto 12 weeks of pregnancy
 Choose the **correct** answer from the options given below :
 (a) B and C only (b) B and D only
 (c) A and B only (d) A and D only
- In the given pedigree chart 'P' is a female suffering from a disease, which is denoted by 'A' dominant allele and 'a' recessive allele ? Find the genotype of 'P'.



- (a) AA (b) $X^A X$
(c) $X^A X^A$ (d) aa

8. Gene HBB for β -thalassemia is present on which chromosome?

- (a) 5 (b) 22 (c) 11 (d) 9

9. Of the following statements which is/are **correct** ?

- A. During incomplete dominance, modified allele is the dominant allele
B. In polygenic inheritance, the effect of each allele is additive
C. A gene is called pleiotropic when it exhibit multiple phenotypic expression
D. Mutation means alteration of DNA sequence which ensures change only in the phenotype of an organism

Choose the **correct** answer from the options given below :

- (a) (A), (B) and (C) only (b) (B) and (C) only
(c) (D) only (d) (C) and (D) only

10. Match **List-I** with **List-II**:

List-I		List-II	
A.	Thalassemia	(i)	47, XXY
B.	Klinefelter's syndrome	(ii)	Sex linked recessive disorder
C.	Turners' syndrome	(iii)	45, XO
D.	Colour blindness	(iv)	Autosomal recessive disease

Choose the **correct** answer from the options given below :

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

11. RNA is a labile molecule due to the presence of :

- (a) 3' -OH group (b) 5' -OH group
(c) 4' -OH group (d) 2' -OH group

12. Enzyme helpful in polymerizing RNA with defined sequences in a template independent manner is :

- (a) Mononucleotide phosphorylase
(b) Polynucleotide phosphorylase
(c) RNA polymerase - I
(d) DNA dependent RNA polymerase

13. Which of the following is not a component of DNA ?

- (a) Thiamine (b) Adenine
(c) Guanine (d) Cytosine

14. Match **List-I** with **List-II**:

List-I Scientist		List-II Contribution	
A.	A. Jeffreys	(i)	Nuclein
B.	Miescher	(ii)	Amino acid formation
C.	J. Monod	(iii)	DNA fingerprinting
D.	S.L. Miller	(iv)	Transcriptionally regulated system

Choose the **correct** answer from the options given below :

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

15. Homologous Organs are :

- (a) Similar in structure and same in functions
(b) Similar in structure and different in functions
(c) Different in structure and same in function
(d) Similar in structure and have same or different functions

16. Arrange the following on the basis of their origin earliest to latest:

- A. *Homo habilis* B. Neanderthal Man
C. *Ramapithecus* D. *Homo sapiens*
E. *Homo erectus*

Choose the **correct** answer from the options given below :

- (a) (D), (B), (C), (A), (E) (b) (C), (A), (E), (B), (D)
(c) (A), (C), (B), (E), (D) (d) (B), (A), (C), (E), (D)

17. Arrange the following steps of decomposition in **correct** order of their sequence :

- A. Humification B. Fecal Matter
C. Leaching D. Mineralisation

Choose the **correct** answer from the options given below :

- (a) (A), (C), (B), (D) (b) (D), (B), (A), (C)
(c) (B), (C), (A), (D) (d) (A), (D), (C), (B)

18. Match **List-I** with **List-II**:

List-I Evolutionary Processes		List-II Example	
A.	Divergent evolution	(i)	Wings of butterfly and birds
B.	Convergent evolution	(ii)	Lemur and spotted cuscus
C.	Anthropogenic evolution	(iii)	Hearts of vertebrates
D.	Adaptive Radiation	(iv)	Antibiotic resistant microbes

Choose the **correct** answer from the options given below :

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

19. Toxic substance released with rupturing of RBC during malaria fever is :

- (a) Haematoxyline (b) Haematin
 (c) Haemozoin (d) Haemin

20. The yellowish fluid secreted by mother during initial days of lactation has abundant :

- (a) IgA (b) IgM (c) IgE (d) IgG

21. Identify the **incorrect** statements.

- A. Gametocytes of *Plasmodium* develop in the RBCs.
 B. Ascariasis pathogens are transmitted to a healthy person through the bite by the female mosquito vectors.
 C. *Entamoeba histolytica* is a helminth parasite in the small intestine of human which causes amoebiasis.
 D. Malarial parasite reproduces asexually in the gut of mosquito.
 E. Filarial worms reside in the lymphatic vessels of the lower limbs.

Choose the **correct** answer from the options given below :

- (a) (A), (B) and (E) only (b) (B), (C) and (D) only
 (c) (A) and (B) only (d) (C) and (D) only

22. Match **List-I** with **List-II**:

List-I Diseases		List-II Pathogen	
A.	Pneumonia	(i)	<i>Wuchereria bancrofti</i>
B.	Typhoid	(ii)	<i>Microsporium</i>
C.	Ringworm	(iii)	<i>Salmonella</i>
D.	Elephantiasis	(iv)	<i>Haemophilus influenzae</i>

Choose the **correct** answer from the options given below :

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

23. Which vitamin is increased during the conversion of fresh milk to curd ?

- (a) B₂ (b) B₅ (c) B₁₂ (d) B₁

24. Match **List-I** with **List-II**:

List-I Function		List-II Organism	
A.	Nitrogen fixation (bacterium)	(i)	<i>Saccharomyces</i>
B.	Phosphorous absorption	(ii)	<i>Azospirillum</i>
C.	Nitrogen fixation (cyanobacterium)	(iii)	<i>Glomus</i>
D.	Ethanol Production	(iv)	<i>Oscillatoria</i>

Choose the **correct** answer from the options given below:

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

25. Match **List-I** with **List-II**:

List-I Microbes		List-II Acid Produced	
A.	<i>Aspergillus</i>	(i)	Lactic acid
B.	<i>Acetobacter</i>	(ii)	Butyric acid
C.	<i>Clostridium</i>	(iii)	Acetic acid
D.	<i>Lactobacillus</i>	(iv)	Citric acid

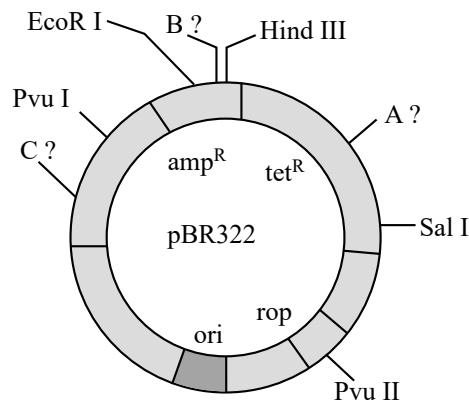
Choose the **correct** answer from the options given below :

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

26. Which of the following product is not developed by the use of biotechnology ?

- (a) Bt cotton
 (b) DNA vaccine
 (c) Human protein enriched milk
 (d) Basmati Rice

27. Identify the missing restriction sites (A, B and C) in the given *E. coli* cloning vector pBR322.



- (a) A - BamH I; B - Cla I; C - Pst I
 (b) A - Pst I; B - Cla I; C - Hind II
 (c) A - BamH I; B - Hind II; C - Cla I
 (d) A - Cla I; B - Pst I; C - BamH I

28. Arrange the following steps in recombinant DNA technology on the basis of their sequence of occurrence :

- A. Isolation of desired DNA fragments
 B. Culturing the host cells
 C. Extraction of desired product
 D. Ligation of DNA fragment into vector
 E. Transferring of recombinant DNA to host

Choose the **correct** answer from the options given below:

- (a) (A), (E), (C), (B), (D) (b) (A), (D), (E), (B), (C)
(c) (B), (C), (A), (D), (E) (d) (B), (A), (D), (C), (E)

29. Which of the following is **not** a cause of biodiversity loss ?

- (a) Fragmentation
(b) Over-exploitation
(c) Co-evolution
(d) Alien species invasion

30. For which of the following human disease, transgenic model was **not** developed ?

- (a) AIDS (b) Cancer
(b) Cystic Fibrosis (d) Rheumatoid arthritis

31. Transposons are :

- (a) House keeping genes (b) Jumping genes
(c) Transporting gene (d) Stationary gene

32. Identify the **incorrect** statements.

- A. *Bacillus thuringiensis* is a transgenic organism.
B. Bt toxin enter the testes or the ovaries of the insect pest, sterilize it and thus prevent it's multiplication.
C. Proteins encoded by *cryIac* and *cryIIAb* control cotton bollworms.
D. Bt protein exists as active toxin in the *Bacillus*.
E. Alkaline pH of the insect gut solubilizes the toxin protein crystals.

Choose the **correct** answer from the options given below :

- (a) (A), (B) and (D) only (b) (B) and (D) only
(c) (C) and (D) only (d) (C), (D) and (E) only

33. Match **List-I** with **List-II**:

List-I Genes/Products		List-II Used in/for	
A.	C - Peptide	(i)	Corn borer
B.	α -1-antitrypsin	(ii)	Rosie
C.	<i>cryIIAb</i>	(iii)	Insulin
D.	α -lactalbumin	(iv)	Emphysema

Choose the **correct** answer from the options given below:

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

34. In which of the following ecosystems, detritus food chain (DFC) is the major conduit for energy flow ?

- (a) Pond Ecosystem (b) River Ecosystem
(c) Forest Ecosystem (d) Marine Ecosystem

35. Which one of the following statements is **wrong** regarding ecological pyramids ?

- (a) They do not include saprophytes (decomposers)
(b) Insect feeding on a big tree is an example of inverted pyramid of numbers
(c) The pyramid of biomass in a sea is inverted
(d) They considered the same species belonging to two or more trophic levels

36. The total energy fixed by a green plant is called :

- (a) Net Production (b) Primary Production
(c) Secondary Production (d) Gross Production

37. Tropical regions account for greater biological diversity because of the following reasons, except :

- (a) Higher productivity due to more availability of solar energy
(b) Lower predation due to diversity of food availability
(c) Tropics are less seasonal and relatively more constant and predictable
(d) These latitudes are relatively undisturbed for many years leads to long evolutionary time for diversification

38. Deserts, rainforests, mangroves, coral reefs, wetlands, estuaries and alpine meadows in India represent :

- (a) Ecological diversity
(b) Genetic diversity
(c) Species diversity
(d) Species diversity and ecological diversity

39. The increase in rate of species loss in the world is due to :

- A. Less use of natural resources
B. Introduction of alien species
C. Species confined to a particular area
D. Removal of one species from co-existed species
E. Destruction of large landscape into small area

Choose the **correct** answer from the options given below :

- (a) (A), (B) and (C) only (b) (B), (D) and (E) only
(c) (B), (C) and (D) only (d) (A), (C) and (D) only

40. Choose the following statements which are **correct** with respect to continuous culture systems:

- A. In simple stirred tank bioreactor, the stirring happens through sparging of air bubbles
B. Bioreactor has an agitator system, oxygen delivery system and foam control system
C. Sampling ports provides vents to withdraw small volumes of culture periodically
D. Culturing in bio reactors is classified as downstream processing

Choose the **correct** answer from the options given below:

- (a) (A), (B) and (C) only (b) (A), (C) and (D) only
(c) (B) and (C) only (d) (A) and (D) only

Read the paragraph and answer the Question given below (Q.41-45):

Humans are sexually reproducing and viviparous. The male reproductive system is composed of a pair of testes, the male sex accessory ducts and the accessory glands and external genitalia. The female reproductive system consists of a pair of ovaries, a pair of oviducts, a uterus, a vagina, external genitalia and pair of mammary glands. The reproductive cycle of female primates is called menstrual cycle. Menstrual cycle starts only after attaining sexual maturation (puberty). Coitus followed by fertilization leads to formation of zygote. After 9 months of pregnancy, the fully developed foetus is ready for delivery.

41. What is the first sign of growing foetus?
 (a) Development of limbs and digits
 (b) Movement of foetus
 (c) Formation of heart
 (d) Development of head
42. How many chromosomes are present in human primary spermatocytes?
 (a) 46 (b) 23 (c) 92 (d) 12
43. The transformation of spermatids into spermatozoa is known as:
 (a) Spermiation (b) Spermiogenesis
 (c) Spermatogenesis (d) Spermatogoniasis
44. Which hormone is essential for maintenance of endometrium during luteal phase ?
 (a) Luteinising Hormone
 (b) Relaxin
 (c) Progesterone
 (d) Follicle Stimulating Hormone
45. The nucleus is present in _____ of human sperm.
 (a) Middle piece (b) Acrosome
 (c) Head (d) Tail
- Read the paragraph and answer the Question given below (Q. 46-50):**
- There is no natural habitat on earth known that is inhabited just by a single species. For any species, the minimal requirement is one more species on which it can feed. Even a plant species, which makes its own food, cannot survive alone and needs soil microbes to break down the organic matter in soil and return the inorganic nutrients for absorption. It is obvious that in nature, animals, plants and microbes do not and cannot live in isolation but interact in various ways to form a biological community.
46. Which of the following is **correct** among the following statements related to species interaction?
 (a) *Calotropis* releases a strong smell to prevent cattles and goats to eat its leaves
 (b) Predators help in maintaining species diversity in a community
 (c) Totally unrelated species never compete for the same resource
 (d) Closely related species competing for the same resources cannot co-exist indefinitely even if the resources are unlimited
47. Which of the following set of organisms is an example of commensalism ?
 (a) *Pisaster* (starfish) and some invertebrates
 (b) Abingdon tortoise and goats
 (c) Sea anemone and clown fish
 (d) Flamingo and resident fishes
48. Which of the following is **not** classified into the category of parasites ?
 (a) Mosquito (b) Cuckoo
 (c) *Cuscuta* (d) Ticks
49. The process in which the fitness of one species (measured in terms of its 'r', the intrinsic rate of increase) is significantly lower in the presence of another species is known as :
 (a) Parasitism (b) Competition
 (c) Predation (d) Commensalism
50. Which of the following is not associated with realistic growth model?
 (a) Sigmoid shaped growth curve
 (b) J - shaped growth curve
 (c) Verhulst - Pearl logistic growth
 (d) Logistic Growth

Answer Key

- | | | | | | | | | | |
|---------|---------|------------|------------|---------|---------|---------|---------|---------|---------|
| 1. (b) | 2. (d) | 3. (c) | 4. (b) | 5. (c) | 6. (d) | 7. (d) | 8. (c) | 9. (b) | 10. (d) |
| 11. (d) | 12. (b) | 13. (a) | 14. (a) | 15. (b) | 16. (b) | 17. (c) | 18. (b) | 19. (c) | 20. (a) |
| 21. (b) | 22. (b) | 23. (c) | 24. (None) | 25. (a) | 26. (d) | 27. (a) | 28. (b) | 29. (c) | 30. (a) |
| 31. (b) | 32. (a) | 33. (None) | 34. (c) | 35. (d) | 36. (b) | 37. (b) | 38. (a) | 39. (b) | 40. (c) |
| 41. (c) | 42. (a) | 43. (b) | 44. (c) | 45. (c) | 46. (b) | 47. (c) | 48. (a) | 49. (b) | 50. (b) |

Explanations

1. (b) Apomixis is the process of seed production without fertilization, where seeds are formed without the fusion of male and female gametes. It is a form of asexual reproduction seen in some plants, allowing them to produce genetically identical seeds.
2. (d) The stages of megasporogenesis in chronological order are:
Megaspore mother cell (C) undergoes meiosis I to form Megaspore dyad (B). The second meiotic division produces four megaspores (tetrad) (A). The functional megaspore develops into the female gametophyte (D).
3. (c) The correct order of match is as follows:
A. Autogamy - (iv) Pollination involving the same flower
B. Geitonogamy - (iii) Pollination involving two flowers of same plant
C. Xenogamy - (i) Pollination involving flower of two different plants
D. Hydrophily - (ii) Pollination involving water
4. (b) LNG-20 is a hormone-releasing intrauterine device (IUD) that releases synthetic hormones to prevent pregnancy. Other options include the Lippes loop, which is a non-medicated IUD, and Multiload 375 and Cu7, which are copper-mediated IUDs.
5. (c) Oral contraceptives primarily work by inhibiting ovulation and altering the uterine lining to prevent implantation, rather than directly affecting sperm motility. IUDs primarily affect sperm motility and its fertilizing capacity.
6. (d) Statement B is incorrect, as in India, under the MTP Act (Amendment) 2021, MTP is allowed up to 20 weeks, and in certain cases, up to 24 weeks, but not “unconditionally” or restricted to 4 months.
Statement C is incorrect, as amniocentesis is not a mandatory requirement before MTP and is generally performed for specific prenatal diagnostic purposes.
7. (d) The pedigree chart shows that “P” is a female suffering from a disease.
Since the inheritance pattern affects both males and females and sometimes skips generations and appears in children whose parents are not affected, it indicates the disease is autosomal recessive.
For “P” to be affected, she must have inherited one recessive allele from each parent, making both parents carriers with the genotype “Aa.” Thus, genotype of “P” is aa.
8. (c) β Thalassemia is caused by mutations in the HBB gene located on chromosome 11 in each parent. The condition arises when one or both copies of this gene are mutated.
9. (b) Statement (A) is incorrect because, in incomplete dominance, neither allele is dominant; instead, the heterozygous phenotype appears as an intermediate between the two alleles, without a clear “dominant” allele. Statement (D) is incorrect because mutations, which are alterations in the DNA sequence, result in both genotypic and phenotypic changes.
10. (d)
(A) Thalassemia - (iv) Autosomal recessive disease
(B) Klinefelter’s syndrome - (i) 47, XXY
(C) Turner’s syndrome - (iii) 45, XO
(D) Colour blindness - (ii) Sex linked recessive disorder
11. (d) RNA is more labile (chemically unstable) because every nucleotide present in it has a hydroxyl (-OH) group attached to the 2' carbon of its ribose sugar. This 2'-OH group makes RNA susceptible to hydrolysis.
12. (b) Polynucleotide phosphorylase is an enzyme that can polymerize RNA in a template-independent manner, meaning it does not require a DNA template to synthesize RNA. Instead, it involves enzymatic synthesis of RNA.
13. (a) Thiamine is not a component of DNA. DNA is composed of four nitrogenous bases: adenine, guanine, cytosine, and thymine. Thiamine is a vitamin (Vitamin B₁) and is not related to DNA structure.
14. (a)
(A) A. Jeffreys - (iii) DNA fingerprinting
(B) Miescher - (i) Nuclein
(C) J. Monod - (iv) Transcriptionally regulated system (*lac* operon)
(D) S.L. Miller - (ii) Amino acid formation
15. (b) Homologous organs are organs that have a similar structure due to a common evolutionary origin, but they may serve different functions in different species. An example is the forelimbs of humans, bats, and whales, which have similar bone structures but are adapted for different functions (grasping, flying, and swimming, respectively).
16. (b) The correct order is (C), (A), (E), (B), (D).
Ramapithecus appeared about 15 million years ago, followed by *Homo habilis* (2.4–1.4 million years ago), *Homo erectus* (1.5 million years ago), Neanderthal Man (1,00,000-40,000 years back), and finally *Homo sapiens*, 75,000-10,000 years ago.
17. (c) The correct order of decomposition steps is:
Fecal Matter (B) – Organic matter from dead organisms, including waste, starts the decomposition process.
Leaching (C) – Water soluble substances go down into the soil horizon and get precipitated as unavailable salts.
Humification (A) – Organic material is transformed into humus.
Mineralisation (D) – Breakdown of humus into inorganic nutrients.
18. (b)
(A) Divergent evolution - (iii) Hearts of vertebrates
(B) Convergent evolution - (i) Wings of butterfly and birds
(C) Anthropogenic evolution - (iv) Antibiotic resistant microbes
(D) Adaptive Radiation - (ii) Lemur and spotted cuscus
19. (c) Haemozoin is a toxic substance released when red blood cells (RBCs)

rupture during a malaria infection. It is produced by the malaria parasite (*Plasmodium*) as it digests haemoglobin in RBCs, leading to symptoms like recurring fever and chills in malaria patients.

20. (a) The yellowish fluid secreted by the mother during the initial days of lactation is called colostrum, which is rich in IgA antibodies. IgA provides passive immunity to the newborn, protecting it against infections.

21. (b) Statement B is incorrect because *Ascaris* pathogens are transmitted through contaminated water, vegetables, fruits, etc and not by mosquito bite.

Statement C is incorrect because *Entamoeba histolytica* is a protozoan parasite, not a helminth.

Statement D is incorrect because the malarial parasite (*Plasmodium*) undergoes sexual reproduction in the mosquito's gut, not asexual reproduction.

22. (b) (A) Pneumonia can be caused by (iv) *Haemophilus influenzae*.

(B) Typhoid is caused by *Salmonella typhi* (iii) bacteria.

(C) Ringworm is a fungal infection caused by *Microsporum* (ii) species.

(D) Elephantiasis is caused by the parasitic worm *Wuchereria bancrofti* (i).

23. (c) During the conversion of fresh milk to curd, the vitamin B₁₂ content increases due to the activity of certain lactic acid bacteria involved in the fermentation process. These bacteria synthesize vitamin B₁₂, enriching the curd with this vitamin.

24. (None) None of the provided options in the question accurately matches all the functions with their respective organisms. The correct match should be (A-ii), (B-iii), (C-iv), (D-i).

(A) Nitrogen fixation (bacterium) - (ii) *Azospirillum*

(B) Phosphorus absorption - (iii) *Glomus* is a mycorrhizal fungus

(C) Nitrogen fixation (cyanobacterium) - (iv) *Oscillatoria*

(D) Ethanol Production - (i) *Saccharomyces* (yeast)

25. (a)

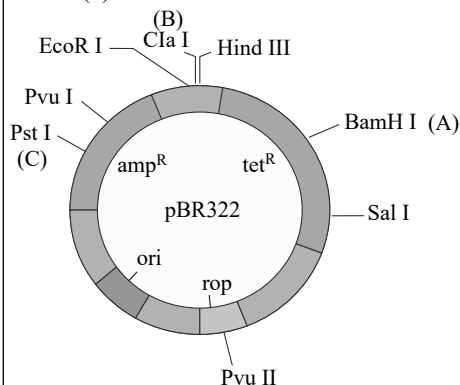
(A) *Aspergillus* - (iv) Citric acid

(B) *Acetobacter* - (iii) Acetic acid

(C) *Clostridium* - (ii) Butyric acid
(D) *Lactobacillus* - (i) Lactic acid

26. (d) Basmati rice is a traditional crop developed through selective breeding rather than biotechnology. The other options - Bt cotton, DNA vaccines, and human protein-enriched milk - are products developed through biotechnological methods.

27. (a)



28. (b) The correct sequence of steps in recombinant DNA technology is:

(A) Isolation of desired DNA fragments → (D) Ligation of DNA fragment into vector → (E) Transferring of recombinant DNA to host → (B) Culturing the host cells → (C) Extraction of desired product

29. (c) Co-evolution is the process by which two or more species evolve in response to each other and typically leads to adaptation rather than biodiversity loss. The other options—fragmentation, over-exploitation, and alien species invasion - are well-known causes of biodiversity loss.

30. (a) Transgenic animal models have been developed for studying diseases like cancer, cystic fibrosis, and rheumatoid arthritis to understand disease mechanisms and test treatments. However, a transgenic model for AIDS has not been effectively developed due to the complexity of the HIV virus and its interaction with the human immune system.

31. (b) Transposons are often referred to as “jumping genes” because they are segments of DNA that can move from one location to another within the genome. This ability to “jump” can cause mutations and play a role in genetic diversity.

32. (a) Statement (A) is incorrect. *Bacillus thuringiensis* (Bt) is a naturally occurring bacterium, not a transgenic

organism. However, genes from Bt are introduced into crops to create transgenic plants like Bt cotton.

Statement (B) is incorrect. Bt toxin works by binding to surface of midgut epithelial cells of insect, causing cell lysis and ultimately killing the insect. It does not sterilize the insect by targeting reproductive organs.

Statement (D) is incorrect. Bt protein exists in an inactive form as a protoxin within *Bacillus thuringiensis*. It becomes active only in the alkaline environment of the insect gut.

33. (None) The C-peptide is a part of proinsulin, which is removed to produce active insulin. α -1-antitrypsin is used in the treatment of emphysema, a lung disease. The *cryIIAb* gene is used in genetically modified crops to protect against pests like the cotton bollworms not corn borer. Rosie is a transgenic cow that produces milk enriched with α -lactalbumin, which is beneficial for human consumption.

34. (c) In a forest ecosystem, the detritus food chain (DFC) plays a major role in the flow of energy. A large amount of energy is transferred through decomposers and detritivores, which break down dead organic matter, recycling nutrients within the ecosystem. Forests have a substantial amount of organic matter in the form of leaf litter, fallen branches, and dead organisms, making the DFC a major conduit for energy flow.

35. (d) Ecological pyramids represent the trophic structure of an ecosystem but do not consider the same species at multiple trophic levels. Each species is assigned to a single trophic level based on its primary role in the ecosystem.

36. (b) Primary Production refers to the total biomass or organic matter produced by plants through photosynthesis per unit area over time.

37. (b) While tropical regions have high biodiversity due to factors like high productivity, stable and predictable climates, and long evolutionary times for species diversification, lower predation is not a primary reason. In fact, tropical regions often have complex food webs with both high diversity and high predation pressures, which contribute to the ecological balance rather than reducing predation.

38. (a) The different ecosystems mentioned - deserts, rainforests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows—represent ecological diversity. This term refers to the variety of ecosystems found within a specific region or across the planet. Ecological diversity encompasses the distinct habitats, biotic communities, and ecological processes in the environment.
39. (b) The main factors contributing to the increase in the rate of species loss are:
- (B) Introduction of alien species which can outcompete, prey on, or bring diseases to native species, leading to their decline.
- (D) Removing a species can disrupt ecological interactions and lead to the decline of other species that depended on it.
- (E) Habitat fragmentation reduces the area available for species to live and thrive, leading to population decline and increased vulnerability to extinction.
40. (c)
- Statement A is incorrect because primary mixing in a stirred-tank bioreactor is achieved by the impeller (flat-bladed stirrer), which actively stirs the contents.
- Statement D is incorrect because culturing in bioreactors is considered upstream processing, whereas downstream processing involves the steps after culturing, such as purification and formulation of the final product.
41. (c) The first sign of a growing fetus is the formation of the heart which occurs after one month of pregnancy. Other developments, such as the formation of limbs and digits, fetal movement, and head development, occur later in the gestation process.
42. (a) Human primary spermatocytes are diploid cells, meaning they contain 46 chromosomes (23 pairs). During meiosis, these primary spermatocytes will divide to form haploid sperm cells, each containing 23 chromosomes.
43. (b) Spermiogenesis is the process in which spermatids transform into mature spermatozoa (sperm cells). This involves morphological changes such as the development of the tail, condensation of the nucleus, and formation of the acrosome.
44. (c) Progesterone is essential for the maintenance of the endometrium during the luteal phase of the menstrual cycle. After ovulation, the corpus luteum produces progesterone, which thickens the endometrium and prepares it for potential implantation of a fertilized egg.
45. (c) In human sperm, the nucleus is located in the head region. The head of the sperm contains the genetic material (DNA) within the nucleus, and it is capped by the acrosome, which helps the sperm penetrate the egg during fertilization.
46. (b) Predators play a crucial role in maintaining species diversity by controlling the population of prey species, which prevents any single species from dominating and outcompeting others. This maintains balance within the ecosystem.
47. (c) Commensalism is a type of symbiotic relationship where one organism benefits while the other is neither benefitted nor harmed. The relationship between the sea anemone and clownfish is an example of commensalism. The clownfish gains protection by hiding among the anemone's stinging tentacles, while the anemone remains unaffected.
48. (a) Mosquitoes are not classified as true parasites because they do not live on or within their host for an extended period. Instead, they temporarily feed on blood and then leave. In contrast, cuckoos exhibit brood parasitism, *Cuscuta* (dodder plant) is a parasitic plant, and ticks are true ectoparasites, attaching to the host to feed for extended periods.
49. (b) Competition is an interaction where the presence of another species negatively affects the fitness of one species, reducing its intrinsic rate of increase (r). Both species compete for the same limited resources, which affects their growth and reproduction rates.
50. (b) A J-shaped growth curve represents exponential growth, where the population grows without any limitations, such as unlimited resources and no competition. However, this type of growth is not realistic in natural environments because resources are always limited. Realistic growth models, such as the sigmoid (S-shaped) curve, follows Verhulst-Pearl logistic growth, incorporate environmental limits that slow population growth as it approaches the carrying capacity.