

**Bangalore Sahodaya Schools Complex Association Pre-Board  
Examination I (2023-2024)**

**Class 12 Biology (Code - 044) – Set - 1**

**Duration: 3 Hours**

**Maximum Marks: 70**

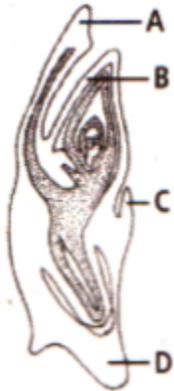
**Section - A (1 Mark)**

**1. In which one of the following, both autogamy and geitonogamy are prevented?**

- a) Wheat
- b) Papaya
- c) Castor
- d) Maize

**Ans:** b) Papaya

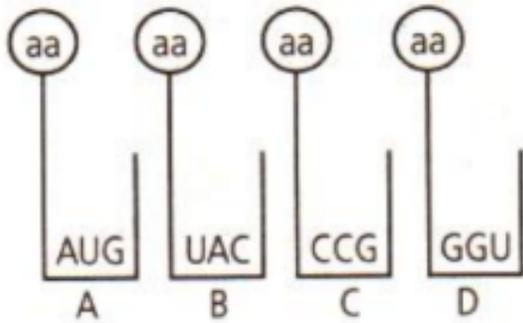
**2. Refer to the given figure and identify the correct option regarding the statements identifying its parts A – D.**



- a) A is cotyledon of monocot embryo, situated towards lateral side of embryonal axis.
- b) B is axis above the level of attachment of A.
- c) C is hollow foliar structure enclosing shoot apex and leaf primordia.
- d) D is differentiated sheath enclosing plumule.

**Ans:** a) A is cotyledon of monocot embryo, situated towards lateral side of embryonal axis.

**3. Find the sequence of binding of the following aminoacyl tRNA complexes during translation to mRNA transcribed by a DNA segment having the base sequences 3 'TACATGGGTCCG5'.**



**Choose the answer showing the correct order of alphabets.**

- a) C, D, B, A
  - b) A, B, D, C
  - c) D, C, A, B
  - d) B, A, D, C
- Ans:** d) B, A, D, C

**4. How many of the following traits of pea plant studied by Mendel are dominant? Round seed, Constricted pod, yellow seed, white flower, green pod, terminal flower.**

- a) 2
  - b) 3
  - c) 4
  - d) 5
- Ans:** b) 3

**5. Blue eye color is recessive to brown eye color. In a population of 100 individuals, how many will have blue eye color if the allelic frequency is 0.2, given that the population is in Hardy-Weinberg equilibrium?**

- a) 32
  - b) 64
  - c) 8
  - d) 4
- Ans:** d) 4

**6. Which one of the following sequences was proposed by Darwin and Wallace for organic evolution?**

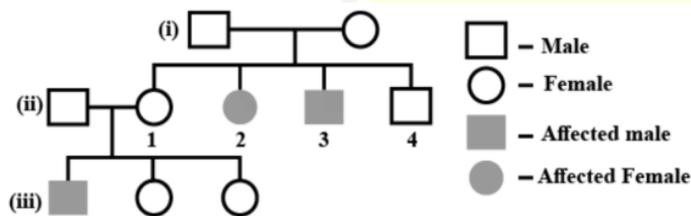
- a) Overproduction, variations, constancy of population size, natural selection.
  - b) Variations, constancy of population size, overproduction, natural selection.
  - c) Overproduction, constancy of population size, variations, natural selection.
  - d) Variations, natural selection, overproduction, constancy of population size.
- Ans:** a) Overproduction, variations, constancy of population size, natural selection.

7. To form a nucleoside, a nitrogenous base is linked to a pentose sugar,

- through a P glycosidic linkage at carbon atom number 1.
- through a P glycosidic linkage at carbon atom number 5.
- through a N-glycosidic linkage at carbon atom number 1.
- through a N-glycosidic linkage at carbon atom number 5.

Ans: c) through a N-glycosidic linkage at carbon atom number 1.

8. Study the given pedigree chart for the disease caused by mutation Y and select the most appropriate option for the genotypes.



Genotypes of parents	Genotypes of 1st and 3rd child on F1
a) $Hb^A Hb^S, Hb^A Hb^A$	$Hb^A Hb^A Hb^A Hb^S$
b) $Hb^A Hb^S, Hb^A Hb^S$	$Hb^A Hb^A Hb^A Hb^A$
c) $Hb^A Hb^A Hb^A Hb^S$	$Hb^A Hb^A Hb^S Hb^S$
d) $Hb^A Hb^S Hb^A Hb^S$	$Hb^A Hb^S Hb^S Hb^S$

Ans: b)  $Hb^A Hb^S, Hb^A Hb^S Hb^A Hb^A Hb^A Hb^A$

9. Read the following statements and select the correct one:

- The property of contact inhibition is shown by cancerous cell.
- The cancer patients are administered with alpha interferon to destroy the tumour.
- The most feared property of the benign tumour is metastasis.
- Cancerous cells divide in a regulated manner.

Ans: b) The cancer patients are administered with alpha interferon to destroy the tumour.

10. Cultivation of Bt Cotton has been much in the news. The prefix 'Bt' here means

- 'barium-treated' cotton seeds
- 'bigger thread' variety of cotton with better tensile strength
- produced by biotechnology using restriction enzymes and ligases from *Bacillus thuringiensis*
- carrying an endotoxin gene

**Ans:** c) produced by biotechnology using restriction enzymes and ligases from *Bacillus thuringiensis*

**11. Significance of 'heat shock' method in bacterial transformation is to facilitate -**

- a) Binding of DNA to the cell wall.
- b) Uptake of DNA through membrane transport proteins.
- c) Uptake of DNA through transient pores in the bacterial cell wall.
- d) Expression of antibiotic resistance gene.

**Ans:** c) Uptake of DNA through transient pores in the bacterial cell wall.

**12. If  $N$  = population density at time  $t$ , then population density at time  $t + 1$  can be written**

**as:**  $N_{t+1} = N_t + [(A + X) - (B + Y)]$

**In the above equation,**

- a)  $A$  is natality and  $Y$  is immigration.
- b)  $B$  is mortality, and  $X$  is immigration.
- c)  $A$  is mortality, and  $X$  is emigration.
- d)  $B$  is natality and  $Y$  is emigration.

**Ans:** b)  $B$  is mortality and  $X$  is immigration.

**Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:**

- a) Both  $A$  and  $R$  are true, and  $R$  is the correct explanation of  $A$ .
- b) Both  $A$  and  $R$  are true, and  $R$  is not the correct explanation of  $A$ .
- c)  $A$  is true, but  $R$  is false.
- d)  $A$  is false, but  $R$  is true.

**13. Assertion: Hybrids are widely used in agriculture to increase productivity, and apomixes can be an important tool for maintaining hybrid culture.**

**Reason: Seeds produced by apomictic plants are identical to the parent, as there is no segregation.**

**Ans:** a) Both  $A$  and  $R$  are true, and  $R$  is the correct explanation of  $A$ .

**14. Assertion: Polymorphism forms the basis of DNA fingerprinting.**

**Reason: Polymorphism arises due to non-inheritable mutations.**

**Ans:** c)  $A$  is true, but  $R$  is false.

**15. Assertion: Acid of stomach kills most of the ingested microorganisms entered through food.**

**Reason: Stomach acid is a type of physical barrier for the body defence mechanism.**

**Ans:** c)  $A$  is true, but  $R$  is false.

**16. Assertion: EcoRI produces sticky ends.**

**Reason: Stickiness of the ends facilitates the action of DNA polymerase.**

**Ans:** c) A is true, but R is false.

## SECTION – B

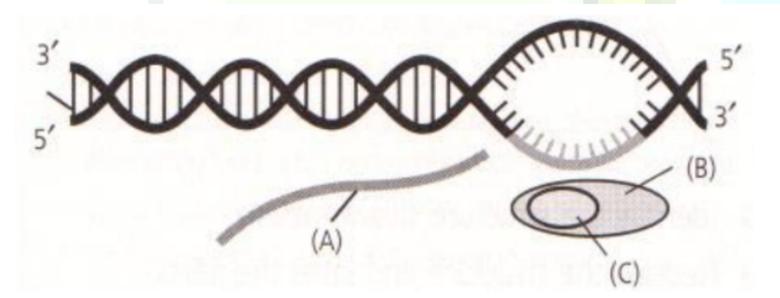
**17. What is the number of chromosomes in the following cells of humans?**

**a) Primary oocyte b) Secondary oocyte c) Ootid d) Follicular cells**

**Ans:**

- a) Primary oocyte - 46
- b) Secondary oocyte - 23
- c) Ootid - 23
- d) Follicular cells - 46

**18. Transcription of DNA mainly consists of three steps. One of the steps of transcription is given below:**



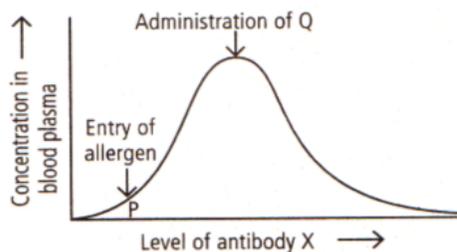
**a) Identify C.**

**b) What changes will take place in A after the completion of above process in eukaryotes?**

**Ans:**

- a) Rho factor
- b) Polyadenylation, capping, and splicing

**19. The given graph shows the concentration of antibody X in blood when an allergen enters the body and when a chemical X is given. Based on this answer, the following questions:**



a) With reference to the given graph explain why there is high level of antibody X after point P?

b) Name the cells and their secretions responsible for the response after point P.

c) Why is there a decrease in the level of antibody X in the blood after point Q?

Ans:

a. As there is exposure to the allergen

b. Mast cells and histamines

c. When anti-histamines/adrenaline/steroids are administered, they block allergy-causing antibodies.

20. In the year 1963, two enzymes responsible for restricting the growth of Bacteriophage in E.coli were isolated. How did these enzymes act to restrict the growth of the bacteriophage?

Ans:

- Added methyl groups to DNA
- Cut DNA

21. a) If the GPP for a patch of forest is 10 kg Carbon/m<sup>2</sup>/year, and the amount of carbon dioxide leaving the ecosystem is 5 kg Carbon/m<sup>2</sup>/year. Calculate the NPP?

b) In the patch of forest mentioned above, how much energy is available at the producer level for herbivore consumption? Assume 1 kg of carbon produces 10,000 kJ of energy.

Ans:

a) GPP- R=NPP

10-5=5kg/m<sup>2</sup>/year-NPP

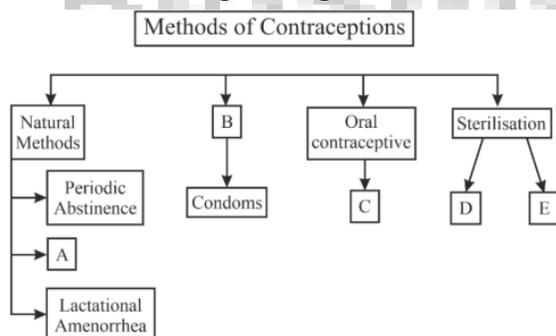
b) 1kg=10,000kJ

As NPP is the available biomass for herbivores,

5 x 10,000=50,000kj

## SECTION – C

22. Consider the given figure and answer the following questions -



a) Identify A, B, C, D, E.

**b) Name an IUD that you would recommend to promote the cervix hostility to sperm.**

**Ans:**

a) A - Withdrawal method

B - Physical barriers

C - Oral pills

D - Vasectomy

E - Tubectomy

b) The hormone-releasing IUDs, e.g., progestasert and LNG-2.0, are recommended to promote the cervix's hostility to sperm.

**23. Explain the events in a normal woman during her menstrual cycle on the following days.**

**i) Ovarian event from 13-15 days.**

**ii) Ovarian hormone levels from 16-23 days.**

**iii) Uterine events from 24-29 days.**

**Ans:**

Ovarian event from 13-15 days- A mature red ovum covered by the corpus luteum is released. Progesterone is also secreted.

Ovarian hormone level from 16 to 23 days- It is called the luteal phase (Secretory Phase), where large amounts of progesterone are secreted to maintain the endometrium.

Uterine events from 24 to 29 days- The endometrium is maintained to sustain pregnancy.

However, in the absence of pregnancy, the endometrium is shed. This shedding off of the ovum is called menstruation.

**24. Some restriction enzymes break a phosphodiester bond on both the DNA strands, such that only one end of each molecule is cut, and these ends have regions of single-stranded DNA. BamHI is one such restriction enzyme which binds at the recognition sequence, 5'-GGATCC-3', and cleaves these sequences just after the 5' Guanine on each strand.**

**a) You are given the DNA shown below:**

**5'-ATTTTGAGGATCCGTAATGTCCT-3**

**3'-TAAAACTCCTAGGCATTACAGGA-5'**

**If this DNA was cut with BamHI, how many DNA fragments would you expect?**

**b) Write the sequence of these double-stranded DNA fragments with their respective polarity.**

**c) Explain how the gene of interest is introduced into a vector.**

**Ans:**

a) Two fragments

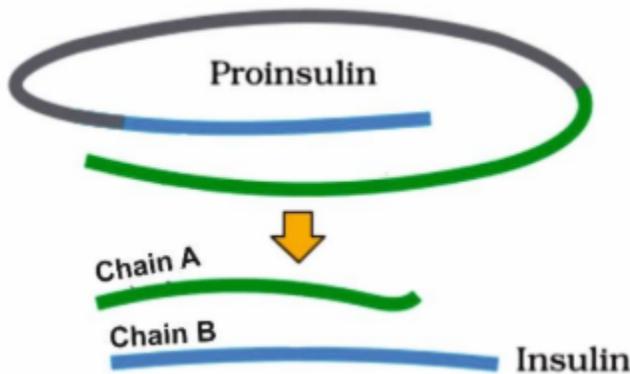
b) 5' ATTTTGAG 3' 5' GATCCGTAATGTCCT3'

3' TAAAACTCCTAG5' 3'GCATTACAGGA5'

c) Restriction enzyme cuts the DNA of the vector at the same sequence, and ligase will help in ligating the gene of interest with the vector.

**OR**

Observe the given structure of a hormone which is produced by beta cells of pancreas and helps to treat diabetes. An American company produced this hormone using rDNA technique.

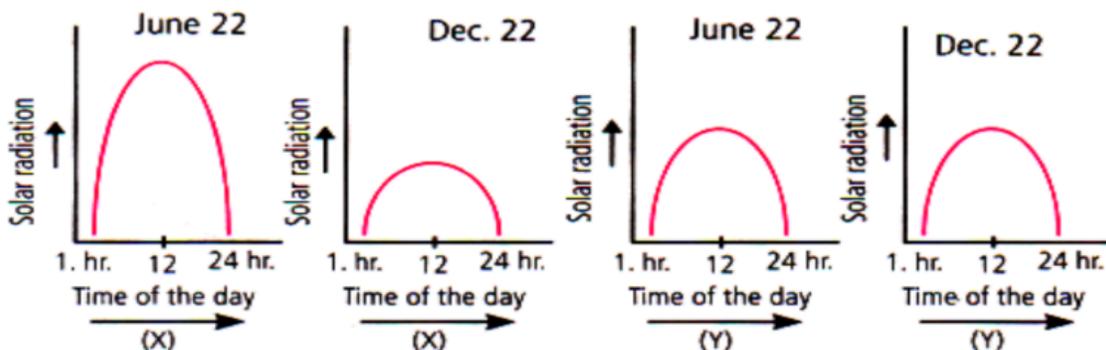


- What type of bonding is present between chains of this hormone?
- Mention the chemical change that the pro-hormone undergoes to be able to act as a mature hormone.
- Why is the hormone produced via rDNA technique considered better than the ones used earlier by diabetic patients?

Ans:

- Disulfide bonds
- Pro-hormone of insulin has 3 chains, A and B connected by the C chain. The C chain is removed to make the hormone active.
- Genetically engineered insulin does not cause unwanted immunological reactions.

25. The graphs (X) and (Y) below depict the diurnal variations in the solar radiations in the month of June (Summer) and in the month of December (Winter).



- Which of the two graphs depicts tropical region and temperate region, respectively?

**b) Which of the two regions (X) or (Y) will show high biological diversity and why?**

**Ans:**

(a) Graphs that represent a tropical region are :

Dec 22 → X

June 22 → Y

The temperate regions are depicted by graphs:

June 22 → X

Dec 22 → Y

(b) The tropical region will show high biological diversity. This is because it produces more solar radiation than temperate zones, and they have a stable climate and few seasonal changes. This encourages more productivity and hence more species richness, leading to higher biological diversity.

**26. Meiotic division during oogenesis is different from that in spermatogenesis. Explain how and why?**

**Ans:**

- In the case of spermatogenesis, meiotic division begins at the time of puberty. Oogenesis begins in the female when the female is still in the womb.
- Formation of primary oocytes stops by the 20th week of gestation of the female child.
- On the contrary, the production of spermatocytes continues throughout the reproductive phase of a male.
- In the case of spermatogenesis, all the stages of meiosis take place quickly after one another. In the case of oogenesis, meiosis is suspended at the Prophase I state.
- Meiosis resumes only once puberty begins.

The following are some reasons for differences in patterns of oogenesis and spermatogenesis:

- Male gametes need to be formed in a very large number to ensure fertilization.
- Female gametes are not exposed to external hazards and hence a smaller number of them would be enough.
- Limiting the production of female gametes helps in the conservation of resources from the female body. The resources can then be properly utilized during the development of the foetus.

**27. With the help of any three suitable examples explain the effect of anthropogenic actions on organic evolution.**

**Ans:**

a) Industrial melanism

b) Herbicide and pesticide resistance in parasitic bacteria due to indiscriminate use.

c) Antibiotic-resistant varieties in bacteria

By taking the above examples, meaningful explanations.

28. a) How does activated sludge get produced during sewage treatment?

b) Explain how this sludge is used in biogas production.

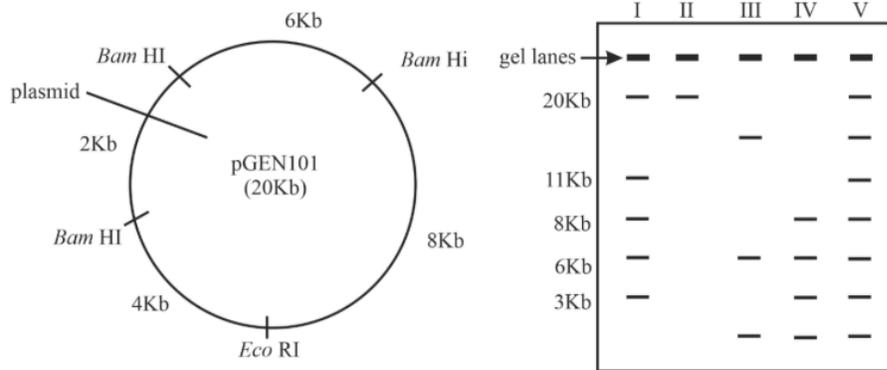
Ans:

- Once the BOD of sewage or wastewater is reduced significantly, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called activated sludge.
- A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide, and carbon dioxide. These gases form biogas and can be used as a source of energy as it is inflammable.

## SECTION – D

*Q. No. 29 and 30 are case-based questions. Each question has 3 subparts with internal choice in one subpart.*

29. When circular plasmids are cut with restriction enzymes, different-sized fragments of DNA are produced. Use the following figure to answer the questions given below. The plasmid pGEN101 shown was treated with various mixtures of restriction enzymes. The electrophoresis gel shows the results of each of those digestions.



a) Which lane (I to V) represents the fragments produced using Bam HI only?

Ans:

a. III lane- 3 cleavage sites, so three fragments.

OR

Which lane represents the fragments produced using Eco RI only?

b) In terms of efficiency, how is Eco RI better than Bam HI in the above case in creating a rDNA.

c) It is theoretically possible for a gene from any organism to function in any other organism. Why is this possible? Discuss.

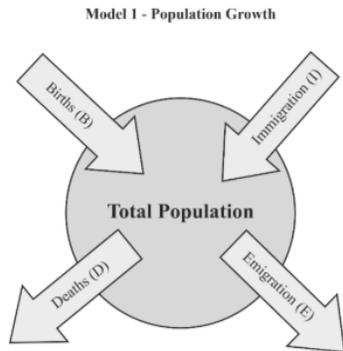
**Ans:**

Lane II represents the fragments produced using Eco RI only.

b. EcoRI is better for creating rDNA as the plasmid has only one restriction site for EcoRI

c. Genes can be moved between species. Because of the universal nature of the genetic code, the polymerase enzyme can accurately transcribe a gene from another organism.

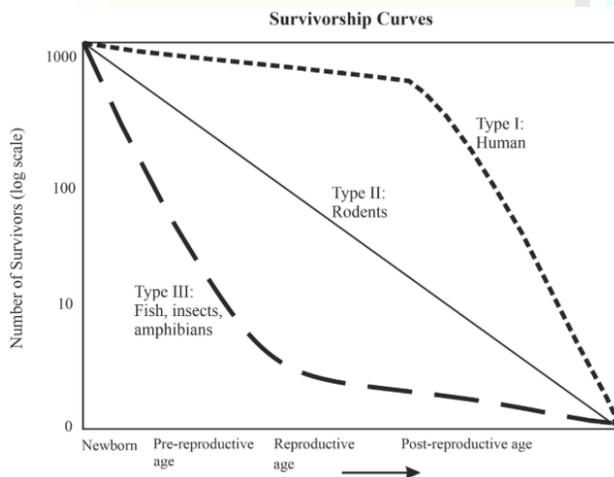
**30. Using Model 1 and the letters B, D, E, and I, write mathematical expressions to show the types of population described below. Note: The use of > and < may be needed.**



a) A declining population (total number of organisms is decreasing).

b) A growing population (total number of organisms is increasing).

c) Read the following graph and answer the questions given below.



i. How do you think populations with Type II or III survivorship compensate for high pre-reproductive mortality?

ii. Consider the evolutionary strategies that each survivorship type has developed for producing and rearing their young. Propose an explanation of why type I survivors have the highest relative number of individuals / 1000 births that survive until they reach post-reproductive age?

**Ans:**

a)  $B+I \leq D+E$  (A declining population)

b)  $B+I \geq D+E$  (A growing population)

c) i. They have a high reproductive rate.

ii. Type 1 survivors have

- Complete internal development of the young one/Internal fertilisation and development.
- Parental care

## SECTION – E

**31. a) A flower of a tomato plant following the process of sexual reproduction produces 160 viable seeds. Complete the following table with proper information.**

Sl. No.	Type of units involved	No. of these units involved	Provide explanation for each of your answer
1	Pollen grains	1a.	1b.
2	Ovules	2a.	2b.
3	Mega spore mother cells	3a	3b
4	Microspore mother cells	4a	4b

**b) How does nutritive tissue in black pepper seed differ from maize seed?**

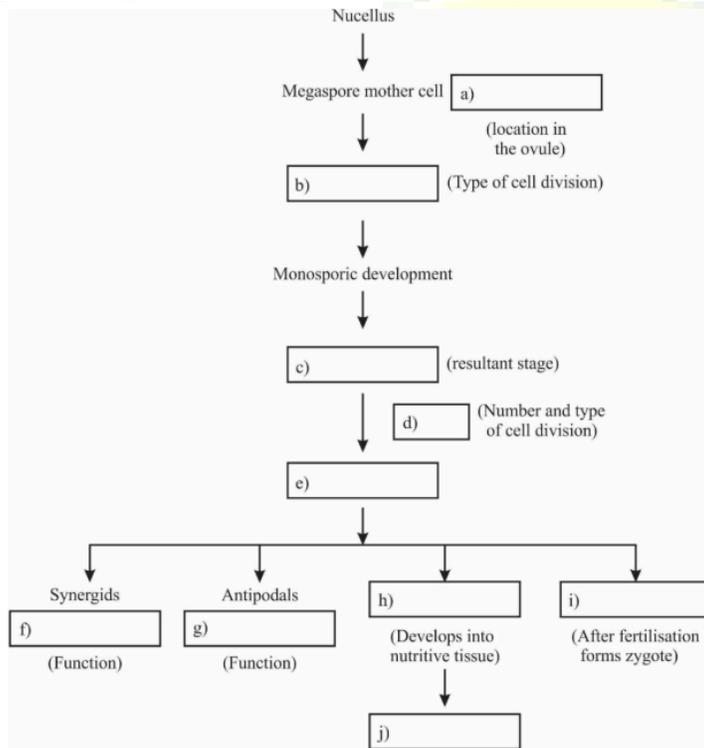
**Ans:**

Sl. No.	Type of units involved	No. of these units involved	Explain each of your answers
1	Pollen grains	160	Each pollen grain has one male gamete that fuses with the egg to form the zygote/ one pollen grain is required for the formation of a seed.
2	Ovules	160	Each ovule has one egg to form the seed.
3	Mega spore mother cells	160	Every megaspore mother cell divides by meiosis to form 4 cells, of which only one forms a functional embryo sac.
4	Microspore mother cells	640	MMC's undergo meiosis to form 4 microspores, each needs to fuse with the egg.

b) Black pepper- persistent nucellus called perisperm is present. It is diploid.  
Maize seed endosperm is the nutritive tissue. It is triploid.

**OR**

**Complete the given flow chart with the help of the clues given:**



**Ans:**

a) Micropylar end

b) Meiosis

c) Megaspore

d) 3 Meiotic divisions

e) Embryo sac

f) Nourishing the ovum/directing the pollen tube

g) Nutrition of the embryo/providing positional information of the embryo sac

h) PEN

i) Egg

j) Triploid endosperm

**32. If the progeny of the cross  $a a B B \times A A b b$  is testcrossed, and the following genotypes are observed among the progeny of the testcross, what is the frequency of recombination between these loci? Represent the test cross using a Punnet square.**

- $A a B b$ -135
- $A a b b$ -430

- aaBb-390
- aabb-120

**Ans:**

Test cross with parent generation, gametes, offspring genotype, and phenotype in the punnet square

$$\text{Frequency} = (135 + 120)/(135+120+390+430) = 24\%$$

**OR**

a) You have an individual who is totally heterozygous for 2 genes that are not linked. One gene is for ear size (AA or Aa being big ears, whereas aa is for small ears), and the other gene is for bulgy eyes (BB and Bb for bulgy eyes, whereas bb represents normal eyes). If you testcross this individual, what are the resulting genotypes and phenotypes?

b) If the 4 types of offspring from the above cross did not show 1:1:1:1, but were as follows, what would this represent?

PERCENTAGES	GENOTYPE	PHENOTYPE
48%	AaBb	Big ears, bulgy eyes
2%	Aabb	Big ears, normal eyes
2%	aaBb	Small ears, bulgy eyes
48%	aabb	Small ears, normal eyes

**Ans:**

a) AaBb X aabb

Gametes: AB, Ab, aB, ab and ab

Offspring:

Male/female	AB	Ab	aB	ab
ab	AaBb	Aabb	aaBb	aabb
Genotype/ Phenotype	Big ears and bulgy eyes	Big ears and normal eyes	Small ears and bulgy eyes	Small ears and normal eyes

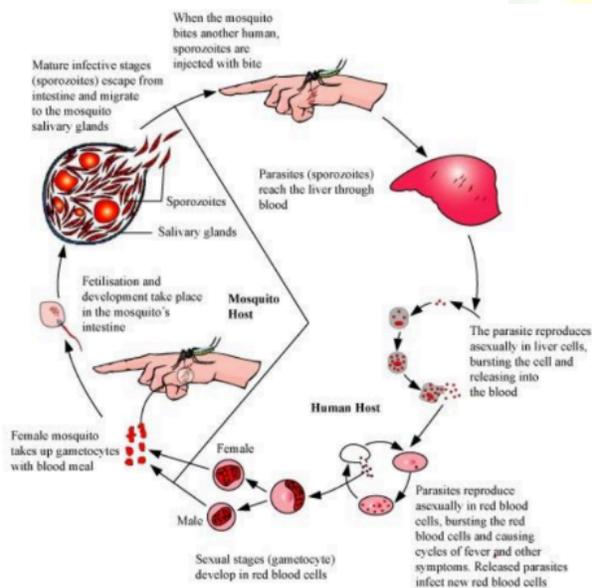
Ratio

1:1:1:1

b) As the parental combination is more compared to the recombinants, we can conclude that A and B genes are linked and the distance between them is less, so the recombinant percentage is relatively very less.

33. Describe the asexual and sexual phases of life cycle of *Plasmodium* that causes malaria in humans.

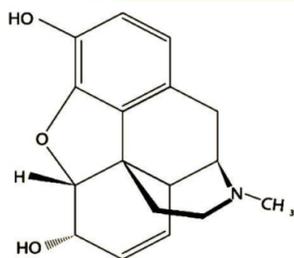
Ans:



OR

(a) Drugs and alcohol give short-term 'high' and long-term 'damages'. Discuss the damages by giving suitable examples.

(b) Which group of drugs does this represent?



(c) What are the modes of consumption of these drugs?

Ans:

- a) Health damages caused by drugs are,
  - i) The immediate adverse effects of drug and alcohol abuse are manifested in the form of reckless behaviour, vandalism, and violence.
  - ii) Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure, or cerebral hemorrhage.
- b) Opioids
- c) It can be taken by snorting and injection.