THE VILLAGE
INTERNATIONAL SCHOOL
"We Nurture Dreams"

Date :06/12/2024 **Grade:12**	**MODEL EXAM-1** **Biology (044)**	**Time : 3 Hours** **MARKS :70**

Marking Scheme

Qn. No		
	SECTION A	
1	Lysergic Acid Diethylamide (LSD) is obtained from Lysergic Acid Diethylamide (LSD) is one of the most dangerous hallucinogens which is obtained from the Ergot fungus called Claviceps purpurea.	1
2	The wall layer of microsporangium which nourishes the pollen grain is: d)tapetum	1
3	Non-sense codons participate in c)Terminating message of gene-controlled protein synthesis	1
4	In a certain species of insects, some have 13 chromosomes, and the others have 14 chromosomes. The 13 and 14 chromosome bearing organisms are a) males and females, respectively	1
5	At a particular locus, the frequency of allele A is 0.8 and that of allele a is 0.2. What would be the frequency of heterozygotes in a random mating population at equilibrium?	1

	a) 0.32	
6	Which type of selection is industrial melanism observed in moth, Biston betularia? (b) Directional	1
7	What is the smallest part of a DNA molecule that can be changed by a point mutation? d) Nucleotide	1
8	A colour blind son born from normal parents, what would be the genotype of the maternal grandfather:- a. X’ Y	1
9	A patient was advised to have a kidney transplant. To suppress the immune reaction, the doctor would administer him: c) Cyclosporin A produced from Trichoderma polysporum	1
10	Discontinuous synthesis of DNA occurs on one strand because b) DNA dependent DNA polymerase catalyses polymerisation only in one direction (5-3‘)	1
11	Which of the following are not examples of analogous structures? b)Wings of bat and forelimb of cattle.	1
12	Which is not the characteristic of a population? c)Stratification	1

DIRECTION:Q. No. 13-16: Consist of two statements— Assertion (A) and Reason (R).Answer these questions selecting the appropriate option given below:

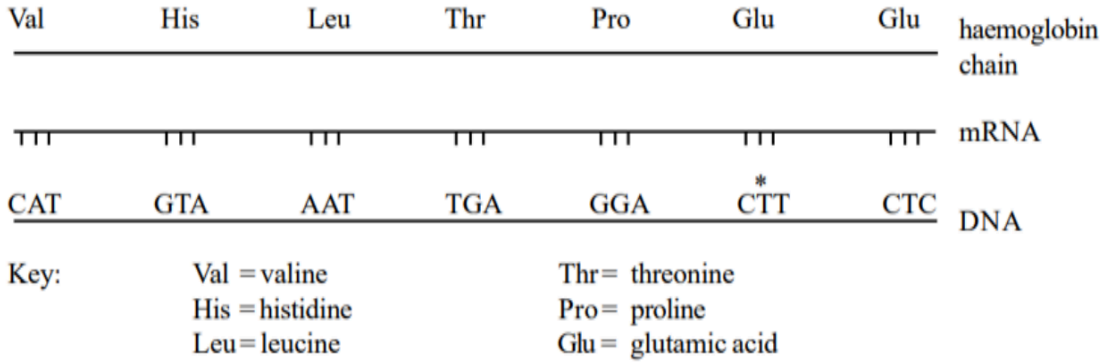
(a) Both A and R are true and R is the correct explanation of A.

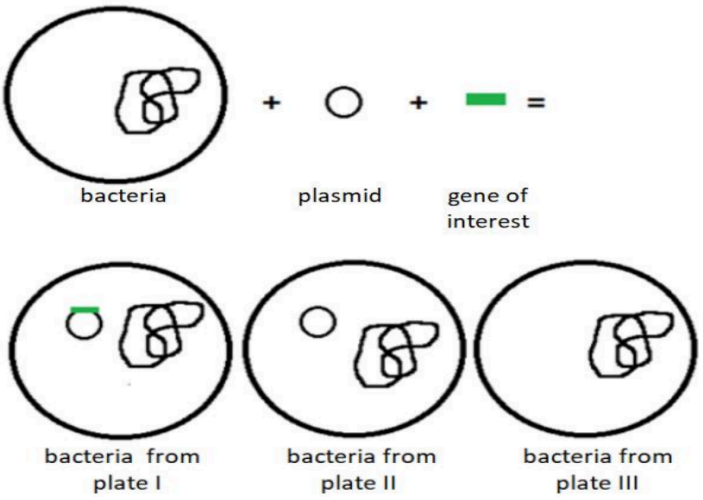
(b) Both A and R are true and R is not the correct explanation of A.

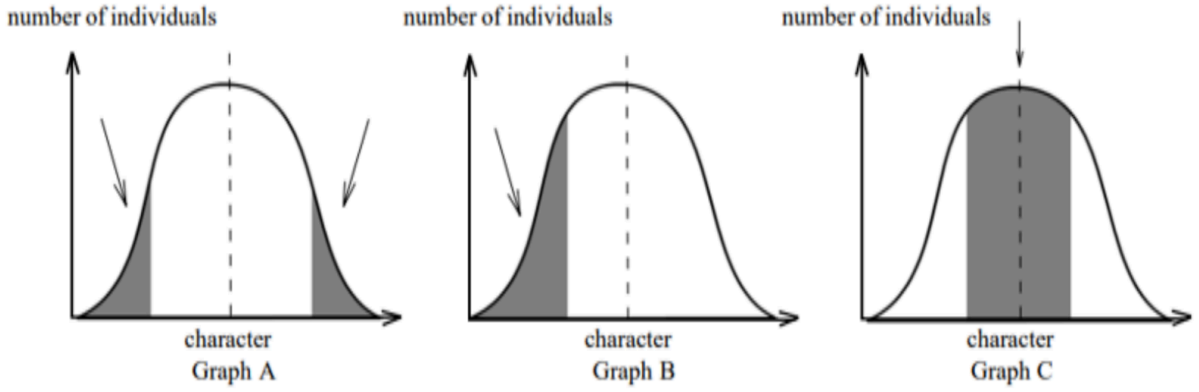
(c) A is true but R is false.

(d) A is False but R is true.

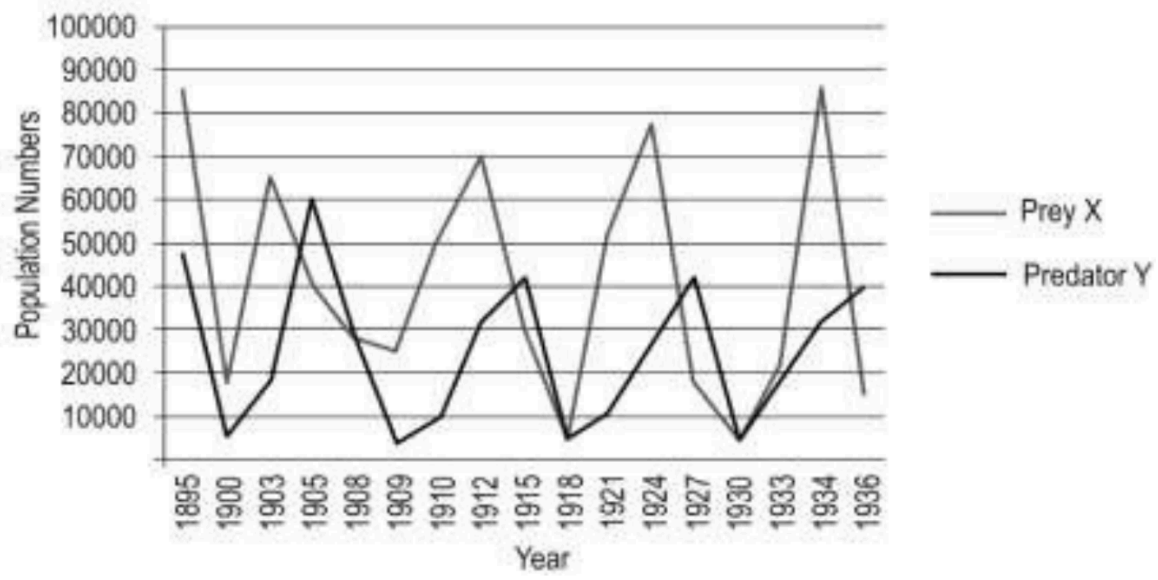
13	Assertion: Primary endosperm nucleus is diploid. Reason: It is the product of double fertilisation A is False but R is true	1
14	Assertion:Ribosomal RNA is synthesised in the nucleus of the cell. Reason: It is translated with the enzyme RNA polymerase III (c) A is true but R is false.	1
15	Assertion: Smoking can raise blood pressure and increase heart rate. Reason: Nicotine stimulates adrenal glands to release adrenaline and noradrenaline into the blood circulation, both of which raise blood pressure and increase heart rate. (a) Both A and R are true and R is the correct explanation of A.	1
16	Assertion: PCR is a powerful technique to identify genetic disorders. Reason: PCR can detect mutations in low amounts of DNA. (a) Both A and R are true and R is the correct explanation of A.	1
	Section—B	
17	Explain the process of hormonal regulation of spermatogenesis. Spermatogenesis is under the control of endocrine hormones. In human male reproductive system spermatogenesis starts at the age of puberty due to significant	2

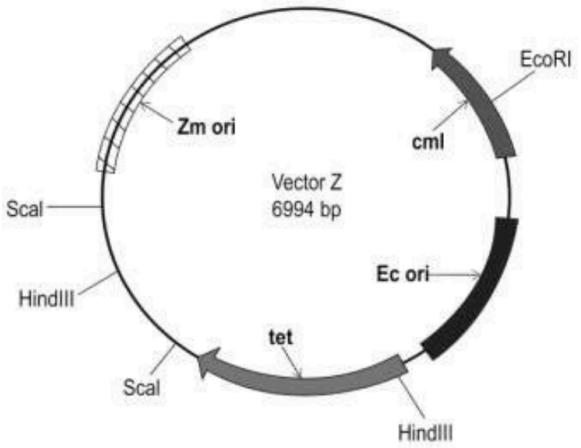
	increase in the secretion of gonadotropin-releasing hormone by hypothalamus. The increased level of GnRH then acts on the anterior pituitary gland and stimulates secretion of the two gonadotropins: Luteinising hormone LH and follicle stimulating hormone FSH. LH acts on leydig cells and stimulates synthesis and secretion of androgens like testosterone which stimulates spermatogenesis. FSH acts on the Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis. Excess of testosterone inhibits the secretion of LHP and GnRH. A glycoprotein called inhibin suppresses FSH synthesis. Thus normal release of testosterone is under negative feedback control.	
18	The diagram below shows the sequence of amino acids in part of a haemoglobin molecule.  Key: Val = valine, His = histidine, Leu = leucine, Thr = threonine, Pro = proline, Glu = glutamic acid a) If the base T* was substituted with A, how would it affect the haemoglobin chain? b) Name the condition and the effects associated with the above substitution. a) CTT would become CAT which codes for valine. Thus, valine would replace glutamic acid at that point. b) Sickle cell anaemia, the mutant haemoglobin molecule undergoes polymerization leading to the change in the shape of the RBC from biconcave disc to elongated sickle like structure	2
19	A child gets colostrum and polio drop both as an infant .Compare their mode of action with respect to our immune system. Colostrum is the first milk from mother to child while feeding and this colostrum is highly rich in antibody content because it carries the antibody from mothers body to the infant body as the newly born baby doesn't have the ability to produce antibody against the foreign body this antibody from mothers body temporarily helps baby to be safe from antigens in surrounding. While polio drops are the vaccine in which inactivated viruses are present and while we take a polio drop our body reacts to the inactivated form of virus and develops memory for future interaction. Both of this are Artificial acquired form of immunity but the polio is the Artificial acquired ACTIVE immunity where infants body is involved in producing immunity where as the colostrum is the natural acquired PASSIVE mode of immunity where body of infant	2

	was not involved in producing immunity on contrary it was receiving ready made antibodies from mothers body	
20	The image below shows the result of plating bacteria in chromogenic medium after incorporating the gene of interest in plasmid. Some plates had blue colonies; some plates had white colonies. A single bacterium extracted from Plate I,II,III is shown below:  On the basis of your observations a) Identify the plate(s) which is/are white. Give a reason. b) Identify the plate(s) which is/are blue. Give a reason. a) Plate I, b-galactosidase enzyme is responsible for blue colour. Gene is inserted in the b-galactosidase site of the plasmid thereby causing insertional inactivation of the enzyme, so no blue colour is made. b) Plate II - Gene of interest not inserted in the plasmid c)Plate III - No plasmid	2
21	Linkage and crossing over of genes are alternatives to each other. Justify with the help of an example? In Drosophila a yellow bodied white eyed female was crossed with brown bodied red eyed male. The F1 progeny produced when intercrossed, it was observed that the F2 phenotypic ratio of Drosophila deviated significantly from Mendel's 9 : 3 : 3 : 1. The genes for eye colour and body colour are closely located on the 'X' chromosome, showing linkage and therefore, these are inherited together. Recombinants were formed due to crossing over but at low percentage.	2
	Section—C	
22	A biologist sees the following cells in a cross-section of the seminiferous tubule and its surrounding tissues and counts the number of various kinds of cells. Spermatozoa, Spermatid, Primary spermatocyte, Secondary spermatocyte, Leydig cells, Sertoli cells, Spermatogonium. From these cells, identify the cells: (a) that are diploid. (b) that can produce hormones and their names	3

23	Answer the following questions based on Meselson and Stahl's experiment on E.coli. (i) Write the name of the chemical substance used as the only source of nitrogen in the experiment. (ii) Why did they allow the synthesis of the light and the heavy DNA molecules in the organism? (iii) How did they distinguish the heavy DNA molecules from the light DNA molecules?	3
24	A pregnant human female was advised to undergo MTP. It was diagnosed that the fetus she was carrying had developed from a zygote having 45 chromosomes with only one X chromosome. a) What is this condition called and how does it arise? b) Why was she advised to undergo MTP? a) The embryo has Turner's Syndrome [0.5] due to aneuploidy of the sex chromosome. Such a disorder is caused due to the absence of one of the X chromosomes, i.e., 45 with XO. b) She was advised MTP as the child will have the following problems: rudimentary ovaries poorly developed breasts lack of other secondary sexual characters delayed or no onset of the menstrual cycle and infertile.	3
25	The graphs below show three types of natural selection. The shaded areas marked with arrows show the individuals in the population which are not selected. The dotted vertical lines show the statistical means.  a) What names are given to the types of selection shown in graphs A, B and C. b)Explain the different types of natural selection with examples? a) A - stabilising; B - directional; C - disruptive; b) Graph A – Stabilising Graph B – Directional Graph C – Disruptive	3
26	(a) Mention any four strategies adopted by flowering plants to prevent self pollination. 1 Pollens release and stigma receptivity is not synchronised.	3

	2 Anther and stigma are placed at different positions so that the pollen cannot come in contact with the stigma on the same flower. 3 Self-incompatibility. 4 Production of unisexual flower. (b) Why is geitonogamy also referred to genetica lautogamy ? The transfer of pollen grains from the anther to the stigma of another flower of the same plant is called geitonogamy. Although geitonogamy is functionally cross pollination involving a pollinating agent genetically it is similar to autogamy since the pollen grains come from the same Plant.	
27	A farmer grew 2 varieties of corn crop in field A and B. He grew normal corn crops in field A and GM corn crops in field B. He observed corn borers attacked only in field A. To control it, spores of Bt were sprayed in field A. a) Name the gene in the spores responsible for the control of this pest. b) What effect will the spores of Bt have on the insect pest? c) How has field B developed resistance against this pest? a) Cry I Ab b) The spores of Bt contain crystalline toxin which is inactive; for this crystalline toxin protein to become active it needs alkaline pH, which is present in insect gut. The gut lining is broken down/mid gut epithelial cells become porous/swollen/cell lysis. c) The Bt-toxin gene is cloned and inserted into the plant genome by recombinant DNA technology. These genetically modified (GM) plants express the Bt-toxin genes and become pest-resistant.	3
28	How does the gene 'I' control ABO blood groups in humans ? Write the effect the gene has on the structure of red blood cells. In humans, the ABO blood groups are controlled by a gene called I. It has three alleles, namely IA, IB and i. A person possesses any two of the three alleles. IA aid IB are dominant over allele i. But IA and IB are co-dominant as they express themselves equally and independently When present together. These three alleles yield six different combinations which give four type of blood groups. The allele pair IAIA or IA i yield Blood groups A, IB IB or lB i the blood group B, IA IB is blood group AB, and ii is blood group O. The plasma membrane of red blood cells has sugar polymers that protrude out from its surface and the kind of sugar is regulated by the gene 'I' of ABO blood group. The alleles IA and IB produce A and B types of sugar, while i does not produce any sugar.	3
Section—D		
29	**Question 1:Read the following and answer any four questions from (i) to (iv) given below:** Predator Y shown in the image below is a type of wild cat that inhabits the forests and preys primarily on prey X which	4

	are herbivores. Shown below is data on their respective populations over time.  (a) What is the likely cause for the pattern seen in the prey and predator populations through the years? (b) Hypothetically, if all the predators of the forests become extinct, what will happen to the vegetation of the forest? (c) Consider a situation where another similar species of predator immigrates to the forest. What is likely to happen over time and why?	
30	Shown below is a cloning vector 'Z' that Kamla wants to use to create a recombinant vector with her gene of interest. The vector consists of sites for three restriction enzymes - ScaI, HindIII and EcoRI. Restriction sites for the same enzymes are also present in the gene of interest. There are two 'ori' sequences - one allows it to replicate in Escherichia coli and another allows replication in Zymomonas mobilis. Apart from this, the vector consists of two antibiotic resistance genes - one against tetracycline (tet) and another against chloramphenicol (cml).	4



(a) What is the advantage of having two 'ori' sequences in the same vector? Give a situation in which this would be particularly useful

Origin of Replication (ori):

- The origin of replication is a specific sequence where DNA replication begins. For a vector to function in both types of cells, it needs two different origins of replication.

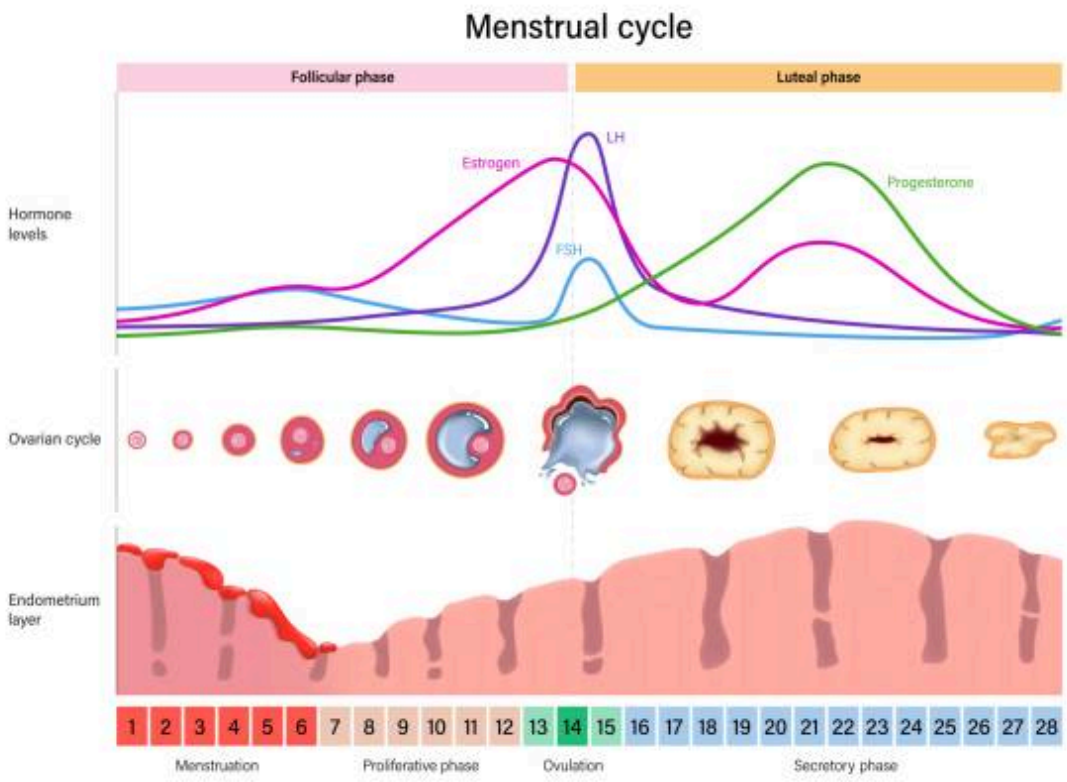
(b) The lac z gene has many recognition sites. Study the segment of DNA given below and answer the questions

5'... ATC GTA AAG CTT CAT…3'
3'... TAG CAT TTC GAA GTA…5'

i) Applying your knowledge of palindrome sequences identify and mark the possible region where the restriction enzyme X will act.

ii) Restriction enzyme Y was used to extract gene of interest from a plant. This gene needs to be inserted in the given DNA segment which has been treated with restriction enzyme X. Will there be a successful recombination? Explain with a reason.

Section—E

31	 Read the graph given above and correlate the uterine events that take place according to the hormonal levels on (i) 6 – 15 days (ii) 16 – 25 days (iii) 26 – 28 days (if ovum is not fertilized) (b) Specify the sources of the hormones mentioned in the graph. Or Given below are certain situations. Analyse the situation and suggest the name of suitable contraceptive device along with mode of action.	5

Situation	Requirement of contraceptive for -	Name of contraceptive device	Mode of action
1	blocking the entry of sperms through cervix	Diaphragms/ cervical caps/ vaults	Cover the cervix during coitus
2	spacing between children	Cu or hormone releasing IUDs such as Cu T/Cu7/ Multiload 375/ Progestasert/LNG 20	Cu ions from Cu containing IUDs increase phagocytosis of sperms within uterus, suppress sperm motility and fertilizing capacity/ hormone releasing IUDs make uterus unsuitable for implantation
3	effective emergency contraceptive	Pills containing Progestogens or progestogen-estrogen combination or IUDs within 72 hours of coitus	Pills inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent the entry of sperms/IUDs - Cu ions increase phagocytosis of sperms within uterus, suppress sperm motility and fertilizing capacity/ hormone releasing IUDs make uterus unsuitable for implantation
4	terminal method to prevent any more pregnancy in female	Tubectomy	Block gamete transport and prevent conception.
5	sterilization in male	Vasectomy	Blocks sperm transport

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32

(a) Do you agree with the perception in our society that the woman is responsible for the gender of the offspring? Substantiate your answer scientifically.

The sex of an individual is determined by the type of the male gamete (X or Y), which fuses with the X chromosome of the female. If the fertilizing sperm is X, then the baby will be a girl and if it is Y, then the baby will be a boy. Hence, it is incorrect to blame a woman for the gender of the child.

(b) How did Morgan explain linkage of genes?

Morgan's work is based on fruit flies (*Drosophila melanogaster*). He formulated the chromosomal theory of linkage. He defined linkage as the co-existence of two or more genes in the same chromosome and performed dihybrid crosses in *Drosophila* to show that linked genes are inherited together and are located on X-chromosome. His experiments have also proved that tightly linked genes show very low recombination while loosely linked genes show higher recombination.

Or

(a) Draw a schematic representation of the structure of a transcription unit and show the following in it:

(i) Direction in which the transcription occurs

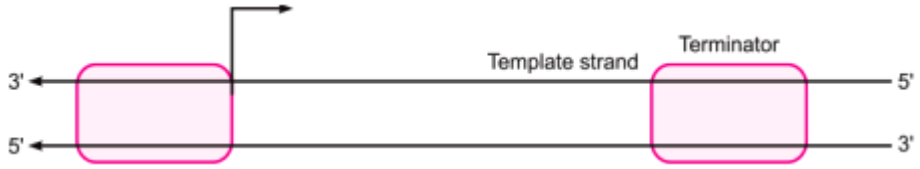
(ii) Polarity of the two strands involved

(iii) Template strand

(iv)Terminator gene

(b) Mention the function of promoter gene in transcription.

5

	a. i. Transcription occurs in 5′→3′. b. Promotor gene has DNA sequence that provide binding site for RNA polymerase.  	
33	It is commonly observed that parents feel embarrassed to discuss freely with their adolescent children about sexuality and reproduction. The result of this parental inhibition is that the children go astray sometimes. (i) Explain the reasons that you feel are behind such embarrassment amongst some parents to freely discuss such issues with their growing children. (a) An embarrassment amongst some parents to freely discuss such issues with their growing children may primarily be because of a conservative attitude. They may have misconceptions that children should be kept away from such discussions. It is seen that illiteracy often breeds such social myths. (ii) By taking one example of a local plant and animal, how would you help these parents to overcome such inhibitions about reproduction and sexuality? Parents need to be made aware to realise that sexuality and reproduction are natural and that every organism is an outcome of that process. When a flower blooms on attaining reproductive maturity, it is often visited by a bee which carries the male gametes within the pollen grains and deposites them on the stigma of a flower. Such an event leads to fruit and seed formation, leading to continuity of race. Or Explain the role of Primary and Secondary Lymphoid organs with the help of suitable examples. The primary role of primary lymphoid organs is to produce and mature lymphocytes, while the primary role of secondary lymphoid organs is to activate lymphocytes and filter out pathogens: **Primary lymphoid organs** The primary lymphoid organs are the bone marrow and thymus: ● **Bone marrow**: Produces blood and immune cells, and is where B cells form and mature ● **Thymus**: Where T cells mature after migrating from the bone marrow **Secondary lymphoid organs**	5

	The secondary lymphoid organs include the spleen, lymph nodes, tonsils, and Peyer's patches: ● **Spleen and lymph nodes**: Filter out pathogens and maintain the population of mature lymphocytes ● **Tonsils and Peyer's patches**: Secondary lymphoid organs **Mucosa-associated lymphoid tissue (MALT)** A diffuse system of small concentrations of lymphoid tissue found in various submucosal membrane sites of the body	