

## Sample Question Paper 2020-21

### Class XII Biology (044) Theory

Time: 3 Hours

Maximum Marks: 70

#### General Instructions:

- (i) All questions are compulsory.
- (ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
- (iii) Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.
- (iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- (v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION A		
	Questions	Marks
1.	Why does endosperm development precede embryo development?	1
2.	How many meiotic divisions are required to produce 76 seeds in a Guava fruit?	1
3.	How does pollination take place in water hyacinth and water lily?	1
4.	Name the glands that contribute to human seminal plasma.	1
5.	A snapdragon plant with violet flowers was crossed with another such plant with white flowers. The F1 progeny obtained had pink flowers. Explain, in brief, the inheritance pattern seen in offsprings of F1 generation?	1
6.	Differentiate between aneuploidy and polyploidy.	1
7.	Predict the effect if, the codon UAU coding for an amino acid at the 25 <sup>th</sup> position of a polypeptide of 50 amino acids, is mutated to UAA.	1
8.	Differentiate between pro-insulin and mature insulin.	1
9.	Name the commonly used vector for cloning genes into higher organisms.	1
10.	Which of the three forests- Temperate, Mangroves and Tropical Evergreen is more vulnerable to invasion by outside animals and plants?	1

11.	<p><b>Assertion:</b> Primary transcripts in eukaryotes are nonfunctional.</p> <p><b>Reason:</b> Methyl guanosine triphosphate is attached to 5' – end of hnRNA.</p> <ol style="list-style-type: none"> <li>Both assertion and reason are true, and reason is the correct explanation of assertion.</li> <li>Both assertion and reason are true, but reason is not the correct explanation of assertion.</li> <li>Assertion is true but reason is false.</li> <li>Both assertion and reason are false.</li> </ol> <p style="text-align: center;"><b>OR</b></p> <p><b>Assertion:</b> An organism with lethal mutation may not even develop beyond the zygote stage.</p> <p><b>Reason:</b> All types of gene mutations are lethal.</p> <ol style="list-style-type: none"> <li>Both assertion and reason are true, and the reason is the correct explanation of the assertion.</li> <li>Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</li> <li>Assertion is true but reason is false.</li> <li>Both assertion and reason are false</li> </ol>	1
12.	<p><b>Assertion:</b> <i>E. coli</i> having pBR322 with DNA insert at BamHI site cannot grow in medium containing tetracycline.</p> <p><b>Reason:</b> Recognition site for Bam HI is present in tet<sup>R</sup> region of pBR322.</p> <ol style="list-style-type: none"> <li>Both assertion and reason are true, and the reason is the correct explanation of the assertion.</li> <li>Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</li> <li>Assertion is true but reason is false.</li> <li>Both assertion and reason are false</li> </ol>	1
13.	<p><b>Assertion:</b> A community with more species is more stable than that with less species.</p> <p><b>Reason:</b> More the number of species, lesser the variation in the total biomass production year after year.</p> <ol style="list-style-type: none"> <li>Both assertion and reason are true, and the reason is the correct explanation of the assertion.</li> <li>Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</li> <li>Assertion is true but reason is false.</li> <li>Both assertion and reason are false</li> </ol>	1

14.	<p><b>Assertion:</b> In <i>Ophrys</i> one petal of the flower bears an uncanny resemblance to the female bee.</p> <p><b>Reason:</b> Two closely related species competing for the same resource can coexist simultaneously.</p> <ol style="list-style-type: none"> <li>Both assertion and reason are true, and the reason is the correct explanation of the assertion.</li> <li>Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</li> <li>Assertion is true but reason is false.</li> <li>Both assertion and reason are false</li> </ol>	1
15.	<p><i>Read the following and answer any <b>four</b> questions from 15(i) to 15(v) given below:</i></p> <p><b>Ecological Indicators</b></p> <p>The presence of dragonflies can reveal changes in the water ecosystems more quickly than studying other animals or plants. In fact, from the nymph to the adult stage, the dragonfly has a significant, positive ecological impact. Dragonfly eggs are laid and hatched in or near water, so their lives impact both water and land ecosystems. Once hatched, dragonfly nymphs can breathe underwater which enables them to eat mosquito larvae, other aquatic insects and worms, and even small aquatic vertebrates like tadpoles and small fish and in the air. Adult dragonflies capture and eat adult mosquitoes.</p> <p>Community wide mosquito control programs that spray insecticides to kill adult mosquitoes also kill dragonflies.</p>	4
i.	<p>The approach to biological control includes:</p> <ol style="list-style-type: none"> <li>Import and release of an insect pest to a new area to provide hosts for natural enemies</li> <li>Import and release of natural enemies from the native home of an alien insect pest that has invaded a new area</li> <li>Preservation of natural enemies (predators &amp; parasitoids) that are already established in an area</li> <li>Use of insecticides to reduce alien insect pests to establish new equilibrium position.</li> </ol>	
ii.	<p>Two diseases less likely to occur in a region with plenty of dragonflies are _____</p> <ol style="list-style-type: none"> <li>Yellow fever and amoebic dysentery</li> <li>Malaria and Yellow fever</li> <li>Anthrax and typhoid</li> <li>Cholera and typhoid</li> </ol>	

iii.	<p>Dragonflies indicate positive ecological impact as-</p> <ol style="list-style-type: none"> <li>The presence of dragonflies indicates polluted water.</li> <li>Dragonfly nymphs selectively eat mosquito larvae.</li> <li>They help to decrease the probability of diseases spread by vectors.</li> <li>Dragonfly do not cause any harm to beneficial species.</li> </ol>	
iv.	<p>The most effective stages in the life cycle of dragonfly that eradicate mosquitoes are-</p> <ol style="list-style-type: none"> <li>Larvae and Adult</li> <li>Caterpillar and Adult</li> <li>Nymph and Adult</li> <li>Pupa and Adult</li> </ol>	
v.	<p><b>Assertion:</b> Releasing dragonflies in areas where there is an outbreak of malarial diseases can be an environment friendly method of control.</p> <p><b>Reason:</b> Dragon flies are dominant species and will not allow mosquitoes to reproduce</p> <ol style="list-style-type: none"> <li>Both assertion and reason are true, and the reason is the correct explanation of the assertion.</li> <li>Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</li> <li>Assertion is true but reason is false.</li> <li>Both assertion and reason are false</li> </ol>	
16.	<p><i>Read the following and answer any <b>four</b> questions from 16(i) to 16(v) given below:</i></p> <p>Sickle cell anemia is a genetic disorder where the body produces an abnormal hemoglobin called hemoglobin S. Red blood cells are normally flexible and round, but when the hemoglobin is defective, blood cells take on a “sickle” or crescent shape. Sickle cell anemia is caused by mutations in a gene called HBB.</p> <p>It is an inherited blood disorder that occurs if both the maternal and paternal copies of the HBB gene are defective. In other words, if an individual receives just one copy of the defective HBB gene, either from mother or father, then the individual has no sickle cell anemia but has what is called “sickle cell trait”. People with sickle cell trait usually do not have any symptoms or problems but they can pass the mutated gene onto their children. There are three inheritance scenarios that can lead to a child having sickle cell anemia:</p> <ul style="list-style-type: none"> <li>- Both parents have sickle cell trait</li> <li>- One parent has sickle cell anemia and the other has sickle cell trait</li> <li>- Both parents have sickle cell anemia</li> </ul>	4

i.	Sickle cell anemia is a/ an _____ disease. a. X linked b. autosomal dominant c. autosomal recessive d. Y linked	
ii.	If both parents have sickle cell trait, then there is _____ of the child having sickle cell anemia. a. 25 % risk b. 50 % risk c. 75% risk d. No risk	
iii.	If both parents have sickle cell trait, then there is _____ of the child having sickle cell trait. a. 25 % risk b. 50 % risk c. 75% risk d. No risk	
iv.	If one parent has sickle cell anemia and the other has sickle cell trait, there is _____ that their children will have sickle cell anemia and _____ will have sickle cell trait. a. 25 % risk, 75% risk b. 50 % risk, 50% risk c. 75% risk, 25% risk d. No risk	
v.	<p>The following statements are drawn as conclusions from the above data (Kenya).</p> <p>I. Patients with SCD (Sickle Cell Disease) are less likely to be infected with malaria.</p>	

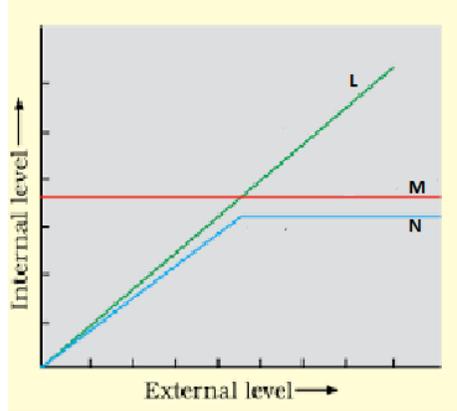
	<p>II. Patients with SCD (Sickle Cell Disease) are more likely to be infected with malaria.</p> <p>III. Over the years the percentage of people infected with malaria has been decreasing.</p> <p>IV. Year 2000 saw the largest percentage difference between malaria patients with and without SCD.</p> <p>Choose from below the correct alternative.</p> <p>a. only I is true</p> <p>b. I and IV are true</p> <p>c. III and II are true</p> <p>d. I and III are true</p>	
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**SECTION – B**

17.	State the composition and principle of oral pills as a contraceptive measure taking the example of Saheli.	2
18.	Karyotype of a child shows trisomy of chromosome number 21. Identify the disorder and state the symptoms which are likely to be exhibited in this case.	2
19.	Explain four advantages of mycorrhizal association to plants.	2
20.	Explain the method to increase the competency of the bacterial cell membrane to take up recombinant DNA?  <b>OR</b> What are bioreactors? How are large volumes of cultures maintained and processed in them?	2
21.	Explain the role of enzymes in the extraction of DNA from <i>Rhizopus</i> in its purest form.	2
22.	What are sticky ends? State their significance in recombination DNA technology.  <b>OR</b> Explain the procedure by which PCR aids in early detection of cancer.	2
23.	Explain how advanced ex-situ conservation techniques assist in preserving threatened species of plants and animals.	2
24.	Define interference competition. Give one example that supports competitive exclusion occurring in nature.	2
25.	The Tropical regions are likely to have more biological diversity than the Temperate ones. Give two reasons to justify the statement.	2

**SECTION – C**

26.	A fully developed foetus initiates its delivery from the mother's womb. Justify the statement.	3
27.	How would you find out the genotype of a pea plant with violet flowers? Explain with the help of Punnett's square showing crosses.	3
28.	Define flocs and state their importance in biological treatment of waste water.	3
29.	A farmer noticed that nematode infection in tobacco plants has resulted in the reduction in the yield. Suggest a strategy which provides cellular defense for providing resistance to this pest. Explain the technique.	3
30.	The graph given below represents three categories of organismic responses - L, M and N to cope with stressful conditions. Identify the categories L and M.	3



Given below are examples of some of the activities performed by animals. Categorise these activities into the appropriate kind of the organismic response (L, M or N) as shown in the graph with reasons.

- i. In summers we sweat profusely.
- ii. Sometimes desert lizards bask in the sun and sometimes they move into shade.

**OR**

Give reasons for the following:

- a. Very small animals are rarely found in polar regions.
- b. Mammals from colder climate generally have shorter ear and limbs.
- c. Initially we feel nausea and fatigue when we reach a high altitude such as Rohtang Pass and then, gradually, we feel normal.

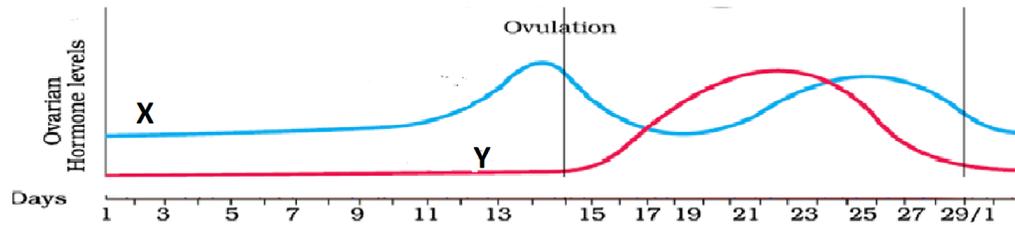
### SECTION - D

31.

Study the graph given below related with menstrual cycle in females:

5

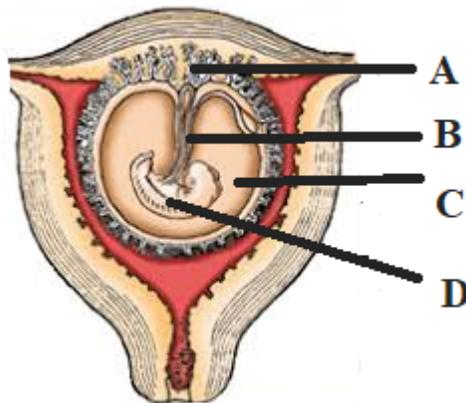
- a. Identify ovarian hormones X and Y mentioned in the graph and specify their source.



- b. Correlate and describe the uterine events that take place according to the ovarian hormone levels X and Y mentioned in the graph on -
- i. 6 – 15 days
  - ii. 16 – 25 days
  - iii. 26 – 28 days (when ovum is not fertilized)

**OR**

The following figure shows a foetus within the uterus. On the basis of the given figure, answer the questions that follow:



- (a) In the above figure, choose and name the correct part (A, B, C or D) that act as a temporary endocrine gland and substantiate your answer. Why is it also called the *functional junction*?
- (b) Mention the role of B in the development of the embryo.
- (c) Name the fluid surrounding the developing embryo. How is it misused for sex-determination?

32.	<p>Evaluate the suitability of DNA and RNA as genetic material and justify the suitability of the one that is preferred as an ideal genetic material.</p> <p style="text-align: center;"><b>OR</b></p> <p>Explain the mechanism of DNA replication as suggested by Watson and Crick.</p>	5
33.	<p>Identify and name the disease in which the patient's cells lose the property of contact inhibition. State its possible causes and explain any <u>three</u> methods to accurately detect the pathological and physiological changes that take place due to the disease in living tissues.</p> <p style="text-align: center;"><b>OR</b></p> <p>A patient had tested positive to ELISA Test. Identify the disease and the pathogen responsible, give reasons for the reduced/ weak immunity of the patient and trace the path, spread and effects of this pathogen in the human body.</p>	5

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**Marking Scheme**  
**Class XII (2020-21)**  
**Biology (044) Theory**

**Time:3 Hours**

**Maximum Marks: 70**

	Value Points	Marks
	<b>SECTION - A</b>	
1	The cells of endosperm are filled with reserve food materials and are used for the nutrition of the developing embryo.	1
2	95	1
3	In water hyacinth and water lily, the flowers emerge above the level of water and are pollinated by insects or wind as in most of the land plants.	1
4	Prostate, Seminal vesicle and Bulbourethral gland. (any two)	1
5	The inheritance is incomplete dominance. In this, a new intermediate phenotype between the two original phenotypes is obtained. One allele for a specific trait is not completely expressed over the other allele for the same trait.	1
6	Aneuploidy is chromosomal abnormality in which one or more chromosomes are gained or lost. Polyploidy is when an entire extra set of chromosomes is added. (It may be triploid or tetraploid.)	1
7	A polypeptide of 24 amino acids will be formed as UAA is a stop codon which will prevent further translation.	1
8	Pro- insulin contains an extra stretch called the C peptide which is not present in the mature insulin.	1
9	Retrovirus/ Adenoviruses/Papilloma virus/Cauliflower mosaic virus/Tobacco mosaic virus	1
10	Tropical Evergreen Forests	1
11	b. Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.  <b>OR</b> b. Both Assertion and Reason are true but Reason, is not the correct explanation of Assertion.	1
12	a. Both assertion and reason are true, and the reason is the correct explanation of the assertion.	1
13	a. Both assertion and reason are true, and the reason is the correct explanation of the assertion.	1
14	c. Assertion is true statement, but reason is false.	1
15	Ecological Indicators (Any four)	4
i.	a. Preservation of natural enemies (predators & parasitoids) vectors.	
ii.	b. Malaria and Yellow fever	

iii.	c. They help to decrease the probability of diseases spread by mosquitoes, horseflies and deer flies.	
iv.	c. Nymph and Adult	
v.	c. Assertion is true statement, but reason is false.	
16	Sickle cell anaemia (Any four)	4
i.	c. autosomal recessive	
ii.	a. 25 % risk	
iii.	b. 50 % risk	
iv.	b. 50 % risk, 50% risk	
v.	d. I and III are true	
<b>SECTION - B</b>		
17	The composition of oral pills comprises: Either progestogens alone <i>or</i> progestogen – estrogen combination Saheli is a Non-steroidal preparation. It inhibits ovulation and implantation. It also alters the quality of cervical mucus to prevent/ retard the entry of sperms.	2
18	Disorder- Down's Syndrome Symptoms: The affected individual is short statured with small round head; has furrowed tongue; partially open mouth; Palm is broad with characteristic palm crease; Physical, psychomotor and mental development is retarded ( <i>any three symptoms</i> )	2
19	The fungal symbiont in mycorrhizal associations with plants: i. absorbs phosphorus from soil and passes it to the plant. ii. provides resistance to root-borne pathogens, iii. enhances tolerance to salinity and drought, iv. induces an overall increase in plant growth and development.	2
20	The Recombinant DNA can be forced into the bacterial cell treated with divalent cations and incubating it with recombinant DNA on ice. This is to be followed by placing it briefly at 42 <sup>0</sup> C (heat shock), and then putting it back on ice. This process would enable the bacteria to take up the recombinant DNA. <b>OR</b> Bioreactors are vessels in which raw materials are biologically converted into specific products such as enzymes using microbial, plant, animal or human cells. A bioreactor provides the optimal conditions for achieving the desired product by providing optimum growth conditions like temperature, pH, substrate, salts, vitamins and oxygen.	2
21	The extraction of DNA from <i>Rhizopus</i> in its purest form can be done by treating the fungal cells with enzymes such as Chitinase which will dissolve the cell wall. The RNA can be removed by treatment with ribonuclease whereas proteins can be removed by treatment with protease. Other molecules can be removed by appropriate treatments thereby purifying DNA.	2
22	• Restriction enzymes cut the strand of DNA a little away from the centre of the	2

	<p>palindrome sites, but between the same two bases on the opposite strands. This leaves single stranded portions at the ends. These overhanging stretches on each strand are called sticky ends.</p> <ul style="list-style-type: none"> <li>• They form hydrogen bonds with their complimentary counterparts and facilitate the action of DNA ligase enzyme.</li> </ul> <p style="text-align: center;"><b>OR</b></p> <ul style="list-style-type: none"> <li>• A single stranded DNA or RNA is tagged with a radioactive molecule(probe)</li> <li>• It is allowed to hybridize to its complementary DNA in a clone of cells followed by detection using autoradiography.</li> <li>• The clone having the mutated gene will hence not appear on the photographic film,</li> <li>• because the probe will not have complementarity with the mutated gene.</li> </ul> <p>Hence, cancer induced mutation can be detected.</p>	
23	<ul style="list-style-type: none"> <li>• Advanced techniques are being used now for <i>ex situ</i> conservation. Gametes of threatened species can be preserved in viable and fertile condition for long periods using cryopreservation techniques. Eggs can, thus, be fertilized <i>invitro</i>.</li> <li>• In plants, the explants can be propagated using tissue culture methods and can be kept for long periods in seed banks.</li> </ul>	2
24	<p>Interference competition is the feeding efficiency of one species which might be reduced due to the interfering and inhibitory presence of the other species, even if resources (food and space) are abundant. Examples that support competitive exclusion occurring in nature are:</p> <ul style="list-style-type: none"> <li>• The Abingdon tortoise became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats.</li> <li>• The larger and competitively superior barnacle <i>Balanus</i> dominates the intertidal area and excludes the smaller barnacle <i>Chathamalus</i> from that zone.</li> </ul> <p>(any 1 example)</p>	2
25	<p>Some possible reasons are:</p> <ul style="list-style-type: none"> <li>• Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.</li> <li>• Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity.</li> <li>• There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.</li> </ul> <p>(Any two reasons)</p>	2
	<b>SECTION - C</b>	
26	<ul style="list-style-type: none"> <li>• The signals for parturition originate from the fully developed foetus and the</li> </ul>	3

	<p>placenta which induce mild uterine contractions called foetal ejection reflex.</p> <ul style="list-style-type: none"> <li>• This triggers the release of oxytocin from the maternal pituitary.</li> <li>• Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin.</li> <li>• The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions.</li> <li>• Parturition is induced by a complex neuroendocrine mechanism involving cortisol, oestrogens and oxytocin.</li> <li>• This leads to expulsion of the baby out of the uterus through the birth canal – parturition.</li> </ul>	
27	<p>Diagrammatic representation of a test cross</p> <p>(1) All flowers are violet Unknown flower is homozygous dominant</p> <p>(0.5) <b>Result</b></p> <p>(0.5) <b>Interpretation</b></p> <p>Dominant Phenotype (Genotype unknown)</p> <p>Half of the flowers are violet and half of the flowers are white. Unknown flower is heterozygous</p>	3
28	<ul style="list-style-type: none"> <li>• Flocs are masses of semi - decayed organic matter along with decomposer microbes which are surrounded by slime. They separate the organic matter from waste water.</li> <li>• Flocs settle down in secondary tanks and take part in the formation of sludge.</li> <li>• They can be used as inoculum in biological treatment of waste water as well as source of biogas and manure.</li> </ul>	3
29	<ul style="list-style-type: none"> <li>• Strategy based on the process of RNA interference (RNAi) - as a method of cellular defence can be used.</li> <li>• This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing).</li> <li>• The source of this complementary RNA can be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate.</li> <li>• Using <i>Agrobacterium</i> vectors, nematode-specific genes are introduced into the host plant. The introduction of DNA produces both sense and anti-sense RNA in the host cells.</li> <li>• Two RNA's being complementary to each other form a double stranded (dsRNA) that initiate RNAi and thus, silence the specific mRNA of the nematode.</li> <li>• As a consequence, the parasite cannot survive in a transgenic host expressing</li> </ul>	3

	specific interfering RNA. The transgenic plant therefore gets protected from the parasite.	
30	<p>L: Conformers, M: Regulators</p> <p>i. To regulate the body temperature – M/Regulators ii. To keep their body temperature constant by behavioural response for coping with variations in environment– L/Conformers</p> <p style="text-align: center;"><b>OR</b></p> <p>a. Since small animals have a larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside; then they have to expend much energy to generate body heat through metabolism. This is the main reason why very small animals are rarely found in polar regions. b. Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. (This is called the <i>Allen's Rule</i>.) c. This is because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen. But gradually we get acclimatised and stop experiencing altitude sickness.</p>	3
	<b><u>SECTION – D</u></b>	
31	<p>a. X- Estrogen secreted by growing follicles; Y – Progesterone secreted by corpus luteum</p> <p>b. Uterine events that take place according to the ovarian hormone levels X and Y on -</p> <p>i. 6 – 15 days: Endometrium of the uterus regenerates by proliferation under the influence of estrogen. 1 ii. 16 – 25 days: Under the influence of Progesterone the endometrium of the uterus is maintained for implantation of fertilised ovum and other events of pregnancy. 1 iii. 26 – 28 days (when ovum is not fertilized): in the absence of fertilisation, corpus luteum degenerates which causes disintegration of endometrium leading to menstruation, marking a new cycle. 1</p> <p style="text-align: center;"><b>OR</b></p> <p>(a) Part labeled A -Placenta. It acts as an endocrine tissue as it produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progestogens, etc. It is also called the <i>functional junction</i> because it facilitates the supply of oxygen and nutrients to the embryo and removes carbon dioxide and excretory/waste materials produced by the embryo. 3 (b) The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. 1 (c) Amniotic fluid; a foetal sex determination test is based on the chromosomal pattern of the cells in the amniotic fluid surrounding the developing embryo. 1</p>	1 1 1 1 1 3 1 1

32	<p>Evaluation of DNA and RNA on the basis of the properties of the genetic material:</p> <ol style="list-style-type: none"> <li>1. It should be able to generate its replica (Replication): As per the rule of base pairing and complementarity, both the nucleic acids (DNA and RNA) have the ability to direct their duplications.</li> <li>2. The genetic material should be chemically and structurally stable enough not to change with different stages of life cycle, age or with change in physiology of the organism. Presence of 2'-OH group and uracil make RNA more reactive and structurally less stable than DNA. Therefore, DNA is a better genetic material than RNA.</li> <li>3. It should provide the scope for slow changes (mutation) that are required for evolution: Both DNA and RNA are able to mutate. In fact, RNA being unstable, mutates at a faster rate. Consequently, viruses having RNA genome and having shorter life span mutate and evolve faster.</li> <li>4. It should be able to express itself in the form of 'Mendelian Characters': RNA can directly code for the synthesis of proteins, hence can easily express the characters. DNA, however, is dependent on RNA for synthesis of proteins. The protein synthesising machinery has evolved around RNA.</li> <li>5. The above discussion indicates that both RNA and DNA can function as genetic material, but DNA being more stable is preferred for storage of genetic information</li> </ol> <p style="text-align: center;"><b>OR</b></p> <p>Mechanism of Replication of DNA suggested by Watson and Crick</p> <ul style="list-style-type: none"> <li>• The two strands of DNA would separate and act as a template for the synthesis of new complementary strands. After the completion of replication, each DNA molecule would have one parental and one newly synthesised strand. This scheme was termed as semiconservative replication of DNA.</li> <li>• In living cells, such as <i>E. coli</i>, the process of replication requires a set of catalysts (enzymes). The main enzyme is referred to as DNA-dependent DNA polymerase, since it uses a DNA template to catalyse the polymerisation of deoxynucleotides.</li> <li>• Furthermore, energetically replication is a very expensive process. Deoxyribonucleoside triphosphates serve dual purposes. In addition to acting as substrates, they provide energy for polymerisation reaction.</li> <li>• For long DNA molecules, since the two strands of DNA cannot be separated in its entire length (due to very high energy requirement), the replication occurs within a small opening of the DNA helix, referred to as replication fork.</li> <li>• The DNA-dependent DNA polymerases catalyse polymerisation only in one direction, that is 5' → 3'.</li> <li>• Consequently, on one strand (the template with polarity 3' → 5'), the replication is continuous, while on the other (the template with polarity 5' → 3'), it is discontinuous. The discontinuously synthesised fragments are later joined by the enzyme DNA ligase.</li> </ul>	5
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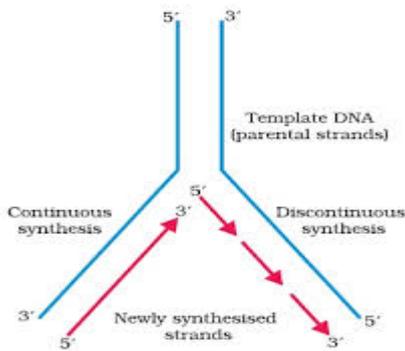


Figure: replication Fork

- The DNA polymerases on their own cannot initiate the process of replication.
- There is a definite region in *E. coli* DNA where the replication originates, such regions are termed as origin of replication.
- In eukaryotes, the replication of DNA takes place at S-phase of the cell- cycle.
- The replication of DNA and cell - division cycle should be highly coordinated. A failure in cell division after DNA replication results into polyploidy.

33

Disease: Cancer

*Probable Causes:*

Physical/ Environmental- Exposure to X – rays/ gamma rays/ UV rays;  
Chemicals/Nicotine in tobacco/ other carcinogens

Biological- Viral oncogenes/ Mutations

*Detection and diagnosis:*

1. Cancer detection is based on biopsy and histopathological studies of the tissue; blood and bone marrow tests for increased cell counts in the case of leukemias. In biopsy, a piece of the suspected tissue cut into thin sections is stained and examined under microscope (histopathological studies) by a pathologist.
2. Techniques like radiography (use of X-rays), CT (computed tomography) and MRI (magnetic resonance imaging) are very useful to detect cancers of the internal organs. Computed tomography uses X-rays to generate a three-dimensional image of the internals of an object. MRI uses strong magnetic fields and non-ionising radiations to accurately detect pathological and physiological changes in the living tissue.
3. Antibodies against cancer-specific antigens are also used for detection of certain cancers.
4. Techniques of molecular biology can be applied to detect genes in individuals with inherited susceptibility to certain cancers.

*(any three methods)*

**OR**

Disease: AIDS (Acquired ImmunoDefeciency Syndrome)

Pathogen: Human Immuno deficiency virus (HIV).

Reason:

Due to decrease in the number of helper T lymphocytes, the person starts suffering from infections that could have been otherwise overcome such as those due to

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<p>bacteria especially <i>Mycobacterium</i>, viruses, fungi and even parasites like <i>Toxoplasma</i>.</p> <p>The <i>path</i> of this pathogen and its <i>spread and effect</i> on the human body:</p> <ul style="list-style-type: none"><li>• After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase.</li><li>• This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles.</li><li>• The macrophages continue to produce virus and in this way acts like a HIV factory.</li><li>• Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses.</li><li>• The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper T lymphocytes in the body of the infected person.</li><li>• During this period, the person suffers from bouts of fever, diarrhoea and weight loss.</li></ul>	3
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