



# ST. LAWRENCE HIGH SCHOOL



A JESUIT CHRISTIAN MINORITY INSTITUTION

## SELECTION TEST

Sub: BIOLOGICAL SCIENCES

Class: XII

F.M :70

Duration: 3 hours 15 Minutes

Date: 17.11.2018

(MODEL ANSWERS)

### PART A

1. Answer the following questions (alternatives to be noted):

2x5=10

a) What is emasculation? How is it related to bagging?

*The removal of flower buds before the anther dehisces using a pair of forceps is called emasculation.*

*Emasculated flowers can be covered with a bag of suitable size, generally made of butter paper to prevent contamination of its stigma with unwanted pollen. This process is called bagging.*

Or

What is incomplete dominance?

*Individual with contrasting features when produce some immediate phenotype, the phenomenon is called incomplete dominance. E.g – Pink flowers in *Mirabilis jalapa*.*

b) What is nucleosome?

*DNA wrapped around proteins forming a beads-on-a-string structure is called nucleosome. It is the chromatin particle composed of five histones (H1, H2A, H2B, H3 and H4) and 200 nucleotide pair DNA.*

c) What is MTP? When is it considered to be safe?

*Intentional or voluntary termination of pregnancy before full is known as Medical termination of pregnancy (MTP).*

*It is considered to be safe during the first trimester (12 weeks) of pregnancy.*

Or

What is colostrum?

*The milk produced, during initial few days of lactation, which is rich in several antibodies essential to develop resistance for the new born babies is called colostrum.*

d) Distinguish between isogamy and anisogamy?

*Isogamy:*

*1. Fusing gametes do not differ morphologically but may be different physiologically.*

*2. Microgametes (male gametes) and macrogametes (female gametes) are not named.*

*3. It takes place in unicellular organisms such as *Monocystis* – a protozoan.*

*Anisogamy:*

*1. Fusing gametes differ in size or motility.*

*2. Microgametes (male gametes) and macrogametes (female gametes) are present.*

*3. It takes place in some fungi higher invertebrates and all vertebrates.*





*Elongation phase of translation-*

*For initiation , the ribosome binds to the mRNA at the start codon (AUG) that is recognized only by the initiator tRNA. The ribosome proceeds to the elongation phase of protein synthesis. During this stage, complexes composed of amino acid linked to tRNA , sequentially bind to appropriate codon in mRNA by forming complementary base pairs with the anticodon. The ribosome moves from codon to codon along the mRNA. Amino acids are added one by one, translated into polypeptide sequences dictated by DNA and represented by mRNA.*

- d) Give the significance of principles of Hardy Weinberg equilibrium.

*The law describes a theoretical situation in which a population is undergoing no evolutionary change. It explains that if evolutionary forces are absent the population is large; its individuals have random mating, each parent produces roughly equal number of gametes and the gametes produced by the mating parents combine at random and the gene frequency remains constant; then the genetic equilibrium of the genes in question is maintained and the variability present in the population is preserved.*

*The law is important primarily because it describes the situation in which there is no evolution, and thus it provides a theoretical baseline for measuring evolutionary change. The equilibrium tendency serves to conserve gains which have been made in the past and also to avoid too rapid changes; in other words, giving a genetic stability to the population. The Hardy-Weinberg equation describes conditions that are not found in natural population.*

Or

Differentiate between homologous and analogous organs. What is adaptive radiation?

(2+1)

*Homologous Structures have similar morphology, embryology and anatomy etc. but are dissimilar in their functions. Example- Forelimbs of mammals*

*Analogous structures are those structures in different species which perform the same function, have similar appearance and structure but are not evolved together; therefore do not share a common ancestor.*

*Example- Wings of birds and insects.*

*Adaptive radiation is an evolutionary divergence of members of a single phyletic line into a series of different niches or adaptive zones. Example- Mammalian limbs, Australian marsupials, etc.*

- e) What is greenhouse effect? Name one device to remove particulate matter from air.

(2+1)

*A greenhouse is a small glasshouse used for growing plants especially during winter. In a greenhouse the glass panel lets the light in , but does not allow the heat to escape. Therefore , the temperature inside becomes warm enabling the plants to grow.*

*One device to remove particulate matter from air is electrostatic precipitator.*

Or

Give one example of GMO. What are the steps of genetic engineering?

*One example of GMO is Bt cotton .*

*The steps of genetic engineering are as follows-(steps to be elaborated)*

*a) Isolation of DNA from desired organism .*

*b) Insertion of DNA*

*c) Cloning of DNA*

- f) Explain codominance with reference to ABO blood grouping.

(3)

*It is a genetical phenomenon where both the alleles of a trait in a heterozygote are fully expressed.*

*In ABO blood group, two alleles of the I gene, which determines ABO blood type, are codominant. Both A and B alleles are dominant over O. As a result, individuals who have an AO genotype will have an A phenotype. People who are type O have OO genotypes. In other words, they inherited a recessive O allele from both parents. The A and B alleles are codominant. Therefore, if an A is inherited from one parent and a B from the other, the phenotype will be AB. Agglutination tests will show that these individuals have the characteristics of both type A and type B blood.*

Phenotype	Genotype
O	ii
A	I <sup>A</sup> I <sup>A</sup> or I <sup>A</sup> i
B	I <sup>B</sup> I <sup>B</sup> or I <sup>B</sup> i
AB	I <sup>A</sup> I <sup>B</sup>

- g) What is BOD? Describe the steps of sewage treatment process.

(2+1)

*Biochemical Oxygen Demand (BOD, also called Biological Oxygen Demand) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.*

*Screening is the first stage of the wastewater treatment process. Screening removes large objects like, diapers, nappies, sanitary items, cotton buds, face wipes and even broken bottles, bottle tops, plastics and rags that may block or damage equipment. □ Special equipment is also used to remove grit that gets washed into the sewer. □*

*PRIMARY TREATMENT □ This involves the separation of organic solid matter (or human waste) from the wastewater. This is done by putting the wastewater into large settlement tanks for the solids to sink to the bottom of the tank. The settled solids are called 'sludge'. At the bottom of these circular tanks, large scrapers continuously scrape the floor of the tank and push the sludge towards the center where it is pumped away for further treatment. The rest of the water is then moved to the Secondary treatment. □*

*SECONDARY TREATMENT □ The water, at this stage, is put into large rectangular tanks. These are called aeration lanes. Air is pumped into the water to encourage bacteria to break down the tiny bits of sludge that escaped the sludge scraping process. □*

*FINAL TREATMENT □ Next, the 'almost' treated wastewater is passed through a settlement tank. Here, more sludge is formed at the bottom of the tank from the settling of the bacterial action. Again, the sludge is scraped and collected for treatment. The water at this stage is almost free from harmful substances and chemicals. The water is allowed to flow over a wall where it is filtered through a bed of sand to remove any additional particles. □ □ The filtered water is then released into the river.*

Or

Describe the immune system along with its components. Name a secondary lymphoid organ in human



beings.

(2+1)

*The immune system is the body's defense against infectious organisms and other invaders. The immune system is made up of a network of cells, tissues, and organs that work together to protect the body.*

- a) *The tonsils and thymus, which make antibodies.*
- b) *The lymph nodes and vessels (the lymphatic system)*
- c) *Bone marrow*
- d) *The spleen, which filters the blood by removing old or damaged blood cells and platelets and helps the immune system by destroying bacteria and other foreign substances.*
- e) *White blood cells.*

*Spleen is a secondary lymphoid organ in human.*

- h) Write two symptoms of Klinefelter's syndrome. Mention the chromosome abnormality in it.

*Two symptoms of Klinefelter's syndrome are:*

- a) *Tall stature*
- b) *High pitch voice*
- c) *presence of gynacomastia*
- d) *sub-fertile to sterile in nature*
- e) *Presence of Barr body in somatic cells*
- f) *May be with undescended testis*
- g) *sparse hair in bears and moustache*

*It is developed in an aneuploid condition when a person has two X chromosomes and one Y chromosome. the karyotype is XXY and has 47 chromosomes.*

(2+1)

Or

Write two symptoms of Down's syndrome and mention the chromosomal abnormality in it.

(2+1)

*Two symptoms of Down's syndrome are-*

- a) *abnormally small chin-microglia*
- b) *Flat nasal bridge*
- c) *Flat face and broad*
- d) *Short neck*
- e) *Brushfield spot*
- f) *Protruding tongue*
- g) *Poor muscle tone*
- h) *oblique eye fissures*
- i) *single palmar fold*

*This condition develops due to trisomy of chromosome number 21.*

- i) Describe the process of oogenesis in human female.

*Oogenesis takes place from oogonium through successive stages*

*i) Multiplication phase: The cells of germinal epithelium of the ovary divide mitotically producing a couple of million egg mother cells in each fetal ovary.*

*ii) Growth phase : Oogonium grows into primary oocyte by taking in food from the surrounding follicles.*

*iii) Maturation phase- Each primary oocyte undergoes two maturation division , first meiotic and second meiotic. In the first meiotic division, the primary oocyte divides into two unequal haploid daughter cells- a large and a secondary oocyte and a very small first polar body. The 1<sup>st</sup> polar body degenerates. The secondary oocyte again divides and unequal cells at fertilization, a large ootid (n) and a very small 2<sup>nd</sup> polar body. The ootid grows into functional ovum within which male and female pronucleus remain distinctly until fusion.*

Or

Differentiate between homothallic and heterothallic organisms. What is contact inhibition?

*Homothallic organisms are those producing male and female reproductive structures in the same plant while heterothallic organisms are those producing male and female reproductive structures in different plants.*

*Inhibition of cell division and cell motility in normal animal cells when in close contact with each other is called contact inhibition.*

3. Answer the following questions (Alternatives are to be noted):-  
5x3=15

a) What is amniocentesis? Describe in brief about the advantages and disadvantages of using oral pills. *Amniocentesis (also referred to as amniotic fluid test) is a medical procedure used in prenatal diagnosis of chromosomal abnormalities and fetal infections, and also for sex determination, in which a small amount of amniotic fluid, which contains fetal tissues, is sampled from the amniotic sac surrounding a developing fetus, and then the fetal DNA is examined for genetic abnormalities*

*Oral contraceptive Pills have the following advantages:*

- *Reduce the symptoms of Pre-Menstrual Syndrome (PMS)*
- *Reduce the risk of Pelvic Inflammatory Disease (infection of the female reproductive system)*
- *Reduce the risk of colon, ovarian, and womb cancers*
- *Reduce the risk of fibroids, ovarian cysts, and non-cancerous breast disease*

*There are some disadvantages*

- *weight gain Nevertheless,*
- *water retention hence should consider switching to formulations containing drospirenone (with anti-mineralocorticoid effect) which prevents water retention.*
- *temporary side effects such as headaches, nausea, swollen breasts, and mood swings.*
- *Some progestogens with androgenic properties may cause acne.*
- *It may increase blood pressure.*
- *It does not protect against sexually transmitted disease*
- *There is a small risk of serious health problems such as blood clots and breast cancer.*

(2+3)

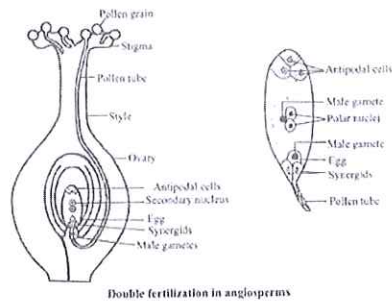
Or

Describe the process of double fertilization in angiosperms.

*This process involves the joining of a female gametophyte (megagametophyte, also called the embryo sac) with two male gametes (sperm). It begins when a pollen grain adheres to the stigma of the carpel, the female reproductive structure of a flower. The pollen grain then takes in moisture and begins to germinate, forming a pollen tube that extends down toward the ovary through the style. The tip of the pollen tube then enters the ovary and penetrates through the micropyle opening in the ovule. The pollen tube proceeds to release the two sperm in the megagametophyte.*

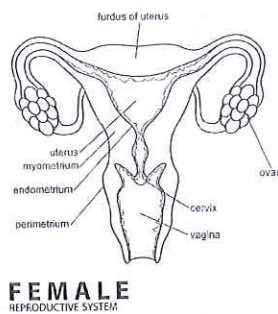
*The ovules are 8 in number and arranged in the form of 3+2+3 (from top to bottom) i.e 3 antipodal cells, 2 polar central cells, 2 synergids & 1 egg cell. One sperm fertilizes the egg cell and the other sperm combines with the two polar nuclei of the large central cell of the megagametophyte. The haploid sperm and haploid egg combine to form a diploid zygote, the process being called syngamy, while the other sperm and the two haploid polar nuclei of the large central cell of the megagametophyte form a triploid nucleus (triple fusion). Some plants may form polyploid nuclei. The large cell of the gametophyte will then develop into the endosperm, a nutrient-rich tissue which provides nourishment to the developing embryo. The ovary, surrounding the ovules, develops into the fruit, which protects the seeds and may function to disperse them.*





Double fertilization in angiosperms

b) Draw the female reproductive system and label its parts.  
(5)



Or

Explain the various events taking place during the menstrual cycle (with reference to the hormones).

*Each month during the years between puberty and menopause, a woman's body goes through a number of changes to get it ready for a possible pregnancy. This series of hormone-driven events is called the menstrual cycle.*

*During each menstrual cycle, an egg develops and is released from the ovaries. The lining of the uterus builds up. If egg does not fertilize, the uterine lining sheds during a menstrual period.*

*A woman's menstrual cycle is divided into four phases:*

- *menstrual phase*
- *follicular phase*
- *ovulation phase*
- *luteal phase*

**Menstrual phase**

*The menstrual phase is the first stage of the menstrual cycle.*

*This phase starts when an egg from the previous cycle isn't fertilized. Because pregnancy hasn't taken place, levels of the hormones estrogen and progesterone drop.*

*The thickened lining of the uterus (endometrium), sheds through the vagina. During the menstrual cycle, uterus release a combination of blood, mucus, and tissue.*

**Ovulation phase**

*Rising estrogen levels during the follicular phase trigger the pituitary gland to release luteinizing hormone (LH). This is what starts the process of ovulation.*

*Ovulation is when the ovary releases a mature egg. The egg travels down the fallopian tube toward the uterus to be fertilized by sperm.*

*Ovulation happens at around day 14 in a 28-day cycle. It lasts about 24 hours.*

**Luteal phase**

*After the follicle releases its egg, it changes into the corpus luteum. This structure releases hormones, mainly progesterone. The rise in hormones keeps the uterine lining thick and ready for a fertilized egg to*

implant.

If there is no fertilization body will produce human chorionic gonadotropin (hCG). It helps maintain the corpus luteum and keeps the uterine lining thick.

The corpus luteum will shrink away and be resorbed. This leads to decreased levels of estrogen and progesterone, which causes the onset of your period. The uterine lining will shed during your period.

c) Describe the process of transcription in brief.

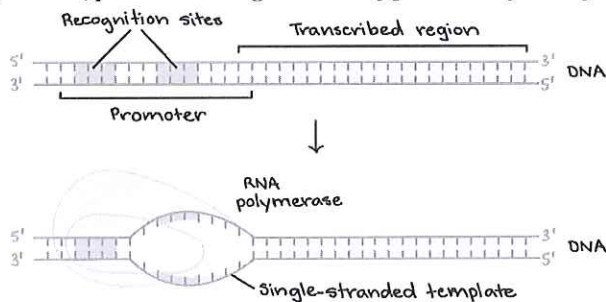
(5)

*Transcription is the first step of gene expression. During this process, the DNA sequence of a gene is copied into RNA.*

*Before transcription can take place, the DNA double helix must unwind near the gene that is getting transcribed. The region of opened-up DNA is called a transcription bubble.*

*To begin transcribing a gene, RNA polymerase binds to the DNA of the gene at a region called the promoter. Basically, the promoter tells the polymerase where to attach on the DNA and begin transcribing. RNA polymerase recognizes and binds directly to these sequences. The sequences position the polymerase in the right spot to start transcribing a target gene, and they also make sure it is pointing in the right direction. Once RNA polymerase is in position at the promoter, the next step of transcription—elongation—can begin.*

*During elongation, RNA polymerase moves along one strand of DNA, known as the template strand, in the 3' to 5' direction. For each nucleotide in the template, RNA polymerase adds a matching (complementary) RNA nucleotide to the 3' end of the RNA strand. The RNA transcript is nearly identical to the non-template, or coding, strand of DNA. However, RNA strands have the base uracil (U) in place of thymine (T), as well as a slightly different sugar in the nucleotide. RNA polymerase will keep transcribing until it gets signals to stop. The process of ending transcription is called termination, and it happens once the polymerase transcribes a sequence of DNA known as a terminator. In Rho-dependent termination, the RNA contains a binding site for a protein called Rho factor. Rho factor binds to this sequence and starts moving up the transcript towards RNA polymerase. Rho-independent termination depends on specific sequences in the DNA template strand. As the RNA polymerase approaches the end of the gene being transcribed, it hits a region rich in C and G nucleotides. The RNA transcribed from this region folds back on itself, and the complementary C and G nucleotides bind together. The result is a stable hairpin that causes the polymerase to stall. In a terminator, the hairpin is followed by a stretch of U nucleotides in the RNA, which matches up with A nucleotides in the template DNA. The complementary U-A region of the RNA transcript forms only a weak interaction with the template DNA. This, coupled with the stalled polymerase, produces enough instability for the enzyme to fall off and liberate the new RNA transcript.*



Or

Describe the function of lac operon.

(5)

**The lac Operon: An Inducer Operon**

*A major type of gene regulation that occurs in prokaryotic cells utilizes and occurs through inducible*



*operons. Inducible operons have proteins that can bind to either activate or repress transcription depending on the local environment and the needs of the cell. The lac operon is a typical inducible operon. As mentioned previously, E. coli is able to use other sugars as energy sources when glucose concentrations are low. To do so, the cAMP–CAP protein complex serves as a positive regulator to induce transcription. One such sugar source is lactose. The lac operon encodes the genes necessary to acquire and process the lactose from the local environment, which includes the structural genes lacZ, lacY, and lacA. lacZ encodes β-galactosidase (LacZ), an intracellular enzyme that cleaves the disaccharide lactose into glucose and galactose. lacY encodes β-galactoside permease (LacY), a membrane-bound transport protein that pumps lactose into the cell. lacA encodes β-galactoside transacetylase (LacA), an enzyme that transfers an acetyl group from acetyl-CoA to β-galactosides. Only lacZ and lacY appear to be necessary for lactose catabolism. CAP binds to the operator sequence upstream of the promoter that initiates transcription of the lac operon. The lac operon uses a two-part control mechanism to ensure that the cell expends energy producing β-galactosidase, β-galactoside permease, and thiogalactoside transacetylase (also known as galactoside O-acetyltransferase) only when necessary. However, for the lac operon to be activated, two conditions must be met. First, the level of glucose must be very low or non-existent. Second, lactose must be present. If glucose is absent, then CAP can bind to the operator sequence to activate transcription. If lactose is absent, then the repressor binds to the operator to prevent transcription. If either of these requirements is met, then transcription remains off. The cell can use lactose as an energy source by producing the enzyme β-galactosidase to digest that lactose into glucose and galactose. Only when both conditions are satisfied is the lac operon transcribed, such as when glucose is absent and lactose is present. This process is beneficial and makes most sense for the cell as it would be energetically wasteful to create the proteins to process lactose if glucose were plentiful or if lactose were not available.*

#### PART-B

**1) Find out the correct answer out of the options given against each question:**

**1x14=14**

1. The embryo sac is
  - i. 8 nucleate**
  - ii. 9-nucleate
  - iii. 7-nucleate
  - iv. 10 –nucleate
2. Menstrual cycle is present in
  - i. Monkeys
  - ii. Deer**
  - iii. Apes
  - iv. Humans
3. The residual persistent nucellus is the
  - i. Endosperm**
  - ii. Perisperm
  - iii. Mesosperm
  - iv. Episperm
4. Which is not an accessory reproductive organ in males
  - i. Seminal vesicles
  - ii. Mons pubis**

- iii. Prostrate
- iv. Bulbourethral gland

5. Which of the following is not an STD?

- i. Syphilis
- ii. AIDS
- iii. genital herpes
- iv. **Ascariasis**

6. A method of in-vitro fertilization is

- I. **IUT**
- ii. GIFT
- iii. ICSI
- iv. AI

7. Which of the following is called 'molecular scissor'?

- i. Taq polymerase
- ii. Recombinant DNA
- iii. **Restriction endonuclease**
- iv. None of these

8. Histones are rich in

- i. **Arginines and Lysine**
- ii. Lysines and alanines
- iii. Alanine and Phenylalanine
- iv. Alanine and glycine

9. Coacervate is

- i. **Lipoprotein**
- ii. Mixture of ammonia, carbohydrate and water
- iii. Fatty acid
- iv. Colloidal material

10. Cocaine is obtained from

- i. ***Erythroxylum coca***
- ii. *Papaver somniferum*
- iii. *Cannabis sativa*
- iv. *Trachyspermum roxburghianum*

11. Crossing between same breed with no common ancestors is called

- i. **Outbreeding**
- ii. Outcrossing
- iii. Inbreeding
- iv. Cross breeding



12. Which scientist proved that DNA is the genetic material?

- i. Haldane
- ii. **Griffith**
- iii. Urey
- iv. Watson

13. The relation between Clown fish and sea anemone is

- i. **Commensalism**
- ii. Mutualism
- iii. Parasitism
- iv. none of these

14. The Phenotypic ratio of F2 generation is

- i. 1:2:3
- ii. 3:1
- iii. 1:2:1
- iv. **9:3:3:1**

2) Answer the following questions:- (Alternatives are to be noted)

1x4=4

1. What are proto- oncogenes?

*A normal gene which, when altered by mutation, becomes an oncogene that can contribute to cancer. Proto-oncogenes may have many different functions in the cell. Some proto-oncogenes provide signals that lead to cell division. Other proto-oncogenes regulate programmed cell death*

Or

What is a selectable marker?

*Selectable marker genes are conditionally dominant genes that confer an ability to grow in the presence of applied selective agents that are normally toxic to plant cells or inhibitory to plant growth, such as antibiotics and herbicides. Example- neomycin*

2. Write the name of one IUD.

*One IUD is CuT/Cu7/Multiload 375*

Or

What are linked genes?

*Linked genes are genes that are likely to be inherited together because they are physically close to one another on the same chromosome. During meiosis, chromosomes are recombined, resulting in gene swaps between homologous chromosomes.*

3. What is pedigree analysis?

*Pedigree in the form of a chart presents a number of generations in a family showing the relationship among the members of the family and the inheritance pattern of different genetic diseases.*

4. What is apiculture?

*Apiculture is the methodology where culture of honey bee by the artificial methods and collection of honey from the bee hive is done.*

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