BIOLOGY

PAPER 1

(THEORY)

Maximum Marks: 70
Time Allotted: Three Hours
Reading Time: Additional Fifteen Minutes

Instructions to Candidates

1. You are allowed **an additional fifteen minutes** for **only** reading the question paper.
2. You must **NOT** start writing during reading time.
3. This question paper has **11 printed pages**. It has **eighteen questions** in all.
4. Answer ***all*** questions.
5. There are **four** sections in the paper: **A, B, C** and **D**. **Internal choices** have been provided in **one question** each in **Sections B, C** and **D**.
6. **Section A** consists of ***one question*** each carrying ***one / two mark(s).***
7. **Section B** consists of ***seven questions*** each carrying ***two marks***.
8. **Section C** consists of ***seven questions*** each carrying ***three marks***.
9. **Section D** consists of ***three questions*** each carrying ***five marks***.
10. **Diagrams should be drawn** wherever necessary using a **pencil** only.
11. The intended marks for questions are given in brackets [ ].

Instruction to Supervising Examiner

1. Kindly read **aloud** the Instructions given above to all the candidates present in the examination hall.

Note: The Specimen Question Paper in the subject provides a realistic format of the Board Examination Question Paper and should be used as a practice tool. The questions for the Board Examination can be set from any part of the syllabus, though the format of the Board Examination Question Paper will remain the same as that of the Specimen Question Paper. The weightage allocated to various topics, as given in the syllabus, will be strictly adhered to.

SECTION A – 20 MARKS

Question 1

Answer the following questions briefly.

(i) Anita is suffering from dry and scaly lesions on various parts of the body. What is the biological name of the causative fungus? **[1]** **(Recall)**

(ii) If the number of chromosomes in an endosperm is 12, then what will be the number of chromosomes in megaspore mother cell? **[1]** **(Application)**

(iii) Renu was conducting an experiment. She started with a single DNA strand and ran six cycles of PCR to produce number of molecules of DNA. **[1]** **(Understanding)**

(iv) At what stage of embryonic development, can the zygote be introduced in the Fallopian tube in ZIFT? **[1]** **(Recall)**

(v) When a cross is made between tall plants with yellow seeds (TtYy) and tall plants with green seeds (Ttyy), what proportions of phenotype in the offspring could be expected to be tall plants with green seeds? **[1]** **(Application)**

(vi) A research scholar isolated a new restriction enzyme from *Thermus aquaticus* strain YT3. It was the fourth restriction enzyme discovered from this strain.

Propose a scientifically accurate name for this enzyme using the standard nomenclature rules. **[1]** **(Application)**

(vii) Construct a pyramid of numbers for an ecosystem in which a single large aquatic plant supports a population of small herbivorous fish, which are consumed by a larger population of predatory fish such as kingfish. **[1]** **(Application)**

(viii) Observe the relation between the first two words and then complete the analogy. **[1]**

Chikungunya: *Aedes* :: Malaria: _____. **(Recall)**

(ix) A young boy named Arjun has sickle-shaped red blood cells. He experiences frequent fatigue, and shows signs of damage to kidney. Genetic analysis reveals a single point mutation in the gene coding for β-globin. **[1]**

Which one of the following genetic phenomena is **MOST LIKELY** responsible for the multiple symptoms observed in Arjun? **(Evaluate)**

(a) Polygenic inheritance
(b) Codominance
(c) Pleiotropy
(d) Incomplete dominance

(x) Kiwi is a dioecious species. Which of the following methods can be definitely ruled out as a possible mode of pollination in that case? **(Analysis)** **[1]**

(P) Cleistogamous autogamy

(Q) Chasmogamous autogamy

(R) Geitonogamy

(S) Xenogamy

(a) Only (P) and (R)

(b) Only (P) and (Q)

(c) Only (Q) and (S)

(d) Only (P), (Q) and (R)

(xi) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. **(Analysis)** **[1]**

Assertion: An amino acid in polypeptide chain is not always altered even due to change in the third nitrogenous base of codon.

Reason: The amino acid does not change due to degeneracy of genetic code.

(a) Both Assertion and Reason are true and Reason is the correct explanation for Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation for Assertion.

(c) Assertion is true and Reason is false.

(d) Both Assertion and Reason are false.

(xii) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. **(Analysis)** **[1]**

Assertion: **'**Bt' toxin gene has been cloned from bacteria *E.coli* and expressed in plants to provide resistance from insect without the need of insecticides.

Reason: **'**Bt' toxin is produced in a crystalline state by the above-mentioned bacterium.

(a) Both Assertion and Reason are true and Reason is the correct explanation for Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation for Assertion.

(c) Assertion is true and Reason is false.

(d) Both Assertion and Reason are false.

(xiii) Why are tendrils of vine (*Vitis*) and pea (*Pisum*) considered to be analogous organs? **(Analysis)** **[1]**

(xiv) Ravi wanted to grow rice in his field. He was very concerned about environment degradation, so he did not want to use chemical fertilisers. Suggest a suitable biological method to Ravi. **(Analysis)** **[1]**

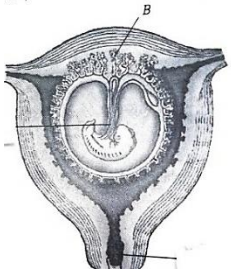
(xv) Answer the following: **[2]**

(a) Expand the abbreviation NPP. **(Recall)**

(b) Rule of Equivalence states that in DNA, adenine equals thymine and guanine equals cytosine. This is due to base pairing in double helix. thus, purines equal pyrimidines. Which scientist offered this concept? **(Recall)**

(xvi) A bilobed dithecous anther has 100 microspore mother cells per microsporangium. How many male gametophytes can this anther produce? **(Application)** **[1]**

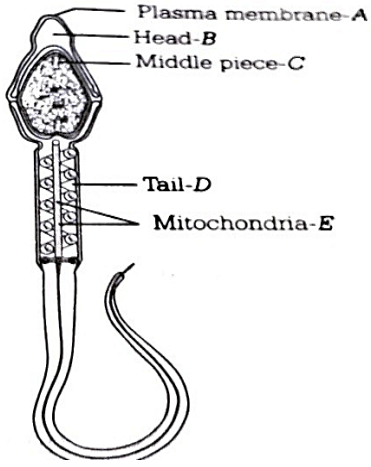
(xvii) The diagram given below represents a specific stage of gestation period. Identify the structure labelled - B. **[1]**



(Recall)

(xviii) Give a reason for each of the following statements: **[2]**

(a) Sameer drew a diagram of human sperm and showed it to his teacher. The teacher rejected the diagram. **(Analysis)**



(b) Even under similar environmental conditions, decomposition of the exoskeleton of millipedes occurs more slowly than the leaves. **(Analysis)**

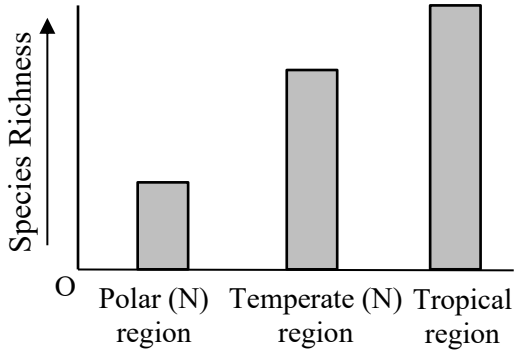
SECTION B – 14 MARKS

Question 2 **[2]**

(i) Construct an ideal pyramid of energy when 1000,000 joules of sunlight is available. Label all its trophic levels. **(Application)**

OR

(ii) The graph given below is based on the data collected from a survey conducted on species richness of a group of mammals in three different climatic regions of the world: Brazil, France and Norway. Brazil has nearly 540 species of mammals, France has nearly 303 species of mammals and Norway has 65 species of mammals.

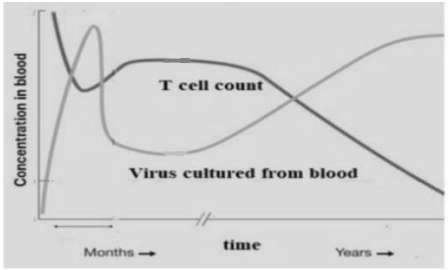


(a) Based on the species richness, identify the location of these countries in the respective climatic regions shown in the graph. **(Understanding)**

(b) In which climatic region, will you place India? **(Analysis)**

Question 3 **[2]**

Given below is the relationship between the HIV levels in the blood and helper T-cell count in a person detected with AIDS. Study the relationship and answer the questions that follow**.**



(i) Describe the trend observed between viral load and immune response following initial infection. **(Understanding)**

(ii) Is the virus permanently eliminated from the body? Justify your answer. **(Evaluate)**

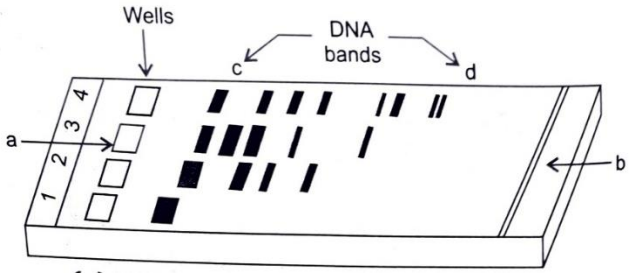
Question 4 **[2]**

As a volunteer for an awareness programme in rural areas, you have been asked to design a poster on sexual health, highlighting birth control options available to males.

What *two* contraceptive methods for males will you highlight in the poster that have negligible chances of failure? Mention the working principle for each method. **(Analysis)**

Question 5 **[2]**

Study the diagram given below and answer the following questions:



(i) Identify the anode end in the diagram. **(Analysis)**

(ii) How are these DNA fragments visualised? **(Recall)**

Question 6 **[2]**

Microbes especially yeasts have been used from time immemorial for the production of beverages like wine, beer, whisky brandy, or rum. Depending on the type of the raw materials used for fermentation and type of processing (with or without distillation) different types of alcoholic drinks are obtained.

(i) Mention the scientific name of the organism used to prepare fermented beverages. **(Recall)**

(ii) Name *any one* beverage obtained without distillation of fermented broth. **(Recall)**

Question 7 **[2]**

(i) Ryan had developed a GM organism. Which government organisation will he approach to obtain the clearance for its mass production? **(Recall)**

(ii) Which bioactive product is used for the treatment of emphysema? **(Recall)**

Question 8 **[2]**

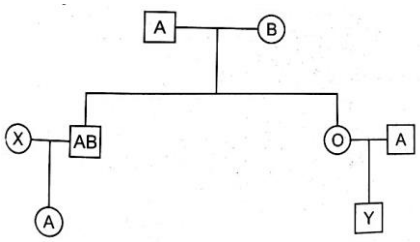
(i) In a barn, there were 30 rats. 5 more rats entered the barn and 6 of the rats were eaten by the cats in one week. If 8 rats were born during the same period, and during the same time, 7 rats left the barn, find the resultant rat population in the barn at the end of one week. **(Application)**

(ii) Define *carrying capacity*. **(Recall)**

SECTION C – 21 MARKS

Question 9 **[3]**

Study the pedigree chart given below showing the pattern of blood group inheritance in a family.



(i) State the genotypes of the following: **(Analysis)**

(a) Parents

(b) The individual 'X' in the second generation

(ii) State the possible blood group(s) of the individual 'Y' in 3rd generation. **(Analysis)**

Question 10 **[3]**

(i) Darwin's finches are best example of adaptive radiation. Justify. **(Evaluate)**

OR

(ii) (a) The recessive allele 'b' occurs with a frequency of 0·8 in a population of moths that is in Hardy Weinberg Equilibrium. What is the frequency of homozygous dominant individuals? **(Application)**

(b) List *any two* differences between *Homo habilis* and *Homo erectus*. **(Recall)**

Question 11 **[3]**

Medical interns Arun and Sam are undergoing training in a hospital. They were assigned three patient cases to review. While they successfully diagnosed the diseases in cases B and C, they could not recall the names of the causative agents. Additionally, they were unable to diagnose the disease of patient A.

The table given below shows their diagnosis.

S.No.	Patient	Symptoms	Disease	Causative agent
(a)	A	Enlarged lymph nodes, headache	---------	*Yersinia pestis*
(b)	B	Cough with greenish or yellow mucus, difficulty in breathing	Pneumonia	----------
(c)	C	Lower limbs excessively swollen	Elephantiasis	----------

Identify the disease affecting patient 'A'. Mention the biological name of the causative agents responsible for the diseases in patients 'B' and 'C'. **(Recall)**

Question 12 **[3]**

A twenty-year old boy, Reshu has become addicted to alcohol.

(i) Mention *any two* possible reasons for his alcohol addiction. **(Recall)**

(ii) Suggest *any one* measure by which addiction can be prevented. **(Recall)**

Question 13 **[3]**

A scientist is attempting to create a recombinant DNA molecule by combining a plasmid vector and a foreign DNA. A plasmid DNA and a linear DNA of the same size have a single site for the restriction enzyme EcoRI. When cut by the same RE and separated by gel electrophoresis, the plasmid shows one DNA band, and the linear DNA shows two bands.

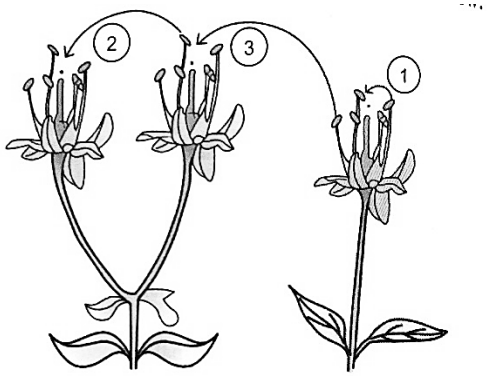
(i) What causes the difference between the number of DNA bands generated from the plasmid and from the linear DNA? **(Analysis)**

(ii) What is the advantage of using agarose in gel electrophoresis? **(Analysis)**

(iii) How does EcoRI differ from an exonuclease? **(Recall)**

Question 14 **[3]**

Study the diagram given below that shows the modes of pollination and answer the questions that follow.



(i) The given diagram shows three methods of pollination in plants. What are the technical terms used for pollen transfer methods labelled '2' and '3'?
(Understanding)

(ii) How does *Salvia* achieve pollination successfully? **(Recall)**

Question 15 **[3]**

A population pyramid is a graphic representation of the distribution of a population by age groups. Diagrammatically represent the three kinds of age pyramids.
(Understanding)

SECTION D – 15 MARKS

Question 16 **[5]**

During a field excursion, a group of class XII students visited Kaziranga National Park and observed efforts to protect the Indian rhinoceros in its natural habitat. They also toured a botanical garden and a gene bank, where they saw endangered plant species and preserved seeds.

Based on this context, answer the following questions:

(i) Name and define the *two* types of conservation methods mentioned above.
(Understanding)

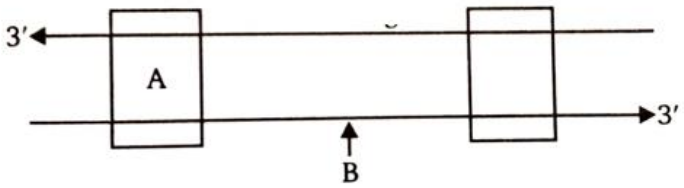
(ii) What is *cryopreservation*? **(Recall)**

(iii) Is Captive breeding an ex-situ or an in-situ strategy. Justify your answer with a reason. **(Evaluate)**

Question 17 **[5]**

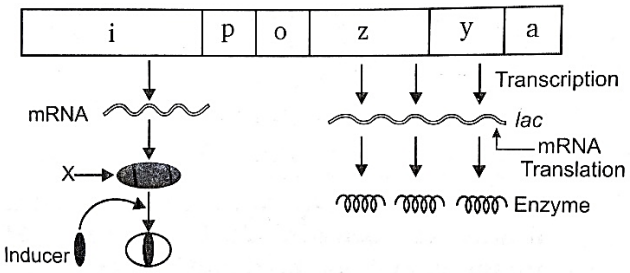
(i) (a) Write a brief note on Griffith's experiment. What was the conclusion drawn from this experiment? **(Understanding)**

(b) Name the parts 'A' and 'B' of the transcription unit shown below. **(Recall)**



OR

(ii) Study the diagram given below and answer the questions that follow.



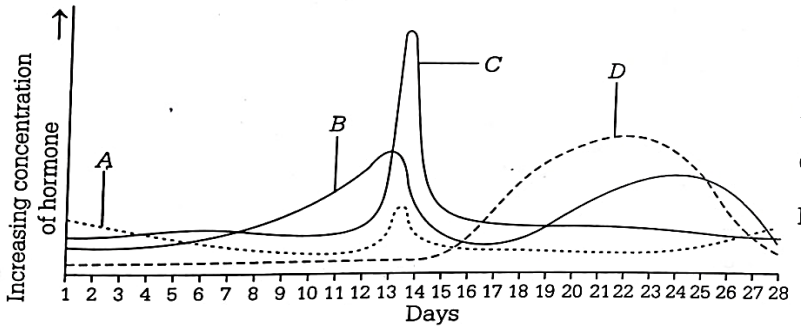
(a) Name the molecule 'X' synthesised by 'I' gene. How does this molecule get inactivated? **(Understanding)**

(b) Name the enzymes coded respectively by genes- z, y, and a. **(Recall)**

(c) Which enzyme binds to the operator to initiate transcription? **(Recall)**

Question 18 **[5]**

(i) The following graph represents the relative concentrations of the four hormones present in the blood plasma of a woman during her menstrual cycle.
Identify the hormones A, B, C and D. **(Analysis)**



(ii) During a fertility consultation, a woman mentions her menstrual cycle lasts for **33 days** regularly. To help her conceive, the doctor advised her to track ovulation. On which day of the menstrual cycle is she most likely to ovulate?

(Application)

BIOLOGY
PAPER 1
(THEORY)
ANSWER KEY
SECTION A – 20 MARKS

Question 1

In answering Multiple Choice Questions, candidates have to write either the correct option number or the explanation against it. Please note that only ONE correct answer should be written.

(i) *Epidermophyton* / *Trichophyton* / *Microsporum* **[1]**

(ii) 8 **[1]**

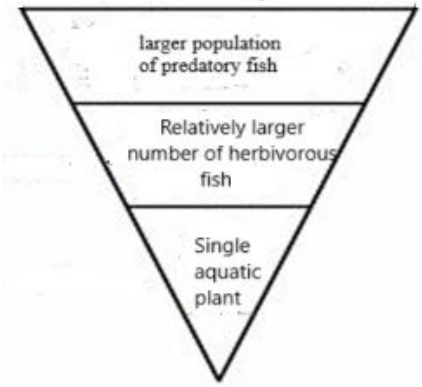
(iii) 64 **[1]**

(iv) 8 – 16 blastomeres **[1]**

(v) 3/8 **[1]**

(vi) TaqYIV **[1]**

(vii) **[1]**



(viii) *Anopheles* **[1]**

(ix) (c) or Pleiotropy **[1]**

(x) (d) or Only P, Q and R **[1]**

(xi) (a) or Both Assertion and Reason are true and Reason is the correct explanation for Assertion. **[1]**

(xii) (d) or Both Assertion and Reason are false. **[1]**

(xiii) Tendrils of vine are modified stems and of pea are modified leaves or leaflets. They perform the same function – climbing and supporting the plants. **[1]**

(xiv) He should use cyanobacteria (*Anabaena, Nostoc, Aulosira)* or Nitrogen-fixing bacteria (*Azospirillum) Azolla (*fern plant that harbours *Anabaena)* **[1]**

(xv) (a) Net Primary Productivity **[1]**

(b) Chargaff **[1]**

(xvi) 1600 **[1]**

(xvii) Placenta / Chorionic villi **[1]**

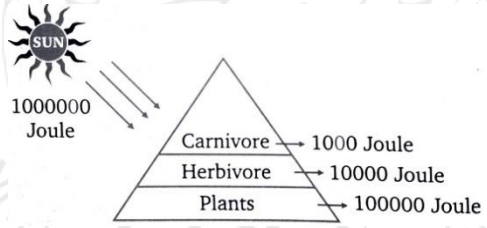
(xviii) (a) Tail part has been labelled in the middle piece of sperm. Head is labelled as middle piece. **[1]**

(b) Millipedes' chitinous exoskeleton decomposes more slowly. **[1]**

SECTION B – 14 MARKS

Question 2 **[2]**

(i)



OR

(ii) (a) Brazil-Tropical region
France- Temperate region
Norway- Polar region

(b) India- Tropical region

Question 3 **[2]**

(i) Initial viral spike → T-cell drop → partial recovery → eventual immune suppression

(ii) No; virus integrates/latent in host cells.

Question 4 **[2]**

Condom – Physical barrier

Vasectomy – No release of sperm

Question 5 **[2]**

(i) Anode end is towards 'b'.

(ii) Agarose gel, containing DNA fragments is stained with ethidium bromide and exposed to UV radiation. Orange color bands of DNA become visible.

Question 6 **[2]**

(i) *Saccharomyces cerevisiae*

(ii) Wine, Beer

Question 7 **[2]**

(i) GEAC

(ii) Alpha – 1 antitrypsin

Question 8 **[2]**

(i) 30 + [(5 + 8) – (6 + 7)] = 30

(ii) Habitats are species specific and have resources up to a limit that can support maximum number of individuals to grow and reproduce, this limit of habitat to subsist a species is called carrying capacity

SECTION C – 21 MARKS

Question 9 **[3]**

(i) (a) Father I^Ai Mother I^Bi

(b) IAi/ IBi/, ii

(ii) A or O

Question 10 **[3]**

(i) Darwin on voyage on the ship H.M.S Beagle, **Galapagos** Island separated from mainland South America – 13 species of Ground finches found on different islands. Original finches were found on mainland- seed seating **beak**; different islands – different types of beaks-for e.g. Vegetarian tree finches, insectivorous eating, Cactus eating. Beak got modified according to the food available on that particular island. It supports **adaptive radiation**.

OR

(ii) (a) Frequency of homozygous dominant individuals-0.04 or 4%

(b)

	Homo habilis	*Homo erectus*
	• 4-4.5 feet in height • Cranial capacity-680-735 cc	• 5.5 feet in height • 1125 cc

Question 11 **[3]**

(A) Plague

(B) *Streptococcus pneumoniae*

(C) *Wuchereria bancrofti*

Question 12 **[3]**

(i) Consumption in social gathering, to relieve social or physical discomforts, desire for excitement, to escape from disappointments, family atmosphere. *(Any two)*

(ii) Avoid undue peer pressure, education, and counselling, seeking help from parents and peers, looking for danger sign, seeking professional and medical help. *(Any one)*

Question 13 **[3]**

(i) Plasmid is circular, therefore when cut by RE it produces only one fragment, whereas the linear DNA is cut to release two fragments.

(ii) Agarose is non-reactive and large pore size allows easier separation of fragments.

(iii) EcoRI is an endonuclease, it cuts the specific inner bonds while exonucleases cut outer bonds starting either from 3'- terminus or from 5'-terminus.

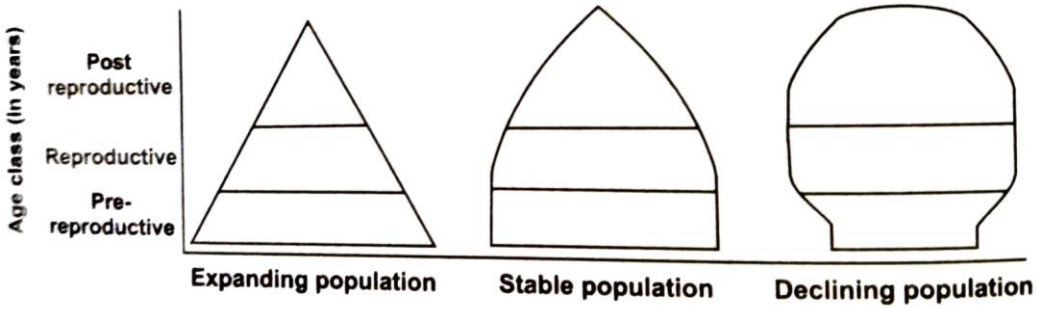
Question 14 **[3]**

(i) 2-Geitonogamy

3-Xenogamy/Allogamy

(ii) Pollinated by insects

Question 15 **[3]**



SECTION D – 15 MARKS

Question 16 **[5]**

(i) (*In-situ* and *ex-situ* conservation methods respectively.

In-situ conservation is the conservation of biotic resources in their natural habitats. Ex-situ conservation is the conservation of threatened species outside their natural habitats.

(ii) Cryopreservation is *in vitro* conservation of tissues, organs, embryos, seeds etc. at low temperature of -196^0C.

(iii) Captive breeding is *ex -situ* conservation method because threatened and endangered species are bred and reared in zoological parks under human supervision

Question 17 **[5]**

(i) (a) Griffith's experiment

Two strains of *Streptococcus pneumoniae*- Smooth Virulent Strain (S-III) and Rough Avirulent Strain (R-II).

R-II were injected into mice- mice remained healthy

S-III were injected into mice; mice developed pneumonia and died.

S-III were heated to 60^0C and killed. These heat-killed bacteria were injected to mice; mice remained healthy.

A mixture of R-II and heat killed S-III bacteria were injected into mice; mice developed pneumonia and died.

Conclusion: Heat killed S-III bacteria introduced some transforming principle that caused transformation of R-II avirulent into virulent S-III bacteria.

(b) A- Promoter; B Coding /Anti template /Sense strand

OR

(ii) (a) X = Repressor protein. This molecule gets deactivated in the presence of inducer (Lactose).

(b) gene 'z'- B-galactosidase;

gene 'y'-permease;

gene 'a'-transacetylase

(c) RNA polymerase

Question 18 **[5]**

(i) A- Follicle Stimulating Hormone (FSH);

B-Estrogen;

C-Luteinizing Hormone (LH);

D -progesterone

(ii) 33 – 14 = 19^{th} day