


Strictly Confidential: (For Internal and Restricted use only)
Senior School Certificate Examination-2020
Marking Scheme – BIOLOGY (SUBJECT CODE - 044)
(PAPER CODE – 57/1/1,2,3)

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them.**
3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
4. Evaluators will mark(✓) wherever answer is correct. For wrong answer 'X' be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
5. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
6. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
7. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
8. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
9. A full scale of marks **0-70** has to be used. Please do not hesitate to award full marks if the answer deserves it.
10. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).
11. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
 - Leaving answer or part thereof unassessed in an answer book.
 - Giving more marks for an answer than assigned to it.
 - Wrong totaling of marks awarded on a reply.

- 
- Wrong transfer of marks from the inside pages of the answer book to the title page.
 - Wrong question wise totaling on the title page.
 - Wrong totaling of marks of the two columns on the title page.
 - Wrong grand total.
 - Marks in words and figures not tallying.
 - Wrong transfer of marks from the answer book to online award list.
 - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
 - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

12. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
13. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
14. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
15. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
16. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges

SECTION – A

1. Meselson and Stahl carried out centrifugation in CsCl_2 density gradient to separate :

- (A) DNA from RNA
- (B) DNA from protein
- (C) The normal DNA from ^{15}N -DNA
- (D) DNA from tRNA

Ans C / The normal DNA from ^{15}N -DNA

[1 Mark]

2. Self-pollination is fully ensured if

- (A) the flower is bisexual.
- (B) the style is longer than the filament.
- (C) the flower is cleistogamous.
- (D) the time of pistil and anther maturity is different.

Ans C / Flower is Cleistogamous

OR

Zoospores are the reproductive units to carry asexual reproduction in

- (A) *Chlamydomonas*
- (B) *Spirogyra*
- (C) Yeast
- (D) *Rhizopus*

Ans A / Chlamydomonas

[1 Mark]

3. Micropropagation can be achieved by

- (A) Self-pollination
- (B) Asexual reproduction
- (C) Tissue culture
- (D) Vegetative propagation

Ans C / Tissue Culture

OR

The microbes commonly used in kitchens are

- (A) Lactobacillus and Yeast

- (B) **Penicillium and Yeast**
- (C) **Microspora and E. coli**
- (D) **Rhizopus and Lactobacillus**

Ans A / Lactobacillus and Yeast

[1 Mark]

4. **The main barrier that prevents the entry of micro-organisms into our body is**

- (A) **Antibodies**
- (B) **Macrophages**
- (C) **Monocytes**
- (D) **Skin**

Ans D / Skin

[1 Mark]

5. **Nematode specific genes were introduced into the tobacco host plant using a vector**

- (A) **pBR 322**
- (B) **Plasmid**
- (C) **Bacteriophage**
- (D) **Agrobacterium**

Ans D / Agrobacterium

[1 Mark]

SECTION – B

6. **Given below is one of the strands of a DNA segment :**



- (a) **Write its complementary strand.**
- (b) **Write a possible RNA strand that can be transcribed from the above DNA molecule formed.**

Ans (a) $5' \xrightarrow{\text{ATGCATGCATGCATGC}} 3'$ (polarity = $\frac{1}{2}$, nucleotide sequence = $\frac{1}{2}$)

(b) $5' \xrightarrow{\text{AUGCAUGCAUGCAUGC}} 3'$ (polarity = $\frac{1}{2}$, nucleotide sequence = $\frac{1}{2}$)

[1 + 1 = 2 Marks]

7. **Wings of birds and wings of butterflies contribute to locomotion. Explain the type of evolution such organs are a result of.**

Ans They are not anatomically similar in structure but perform same function , hence these are analogous structure = $\frac{1}{2} + \frac{1}{2}$

type of evolution is convergent evolution = 1

//

similar habitat of birds and butterflies has resulted in selection of similar adaptive features (wings) in different groups of organisms, but towards the same function = $\frac{1}{2} + \frac{1}{2}$

convergent evolution = 1

[2 Marks]

8. It is often observed that the chances of a person suffering from measles in his or her lifetime are low if he or she has suffered from the disease in their early childhood. Justify the statement.

Ans Memory cells develop during measles in early childhood, subsequent encounters with the same pathogen elicits a highly intensified secondary / anamnestic response = 1+1

[2 Marks]

9. List the three hormones produced in women only during pregnancy. What happens to the levels of estrogen and progesterone during pregnancy?

Ans

- Human chorionic gonadotropin / hCG,
- Human placental lactogen / hPL,
- Relaxin,

(The level of progesterone & estrogen) increases = $\frac{1}{2} \times 4$

[2 Marks]

10. A student on a field trip suddenly felt breathlessness and started to sneeze very badly. Name this response and explain what it is due to.

Ans Allergy = 1

Allergens (dust / pollen / mites etc.), due to release of chemicals like histamine/serotonin (from mast cells)
= $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

11. With the help of a suitable example, explain how cross-breeding is carried out in developing a new breed in animals.

Ans Mating of superior male of one breed with superior female of another breed. = 1

Hisardale, is a new breed of sheep (developed in Punjab) by crossing Bikaneri Ewes and Marino Rams.

= $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

12. Name the genus of baculovirus that acts as a biological control agent in spite of being a pathogen. Justify by giving three reasons that make it an excellent candidate for the job.

Ans Genus - *Nucleopolyhedrovirus*, species-specific, Narrow spectrum, No negative impact on (plants / mammals / birds / fish) non-target organisms = $\frac{1}{2} \times 4 = 2$

OR

**“Micro-organisms play an important role for the biological treatment of sewage.”
Justify**

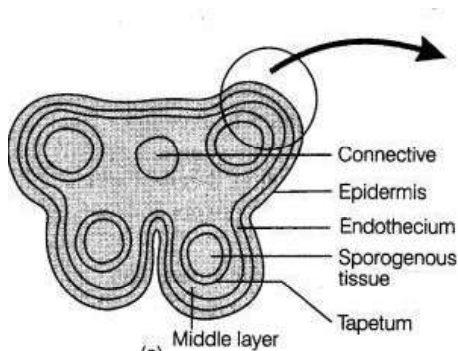
Ans Primary effluent passed into aeration tanks, constantly agitated and air is pumped in, allows growth of useful aerobic microbes into flocs / (masses of bacteria and fungal filaments), these microbes consume organic matter and reduce Biochemical oxygen demand (BOD) of effluent. = $\frac{1}{2} \times 4$

[2 Marks]

Section C

13. Draw a schematic transverse section of a mature anther of an angiosperm. Label its epidermis, middle layers, tapetum, endothecium, sporogenous tissue and the connective.

Ans



$$= \frac{1}{2} \times 6$$

[3 Marks]

14. Differentiate between wind pollinated and insect pollinated flowers.

Ans

Wind pollinated

Pollen grains are light non sticky / well exposed stamens / Large feathery stigma / single ovule in each flower / Small flowers packed in inflorescence

Any three ($\frac{1}{2} \times 3$)

Insect pollinated

Pollen grains sticky / Floral rewards / Fragrant / Nectar rich / Large Flower

Any three ($\frac{1}{2} \times 3$)

[3 Marks]

15. Generally it is observed that human males suffer from hemophilia more than human females, who rarely suffer from it. Explain giving reasons.

Ans This is a sex linked / X chromosomes linked recessive disease, the heterozygous female / carrier for hemophilia may transmit the disease to sons (male progeny), The possibility of hemophilic female/daughter is rare because mother of such a female has to be at least carrier and the father should be hemophilic. = 1+1+1

[3 Marks]

OR

F₁ progeny of pea plant bearing violet flowers and snapdragon plant bearing red flowers were selfed to produce their respective F₂ progeny.

Compare the phenotypes, the genotypes and the pattern of inheritance of their respective F₂ progeny.

Ans F₁ Violet flower of Pea

Ww Ww / WW WW
Selfing Selfing

F₁ Red flower of snapdragon

RR RR
Selfing

| Case 1 | | | / | Case 2 | | |
|--------------|--------------|--------------|---|--------------|--------------|--------------|
| | <div>W</div> | <div>w</div> | | <div>W</div> | <div>W</div> | |
| <div>W</div> | WW | Ww | | <div>W</div> | WW | WW |
| <div>w</div> | Ww | ww | | <div>W</div> | WW | WW |
| | | | | | | <div>R</div> |
| | | | | | | <div>R</div> |
| | | | | | | RR |
| | | | | | | RR |

Phenotypic ratio

Violet : White

3 : 1

Genotypic Ratio

1 : 2 : 1

Pattern of inheritance

Pea plant

Snapdragon

100% WW /

all violet flowers

Phenotypic ratio

Red

100%

Genotypic Ratio

RR (100%)

Complete dominance

Incomplete dominance

$\frac{1}{2} \times 2$

$\frac{1}{2} \times 2$

$\frac{1}{2}$

$\frac{1}{2}$

[3 Marks]

- 16. Explain the changes that milk undergoes when suitable starter/inoculum is added to it. How does the end product formed prove to be beneficial for human health ?**

Ans Lactobacillus / lactic acid bacteria (LAB) present in inoculum , grows in milk at a suitable / optimum temperature, multiplies converting milk to curd, produce acids that coagulate and partially digest the milk proteins. = $\frac{1}{2} \times 4$

This improves its nutritional quality by increasing Vitamin B₁₂, LAB check diseases causing microbes in our stomach = $\frac{1}{2} \times 2$

[3 Marks]

- 17. Alien species invasion has been a threat to biodiversity. Justify with the help of a suitable example. List any other three causes responsible for such a loss.**

Ans Example of Alien species invasion

Nile Perch , introduced into lake Victoria (in East Africa) , led to extinction of Cichlid fish (more than 200 species) in the lake

//

Introduction of African cat fish (*Clarias gariepinus*) , for aquaculture, posing threat to indigenous catfish

//

Introduction of carrot grass (*Parthenium*) / *Lantana* / Water hyacinth (*Eicchornia*) ,which are invasive weed , that pose threat to native species

or any other appropriate example. = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Causes of biodiversity loss

- (i) Habitat loss and fragmentation
- (ii) Over exploitation
- (iii) Co-extinction

$$= \frac{1}{2} \times 3 = 1\frac{1}{2}$$

[3 Marks]

18. Study the table given below and identify a, b, c, d, e and f :

| Crops | Variety | Resistance to disease |
|-------|------------------|-----------------------|
| a | Pusa sadabahar b | |
| c | d | White rust |
| e | Himgiri | f |

| | | | |
|-----|----------|---------------------------|------------------------------------|
| Ans | Crop | Variety | Resistance to diseases. |
| a. | Chilli | - | b. Mosaic Virus /Leaf Curl |
| c | Brassica | d. Pusa Swarnim/karan Rai | |
| e. | Wheat | - | f. Leaf & stripe rust / hill bunt. |

$$= \frac{1}{2} \times 6$$

[3 Marks]

OR

What is plant breeding ? Explain the two steps involved in classical plant breeding.

Plant breeding is the purposeful manipulation of plants species in order to create desired plant types, that are better suited for cultivation / better yield / disease resistant.

$$\frac{1}{2} \times 2 = 1$$

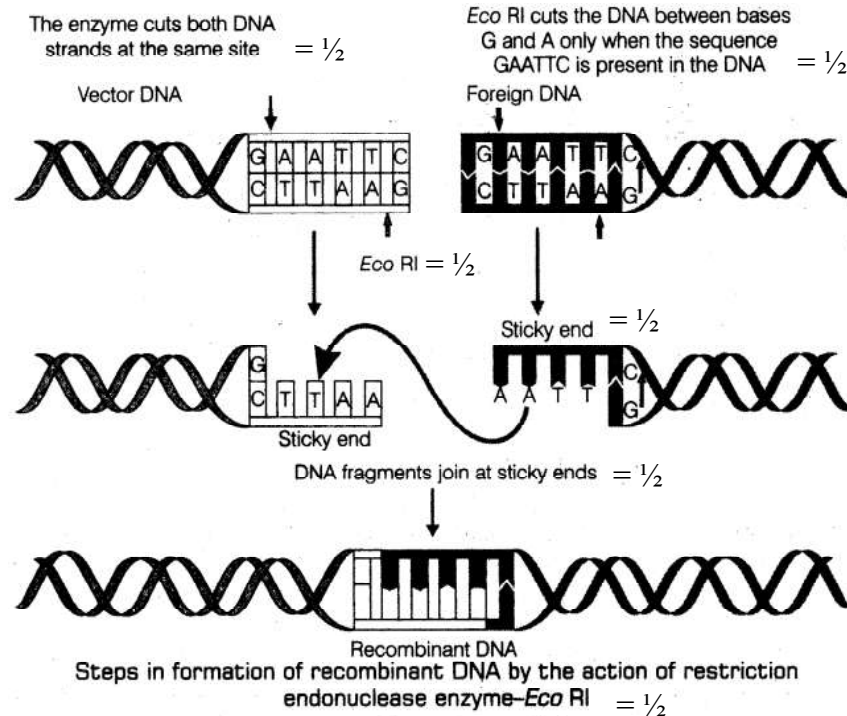
Classical Plant breeding involves crossing or hybridisation of pure lines, followed by artificial selection to produce plants with desirable traits of higher yield / nutrition / resistance to diseases.

$$= 1+1$$

[3 Marks]

19. Explain the three steps carried out in the formation of recombinant DNA using the enzyme EcoRI.

Ans



//

Eco R1 cuts vector DNA , foreign DNA/ gene of interest , at pallindromic site /

5'GAATTC3'

3'CTTAAG5' (between bases G & A only), sticky end (over hanging stretch of bases) formed at each strand, Joining of sticky ends from DNA fragments by enzyme DNA Ligase,Recombinant DNA(rDNA) is formed = $\frac{1}{2} \times 6$

[3 Marks]

20. Name any two natural cloning vectors. Give reasons that make them act as cloning vectors. Write the two characteristics the engineered vectors are made to possess

Ans Plasmids , bacteriophages = $\frac{1}{2} + \frac{1}{2}$

ability to replicate within bacterial cells , high copy number within the bacterial cells = $\frac{1}{2} + \frac{1}{2}$

Characteristics of engineered Vectors: easy linking of foreign DNA,

Selection of recombinants from non- recombinants /selectable marker = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

21. Explain the difference between commensalism and mutualism types of interactions, with the help of a suitable example of each.

Ans **Mutualism**

Commensalism

- both the interacting species are benefitted = 1 - One species is benefitted and other is

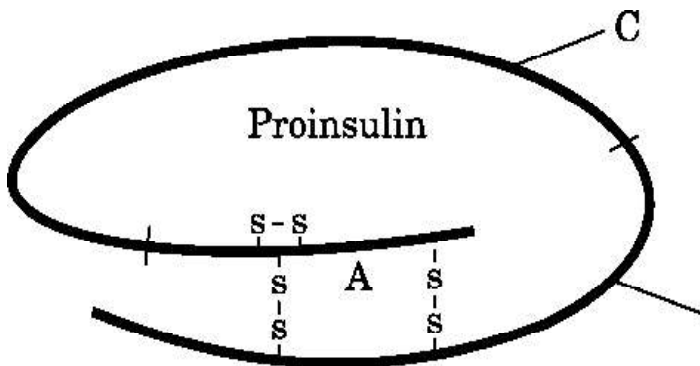
- Explanation of any one example
lichen/Mycorrhizae /fig & wasp
or any other suitable example = $\frac{1}{2}$

- neither harmed nor benefitted = 1
- Explanation of any one example
orchid growing on mango branch /
barnacle on back of whale / cattle
egret & grazing cattle or any other
suitable example = $\frac{1}{2}$

[1 + 1 + $\frac{1}{2}$ + $\frac{1}{2}$ = 3 Marks]

SECTION D

22. Insulin in the human body is secreted by pancreas as prohormone/proinsulin. The schematic polypeptide structure of proinsulin is given below. This proinsulin needs to undergo processing before it becomes functional in the body. Answer the questions that follow



- State the change the proinsulin undergoes at the time of its processing to become functional.
- Name the technique the American company Eli Lilly used for the commercial production of human insulin.
- How are the two polypeptides of a functional insulin chemically held together ?

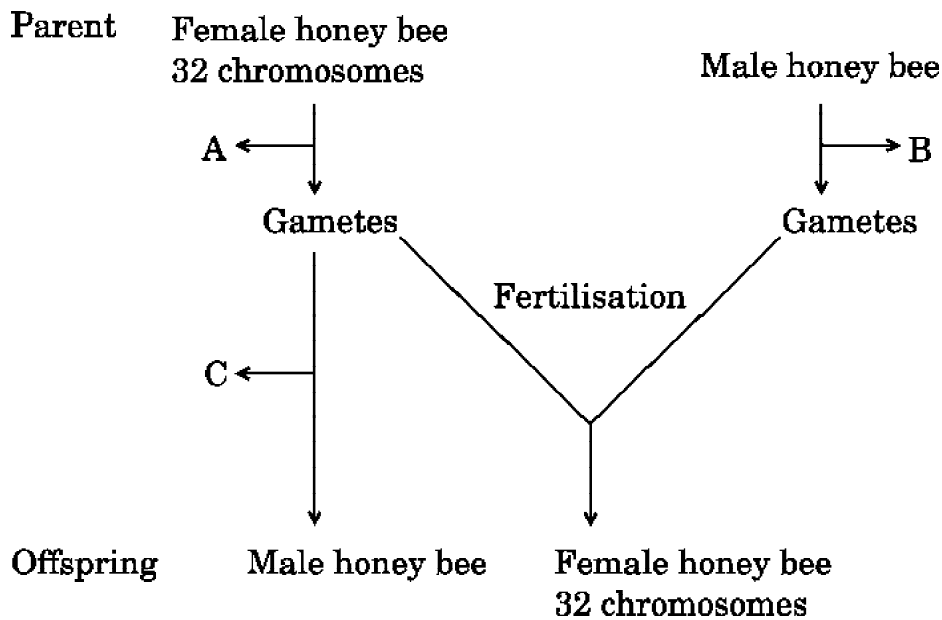
Ans (a) 'C' Peptide is removed = 1

(b) r-DNA technology / Recombinant DNA Technology = 1

(c) Disulphide bonds = 1

[3 Marks]

- 23 The cytological observations made in a number of insects led to the development of the concept of genetic/chromosomal basis of sex-determination mechanism. Honey bee is an interesting example to study the mechanism of sex-determination. Study the schematic cross between the male and the female honey bees given below and answer the questions that follow :



- (a) Identify the cell divisions 'A' and 'B' that lead to gamete formation in female and male honey bees respectively.
- (b) Name the process 'C' that leads to the development of male honey bee (drone).

Ans (a) 'A' - meiosis

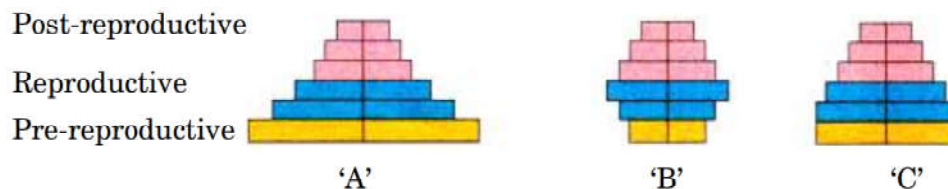
'B' - Mitosis

(b) 'C' - Parthenogenesis

= 1+1+1

[3 Marks]

24. Study the age pyramids 'A', 'B' and 'C' of the human population given below and answer the questions that follow :



(a) Identify pyramids 'B' and 'C'.

(b) Write the basis on which the above pyramids are plotted.

Ans (a) B- Stable population = 1

C- Declining population = 1

(b) Age Distribution of male and female of human population = 1

[2 + 1 = 3 Marks]

SECTION E

25. (a) IVF is a very popular method these days that is helping childless couples to bear a child. Describe the different steps that are carried out in this technique.
- (b) Would you consider Gamete Intrafallopian Transfer (GIFT) as an IVF ? Give a reason in support of your answer.

Ans (a) Ova from the wife /donor (female) and sperms from the husband / donor (male) , are collected and induced to form zygote , in simulated conditions in laboratory , the zygote/ early embryos(upto 8 blastomeres) then transferred into the fallopian tube(ZIFT), and embryos with more than 8 blastomeres, into the uterus(IUT) to complete its further development. = $\frac{1}{2} \times 6$

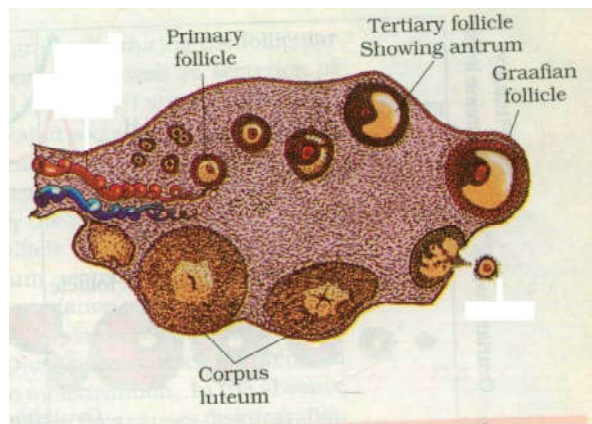
(b) No, GIFT cannot be considered as IVF technique because fertilisation takes place in the female body / in vivo. =1+1

[3 +2 = 5 Marks]

OR

- (a) Draw a sectional view of a human ovary and label primary follicle, tertiary follicle, Graafian follicle and corpus luteum in it.
- (b) Name the gonadotropins and explain their role in oogenesis and the release of ova.

Ans a.



= $\frac{1}{2} \times 4$

b. LH , FSH = $\frac{1}{2} + \frac{1}{2}$

Both LH and FSH increase during follicular phase and stimulate follicular development , secretion of estrogen by the growing follicles, LH surge (rapid secretion of LH) during mid cycle / 14th day induces rupture of graafian follicle, and release of ova / secondary oocyte = $\frac{1}{2} \times 4 = 2$

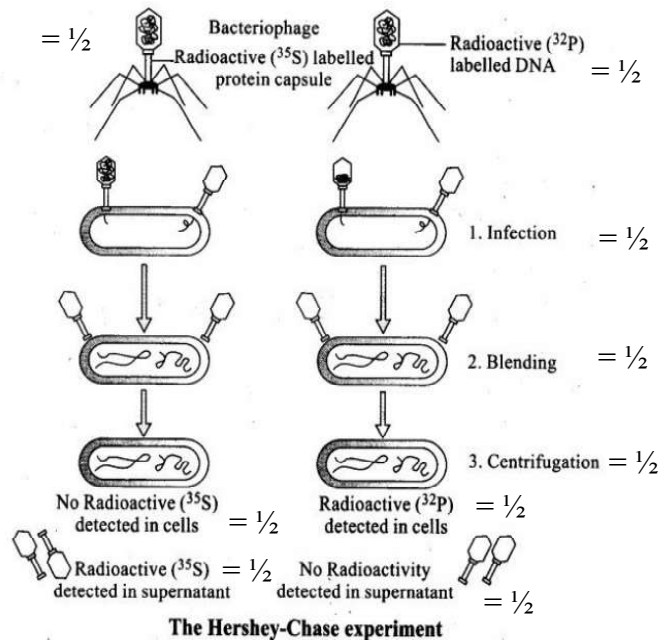
[2 + 3 = 5 Marks]

26. Describe the experiment carried out by Hershey and Chase. Write the conclusion they arrived at.

Ans They grew viruses on a medium containing radioactive phosphorus / P^{32} , and some on radioactive sulphur / S^{35} , radioactive DNA contained in viruses grown on radioactive phosphorus , radioactive protein contained in virus grown in radioactive sulphur , Radioactive phages were allowed to attach to E.coli bacteria , the virus coats were removed from bacteria

by agitating in a blender, the virus particles were separated from the bacteria on centrifugation, Bacteria infected with viruses containing radioactive DNA were radioactive, whereas bacterial cells infected with virus containing radioactive protein did not show radioactivity, = $\frac{1}{2} \times 9$

//



$$= \frac{1}{2} \times 9$$

Conclusion- DNA is therefore the genetic material that is passed from virus to bacteria = $\frac{1}{2}$

[$4\frac{1}{2} + \frac{1}{2} = 5$ Marks]

OR

- (a) Describe the observations made on collection of white winged moths and dark winged moths in England between the years 1850 and 1920. What did these observations lead to ?
- (b) How is the use of herbicides, pesticides and antibiotics by humans for various purposes, comparable with the observations made on moths in the above question ? What is this type of phenomenon called ?

- Ans a. Before industrialisation tree bark were covered with light coloured lichens, In this background white winged moth survived but dark coloured moth was picked out by predators, post industrialisation tree trunks become dark due to industrial smoke and soot, under this condition the white winged moth did not survive due to predators, while the dark winged/melanised moth survived, this showed that organism that are better adapted to survive are selected by Nature/Natural selection. = $\frac{1}{2} \times 6$
- b. Excessive use of these chemicals has resulted in the selection of resistant varieties, in a much lesser time (scale). = $\frac{1}{2} \times 2$

These are examples of evolution by anthropogenic action. = 1

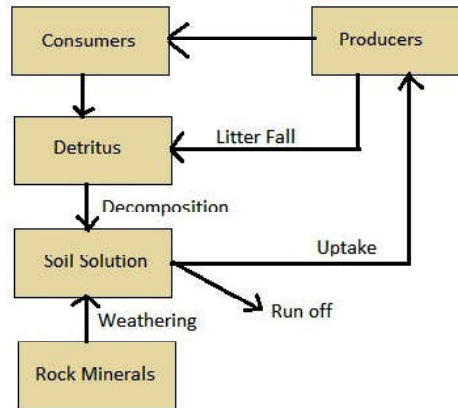
[$3 + 2 = 5$ Marks]

27. Describe the model of phosphorus cycle in the terrestrial ecosystem.

Ans Phosphorus a major constituent of biological membrane / nucleic acids / cellular energy transfer system , Many animals need it for making shells / bones and teeth , the natural reservoirs of phosphorous is rock , which contains phosphorous in the form of phosphate reserves , on weathering minute amount of phosphate dissolve in soil solution , and absorbed by roots , Herbivores , obtain these elements from plants waste products and dead organism , decomposed by phosphate-solubilising bacteria , releasing phosphorus = $\frac{1}{2} \times 10$

//

Marks can also be awarded for the steps given in the proper sequence, with other details



= $\frac{1}{2}$ marks for each given label

[5 Marks]

OR

Describe the DDT biomagnification occurring in an aquatic food chain. State the negative effects the process has on the organisms at the last trophic level of the food chain.

Ans Biomagnification refers to increase in concentration of the toxicant at successive trophic levels , Toxic substance accumulated by an organism cannot be metabolised or excreted and is passed on to the next higher trophic level = $\frac{1}{2} \times 2$

Biomagnification of DDT in an aquatic food chain

Water → Zooplankton → small fish → Large Fish → Fish eating bird. = $\frac{1}{2} \times 5$

0.003 ppb 0.04 ppm 0.5 ppm 2 ppm 25 ppm

High concentration of DDT disturb calcium metabolism in birds, causes thinning of eggshell , their premature breaking eventually causing decline in bird population = $\frac{1}{2} \times 3$

[5 Marks]