

Senior School Certificate Examination
COMPARTMENT (2015)
Marking Scheme - Biology (Theory)
Expected Answers/Value Points

General Instructions

The Marking Scheme and mechanics of marking

1. In the marking scheme-the marking points are separated by commas, one oblique line (/) indicates acceptable alternative, two obliques (//) indicate complete acceptable alternative set of marking points.
2. Any words/phrases given within brackets do not have marks.
3. Allow spelling mistakes unless the misspelt word has another biological meaning. Ignore plurals unless otherwise stated in the marking scheme.
4. In any question exclusively on diagram no marks on any description. But in questions on descriptions, same value points may be marked on the diagrams as a substitute.
5. All awarded marks are to be written in the left hand margin at the end of the question or its part.
6. Place a tick (✓) in red directly on the key/operative term or idea provided it is in correct context. Place “Half-tick” ½ wherever there is ½ mark in the marking scheme. (Do not place tick indiscriminately just to show that you have read, the-answer).
7. If no marks are awarded to any part or question put a cross (x) at incorrect value portion and mark it zero (in words only).
8. Add up ticks or the half ticks for a part of the question, do the calculation if any, and write the part total or the question total in the left hand margin.
9. Add part totals of the question and write the question total at the end. Count all the ticks for the entire question as a recheck and draw a circle around the question total to confirm correct addition.
10. If parts have been attempted at different places do the totalling at the end of the part attempted last.
11. If any extra part is attempted or any question is reattempted, score out the last one and write “extra”.
12. In questions where only a certain number of items are asked evaluate only that many numbers in sequence as is asked ignoring all the extra ones even if otherwise correct.
13. Transcribe the marks on the cover page. Add up question totals. Recheck the script total by adding up circled marks in the script.
14. Points/answer given in brackets in marking scheme are not so important and may be Ignored for marking.

Question Paper code 57/1/3

Q nos 1-5 are of one mark each

Q1 Name the negatively charged and positively charged components of a nucleosome.

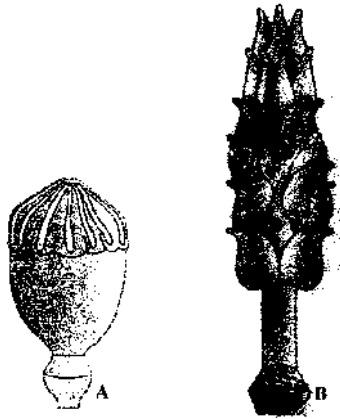
Ans. Negatively charged component DNA , positively charged component histone octamer $\frac{1}{2} + \frac{1}{2}$

Q2. Name the type of interaction that exists between barnacles and whale.

Ans. Commensalism

1

Q3 . These pictures show the gynoecium of (A) Papaver and (B) Michellia flowers. Write the difference in the structure of their ovaries.



Ans. a. (multicarpellary) ovary showing fused/ syncarpous pistil

$\frac{1}{2}$

b. (multicarpellary) ovary showing free/ apocarpous pistil

$\frac{1}{2}$

Q4. How do cytokine barriers help in evading viral injections?

Ans. Virus infected cells secrete proteins called interferons , which protect non-infected cells from further infection

1

Q5. State the chromosomal defect in individuals with Turner's syndrome.

Ans.(In female) Monosomy of sex chromosome // XO condition // Absence of one X chromosome 1

SECTION – B

Q nos 6-10 are of two marks each

Q6. What is EcoRI ? How does EcoRI differ from an exonuclease?

Ans. EcoRI is restriction endonuclease enzyme.

1

Exonuclease removes nucleotides from the ends of DNA while $\frac{1}{2}$

EcoRI makes cuts at specific position within the DNA $\frac{1}{2}$

Q7. A childless couple has agreed for a test tube baby programme. List only the basic steps the procedure would involve to conceive the baby.

OR

Banana fruit is said to be parthenocarpic where as turkey is said to be parthenogenetic. Why?

Ans. Extraction of gametes from the parents/donors. $\frac{1}{2}$
Invitro / fertilisation (simulated conditions in laboratory) $\frac{1}{2}$
transfer of the zygote / early embryo, (at 8 blastomere stage)into the fallopian tube $\frac{1}{2} + \frac{1}{2}$

OR

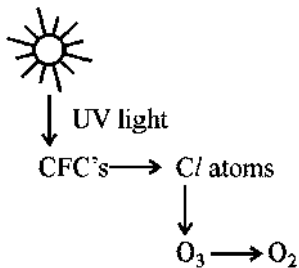
Banana –the fruit develops without fertilisation from an unfertilised ovary. 1
Turkey- the ovum/ Female gamete develop into a new chick without fertilisation. 1

Q8. How do mammals living in colder regions and seals living in polar regions able to reduce the loss of their body heat?

Ans. Mammals from colder climates generally have shorter ears and limbs which minimise heat loss (Allen's rule)

In polar region seals have thick layer of fat (blubber) below their skin that acts as insulator and reduce loss of body heat $1+1$

**Q9. (a) What are the after effects of the degradation of ozone?
(b) How does it affect human health?**



Ans. a. Thinning of Ozone/ Ozone depletion /UV-B penetrates Ozone- forms hole- reaches earth. 1

b. UV-B damages DNA causes mutation, ageing of skin/ damage of skin cells/ skin cancer/ inflammation of cornea (snow blindness, cataract) (any two) $\frac{1}{2} + \frac{1}{2}$

Q10. What is chance mutation ? Explain this phenomenon using application of DDT as an example.

Ans. DDT is an insecticide- kills most of the insect s , but some become resistant varieties, in much less time scale of just months or years , It is a chance event in nature- so chance Mutation $4 \times \frac{1}{2} = 2$

SECTION - C

Q nos 11-22 are of three marks each

Q11. How does the HIV breakdown the immune system of the AIDS patient?

Ans.

- Virus enters in macrophages
- RNA genome replicates to form viral DNA with help of reverse transcriptase,
- Viral DNA gets incorporated into host cells' DNA to produce virus particles,
- HIV enters into helper 'T' lymphocytes and produces progeny virus,
- Which are released in the blood and attack other helper 'T' lymphocytes,
- This leads to progressive decrease number of helper 'T' lymphocytes and the persons starts suffering from infections (loss of immunity) $\frac{1}{2} \times 6 = 3$

Q12 (a) State what happens in the human body when malarial parasites infected RBCs burst to release the parasites in the blood.

(b) Mention the specific sites in the host body where production of

(i) sporozoites and

(ii) gametocytes take place in the life cycle of the malarial parasites.

Ans. (a) The rupture of RBCs results in releasing toxic substance haemozoin, which is responsible for chill and high fever (3-4 days) 1

(b) (i) intestine of mosquito ½
 (ii) RBCs of human ½

Q13. Explain succession of plants in xerophytic habitat until it reaches climax community.

Ans. Lichens on bare rock, acids to dissolve rock (weathering of soil), Bryophytes to hold soil water, grass, small plants / shrubs, trees- forest (Climax community) ½ x6=3

Q14. Explain the changes that can be observed in the characteristics of river water when

sewage is discharged into it and a few weeks after the discharge with respect to:

(i) level of dissolved oxygen

(ii) population of fresh water organisms.

| Criteria/Time of Sewage discharged | When Sewage is discharged | Few weeks after discharge |
|-------------------------------------|---|---|
| Level of dissolved oxygen | Microorganisms involved in biodegradation of organic matter consume a lot of oxygen, resulting in sharp decline in dissolved oxygen ½ +½ | Level of dissolved oxygen increases as sewage decreases ½ +½ |
| Population of fresh water organisms | decline in dissolved oxygen causes mortality of fresh water organisms ½ | Reappearance of population fresh water organisms ½ |

Q15. A sugarcane has been affected by virus. How can a virus free cane be developed from it ? Explain the procedure.

Ans. Tissue culture / micropropagation, 1

Meristem (Apical and axillary) can be removed from the explants, grown in vitro culture with special nutrient medium (with sucrose acids, auxins & cytokinin), under sterile / aseptic condition, plantlets develop as virus free plants ½ x4=2

Q16. Why is Taq polymerase preferred in PCR ? Mention the source of this enzyme.

Ans. Taq polymerase is used for amplification of DNA /gene, (Usually enzymes also get denatured) Taq polymerase remains active at high temperature, Thermus aquaticus (If bacteria written give only ½) 1+1+1=3

Q17. How did industrialization play a role in Natural Selection of light and dark coloured moth in England?

OR

What do you infer from the resemblance between flying squirrel and flying phalanger with reference to their evolution.

Ans. Before industrialisation there were more white winged –moth on trees than dark winged. ½

- After industrialisation due to industrial smoke and soot, tree trunks became dark, ½ + ½

- Under this condition the white winged moths did not survive, due to predation $\frac{1}{2} + \frac{1}{2}$
- And dark coloured moth survive/ able to camouflage to survive $\frac{1}{2}$

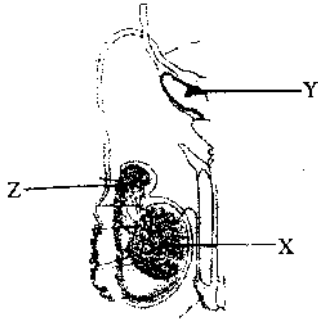
OR

Evolution of marsupial mammals has resulted in flying phalanger, through adaptive radiation. $\frac{1}{2} + \frac{1}{2}$

Evolution of placental mammals has led to the evolution of a flying squirrel (independently) 1

The resemblance between the two, proves convergent evolution. $\frac{1}{2} + \frac{1}{2}$

Q18.



The above diagram shows human male reproductive system (one side only).

- Identify 'X' and write its location in the body.
- Name the accessory gland 'Y' and its secretion.
- Name and state the function of 'Z'.

Ans. (a) X=Testicular lobules, location – Testis// Testis , location outside the abdominal cavity/ scrotum $\frac{1}{2} + \frac{1}{2}$

(b) Y= Accessory glands , seminal plasma $\frac{1}{2} + \frac{1}{2}$

(c) Z= epididymis, function: storage of sperms $\frac{1}{2} + \frac{1}{2}$

Q19. (a) Differentiate between a template strand and coding strand of DNA.

(b) Name the source of energy for the replication of DNA.

Ans.

| Role/Strand | Template strand | Coding strand |
|-------------|--------------------------------|----------------------------|
| function | codes for the protein molecule | Does not code for anything |
| polarity | $3' \rightarrow 5'$ | $5' \rightarrow 3'$ |

1+1

b. Deoxy nucleoside triphosphates

1

Q20. Which chromosome carries the mutated gene causing B thalassaemia ? What are the problems caused by the mutation?

Chromosome number 11 carries the Mutant gene causing B thalassaemia 1

It causes formation of abnormal haemoglobin molecules, resulting into anaemia 1+1

Q21. Explain the events in a normal woman during her menstrual cycle on the following days.

(a) Ovarian event from 13-15 days

(b) Ovarian hormones level from 16 to 23 days

(c) Uterine events from 24 to 29 days

Ans. (a) Rupture of Graafian follicle leads to ovulation / release of ovum

(b). Estrogen level is low

(c). Disintegration of endometrium and menstrual cycle begins

1+1+1=3

Q22. How does a detritivore differ from a decomposer ? Explain with an example each.

Ans.

| | Detritivore | Decomposer |
|---|---|---|
| 1 | feeds on waste dead plant and animal remains including faecal matter. | degrades dead organic matter |
| 2 | breaks feeding material into fragments | secretes enzymes into dead organic matter for decomposition |
| 3 | Eg. Earth worm | eg- Bacteria/ Fungi |

1+1+1=3

Section D

Q no 23 is of four marks

Q23. A youth in his twenties met with an accident and succumbed to the injuries. His parents agreed to donate his organs. List any two essential clinical steps to be undertaken before any organ transplant. Why is the transplant rejected sometimes ? What views would you share with your health club members to promote organ donation?

Ans. Blood group matching, and tissue matching should be done prior to the organ transplant, the body is able to identify the 'non-self' graft, triggers the cell mediated immune response, this rejects the graft

5x 1/2 = 2 1/2

Views-

Cornea can be transplanted to any one and a blind can see the world. Heart / lung/ Kidney can be transplanted and a person is gifted with life, the mind set to volunteer to register for organ donation – (particularly eye donation) (any other valid views) (3x 1/2 = 1 1/2)

Section E

Q nos 24-26 are of five marks each

Q24. Explain the application of biotechnology in producing Bt cotton.

OR

Unless the vector and source DNA are cut, fragments separated and joined, the desired recombinant vector molecule cannot be created.

(a) How are the desirable DNA sequences cut?

(b) Explain the technique used to separate the cut fragments.

(c) How are the resultant fragments joined to the vector DNA molecule?

Ans. Bt toxin gene has been cloned from the bacteria, and has been expressed in plants, to provide resistance to insects (without the need for insecticide), Bt toxin gene forms protein crystals, these crystals contain a toxic insecticidal protein, Bt toxin protein exists as inactive protoxin in the host, but once the insect ingests the inactive toxin, it is converted in active form of toxin, due to alkaline pH of the gut which solubilises the crystals, causing death of the insect.

(10 x 1/2 = 5)

OR

(a) DNA sequences of the vector as well as the source are cut by the same restriction enzyme like EcoRI in a palindromic Sequence $\frac{1}{2} + \frac{1}{2}$

(The Cut ends overhang as sticky ends in the medium.)

(b) These cut ends fragments are to be extracted from the culture medium using gel electrophoresis. $\frac{1}{2}$

This has an agarose gel matrix $\frac{1}{2}$

Fragments are fed in the wells $\frac{1}{2}$

They are negatively charged $\frac{1}{2}$

So move towards anode under an electric field through the gel $\frac{1}{2}$

smaller fragments move faster, thus separated $\frac{1}{2}$

(c) Fragments are now added to the medium containing the vector DNA $\frac{1}{2}$

The sticky ends facilitate the action of the enzyme ligase joins the source DNA to the Vector $\frac{1}{2}$

(10x $\frac{1}{2}$ = 5)

Q25. (a) Draw a labelled diagram of the sectional view of microsporangium of an angiosperm.

(b) Explain the development of male gametophyte in the microsporangium.

OR

(a) Name the hormone that initiates spermatogenesis in humans. Describe the process of spermatogenesis in sequence mentioning the ploidy of the cells at each step.

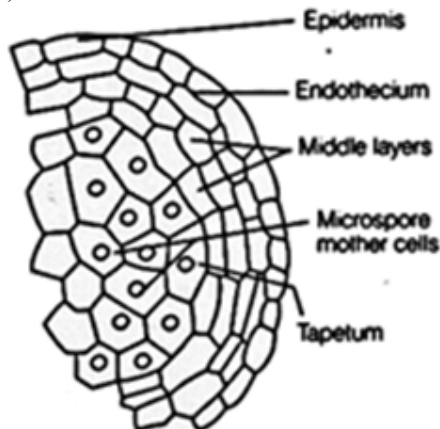
(b) Draw the diagram of a mature human sperm and label the parts that

(i) helps it reaching to the ovum.

(ii) providing energy for it to reach the ovum.

(iii) helping it to gain entry into the ovum.

(a)



(five correct labelling $5 \times \frac{1}{2} = 2\frac{1}{2}$)

(b) each cell of sporogenous tissue, gives rise to microspore mother cell \rightarrow meiosis/ microsporogenesis, \rightarrow microspore Tetrad \rightarrow 4-pollen grains (male gametophyte) 2-celled stage $5 \times \frac{1}{2} = 2\frac{1}{2}$

OR

(a) Gonadotropin releasing hormone/ GnRH

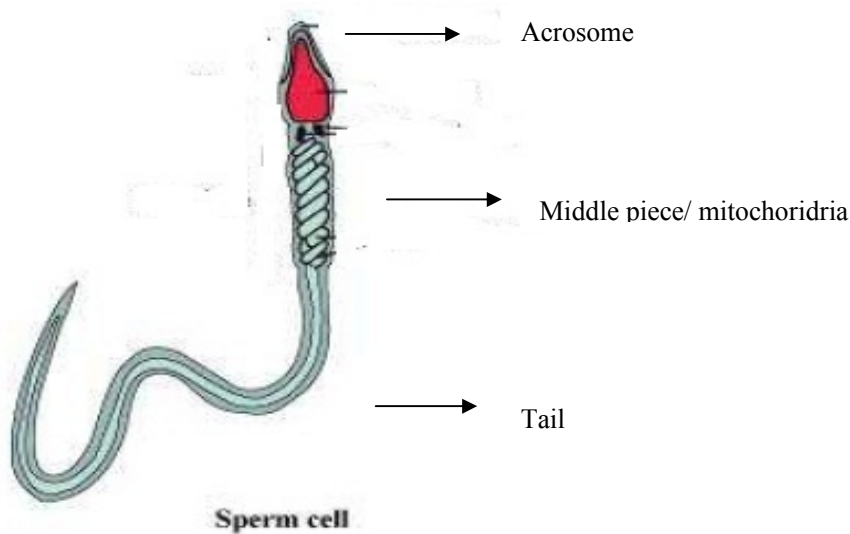
1

Process of spermatogenesis

- The Spermatogonia (present on inside wall of seminiferous tubules) are diploid (2N)

- (Some of the spermatogonia) primary spermatocytes which undergo Ist meiosis leading to formation of two equal haploid cells(N) called secondary spermatocyte.
- The secondary spermatocytes under go the second meiotic division to form 4 equal haploid(N) Spermatids.
- Now spermatids transform into spermatozoa (N)// Correct flow chart of spermatogenesis
 $4 \times \frac{1}{2} = 2$

(b)



Correct diagram- $\frac{1}{2}$

- | | | |
|------|----------------------------|---------------|
| I. | Tail | $\frac{1}{2}$ |
| II. | Middle piece/ mitochondria | $\frac{1}{2}$ |
| III. | Acrosome | $\frac{1}{2}$ |

Q26. Explain the process of DNA replication with the help of a replicating fork.

OR

(a) Dihybrid cross between two garden pea plant one homozygous tall with round seeds and the other dwarf with wrinkled seeds was carried.

(i) Write the genotype and phenotype of the F1 progeny obtained from this cross.

(ii) Give the different types of gametes of the F1 progeny.

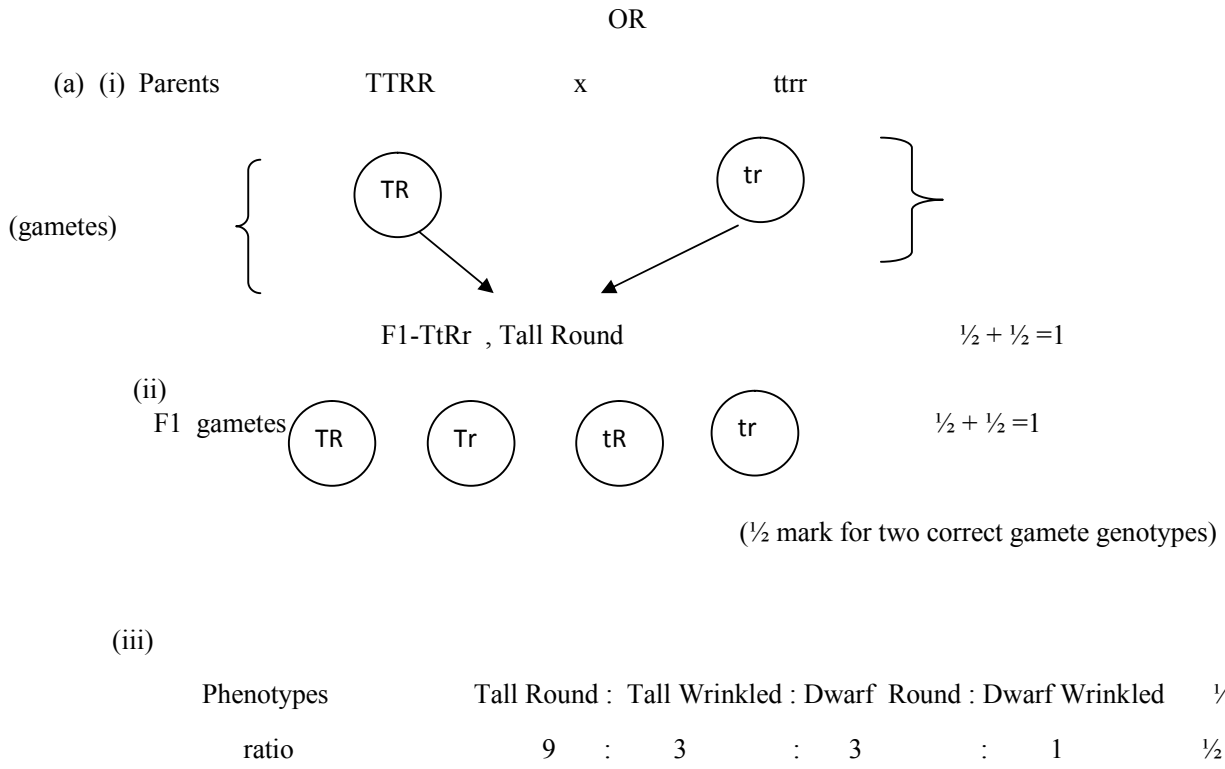
(iii) Write the phenotypes and its ratios of the F2 generation obtained in this cross along with the explanation provided by Mendel.

(b) How were the observations of F2 progeny of dihybrid crosses in Drosophila by Morgan different from that of Mendel carried in pea plants ? Explain giving reasons.

Ans. There is a definite region in DNA where the replication originates called as origin of replication, For long DNA molecules since the two strands of DNA cannot be separated in its entire length, the replication occurs within a small opening of the DNA helix, referred to as replication fork.

The DNA dependent DNA polymerase, catalyze polymerization only in one direction, that is 5'-->3', 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 discontinuous synthesized fragments are later joined by the enzyme DNA ligase.

(10 x $\frac{1}{2}$ = 5)



Explanation:- The law of independent assortment states that when two pairs of traits are combined in a hybrid, segregation of one pair of character is independent of the other pair of characters. 1.

(b) Morgan observed the result of linkage of genes on a chromosome, but Mendel did not observe phenomenon of linkage in pea plants // F2 ratio of Morgan deviated significantly from 9:3:3:1 ratio (Mendelian ratio) 1