

Central Board of School Education

Marking Scheme 2016

[Official]

Senior School Certificate Examination

March 2016

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" $\frac{1}{2}$ wherever there is $\frac{1}{2}$ 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 (×) 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 57/1/1

SECTION – A

(Q. Nos. 1 - 5 are of one mark each)

1. According to de-Vries what is saltation ?

Ans. Single step (large) mutation

[1 mark]

2. Excessive nutrients in a fresh water body cause fish mortality. Give two reasons.

Ans. Excessive nutrients result in excessive algal growth / eutrophication / algal bloom / toxins produced by algal bloom , water quality becomes poor / BOD increases / oxygen level decreases = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

3. Suggest the breeding method most suitable for animals that are below average in milk productivity.

Ans. Outbreeding / Outcrossing / Cross-breeding / artificial insemination / hybridisation

[1 mark]

4. State a difference between a gene and an allele.

Ans. Gene - contains information that is required to express a particular trait // unit of inheritance // segment of DNA called cistron //

sequence of DNA coding for tRNA / rRNA / polypeptide / enzyme

Allele - Genes which code for a pair of contrasting traits / (slightly) different forms of the same gene / individual gene in a particular gene pair (for same character)

[1 mark]

5. Suggest a technique to a researcher who needs to separate fragments of DNA.

Ans. (Gel) electrophoresis

[1 mark]

SECTION B

(Q. Nos. 6 - 10 are of two marks each)

6. Explain the significance of meiocytes in a diploid organism.

Ans. Undergo meiosis / undergo gametogenesis / form haploid gametes , help to restore 2n (diploidy) through zygote formation or syngamy / help to restore chromosome number = $1 + 1$

[2 marks]

7. Mention the kind of biodiversity of more than a thousand varieties of mangoes in India represent. How is it possible ?

Ans. Genetic diversity / single species show high diversity at genetic level = 1

Single species show high diversity at genetic level over its distributional range / different varieties grow in different geographical areas / climatic conditions / breeding / mutations = 1

[1 + 1 = 2 marks]

8. List the events that reduce the Biological Oxygen Demand (BOD) of a primary effluent during sewage treatment.

Ans. Effluent from the primary settling tank passed into aeration tank, agitated mechanically and air is pumped into it, vigorous growth of aerobic microbes into flocs, microbes consume major part of the organic matter in effluent = $\frac{1}{2} \times 4$

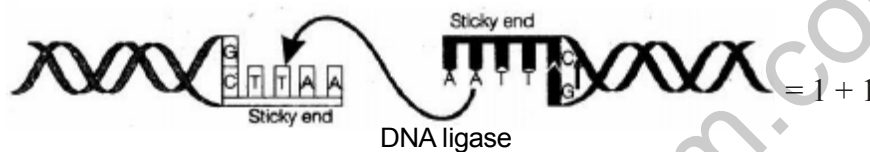
[2 marks]

9. Discuss the role the enzyme DNA ligase plays during DNA replication.

Ans. (Discontinuous) DNA fragments, are joined / sealed by them

// sticky ends of vector and foreign DNA, joined by them

The following diagram can be considered in lieu of explanation



[2 marks]

10. Name the causative organism of the disease amoebiasis. List three symptoms of the disease.

Ans. - *Entamoeba histolytica* = $\frac{1}{2}$

- Constipation, abdominal pain, cramps, stool with excess mucous / blood clots

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

[$\frac{1}{2} + 1\frac{1}{2} = 2$ marks]

OR

Identify 'A', 'B', 'C' and 'D' in the given table.

Crop	Variety	Resistance to disease
A	Himgiri	Leaf rust
Cauliflower	Pusa Shubhra	B
Brassica	Pusa Swarnim	C
Cowpea	D	Bacterial blight

Ans. A = Wheat = $\frac{1}{2}$

B = Black rot / Curl blight black rot = $\frac{1}{2}$

C = White rust = $\frac{1}{2}$

D = Pusa Komal = $\frac{1}{2}$

[2 marks]

SECTION-C

Q. Nos. 11- 22 are of three marks each

11. Why is breast-feeding recommended during the initial period of an infant's growth ? Give reasons.

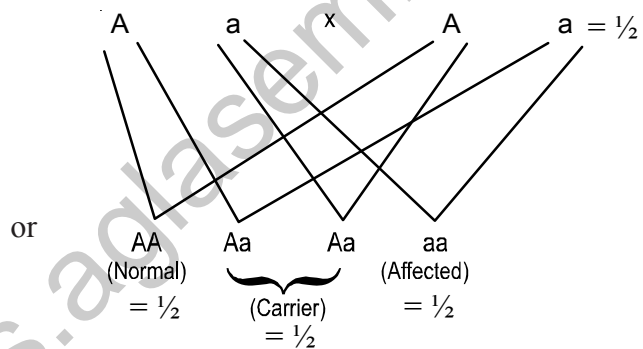
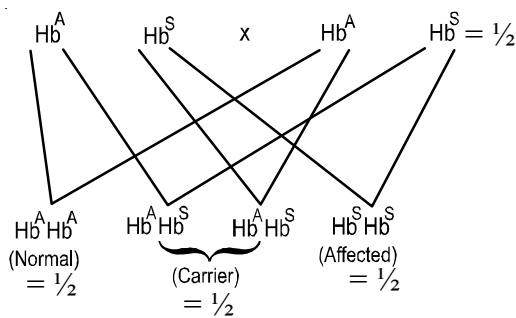
Ans. Colostrum , rich in nutrients , rich in antibodies / rich in IgA / provide passive immunity / provides immunity to new born / helps to develop resistance in new born / readily available for new born / hygenic / develops a bond between mother and child.

(Any three)

[3 marks]

12. Give an example of an autosomal recessive trait in humans. Explain its pattern of inheritance with the help of a cross.

Ans. Sickle cell anaemia / Phenylketonuria / Thalassemia / O Blood group / Non - rolling of tongue / Fused or attached ear lobes / Inability to taste PTC (phenyl thiocarbamide)=1



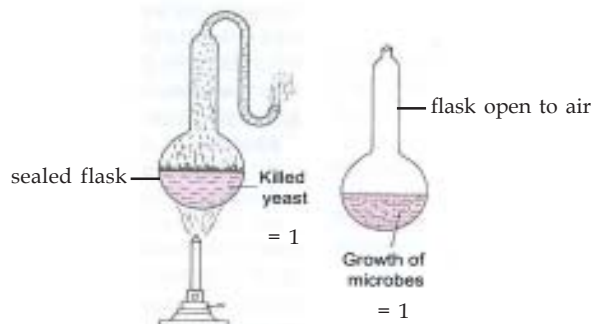
* Similar cross can be considered for any other trait mentioned above

[1 + 2 = 3 marks]

13. Describe the experiment that helped Louis Pasteur to dismiss the theory of spontaneous generation of life.

Ans. Two pre sterilised flasks with killed yeast , one sealed , other open to air , differential growth of life in two flasks / life was found only in open flask. = 1/2 x 4

// the following diagram can be considered in lieu of above explanation



life comes from pre-existing life (it came from air entering the flask) / proved the theory of biogenesis = 1

[2 + 1 = 3 marks]

14. **Plant breeding technique has helped sugar industry in North India. Explain how.**

Ans. Two species (*Saccharum barberi* and *Saccharum officinarum*) were crossed to get sugarcane varieties with high yield / thick stem / high sugar content / ability to grow in North India

(Any three points)

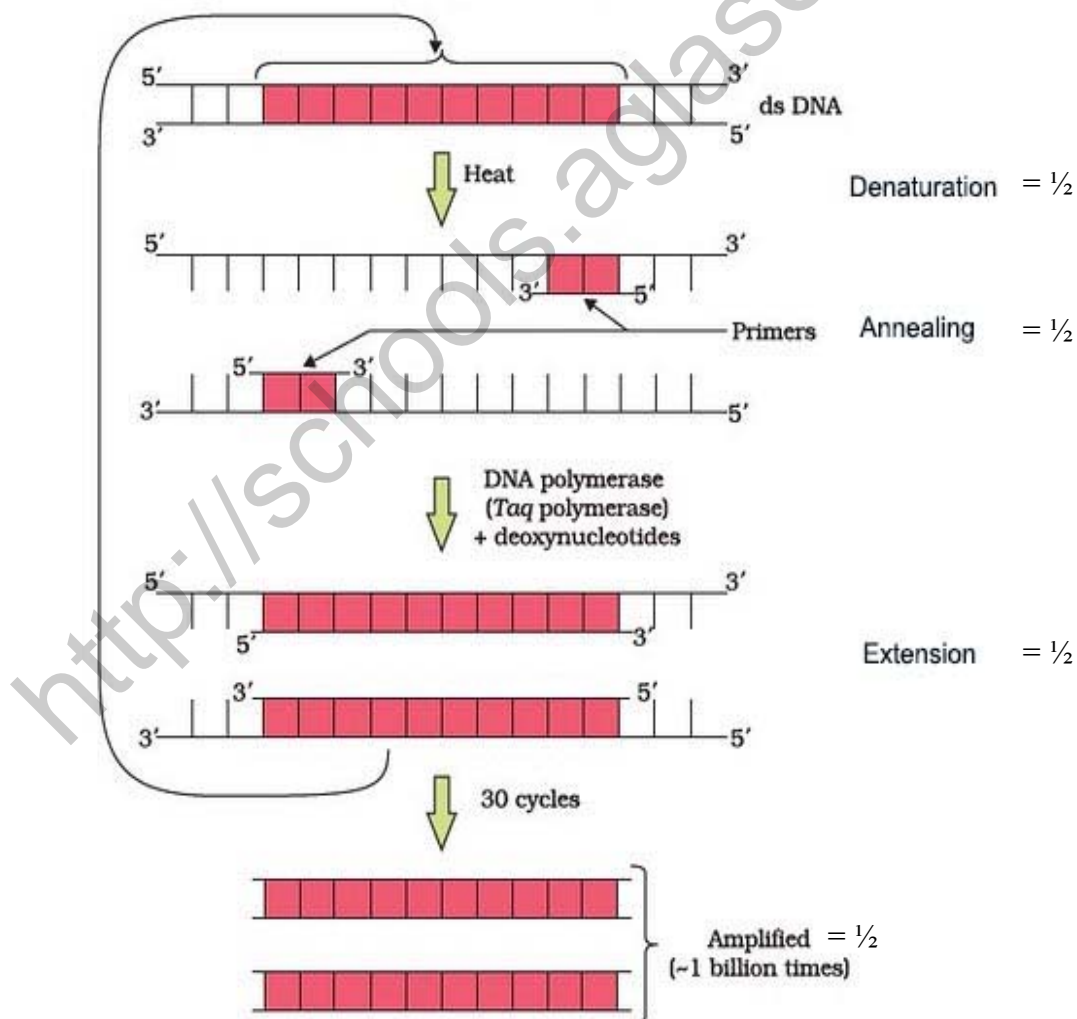
[3 marks]

15. **Suggest and describe a technique to obtain multiple copies of a gene of interest *in vitro*.**

Ans. PCR / polymerase chain reaction = 1

Separation / denaturation of two strands of two dsDNA, using two sets of primers / small chemically synthesised oligonucleotides complementary to regions of DNA and (thermostable) DNA polymerase / Taq polymerase, extension of the primers, by enzyme using nucleotides replicates the DNA and if the process of replication is repeated many times multiple copies of DNA are produced = $\frac{1}{2} \times 4$

The following diagram can be considered in lieu of the explanation



[1 + 2 = 3 marks]

16. What is GMO ? List any five possible advantages of a GMO to a farmer.

Ans. - Plants / bacteria / fungi / animals whose genes have been altered by manipulation = $\frac{1}{2}$

- Tolerance to abiotic stresses / like cold / drought / salt / heat ,
- reduced reliance on chemical pesticides / pest resistant crops ,
- reduce post harvest losses ,
- increased efficiency of mineral usage by plants ,
- enhanced nutritional value ,
- to create tailor made plant

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

[3 marks]

17. During a school trip to 'Rohtang Pass', one of your classmate suddenly developed 'altitude sickness'. But, she recovered after sometime.

- (a) Mention one symptom to diagnose the sickness.
- (b) What caused the sickness ?
- (c) How could she recover by herself after sometime ?

Ans. (a) Nausea / fatigue / heart palpitation = 1

(b) Low atmospheric pressure at high altitude , body deprived of $O_2 = \frac{1}{2} + \frac{1}{2}$

(c) Increase in RBC , decreases binding capacity of haemoglobin , increased breathing rate , get acclimatised (Any two) = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 + 1 = 3 marks]

18. How has RNAi technique helped to prevent the infestation of roots in tobacco plants by a nematode *Meloidegyne incognita* ?

Ans. Using *Agrobacterium* vectors , nematode specific genes introduced into host plant , produced sense - antisense RNA in host cells , ds RNA - initiated RNAi , silenced specific mRNA of nematode , parasite could not survive in transgenic host = $\frac{1}{2} \times 6$

[3 marks]

19. "In a food-chain, a trophic level represents a functional level, not a species." Explain.

Ans. Position of a species in any trophic level is determined by the function performed by that mode of nutrition of species in a particular food chain / A given species may occupy more than one trophic level in the same ecosystem (in different food chains) at the given time , If the function of the mode of nutrition of species changes its position shall change in the trophic levels , same species can be at primary consumer level in one food chain and at secondary consumer level in another food chain in the same ecosystem at the given time = 1×3

Similar value points explained with the help of a suitable example = 3

[3 marks]

OR

- (a) *Name any two places where it is essential to install electrostatic precipitators. Why it is required to do so ?*
- (b) **Mention one limitation of the electrostatic precipitator.**

Ans. (a) Thermal power plants / smelters / other particulate matter releasing industries = $\frac{1}{2} + \frac{1}{2}$

(Any two)

To remove particulate matter = 1

- (b) Very very small particulate matter / less than 2.5 micrometres are not removed / velocity of air between plates must be low enough to allow the dust to fall / cannot work without electricity = 1

[2 + 1 = 3 marks]

20. Prior to a sports event blood & urine samples of sportspersons are collected for drug tests.

- (a) **Why is there a need to conduct such tests ?**
- (b) **Name the drugs the authorities usually look for.**
- (c) **Write the generic names of two plants from which these drugs are obtained.**

Ans. (a) To detect drug abuse / use of banned drugs / use of cannabinoids / anabolic steroids / narcotic analgesic / diuretics / hormones / drugs used to accelerate performance / increase muscle strength / bulk / promote aggressiveness / to ensure fair game

- (b) Cannabinoids / cocaine / coca alkaloid / coke / crack / hashish / charas / ganja / hemp plant extract

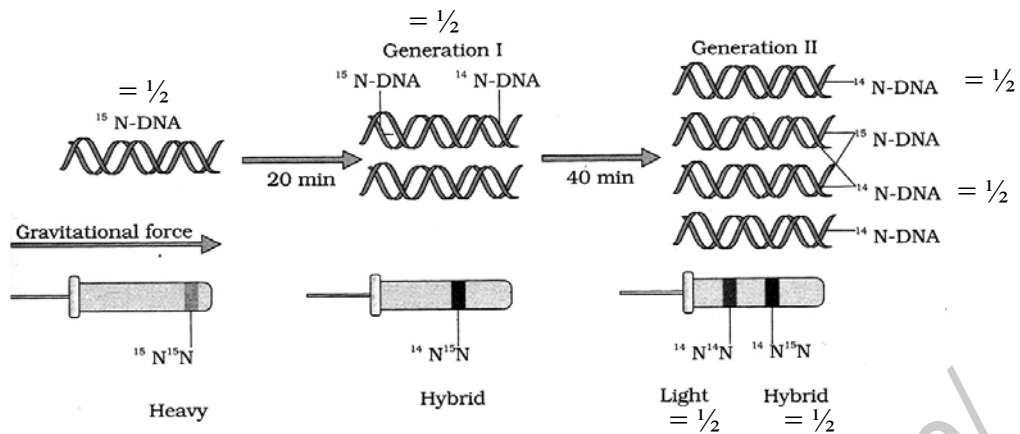
(c) *Cannabis / Atropa / Erythroxylum / Datura (Any two)*

[1 × 3 = 3 marks]

21. Describe the experiment that helped demonstrate the semi-conservative mode of DNA replication.

Grown *E.coli* in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA, Then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$, The extracted DNA are centrifuged in CsCl and measured to get their densities, DNA extracted from the culture after one generation (20 minutes), showed intermediate hybrid density, DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA = $\frac{1}{2} \times 6 = 3 //$

A correctly labelled diagrammatic representation in lieu of the above explanation of experiment to be considered = 3



[3 marks]

22. Given below is a list of six micro-organisms. State their usefulness to humans.

- Nucleopolyhedrovirus*
- Saccharomyces cerevisiae*
- Monascus purpureus*
- Trichoderma polysporum*
- Penicillium notatum*
- Propionibacterium sharmanii*

- Ans.
- As bio control agents / species specific / narrow spectrum insecticidal application / no negative impacts on plants / mammals / birds / fish / non target insects / Integrated Pest Management
 - Used in bread making / brewing industry / ethanol / CO_2 production
 - Cholesterol lowering agent / competitively inhibiting the enzyme responsible for synthesis of cholesterol
 - Produces Cyclosporin - A / immuno suppressive agent
 - Produces antibiotic penicillin
 - Produces large holes in Swiss cheese / produces large amount of CO_2 in swiss cheese

[$\frac{1}{2} \times 6 = 3$ marks]

SECTION - D

(Q. Nos. 23 is of four mark)

23. Reproductive and Child Healthcare (RCH) programmes are currently in operation. One of the major tasks of these programmes is to create awareness amongst people about the wide range of reproduction related aspects. As this is important and essential for building a reproductively healthy society.

- “Providing sex education in schools is one of the ways to meet this goal.” Give four points in support of your opinion regarding this statement.
- List any two ‘indicators’ that indicate a reproductively healthy society.

- Ans. (a) - Provide right information to the young so as to discourage children from believing in myths and misconception about sex related aspects.
- Proper information about reproductive organs
 - Proper information about adolescence and related changes
 - Safe hygienic practices
 - STDs / AIDS
 - Available birth control options
 - Care of pregnant mothers
 - Post natal care
 - Importance of breast feeding
 - Equal opportunities for male and female child
 - awareness of problems due uncontrolled population growth
 - Sex abuse
 - Sex related crimes

(Any four) = $\frac{1}{2} \times 4$

- (b) Better awareness about sex related matters / increase number of assisted deliveries / better post natal care / decrease in IMR (Infant Mortality Rate) / decrease MMR (Maternal Mortality Rate) / increase number of couples with small families / better detection and cure of STDs / overall increased medical facilities for sex related problems / total well being in all aspects of reproduction / physical - behavioural - social / physically and functionally normal reproductive organs / normal emotional and behavioural interaction among all sex related aspects.

(Any two) = 1 + 1

[2 + 2 = 4 marks]

SECTION - E

(Q. Nos. 24 - 26 are of five marks each)

24. (a) Explain the post-pollination events leading to seed production in angiosperms.
- (b) List the different types of pollination depending upon the source of pollen grain.

Ans. (a) Pollen pistil interaction, germination of pollen tube that carries two male gametes, double fertilization / syngamy and triple fusion, development of endosperm, development of embryo, maturation of ovule into seed. = $\frac{1}{2} \times 6$

(b) Autogamy / self pollination / Geitonogamy = 1

Xenogamy / cross pollination = 1

[3 + 2 = 5 marks]

OR

- (a) Briefly explain the events of fertilization and implantation in an adult human female.
- (b) Comment on the role of placenta as an endocrine gland.

(a) **Fertilization**

- Sperm comes in contact and enters the secondary oocyte
- activates / induces secondary oocyte to complete meiosis II leads to formation of ovum / ootid
- the haploid nucleus of sperm and that of ovum fused to form a diploid zygote completing the process of fertilization = $\frac{1}{2} \times 3$

Implantation

- Trophoblast layer of blastocyst attaches to the endometrium (of the uterus)
 - The uterine cells divide rapidly and cover the blastocyst ,
 - The blastocyst becomes embedded in the endometrium and the implantation is completed = $\frac{1}{2} \times 3$
- (b) - hCG (human chorionic gonadotropin)
- hPL (human placental lactogen)
 - estrogen
 - progestogens = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

25. (a) **How are the following formed and involved in DNA packaging in a nucleus of a cell?**(i) **Histone octamer**(ii) **Nucleosome**(iii) **Chromatin**(b) **Differentiate between Euchromatin and Heterochromatin.**

- Ans. (a) (i) Eight molecules of (positively charged basic proteins called) histones are organised to form histone octamer
- (ii) Negatively charged DNA wrapped around positively charged histone octamer to give rise to nucleosome
- (iii) Nucleosome constitute the repeating unit of a structure called chromatin = 1×3

(b) **Euchromatin**

- Loosely packed
- Stains light
- Transcriptionally active

Heterochromatin

- Densely packed
- Stains dark
- Transcriptionally inactive

(Any two differences) = 1 + 1

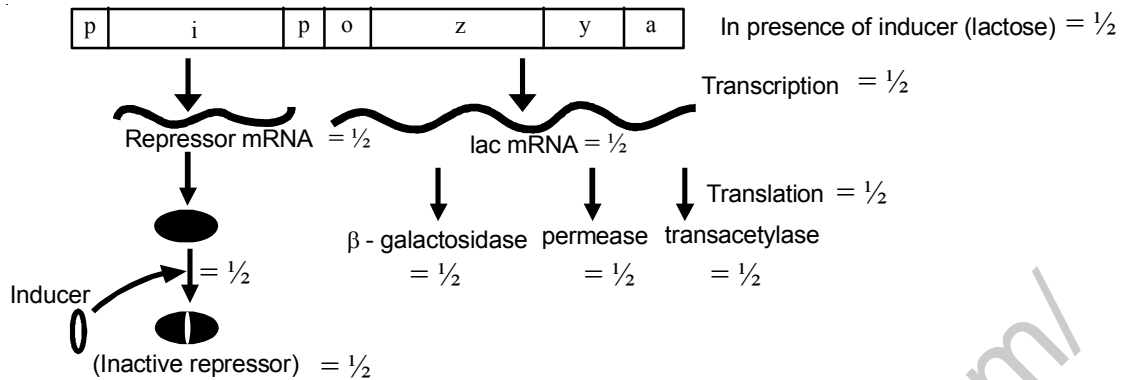
[3 + 2 = 5 marks]

OR**Explain the role of lactose as an inducer in a *lac* operon.**

- Ans. Lactose / inducer binds with repressor protein , inactivates it , frees operator gene , RNA polymerase freely move over structural genes / RNA polymerase access to the promoter , transcribing to , lac

mRNA, which on translation, produce transacetylase, permease, β -galactosidase = $\frac{1}{2} \times 10 //$

The following diagram to be considered in lieu of above explanation



= $\frac{1}{2} \times 10$

[5 marks]

26. (a) Why should we conserve biodiversity? How can we do it?
 (b) Explain the importance of biodiversity hot-spots and sacred groves.

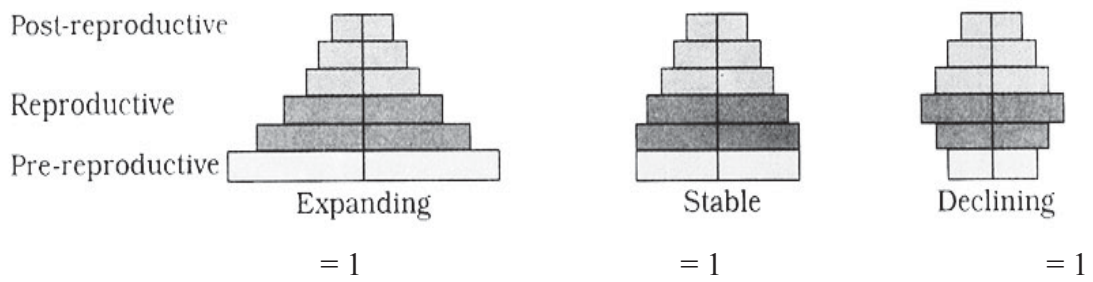
- Ans. (a) (i) - Narrowly utilitarian - related examples like derive economic benefits from nature food (cereals, pulses, fruits) / firewood / fibre / construction materials / industrial products (tannins, lubricants, dice, resins, perfumes) / product of medicinal importance / drugs = $\frac{1}{2}$
- Broadly utilitarian - 20% of total O_2 from Amazon forests / pollination / aesthetic pleasures = $\frac{1}{2}$
- Ethical - millions of species (plants, animals, microbes) share this planet / we need to realise that every species has an intrinsic value (even if it may not current or any economic value to us) / we have a moral duty to care for their wellbeing and pass on our biological legacy to future generations = $\frac{1}{2}$
- (ii) - In situ conservation / biosphere reserves / national parks / sanctuaries / sacred groves = $\frac{1}{2} //$
- Ex situ conservation / zoological parks / botanical gardens / wild life safari parks / cryopreservation / seed banks / tissue culture (eggs in vitro) = $\frac{1}{2}$
- (b) Hot spots - regions with high level of species richness, high degree of endemism = 1 + 1
- Sacred groves - tracts of forest containing tree / wild life were venerated, and given total protection // to protect last refuges for a large number of rare, and threatened plants = $\frac{1}{2} + \frac{1}{2}$

[2 + 3 = 5 marks]

OR

- (a) Represent diagrammatically three kinds of age-pyramids for human populations.
 (b) How does an age pyramid for human population at given point of time helps the policy-makers in planning for future.

Ans. (a)



Ans. (b) Planning of health / education / transport / infra-structure / finance / food / employment can depend on the age-pyramid analysis of a population / any other relevant point. (Any two explanation) = 1 + 1

[3 + 2 = 5 marks]

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