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Senior School Certificate Examination

March 2010

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 subsitute.

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 (×) 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.

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SECTION A

Q.Nos. 1 - 8 are of one mark each

1. Mention the site where syngamy occurs in amphibians and reptiles respectively.

Ans Amphibians – outside the body / in external medium = ½

Reptiles – inside the body = ½

[½ + ½ = 1 Mark]

2. How is snow-blindness caused in humans ?

Ans High dose of UV-B radiation, inflammation of cornea = ½ + ½

[1 Mark]

3. Name one autosomal dominant and one autosomal recessive Mendelian disorder in humans.

Ans Autosomal dominant – Myotonic dystrophy = ½

Autosomal recessive – Phenylketonuria / sickle cell anaemia / cystic fibrosis/ Thalesemia = ½

[1 Mark]

4. How is the action of exonuclease different from that of endonuclease ?

Ans Exonuclease : removes nucleotides from the ends of DNA molecules = ½

Endonuclease : makes cut at specific position within a DNA = ½

[1 Mark]

5. India has more than 50,000 strains of rice. Mention the level of biodiversity it represents.

Ans Genetic Biodiversity

[1 Mark]

6. Mention the information that the health workers derive by measuring BOD of a water body.

Ans A measure of organic waste matter present in the water, greater the BOD more is its polluting potential = ½ + ½

[½ + ½ =1 Mark]

7. Name the enzyme involved in the continuous replication of DNA strand. Mention the polarity of the template strand.

Ans (DNA dependent) DNA polymerase 3' –> 5' = ½ + ½

[½ + ½ =1 Mark]

8. Offsprings derived by asexual reproduction are called clones. Justify giving two reasons.

Ans Morphologically (structurally) similar, genetically identical = ½ + ½

[½ + ½ =1 Mark]

SECTION B

Q.Nos. 9 - 18 are of 2 marks each.

9. Mention the role of ribosomes in peptide-bond formation. How does ATP facilitate it ?

Ans Provides the sites for the binding of amino acid, acts as a catalyst (23S r RNA) for the formation of peptide bond = ½ + ½

ATP provides the energy for the bond formation = 1

[1 + 1 = 2 Markss]

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10. How do copper and hormone releasing IUDs act as contraceptives ? Explain.

Ans Copper releasing IUDs- Increase phagocytosis of sperms, supress sperm mobility, supress the fertilising capacity of sperm **(Any two)** = ½ + ½

Hormone releasing IUDs - Increase phagocytosis of sperms, supress sperm mobility, supress the fertilising capacity of sperm , make the uterus unsuitable for implantation, make the cervix hostile to the sperms **(Any two)** = ½ + ½

[1 + 1 = 2 Marks]

11. If you squeeze a seed of orange you might observe many embryos of different sizes. How is it possible ? Explain.

Ans Some of the nucellar cells, surrounding embryo sac divide, protrude into the embryo sac, develop into the embroys thus each seed contains many embryos of different sizes = ½×4

[½ × 4 = 2 Marks]

12. A recombinant DNA is formed when sticky ends of vector DNA and foreign DNA join. Explain how the sticky ends are formed and get joined.

Ans Restriction enzymes cut the DNA sequence a little away from the centre of the palindrome site but between the same two bases on the opposite strands, leaving single stranded portions at the ends these over hanging stretches are called sticky ends on each strand.They form hydrogen bonds with the complementary cut counterparts, facilitates the action of ligase enzymes to join the foreign and the vector DNA strands = ½ × 4

[½ × 4 = 2 Marks]

13. (i) Mention the number of primers required in each cycle of polymerase chain reaction (PCR). Write the role of primers and DNA polymerase in PCR.

(ii) Give the characteristic feature and source organism of the DNA polymerase used in PCR.

Ans (i) 2 sets of primers, DNA polymerisation / extends the primers using the nucleotides = ½ + ½

(ii) Thermostable / remain active during high temperature induced denaturation of DNA,

Thermus aquaticus = ½ + ½

[1 + 1 = 2 Marks]

14. Define the term 'health'. Mention any two ways of maintaining it.

OR

Why does a doctor administer tetanus antitoxin and not a tetanus vaccine to a child injured in a roadside accident with a bleeding wound ? Explain.

Ans State of complete physical mental and social well being = 1

Balance diet , personal hygiene / regular exercise **(Any two)** = ½ + ½

[1 + 1 = 2 Marks]

OR

Tetanus is a deadly disease requiring a quick immune response, so preformed antibodies are injected directly = 1 + 1

[2 Marks]

15. Giving two reasons explain why there is more species biodiversity in tropical latitudes than in temperate ones.

Ans
- Remain relatively undisturbed for millions of years so longer time for diversification
- Less seasonal / more constant / predictable weather
- More solar energy available for productivity

(Any two) = 1 + 1

[1 + 1 = 2 Marks]

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16. Name an opioid drug and its source plant. How does the drug affect the human body ?

Ans Heroin (smack) / morphine = ½

Poppy plant / *Papaver somniferum* = ½

Binds with opioid receptors in CNS / gastro intestinal tract , and slows down the system / depressent = ½ + ½

[½ + ½ + 1 = 2 Marks]

17. Mention the major cause of air pollution in metro cities. Write any three ways by which it can be reduced.

Ans Automobiles = ½

Using catalytic converters, application of stringent pollution level norms, switching over to CNG as fuel, phasing out old vehicles, using unleaded petrol, using low sulphur petrol or diesel **(Any three)** = ½ × 3

[½ + 1½ = 2 Marks]

18. How did Eli Lilly synthesise the human insulin ? Mention one difference between this insulin and the one produced by the human pancreas.

Ans Produce proinsulin chain A and chain B using separate DNA sequences introduced in the plasmids of *E.coli*, extracted, combined by disulphide bond produces mature insulin = ½ × 3

Insulin produced by human pancreas has an additional C peptide = ½

[1½ + ½ = 2 Marks]

SECTION C

O.Nos. 19 - 27 are of 3 marks each.

19. (i) Write the characteristic features of anther, pollen and stigma of wind pollinated flowers.

(ii) How do flowers reward their insect pollinators ? Explain.

Ans (i) Pollen - light / large number / non sticky,

Anther – well exposed

Stigma - large / feathery / open / sticky = ½ ×3

(ii) Provides nectar / food for the larvae / pollen grains / safe place to lay eggs **(Any three)** = ½ ×3

[1½ + 1½ = 3 Marks]

20. (i) Why are grasshopper and *Drosophila* said to show male heterogamity ? Explain.

(ii) Explain female heterogamity with the help of an example.

Ans (i) In grasshopper males have one X only (XO type) , in *Drosophila* males have one X and one Y (XY type) - Males in both produce 2 different kinds of gametes so heterogametic = ½ + ½ + 1

(ii) In birds female has ZW, produce two kinds of gametes and so heterogametic = ½ + ½

[2 + 1 = 3 Marks]

21. In a series of experiments with *Streptococcus* and mice F. Griffith concluded that R-strain bacteria had been transformed. Explain.

Ans S strain bacteria when injected - mice die , R - mice live , heat killed S - mice live , heat killed S + live R - mice die , recovered living S from dead mice , R strain bacteria had been transformed to S strain by the genetic material of heat killed S strain = ½ × 6

[½ × 6 = 3 Marks]

22. (a) How does the Hardy - Weinberg's expression ($p^2 + 2pq + q^2 = 1$) explain that genetic

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equilibrium is maintained in a population ?

(b) List any two factors that can disturb the genetic equilibrium.

Ans (a) Gene frequencies in a population are stable, constant from generation to generation, until some change in frequency happens, due to some factor = ½ × 4

(b) gene migration / gene flow / gene drift / mutation / genetic recombination / natural selection **(Any two)** = ½ × 2

[2 + 1 = 3 Marks]

23. Mention the name of the causal organism, symptoms and the mode of transmission of the disease Amoebiasis.

Ans *Entamoeba histolytica* =1

Constipation / abdominal pain / cramps / mucous stool / stool with blood clots **(Any two)** = ½ + ½

Houseflies carrier from faeces to person via food products / contaminated water = 1

[1 + 1 + 1 = 3 Marks]

24. (i) Mention the property that enables the explants to regenerate into a new plant.

(ii) A banana herb is virus-infected. Describe the method that will help in obtaining healthy banana plants from this diseased plant.

Ans (i) Totipotency =1

(ii) Extract the disease free meristem, in vitro culture to get virus free plants = 1 + 1

[1 + 2 = 3 Marks]

25. Mention the product and its use produced by each of the microbes listed below :

(i) ***Streptococcus***

(ii) ***Lactobacillus***

(iii) ***Saccharomyces cerevisiae***

Ans (i) Streptokinase, clotbuster / dissolves clot from blood vessels = ½ + ½

(ii) Lactic acid , coagulates milk/partial digestion of milk proteins = ½ + ½

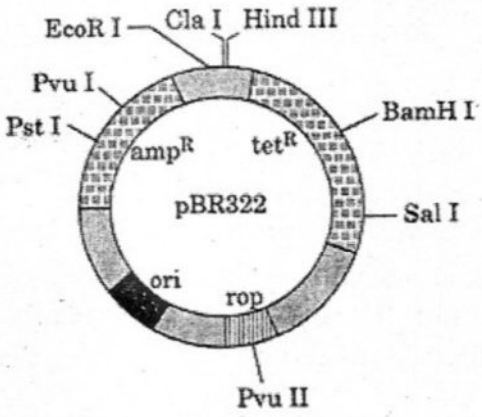
(iii) Ethyl alcohol + CO_2 , ferments dough to make bread / idli = ½ + ½

[1 + 1 + 1 = 3 Marks]

26. (i) Name the organism in which the vector shown is inserted to get the copies of the desired gene.

(ii) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.

(iii) Name and explain the role of a selectable marker in the vector shown.



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OR

Name the insect pest that is killed by the products of cry I Ac gene. Explain how the gene makes the plant resistant to the insect pest.

Ans (i) *Escherichia coli* / *E.coli* = 1

(ii) ori = 1

(iii) amp^R is the marker gene that helps in identification and elimination of the non transformant growing in ampicillin medium / selectively permitting the growth of the transformant resistant to ampicillin =1

// tet^R is the marker gene that helps in identification and elimination of the non transformant growing in tetracycline medium / selectively permitting the growth of the transformant resistant to tetracyline =1

[1 + 1 + 1 = 3 Marks]

OR

Meloidegyne incognitia = 1

The gene (cry IAc) produces crystals of insecticidal protein which is inactive protoxin, when the bollworm eats the protoxin the alkaline pH of the gut activates it , activated protoxin binds to the midgut epithelial cells , creates pores / causes swelling / causes lysis / kills the worm = ½ × 4

[1 + 2 = 3 Marks]

27. How do organisms like fungi, zooplanktons and bears overcome the temporary short-lived climatic stressful conditions ? Explain.

Ans Fungi - produce thick walled spores to survive unfavourable condition = 1

zooplanktons - diapause to suspend development = 1

bear – undergo hibernation in winter = 1

[1 + 1 + 1 = 3 Marks]

SECTION D

Q.Nos. 28 - 30 are of 5 marks each.

28. Describe in sequence the events that lead to the development of a 3-celled pollen grain from microspore mother cell in angiosperms.

OR

(a) Give a schematic representation showing the events of spermatogenesis in human male.

(b) Describe the structure of a human sperm.

Ans Microspore mother cell , meiosis , 4 haploid microspores , tetrad , Each micorspore is a pollen grain , with two layered wall - outer exine (made of sporopollenin) and inner intine (made up of cellulose and pectin), pollen grain contain one larger vegetative cell , and a smaller generative cell , which divides mitotically , into two male gametes = ½ × 10

[½ × 10 = 5 Marks]

OR

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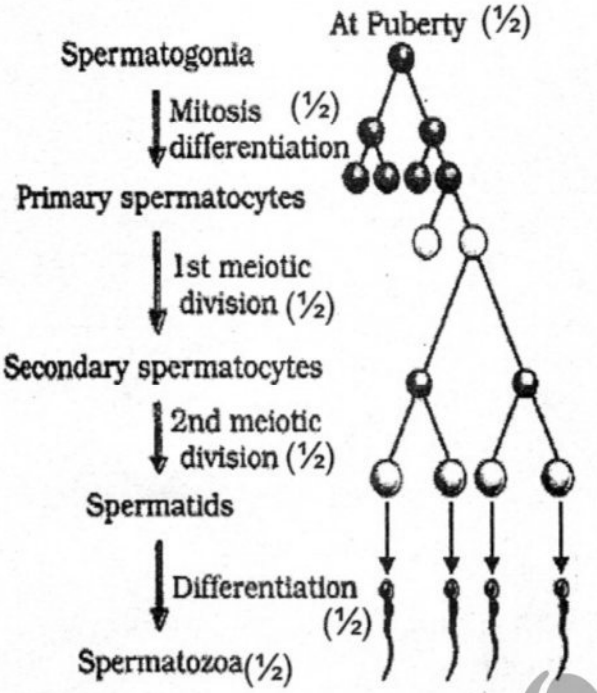
(a)



= ½ × 6

(b) Sperm – enveloped by plasma membrane
Head – haploid nucleus , acrosomes with enzymes
Middle piece – with mitochondria
tail = ½ ×4
// If illustrated with the above labellings correctly - marks to be awarded

[3 + 2 = 5 Marks]

29. (a) State the law of independent assortment.

(b) Using Punnett Square demonstrate the law of independent assortment in a dihybrid cross involving two heterozygous parents.

OR

How did Alfred Hershey and Martha Chase arrive at the conclusion that DNA is the genetic material ?

Ans (a) 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

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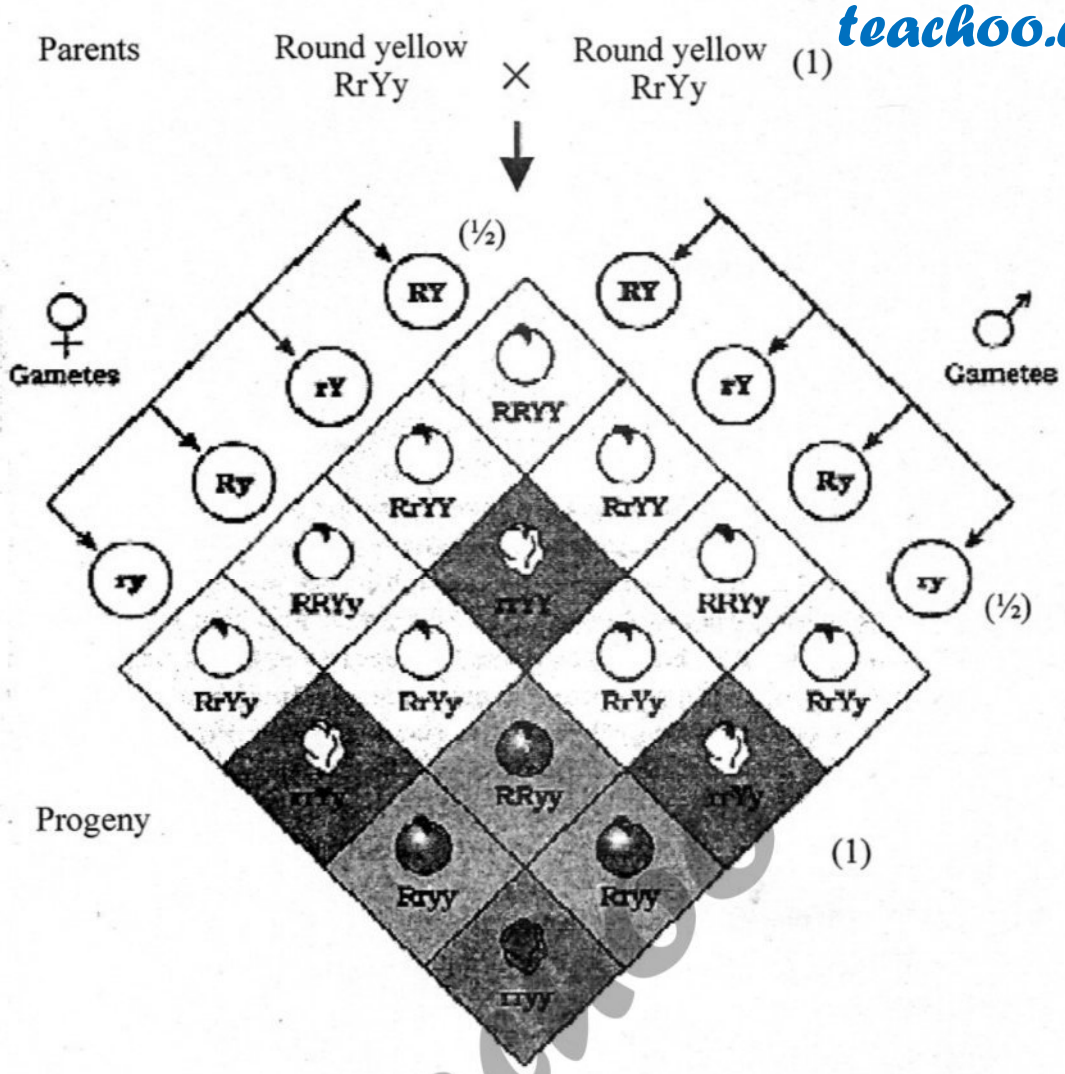
(b)



Both parental type and recombinant types are observed to show that genes for the colour and genes for the shape of seeds segregate independently during gametes formation = 1

[1 + 3 + 1 = 5 Marks]

OR

Hershey and Chase grew some viruses in a medium that contained ^{32}P radioactive phosphorus , these were allowed to infect *E. coli,* medium was agitated in a blender viral coats and the bacterial cells with viral particles where separated by spinning them in a centrifuge, in this case no radioactivity in the supernatant as the protein coats do not incorporate ^{32}P , but the viral DNA had ^{32}P and passed to it to the bacterial cell , so radioactivity was detected in the cells, proves that DNA is the hereditary material , They repeated the procedure with radioactive sulphur ^{35}S , in this case no radioactivity was detected in the bacterial cell as S is not incorporated in DNA, while radioactivity was detected in the supernatant with protein coats of viruses = ½ × 10

[½ × 10 = 5 Marks]

// **The following diagrammatic representation can be considered in lieu of the above explanation.**

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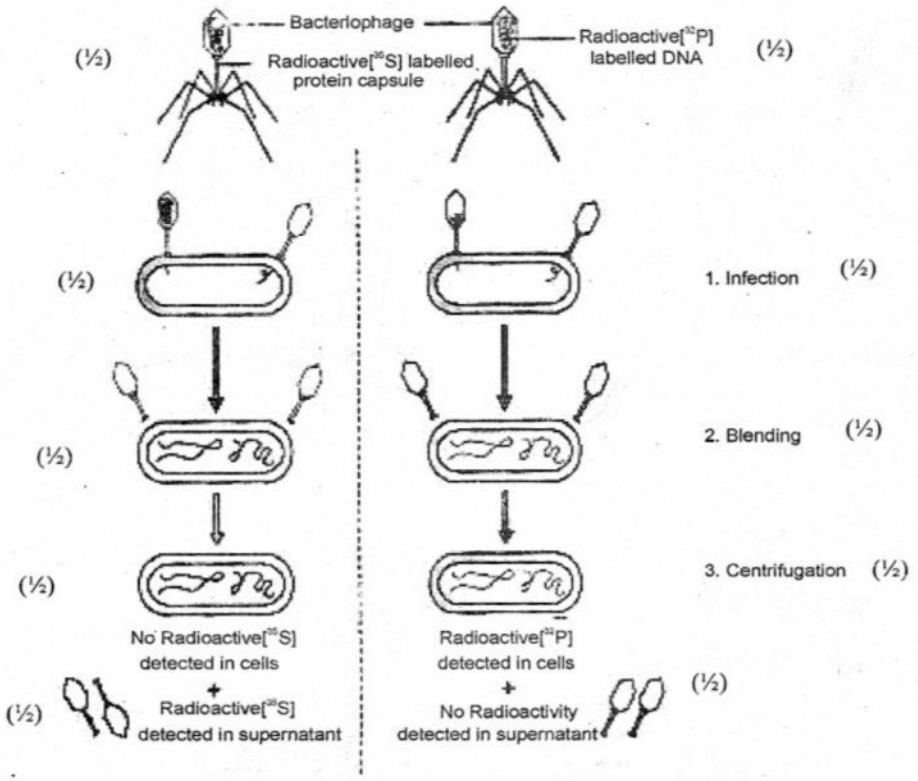

[½ × 10 = 5 Marks]

30. (a) Why are herbivores considered similar to predators in the ecological context? Explain.

(b) Differentiate between the following interspecific interactions in a population :

(i) Mutualism and Competition

(ii) Commensalism and Amensalism

OR

(a) Trace the succession of plants on a dry bare rock.

(b) How does phosphorus cycle differ from carbon cycle ?

Ans (a) Transfer of energy fixed by plants to the next trophic level - carnivores,
Maintain the plant population under control = ½ + ½

(b) (i) In mutualism both the species benefit = 1
In competition - survival of both challenged / struggle for existence = 1

(ii) Commensalism – One is benefitted. The other is neither benefitted nor harmed =1
Amensalism – One is harmed and the other is unaffected = 1

[1 + 4 = 5 Marks]

OR

(a) Primary succession - lichens , secrete acids to cause weathering of rock and soil formation ,
Small plants like bryophytes , to hold the soil ,
Herbs , scrubs , shrubs succeed in existence ,
Trees, forest , climax community = ½ × 8

b) – No respiratory release of phosphorus unlike CO_2 in carbon cycle / No gaseous exchange
– Inputs of phosphorus through rainfall is less than carbon input = ½ + ½

[4 + 1 = 5 Marks]

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SECTION A

Q.Nos. 1 - 8 are of one mark each

1. India has more than 50,000 strains of rice. Mention the level of biodiversity it represents.

Ans Genetic Biodiversity

[1 Mark]

2. Write the genotype of (i) an individual who is carrier of sickle cell anaemia gene but apparently unaffected, and (ii) an individual affected with the disease.

Ans (i) $Hb^A Hb^S = ½$

(ii) $Hb^S Hb^S = ½$

[½ + ½ = 1 Mark]

3. Name the enzyme involved in the continuous replication of DNA strand. Mention the polarity of the template strand.

Ans (DNA dependent) DNA polymerase 3' → 5' = ½ + ½

[½ + ½ =1 Mark]

4. Mention the information that the health workers derive by measuring BOD of a water body.

Ans A measure of organic waste matter present in the water, greater the BOD more is its polluting potential = ½ + ½

[½ + ½ =1 Mark]

5. How is snow-blindness caused in humans ?

Ans High dose of UV-B radiation, inflammation of cornea = ½ + ½

[1 Mark]

6. Mention a characteristic feature and a function of zoospores in some algae.

Ans Biflagellated / motile / microscopic / aquatic bodies **(Any one)** = ½

Asexual reproductive bodies = ½

[½ + ½ = 1 Mark]

7. Mention the site where syngamy occurs in amphibians and reptiles respectively.

Ans Amphibians – outside the body / external medium = ½

Reptiles – inside the body = ½

[½ + ½ = 1 Mark]

8. How is the action of exonuclease different from that of endonuclease ?

Ans Exonuclease : removes nucleotides from the ends of DNA molecules = ½

Endonuclease : makes cut at specific position within a DNA = ½

[1 Mark]

SECTION B

Q.Nos. 9 - 18 are of 2 marks each.

9. Placenta acts as an endocrine tissue. Justify.

Ans Produces hormones like (hCG) Human chorionic gonadotropin, (hPL) human placental lactogen , estrogen, progestogens **(Any two)** = ½ × 4

[½ × 4 = 2 Marks]

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10. Differentiate between menarche and menopause.

Ans Menarche - First menstruation (that begins at puberty) = 1

Menopause - Cessation of mestrual cycles (around 50 years of age) = 1

[1 + 1 = 2 Marks]

11. (i) Mention the number of primers required in each cycle of polymerase chain reaction (PCR). Write the role of primers and DNA polymerase in PCR.

(ii) Give the characteristic feature and source organism of the DNA polymerase used in PCR.

Ans (i) 2 sets of primers, DNA polymerisation / extends the primers using the nucleotides = ½ + ½

(ii) Thermostable / remain active during high temperature induced denaturation of DNA,

Thermus aquaticus = ½ + ½

[1+1=2 Marks]

12. Define the term 'health'. Mention any two ways of maintaining it.

OR

Why does a doctor administer tetanus antitoxin and not a tetanus vaccine to a child injured in a roadside accident with a bleeding wound ? Explain.

Ans State of complete physical mental and social well being = 1

Balance diet , personal hygiene , regular exercise **(Any two)** = ½ + ½

[1+1= 2 Marks]

OR

Tetanus is a deadly disease requiring a quick immune response, so preformed antibodies are injected directly = 1 + 1

[2 Marks]

13. List the features that make a stable biological community.

Ans
- should not show too much variations in productivity from year to year
- must be either resistant or resilient to occasional disturbance (natural / man made)
- must also be resistant to invasion by alien species

(Any two) = 1 + 1

[2 Marks]

14. A recombinant DNA is formed when sticky ends of vector DNA and foreign DNA join. Explain how the sticky ends are formed and get joined.

Ans Restriction enzymes cut the DNA sequence a little away from the centre of the palindrome site but between the same two bases on the opposite strands, leaving single stranded portions at the ends These over hanging stretches are called sticky ends on each strand.They form hydrogen bonds with the complementary cut counterparts, facilitates the action of ligase enzymes to join the foreign and the vector DNA strands = ½ × 4

[½ × 4 = 2 Marks]

15. Name an opioid drug and its source plant. How does the drug affect the human body ?

Ans Heroin (smack) / morphine = ½

Poppy plant / *Papaver somniferum* = ½

Binds with opioid receptors in CNS / gastro intestinal tract , and slows down the system / depressent = ½ + ½

[½ + ½ + 1 = 2 Marks]

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16. How did Eli Lilly synthesise the human insulin ? Mention one difference between this insulin and the one produced by the human pancreas.

Ans Produce proinsulin chain A and chain B using separate DNA sequences introduced in the plasmids of *E.coli*, extracted, combined by disulphide bond –> mature insulin = ½ × 3

Insulin produced by human pancreas has additional C peptide = ½

[1½ + ½ = 2 Marks]

17. Mention how e-waste is produced and disposed off. Write the solution for its treatment.

Ans Irreparable computers and other electronic goods ,

Buried in landfills , incinerated ,

Recycling should be carried out in an environment friendly manner = ½ × 4

[½ + ½ + 1 = 2 Marks]

18. Mention the role of ribosomes in peptide-bond formation. How does ATP facilitate it ?

Ans Provides the sites for the binding of amino acid, acts as a catalyst (23S r RNA) for the formation of peptide bond = ½ + ½

ATP provides the energy for the bond formation = 1

[1 + 1 = 2 Marks]

SECTION C

Q.Nos. 19 - 27 are of 3 marks each.

19. In a series of experiments with *Streptococcus* and mice F. Griffith concluded that R-strain bacteria had been transformed. Explain.

Ans Ans S strain bacteria when injected - mice die ; R - mice live; heat killed S - mice live; heat killed S + live R - mice die ; recovered living S from dead mice; R strain bacteria had been transformed to S strain by the genetic material of heat killed S strain = ½ × 6

[½ × 6 = 3 Marks]

20. Mention the name of the causal organism, symptoms and the mode of transmission of the disease Amoebiasis.

Ans *Entamoeba histolytica* =1

Constipation / abdominal pain / cramps / mucous stool / stool with blood clot **(Any two)** = ½ + ½

Houseflies carrier from faeces to person via food products / contaminated water = 1

[1 + 1 + 1=3 Marks]

21. Explain the process of artificial hybridisation to get improved crop variety in (i) plants bearing bisexual flowers (ii) female parent producing unisexual flowers.

Ans (i) Removal of anthers from the flower bud before the anther dehisces using a pair of forceps (emasculation), covering them with a bag of butter paper, to screen unwanted pollen , When the stigma is receptive, mature pollen is dusted on the stigma and bagged again = ½ × 4

(ii) The female flower buds are bagged before the flowers open, When the stigma becomes receptive pollination is carried out using the desired pollen and the flower is rebagged = ½ × 2

[2 + 1 = 3 Marks]

22. How do organisms like fungi, zooplanktons and bears overcome the temporary short-lived climatic stressful conditions ? Explain.

Ans Fungi - produce thick walled spores to survive unfavourable condition = 1

zooplanktons - diapause to suspend development = 1

bear – undergo hibernation in winter = 1

[1 + 1 + 1 = 3 Marks]

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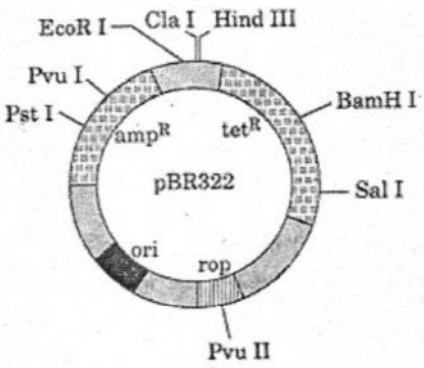
23. (i) Name the organism in which the vector shown is inserted to get multiple copies of the desired gene.

(ii) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.

(iii) Name and explain the role of a selectable marker in the vector shown.



OR

Name the insect pest that is killed by the products of *cry* I*Ac* gene. Explain how the gene makes the plant resistant to the insect pest.

Ans (i) *Escherichia coli* / *E.coli* = 1

(ii) ori = 1

(iii) amp^R is the marker gene that helps in identification and elimination of the non transformant growing in ampicillin medium / selectively permitting the growth of the transformant resistant to ampicillin =1

// tet^R is the marker gene that helps in identification and elimination of the non transformant growing in tetracycline medium / selectively permitting the growth of the transformant resistant to tetracyline =1

[1 + 1 + 1 = 3 Marks]

OR

Meloidegyne incognitia = 1

The gene (cry IAc) produces crystals of insecticidal protein which is inactive protoxin, when the bollworm eats the protoxin the alkaline pH of the gut activates it , activated protoxin binds to the midgut epithelial cells , creates pores / causes swelling / causes lysis / kills the worm = ½ × 4

[1 + 2 = 3 Marks]

24. Mention the product and its use produced by each of the microbes listed below :

(i) *Streptococcus*

(ii) *Lactobacillus*

(iii) *Saccharomyces cerevisiae*

Ans (i) Streptokinase, clotbuster / dissolves clot from blood vessels = ½ + ½

(ii) Lactic acid , coagulates milk/partial digestion of milk proteins = ½ + ½

(iii) Ethyl alcohol+CO_2 , ferments dough to make bread / idli = ½ + ½

[1+1+1=3 Marks]

25. (a) How does the Hardy - Weinberg's expression ($p^2 + 2pq + q^2 = 1$) explain that genetic equilibrium is maintained in a population ?

(b) List any two factors that can disturb the genetic equilibrium.

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Ans (a) Gene frequencies in a population are stable, constant from generation to generation, until some change in frequency happens, due to some factor = ½ × 4

(b) gene migration / gene flow / gene drift / mutation / genetic recombination / natural selection **(Any two)** = ½ × 2

[2 + 1 = 3 Marks]

26. (i) Mention the property that enables the explants to regenerate into a new plant.

(ii) A banana herb is virus-infected. Describe the method that will help in obtaining healthy banana plants from this diseased plant.

Ans (i) Totipotency =1

(ii) Extract the disease free meristem, in vitro culture to get virus free plants = 1 + 1

[1 + 2 = 3 Marks]

27. Explain the sex determination mechanism in humans. How is it different in birds ?

Ans Human : Females produces all gametes with X chromosome , If the egg fuses with a sperm with X chromosome a daughter is born , If the egg fuses with the sperm with Y chromosome a son is born = ½ × 3

Birds : Male produces all gametes with Z chromosome , If the sperm fuses with egg with Z chromosome a male is born , If the sperm fuses with egg with W chromosome a female is born = ½ × 3

[1½ + 1½ = 3 Marks]

SECTION D

Q.Nos. 28 - 30 are of 5 marks each.

28. (a) State the law of independent assortment.

(b) Using Punnett Square demonstrate the law of independent assortment in a dihybrid cross involving two heterozygous parents.

OR

How did Alfred Hershey and Martha Chase arrive at the conclusion that DNA is the genetic material ?

Ans (a) 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

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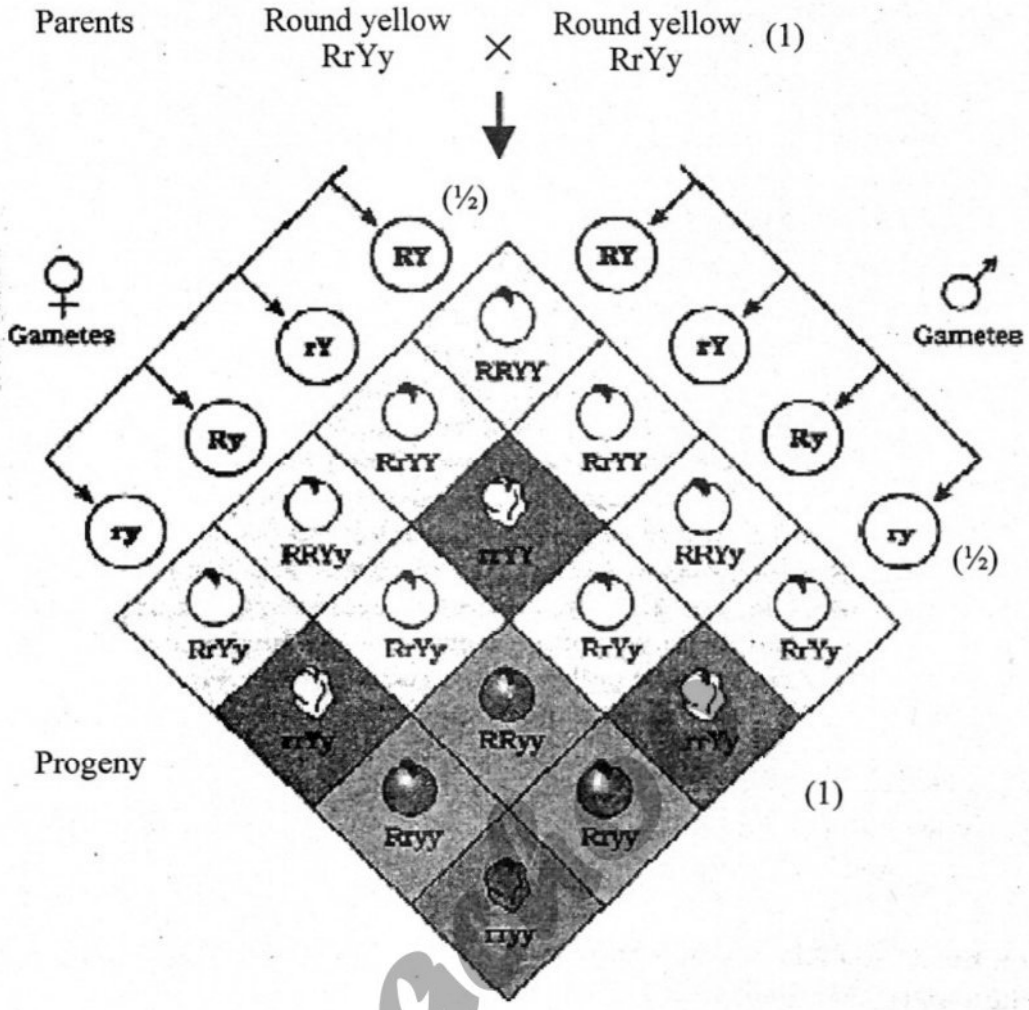
(b)



Both parental type and recombinant types are observed to show that genes for the colour and genes for the shape of seeds segregate independently during gametes formation = 1

[1 + 3 + 1 = 5 Marks]

OR

Hershey and Chase grew some viruses in a medium that contained ^{32}P radioactive phosphorus , these were allowed to infect *E. coli,* medium was agitated in a blender viral coats and the bacterial cells with viral particles where separated by spinning them in a centrifuge, in this case no radioactivity in the supernatant as the protein coats do not incorporate ^{32}P , but the viral DNA had ^{32}P and passed to it to the bacterial cell , so radioactivity was detected in the cells, proves that DNA is the hereditary material. They repeated the procedure with radioactive sulphur ^{35}S , in this case no radioactivity was detected in the bacterial cell as S is not incorporated in DNA, while radioactivity was detected in the supernatant with protein coats of viruses = ½ × 10

[½ × 10 = 5 Marks]

// **The following diagrammatic representation can be considered in lieu of the above explanation.**

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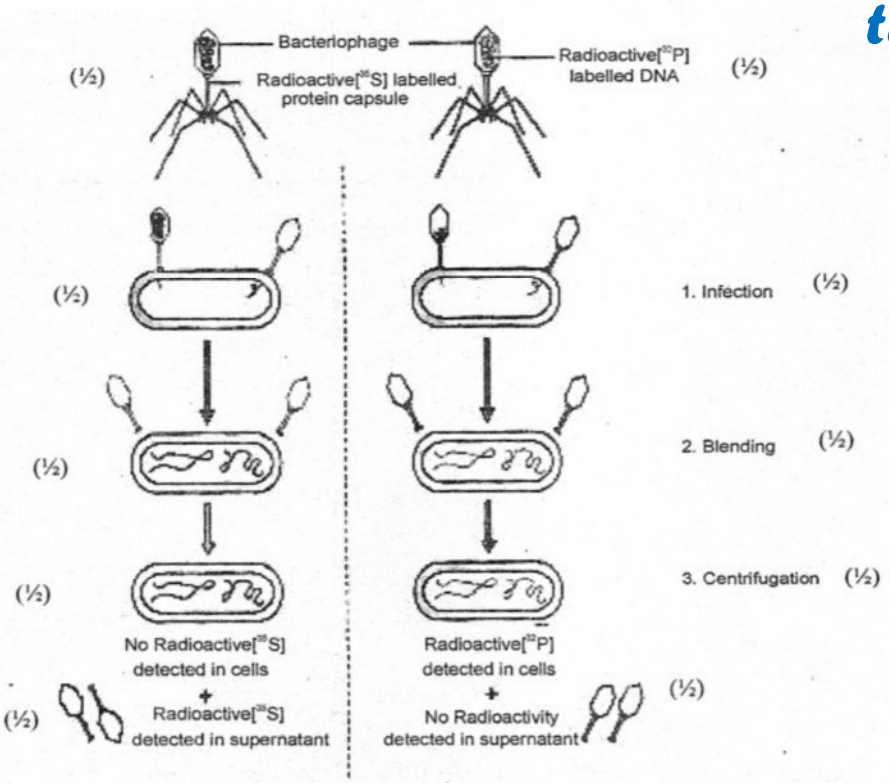

[½ × 10 = 5 Marks]

29. (a) Why are herbivores considered similar to predators in the ecological context? Explain.

(b) Differentiate between the following interspecific interactions in a population :

(i) Mutualism and Competition

(ii) Commensalism and Amensalism

OR

(a) Trace the succession of plants on a dry bare rock.

(b) How does phosphorus cycle differ from carbon cycle ?

Ans (a) Transfer of energy fixed by plants to the next trophic level - carnivores,
Maintain the plant population under control = ½ + ½

(b) (i) In mutualism both the species benefit =1
In competition - survival of both challenged / struggle for existence = 1

(ii) Commensalism – One is benefitted. The other is neither benefitted nor harmed =1
Amensalism – One is harmed and the other is unaffected = 1

[1 + 4 = 5 Marks]

OR

(a) Primary succession - lichens , secrete acids to cause weathering of rock and soil formation ,
Small plants like bryophytes , to hold the soil ,
Herbs , scrubs , shrubs succeed in existence ,
Trees, forest , climax community = ½ × 8

(b) – No respiratory release of phosphorus unlike CO_2 in carbon cycle / No gaseous exchange
– Inputs of phosphorus through rainfall is less than carbon input = ½ + ½

[4 + 1 = 5 Marks]

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30. (a) **Trace the development of megaspore mother cell up to the formation of a mature embryo-sac in a flowering plant.**

(b) **Draw a labelled diagram of the structure of mature dicot embryo.**

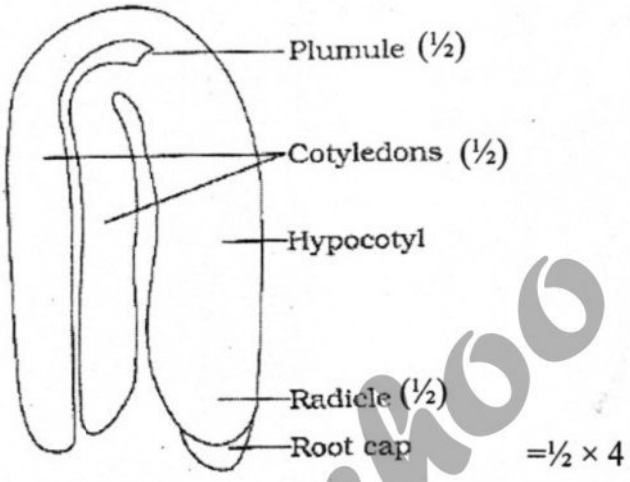
OR

(a) **Draw a diagrammatic labelled sectional view of a seminiferous tubule of a human.**

(b) **Describe in sequence the process of spermatogenesis in humans.**

Ans (a) MMC (megaspore mother cell) under goes meiosis to form four megaspores, one of the megaspores is functional while other three degenerate , the nucleus of functional megaspore divides thrice mitotically , to form 8 nucleate stage of the embryosac followed by the formation of cell walls , cells are arranged as one egg cell and two synergids at micropylar end, 3 antipodals at chalazal end and two polar nuclei at the centre = ½ × 6

(b)



=½ × 4

hypocotyl or root cap to be labelled = ½

[3 + 2 = 5 Marks]

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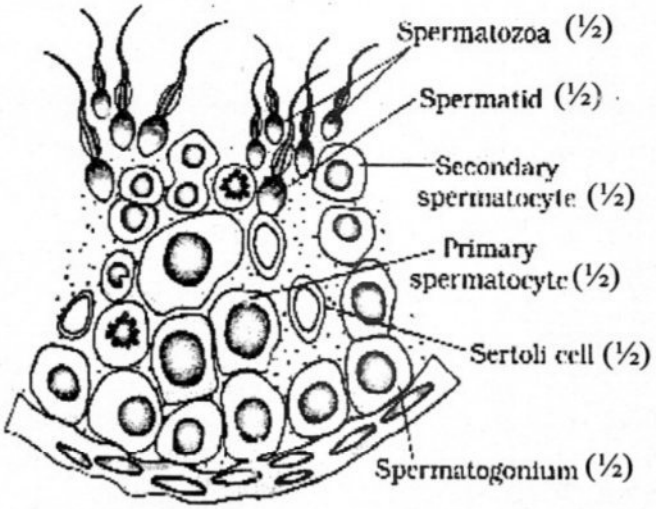
OR

(a)



= ½ × 6

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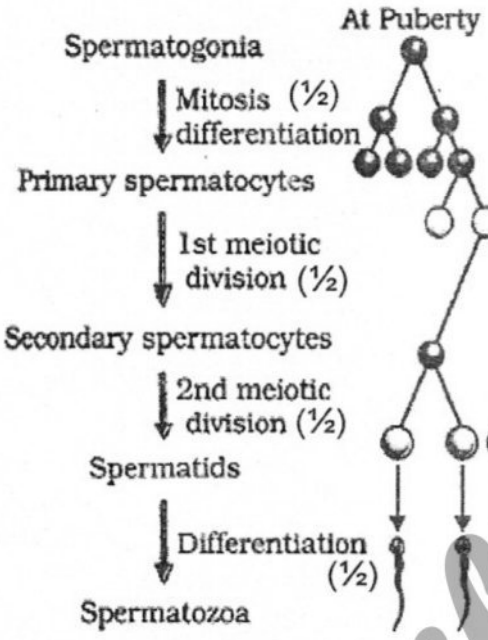
(b) At puberty spermatogonia undergo mitosis to form primary spermatocytes, each undergoes first meiotic division to form two secondary spermatocytes, each completes second meiotic division to form two spermatids, spermatid undergoes spermiogenesis to form spermatozoa = ½ × 4

// **Labelled schematic representation may be considered in lieu of explanation**



= ½ × 4

[3 + 2 = 5 Marks]

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SECTION A

Q.Nos. 1 - 8 are of one mark each

1. A human being suffering from Down's Syndrome shows trisomy of 21st chromosome. Mention the cause of this chromosomal abnormality.

Ans Failure of segregation of chromatids during cell division / presence of extra 21st chromosome = 1

[1 Mark]

2 Mention the site where syngamy occurs in amphibians and reptiles respectively.

Ans Amphibians – outside the body / external medium = ½

Reptiles – inside the body = ½

[½ + ½ = 1 Mark]

3. India has more than 50,000 strains of rice. Mention the level of biodiversity it represents.

Ans Genetic Biodiversity

[1 Mark]

4. Pea flowers produce assured seed sets. Give a reason.

Ans Pea flower is a cleistogamous flower / do not open = 1

[1 Mark]

5. Mention the information that the health workers derive by measuring BOD of a water body.

Ans A measure of organic waste matter present in the water, greater the BOD more is its polluting potential = ½ + ½

[½ + ½ = 1 Mark]

6. Name the enzyme involved in the continuous replication of DNA strand. Mention the polarity of the template strand.

Ans (DNA dependent) DNA polymerase 3' –> 5' = ½ + ½

[½ + ½ = 1 Mark]

7. How is the action of exonuclease different from that of endonuclease ?

Ans Exonuclease : removes nucleotides from the ends of DNA molecules = ½

Endonuclease : makes cut at specific position within a DNA = ½

[1 Mark]

8. How is snow-blindness caused in humans ?

Ans High dose of UV-B radiation, inflammation of cornea = ½ + ½

[1 Mark]

SECTION B

Q.Nos. 9 - 18 are of 2 marks each.

9. Define the term 'health'. Mention any two ways of maintaining it.

OR

Why does a doctor administer tetanus antitoxin and not a tetanus vaccine to a child injured in a roadside accident with a bleeding wound ? Explain.

Ans State of complete physical mental and social well being = 1

Balance diet , personal hygiene , regular exercise **(Any two)** = ½ + ½

[1 + 1 = 2 Marks]

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OR

Tetanus is a deadly disease requiring a quick immune response, so preformed antibodies are injected directly = 1 + 1

[2 Marks]

10. A recombinant DNA is formed when sticky ends of vector DNA and foreign DNA join. Explain how the sticky ends are formed and get joined.

Ans Restriction enzymes cut the DNA sequence a little away from the centre of the palindrome site but between the same two bases on the opposite strands, leaving single stranded portions at the ends These over hanging stretches are called sticky ends on each strand.They form hydrogen bonds with the complementary cut counterparts, facilitates the action of ligase enzymes to join the foreign and the vector DNA strands = ½ × 4

[½ × 4 = 2 Marks]

11. How did Eli Lilly synthesise the human insulin ? Mention one difference between this insulin and the one produced by the human pancreas.

Ans Produce proinsulin chain A and chain B using separate DNA sequences introduced in the plasmids of *E.coli*, extracted, combined by disulphide bond –> mature insulin = ½ × 3

Insulin produced by human pancreas has additional C peptide = ½

[1½ + ½ = 2 Marks]

12. (i) Mention the number of primers required in each cycle of polymerase chain reaction (PCR). Write the role of primers and DNA polymerase in PCR.

(ii) Give the characteristic feature and source organism of the DNA polymerase used in PCR.

Ans (i) 2 sets of primers, DNA polymerisation / extends the primers using the nucleotides = ½ + ½

(ii) Thermostable / remain active during high temperature induced denaturation of DNA,

Thermus aquaticus = ½ + ½

[1 + 1 = 2 Marks]

13. Differentiate between major structural changes in the human ovary during the follicular and luteal phase of the menstrual cycle.

Ans Follicular phase:Primary follicle matures to form Graafian follicle = 1

Luteal Phase : The ruptured Graafian follicle changes into corpus luteum =1

[1 + 1 = 2 Marks]

14. Name an opioid drug and its source plant. How does the drug affect the human body ?

Ans Heroin (smack) / morphine = ½

Poppy plant / *Papaver somniferum* =½

Binds with opioid receptors in CNS / gastro intestinal tract , and slows down the system / depressent = ½ + ½

[½ + ½ + 1 = 2 Marks]

15. Alien species are a threat to native species. Justify taking examples of an animal and a plant alien species.

Ans The Nile perch introduced in lake Victoria in East Africa led eventually to the extinction of more then 200 species of Cichlid fish in the lake / African cat fish (*Clarias gariepinus*) for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers = 1

Invasive weed species *Eicchornia* (water hyacinth) / *Parthenium* (carrot grass) / *Lantana* have posed, a threat to our native species = 1

[1 + 1 = 2 Marks]

16. Mention the role of ribosomes in peptide-bond formation. How does ATP facilitate it ?

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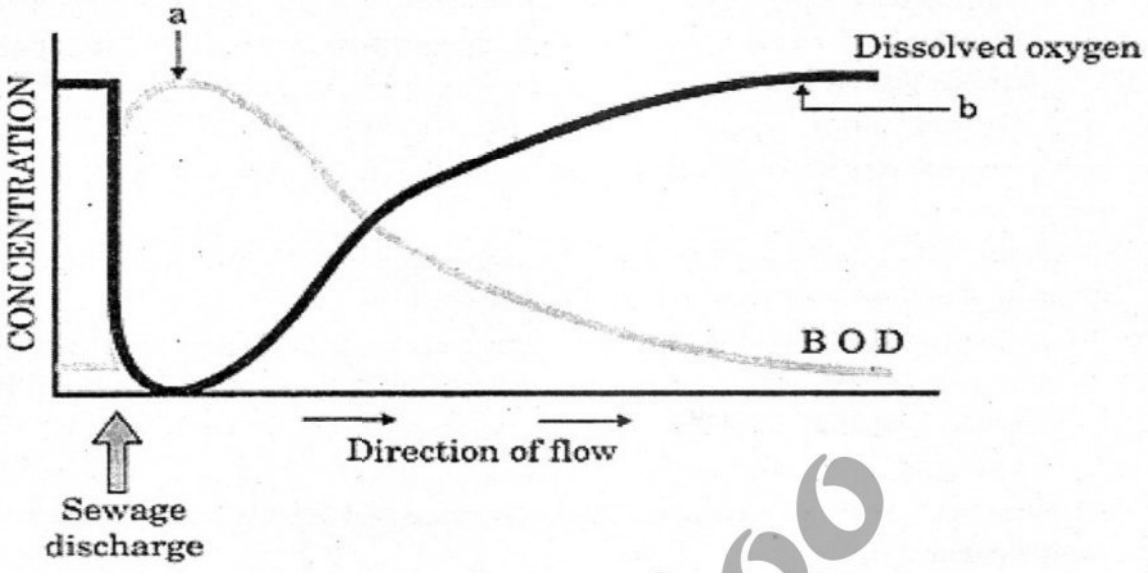
Ans Provides the sites for the binding of amino acid, acts as a catalyst (23S r RNA) for the formation of peptide bond,= ½ + ½

ATP provides the energy for the bond formation =1

[1 + 1 = 2 Marks]

17. Explain giving reasons the cause of appearance of peaks 'a' and 'b' in the graph shown below.



Effect of sewage discharge on some important characteristics of a river

Ans a - disappearance of clean water / polluted water leading to the death of fish = 1

b - reappearance of clean water organisms = 1

[1 + 1 = 2 Marks]

18. Explain the zygote intra fallopian transfer technique (ZIFT). How is intrauterine transfer technique (IUT) different from it ?

Ans ZIFT - When the zygote at 8 celled stage is transferred to the fallopian tube = 1

IUT - When the zygote at 8 celled stage is implanted in the uterus = 1

[1 + 1 = 2 Marks]

SECTION C

Q.Nos. 19 - 27 are of 3 marks each.

19. How do organisms like fungi, zooplanktons and bears overcome the temporary short-lived climatic stressful conditions ? Explain.

Ans Fungi - produce thick walled spores to survive unfavourable condition = 1

zooplanktons - diapause to suspend development = 1

bear – undergo hibernation in winter = 1

[1 + 1 + 1 = 3 Marks]

20. Explain the mechanism of sex determination in insects like *Drosophila* and grasshopper.

Ans In Drosophila sex is determined by the type of sperm, with X or with Y, fertilising the ovum with X , In grasshopper sex is determined by the type of sperm, with X or without sex chromosome, fertilising the ovum with X = ½ × 6

[It may be explained by showing a cross]

[½ × 6 = 3 Marks]

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21. (a) How does the Hardy - Weinberg's expression ($p^2 + 2pq + q^2 = 1$) indicate that genetic equilibrium is maintained in a population ?

(b) List any two factors that can disturb the genetic equilibrium.

Ans (a) Gene frequencies in a population are stable, constant from generation to generation, until some change in frequency happens, due to some factor = ½ × 4

(b) gene migration / gene flow / gene drift / mutation / genetic recombination / natural selection **(Any two)** = ½ × 2

[2 + 1 = 3 Marks]

22. (i) Mention the property that enables the explants to regenerate into a new plant.

(ii) A banana herb is virus-infected. Describe the method that will help in obtaining healthy banana plants from this diseased plant.

Ans (i) Totipotency = 1

(ii) Extract the disease free meristem, in vitro culture to get virus free plants = 1 + 1

[1 + 2 = 3 Marks]

23. In a series of experiments with *Streptococcus* and mice F. Griffith concluded that R-strain bacteria had been transformed. Explain.

Ans S strain bacteria when injected - mice die ; R - mice live; heat killed S - mice live; heat killed S + live R - mice die ; recovered living S from dead mice; R strain bacteria had been transformed to S strain by the genetic material of heat killed S strain = ½ × 6

[½ × 6 = 3 Mark]

24. Mention the name of the causal organism, symptoms and the mode of transmission of the disease Amoebiasis.

Ans *Entamoeba histolytica* = 1

Constipation / abdominal pain / cramps / mucous stool / stool with blood clot **(Any two)** = ½ + ½

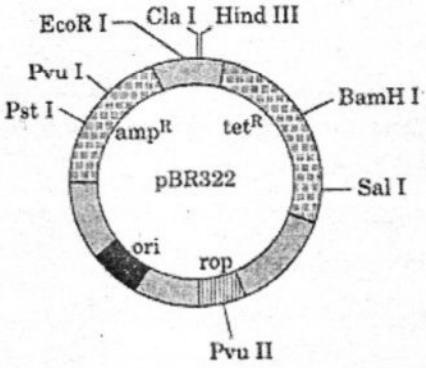
Houseflies carrier from faeces to person via food products / contaminated water = 1

[1 + 1 + 1 = 3 Marks]

25. (i) Name the organism in which the vector shown is inserted to get the copies of the desired gene.

(ii) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.

(iii) Name and explain the role of a selectable marker in the vector shown.



OR

Name the insect pest that is killed by the products of *cry* I*Ac* gene. Explain how the gene makes the plant resistant to the insect pest.

Ans (i) *Escherichia coli* / *E.coli* = 1

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(ii) ori = 1

(iii) amp^R is the marker gene that helps in identification and elimination of the non transformant growing in ampicillin medium / selectively permitting the growth of the transformant resistant to ampicillin =1

// tet^R is the marker gene that helps in identification and elimination of the non transformant growing in tetracycline medium / selectively permitting the growth of the transformant resistant to tetracyline =1

[1 + 1 + 1 = 3 Marks]

OR

Meloidegyne incognitia = 1

The gene (cry IAc) produces crystals of insecticidal protein which is inactive protoxin, when the bollworm eats the protoxin the alkaline pH of the gut activates it , activated protoxin binds to the midgut epithelial cells , creates pores / causes swelling / causes lysis / kills the worm = ½ × 4

[1 + 2 = 3 Marks]

26. Mention the product and its use produced by each of the microbes listed below :

(i) *Streptococcus*

(ii) *Lactobacillus*

(iii) *Saccharomyces cerevisiae*

Ans (i) Streptokinase, clotbuster / dissolves clot from blood vessels = ½ + ½

(ii) Lactic acid , coagulates milk/partial digestion of milk proteins = ½ + ½

(iii) Ethyl alcohol+CO_2, ferments dough to make bread / idli = ½ + ½

[1 + 1 + 1 = 3 Marks]

27. (a) Mention any four strategies adopted by flowering plants to prevent self-pollination.

(b) Why is geitonogamy also referred to as genetical autogamy ?

Ans (a) Pollen release and stigma receptivity are at different times = ½

Anther and stigma are placed at different positions = ½

Self incompatibility / prevents pollen from fertilising the ovule of the same plant = ½

Production of unisexual flowers = ½

(b) Pollen grains come from the same plant = 1

[2 + 1 = 3 Marks]

SECTION D

Q.Nos. 28 - 30 are of 5 marks each.

28. (a) Why are herbivores considered similar to predators in the ecological context ? Explain.

(b) Differentiate between the following interspecific interactions in a population :

(i) Mutualism and Competition

(ii) Commensalism and Amensalism

OR

(a) Trace the succession of plants on a dry bare rock.

(b) How does phosphorus cycle differ from carbon cycle ?

Ans (a) Transfer of energy fixed by plants to the next trophic level - carnivores,

Maintain the plant population under control = ½ + ½

(b) (i) In mutualism both the species benefit =1

In competition - survival of both challenged / struggle for existence = 1

(ii) Commensalism – One is benefitted. The other is neither benefitted nor harmed =1

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Amensalism – One is harmed and the other is unaffected = 1

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[1 + 4 = 5 Marks]

OR

(a) Primary succession - lichens , secrete acids to cause weathering of rock and soil formation ,
Small plants like bryophytes , to hold the soil ,
Herbs , scrubs , shrubs succeed in existence ,
Trees, forest , climax community = ½ × 8

(b) – No respiratory release of phosphorus unlike CO_2 in carbon cycle / No gaseous exchange
– Inputs of phosphorus through rainfall is less than carbon input = ½ + ½

[4 + 1 = 5 Marks]

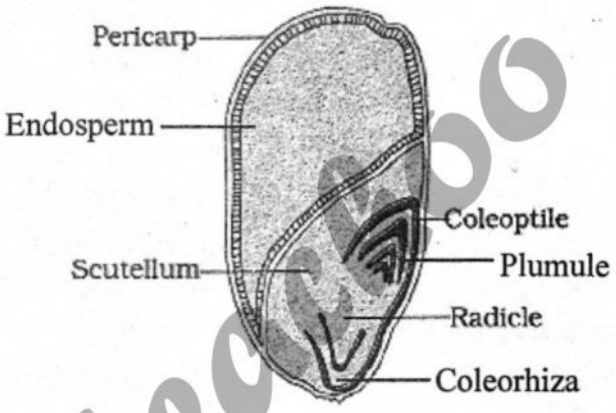
29. (a) Draw a labelled longisectional view of an albuminous 'seed'.

(b) How are seeds advantageous to flowering plants ?

OR

Describe the post-zygotic events leading to implantation and placenta formation in humans. Mention any two functions of placenta.

Ans (a) Maize seed / castor seed / onion seed **(Any one figure)**



(Any three labelling) = 1 × 3

(b)
- Better adaptive strategies for dispersal to new habitats
- They have food reserves for the seedling or embryo
- The seed coat provides protection to the embryo
- Generate genetic variation
- Remain viable for a considerable period of time

(Any two) = 1 × 2

[3 + 2 = 5 Marks]

OR

Zygote moves through oviduct and cleavage begins, forms blastomeres , at 8-16 cell stage embryo is called morula , mitosis continues and embryo moves to uterus , blastomeres form outer layer called trophoblast, the rest of the cells form inner mass of cells , at blastocyst stage embryo gets implanted , trophoblast puts forth chorionic villi which finally along with uterine tissue forms placenta = ½ × 8

Functions of Placenta :

- Supplies O_2 and nutrients to the embryo
- Removes CO_2 and excretory waste

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- Endocrinal function producing human chorionic gonadotropin (hCG) / human placental lactogen (hPL) / estrogen / progestogens
  (Any two) = ½ × 2

[4 + 1 = 5 Marks]

30. (a) State the law of independent assortment.

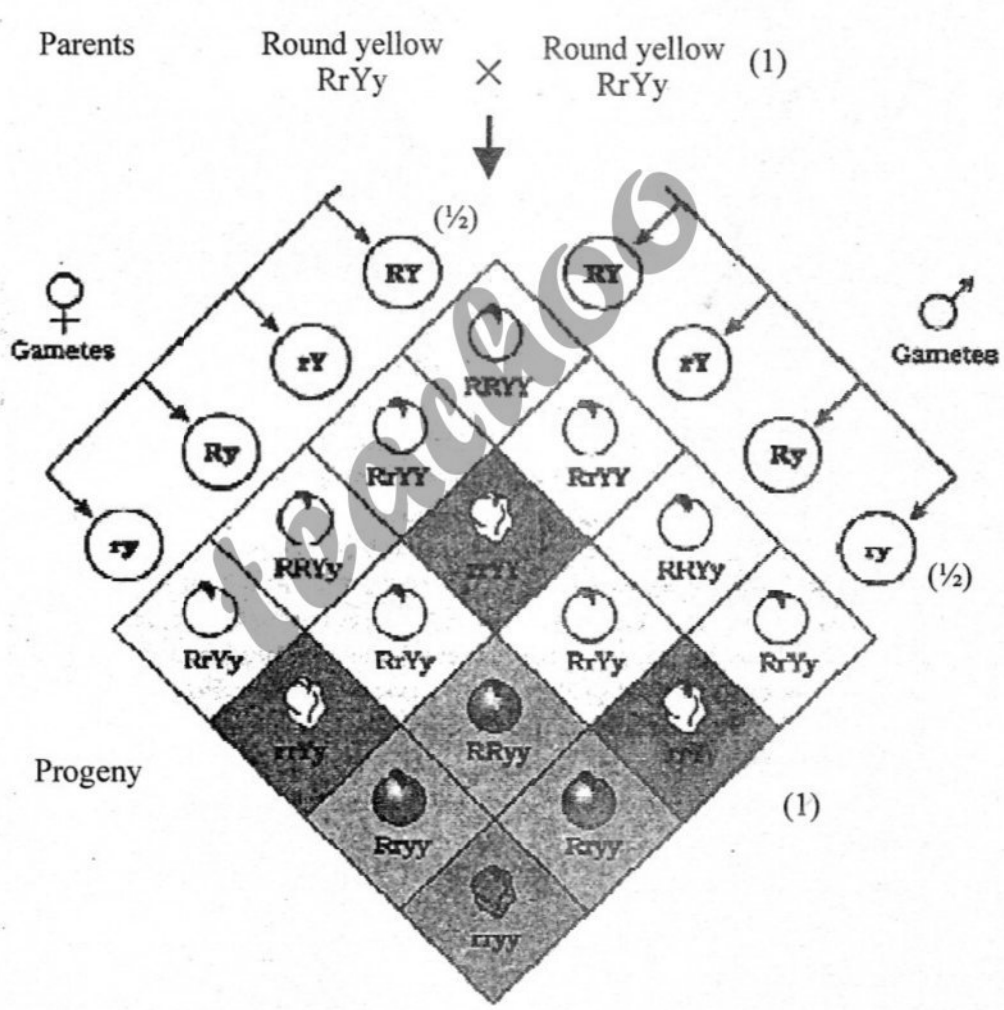
(b) Using Punnett Square demonstrate the law of independent assortment in a dihybrid cross involving two heterozygous parents.

OR

How did Alfred Hershey and Martha Chase arrive at the conclusion that DNA is the genetic material ?

Ans (a) 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)



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these were allowed to infect *E. coli,* medium was agitated in a blender viral coats and the bacterial cells with viral particles where separated by spinning them in a centrifuge, in this case no radioactivity in the supernatant as the protein coats do not incorporate ^{32}P , but the viral DNA had ^{32}P and passed to it to the bacterial cell , so radioactivity was detected in the cells, proves that DNA is the hereditary material. They repeated the procedure with radioactive sulphur ^{35}S , in this case no radioactivity was detected in the bacterial cell as S is not incorporated in DNA, while radioactivity was detected in the supernatant with protein coats of viruses $= ½ \times 10$

[$½ \times 10 = 5$ Marks]

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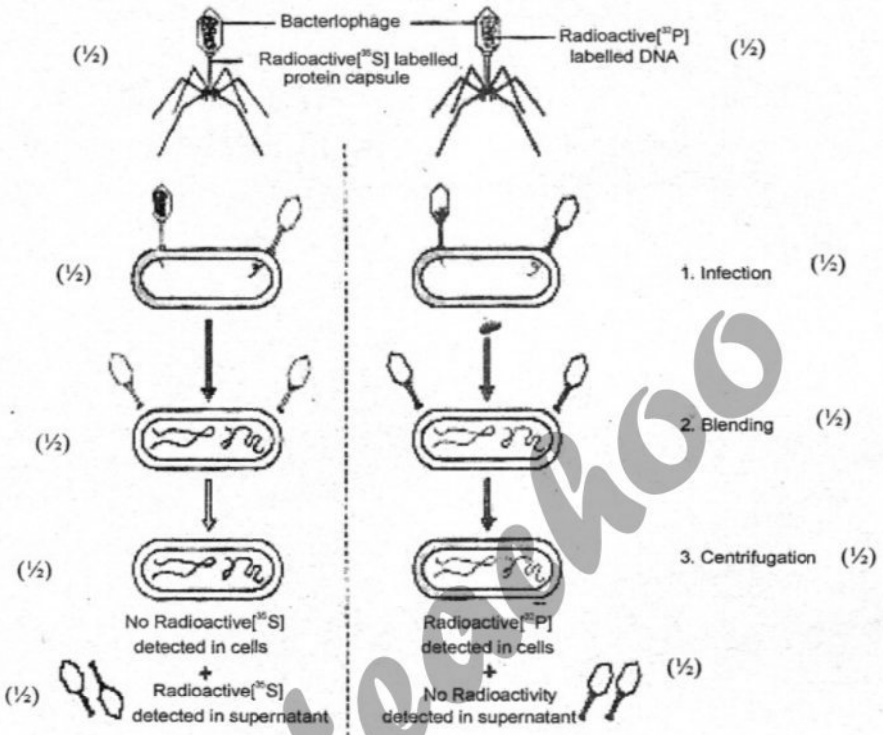

[$½ \times 10 = 5$ Marks]

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