2015

List of Participants

S.No.	Name of Participants	Coordinator/Expert	Office	Residence
1.	Mrs. Rachna Gupta Vice Principal Delhi Public School Sec. C, Pocket 5, Vasant Kunj	Coordinator		9811345797
2.	Mr. Y.P. Purang Retd. ADE- C-2/113, Janak Puri New Delhi-110058	Subject-Expert		9810529809
3.	MS. RITA TALWAR 54, Khan Market New Delhi - 110 003	Subject-Expert Retd. Principal		9810443125
4.	MRS. SHIVANI GOSWAMI 563, Golf Vista Apptt. Sector Alpha-II, Greater Noida Gautam Budh Nagar, U.P.-201 308	Subject Expert		9958477758
5.	MS. SHIPRA SARCAR Principal Air Force Golden Jublee Institute Subroto Park, New Delhi	Expert	011-25694353	9958456081
6.	MS. RIMA DEY B-905, Plot B9/1B Sharmdeep Aptts, Sec. - 62 Noida (UP)	Expert		9891120671
7.	MRS. SUSHIL MALHOTRA D-46B/13B 1ST Floor, Single Storey Vijay Nagar Delhi -09	Expert		9711032234
8.	MR. VIRENDRA SRIVASTAVA B - 3B/95 B, Janakpuri New Delhi- 110058	Subject Expert		9810377435
9.	MRS. NEETA RASTOGI Principal Sadhu Vaswani Intl. School for Girls 2nd Street, Shanti Niketan New Delhi-110021	Representative Delhi		9811778593
10.	MS. Poonam. Khurana DAV Model School, Sector - 15A Chandigarh	Panchkula		09876421755
11.	DR. Manoj Kumar Das Principal Jawahar Navidaya Vidyalaya Konark, Puri Odisha-752111	Bhubaneshwar		9437429291
12.	SH. R SANKAR Principal Kendriya Vidyalaya No. 2, Uppal Hyderabad, Telangana -500039	Chennai		040-27202031 9491073600

13	SH. VALSALA NAIR Principal Kendriya Vidyalaya SAP Camp, Peroorkada, Trivandrum, Kerala -695005	Thiruvananthapuram		09496388999
14.	MRS. TOOLIKA GOEL Vice Principal Silver Bells Public School Shamli (UP) - 247776	Shamli		98737050093
15.	MRS. RAJNI YADAV Mayoor School Alwar-Gate Ajmer	Ajmer		09001967576
16.	MR. RANVEER SINGH D.O.E. GSBV Timarpur Delhi			9891069977
17.	Mr. R P Singh D.O.E. GSBV Ranapratab Bagh Delhi			9990081661
18.	MRS. ANURADHA RAY HOD DPS Vasant Kunj New Delhi-110070	Delhi	011-43261200	9899707132 011-25096658

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25.03.2015

Senior School Certificate Examination

March 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 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.

Question Paper Code 57/1/1

SECTION – A

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

1. A geneticist interested in studying variations and patterns of inheritance in living beings prefers to choose organisms for experiments with shorter life cycle. Provide a reason.

Ans. Many generations can be obtained (in a short time)

// variations can be exhibited / selected faster

[1 Mark]

2. Name the transcriptionally active region of chromatin in a nucleus.

Ans. Euchromatin / Exon

[1 Mark]

3. State a reason for the increased population of dark coloured moths coinciding with the loss of lichens (on tree barks) during industrialization period in England.

Ans. Natural selection / survival of fittest / escaped predators due to camouflage

[1 Mark]

4. Indiscriminate diagnostic practices using X-rays etc., should be avoided. Give one reason.

Ans. (Act as) Carcinogen / (harmful) mutation / chromosomal aberration / damage to DNA / normal cells converted to neoplastic

[1 Mark]

5. What is Biopiracy ?

Ans. Illegal / non-authorized / non-compensated use of bioresources by organisations (MNC)

[1 Mark]

SECTION-B

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

6. After a brief medical examination a healthy couple came to know that both of them are unable to produce functional gametes and should look for an 'ART' (Assisted Reproductive Technique). Name the 'ART' and the procedure involved that you can suggest to them to help them bear a child.

Ans. Test tube baby programme = ½

Collection of ova and sperm from donor = ½

(Corresponding procedure correctly explained)= ½ + ½

Explanation:

IVF - Fertilisation outside the body in almost similar conditions as that in the body

ICSI - Sperm is directly injected into the ovum

ET - Embryo is transferred into reproductive tract / uterus

ZIFT - Zygote or early embryos (upto eight blastomeres) transferred into fallopian tube

IUT - Early embryos (with more than eight blastomeres) transferred into uterus

[2 Marks]

7. Differentiate between male and female heterogamety.

Ans.

	Male heterogamety	Female heterogamety
(i)	Male produces two types of gametes (while female produces only one type of gamete)	Female produces two types of gametes (while male produces only one type of gamete) = 1
(ii)	XY / XO type // two types of heterogamety	ZW type // one type of heterogamety = 1

[2 Marks]

8. How has mutation breeding helped in improving the production of mung bean crop ?

Ans. Produce disease resistant varieties , against yellow mosaic virus / powdery mildew = 1 + 1

[2 Marks]

9. Mention a product of human welfare obtained with the help of each one of the following microbes:

(a) LAB

(b) Saccharomyces cerevisiae

(c) Propionibacterium sharmanii

(d) Aspergillus niger.

Ans. a) Milk to curd = ½

b) Bread / ethanol / alcoholic drinks / whiskey / brandy / beer / rum = ½

c) Swiss cheese = ½

d) Citric acid = ½

[½ × 4 =2 Marks]

10. Many fresh water animals can not survive in marine environment. Explain.

Ans. High salt concentration outside / hypertonic surroundings = 1

Loss of water from body / exosmosis from animal body / animal suffers osmotic problems = 1

[2 Marks]

OR

How are productivity, gross productivity, net primary productivity and secondary productivity interrelated ?

Ans. Productivity is rate of biomass production = ½

GPP - R = NPP = 1

NPP - is biomass available to consumers for secondary productivity = ½

[½ + 1 +½ = 2 Marks]

SECTION - C

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

11. Double fertilization is reported in plants of both, castor and groundnut. However, the mature seeds of groundnut are non-albuminous and castor are albuminous. Explain the post fertilization events that are responsible for it.

Ans. Development of endosperm (preceding the embryo) takes place in both ,

developing embryo derives nutrition from endosperm = ½ + ½

Endosperm is retained / persists / not fully consumed in castor , endosperm is consumed in groundnut = 1 + 1

[3 Marks]

12. Describe the process of Parturition in humans.

Ans. - Signals originate from the fully developed foetus and placenta ,
- Induce mild uterine contractions (foetal ejection reflex) ,
- Triggers release of oxytocin (from maternal pituitary) ,
- Oxytocin acts on uterine muscles and cause stronger uterine contractions ,
- Stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contraction
- Expel the baby from the uterus = ½ × 6

[3 Marks]

13. A teacher wants his/her students to find the genotype of pea plants bearing purple coloured flowers in their school garden. Name and explain the cross that will make it possible.

Ans. Test cross = 1

Purple flower to be crossed with white (homozygous recessive) flower = 1

If all flowers of F_1 are purple then genotype is homozygous dominant / PP = ½

If 50% are purple and 50% are white then genotype is heterozygous dominant / Pp = ½

// (same thing can be shown with the help of crosses)

[3 Marks]

14. (a) A DNA segment has a total of 1000 nucleotides, out of which 240 of them are adenine containing nucleotides. How many pyrimidine bases this DNA segment possesses ?

(b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer.

Ans. (a) Pyrimidine = 500 , = ½

(i) Calculation

A = T , A = 240 hence T = 240

A + T = 240 + 240 = 480

so G + C = 1000 - 480 = 520

G = C , so $C = \frac{520}{2} = 260$

so pyrimidines = C + T

= 260 + 240 = 500

(ii) Purine A and G always pair with T and C respectively

(iii) $\frac{A}{G} = \frac{T}{C} = 1$ (Chargaff rule)

= ½

(b)

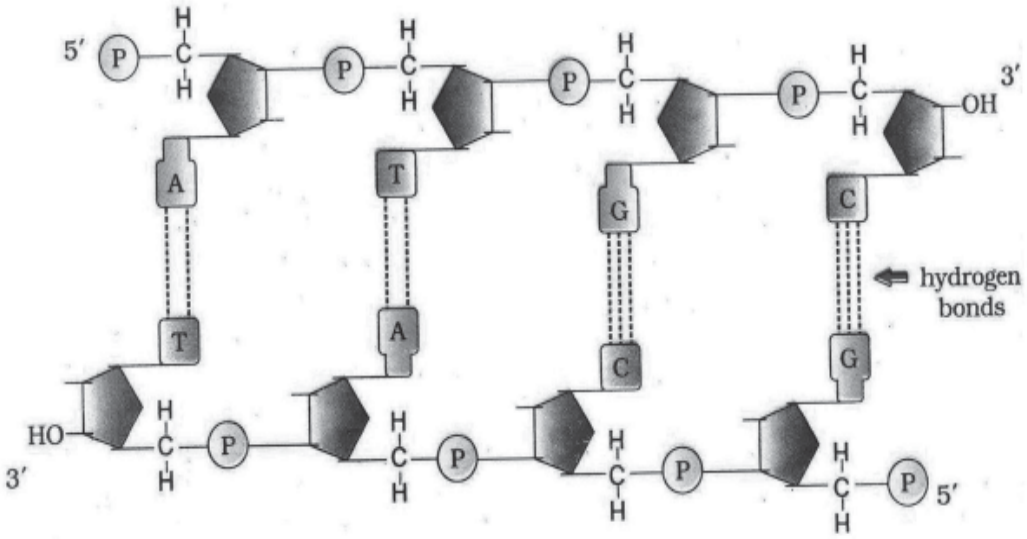


Diagram showing polarity = ½

A-T = ½

G-C= ½

H-bond = ½

[1 + 2 = 3 Marks]

15. Explain adaptive radiation with the help of a suitable example.

Ans. Evolution of different species in a given geographical area starting from a point and literally radiating

to other geographical areas / habitat is called adaptive radiation = 1

A number of marsupials each different from other / Tasmanian wolf / Tiger Cat / Banded anteater / Marsupial rat / Kangaroo/ Wombat / Bandicoot / Koala / Marsupial mole / Sugar glider (any two or more) , evolved from an ancestral stock , but all within Australian continent = 1 + ½ + ½ = 2

// Darwin's finches , from original seed eating features many other forms with altered beaks arose , enabling them to become insectivorous / vegetarian finches on the same (Galapagos) islands = 1 + ½ + ½ = 2

[1 + 2 = 3 Marks]

16. A team of students are preparing to participate in the interschool sports meet. During a practice session you find some vials with labels of certain cannabinoids.

(a) Will you report to the authorities ? Why ?

(b) Name a plant from which such chemicals are obtained.

(c) Write the effect of these chemicals on human body.

Ans. (a) Yes = ½

May be abused by sports person = ½

(b) *Cannabis (sativa)* /any other relevant plant = 1

(c) Effects cardiovascular system of the body = 1

[1+ 1 + 1 = 3 Marks]

17. Enlist the steps involved in inbreeding of cattle. Suggest two disadvantages of this practice.

Ans. Inbreeding involves mating of closely related individuals within the same breed for 4-6 generations = ½

Superior males and superior females are identified and mated in pairs , the progeny are evaluated , superior males and females among them are selected for further mating = ½ × 3

Disadvantages : Inbreeding depression , reduction in fertility , reduction in productivity (any two) = ½ × 2

[3 Marks]

18. Choose any three microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen.

Mycorrhiza ; Monascus ; Anabaena ; Rhizobium ; Methanobacterium ; Trichoderma.

Ans. Mycorrhiza : (Fungal symbiont of the association) Abosrb phosphorus from soil

Anabaena : Fix atmospheric nitrogen / Adds organic matter to the soil

Rhizobium : Fix atmospheric nitrogen (in leguminous plants)

Methanobacterium : They digest cellulosic material and the product / spent slurry can be used as fertiliser

Trichoderma : Biocontrol agent for several plant pathogens

(Any 3 microbes = ½ × 3 = 1½)

(Any 3 corresponding roles = ½ × 3 = 1½)

[3 Marks]

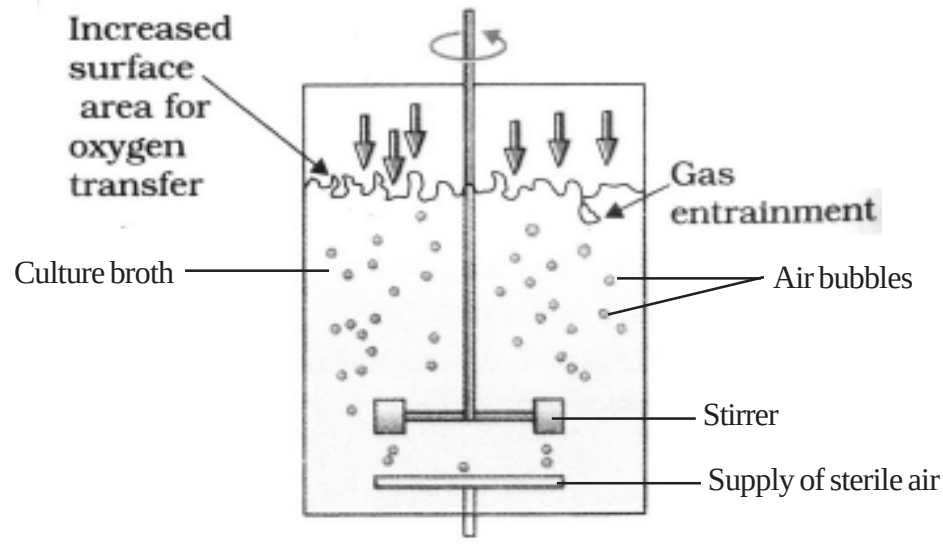
19. Recombinant DNA-technology is of great importance in the field of medicine. With the help of a flow chart, show how this technology has been used in preparing genetically engineered human insulins.

Ans. Insulin consists of two (short) polypeptide chains (A and B) , linked by disulphide bonds , two DNA sequences corresponding to chain A and B prepared (by Eli Lily company) , introduced them into plasmids of E. coli , chain A and B produced separately , extracted and combined by creating disulphide bonds = ½ × 6

[3 Marks]

20. Draw a labelled sketch of sparged-stirred-tank bioreactor. Write its application.

Ans.



Correct diagram = 1

Any two correct labellings = ½ + ½

Application = Produces larger biomass leading to higher yields of desired protein / recombinant protein / processing large volume of culture / conversion of raw materials into specific product biologically = 1

[3 Marks]

21. Following the collision of two trains a large number of passengers are killed. A majority of them are beyond recognition. Authorities want to hand over the dead to their relatives. Name a modern scientific method and write the procedure that would help in the identification of kinship.

Ans. DNA fingerprinting (analysis) = ½

- Isolation and digestion of DNA by restriction endonuclease
- Separation of DNA fragments by electrophoresis and transferring them to synthetic membranes / nitrocellulose / nylon
- Hybridisation using labelled VNTR probe
- Detection of hybridised DNA fragments by autoradiography
- Matching banding pattern of DNA / DNA fingerprints / autoradiograms of the passengers killed and that of relatives = ½ × 5

[3 Marks]

22. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans. As a biology student what method would you suggest along with its advantages that can protect such threatened species from getting extinct ?

Ans. Ex-situ conservation = 1

Threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care = 1

Botanical garden / tissue culture / micro propagation / seed bank = ½

Zoological park / wild life safari park / cryopreservation = ½

[3 Marks]

OR

"Determination of Biological Oxygen Demand (BOD) can help in suggesting the quality of a water body." Explain.

Ans. High BOD of a water body indicates more number of micro-organisms in water , resulting in bad quality of water / death of aquatic creatures , more polluting potential = 1 × 3

// Lower BOD of water body indicates less number of micro-organisms in water , good quality of water / aquatic life flourishes , less polluting potential = 1 × 3

[3 Marks]

SECTION-D

Q. Nos. 23 is of four marks

23. Since October 02, 2014 "Swachh Bharat Abhiyan" has been launched in our country.

(a) Write your views on this initiative giving justification.

(b) As a biologist name <u>two</u> problems that you may face while implementing the programme in your locality.

(c) Suggest <u>two</u> remedial methods to overcome these problems.

Ans. (a) Value point conveying importance of clean environment / surrounding = 1

(b) Social attitude / co-ordination / financial issues / disposal of collected garbage / separation of biodegradable and non-degradable waste / lack of awareness / any other relevant problem (Any two) = 1 + 1

(c) Campaigning / creating awareness / organising competitions / giving incentives / provision of imposing penalty / complaining to appropriate authority / publicity through mass media / using masks or gloves for separation and disposal of various categoriers of garbage or any other relevant point (Any two) = ½ + ½

[1 + 2 + 1 = 4 Marks]

SECTION - E

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

24. A flower of tomato plant following the process of sexual reproduction produces 240 viable seeds.

Answer the following questions giving reasons :

(a) What is the minimum number of pollen grains that must have been involved in the pollination of its pistil ?

(b) What would have been the minimum number of ovules present in the ovary ?

(c) How many megaspore mother cells were involved ?

(d) What is the minimum number of microspore mother cells involved in the above case ?

(e) How many male gametes were involved in this case ?

Ans. (a) 240 , one pollen grain participates in fertilisation of one ovule = ½ + ½

(b) 240 , one ovule after fertilisation forms one seed = ½ + ½

(c) 240 , each MMC forms four megaspores out of which only one remain functional = ½ + ½

(d) 60 , each microspore mother cell meiotically divides to form four pollen grains (240/4 = 60) = ½ + ½

(e) 480 , each pollen grain carries two male gametes (which participate in double fertilisation) (240 × 2 = 480) = ½ + ½

[1 × 5 = 5 Marks]

OR

During the reproductive cycle of a human female, when, where and how does a placenta develop? What is the function of placenta during pregnancy and embryo development ?

Ans. After implantation , uterus , chorionic villi and uterine tissue become interdigitated (physically fused) = 1 + 1 + 1

Placenta facilitates supply of oxygen / nutrients to the embryo = ½

Removal of carbon dioxide / waste material / excretory material produced by the embryo = ½

Production of hCG / hPL / estrogens / progestogens (Any two) = ½ × 2

[3 + 2 = 5 Marks]

25. Explain the genetic basis of blood grouping in human population.

Ans. (i) Blood group in human population determined by gene ' I ' , which has three allele I^A and I^B and i (multiple allelism) =½ + ½

(ii) I^A I^B are dominant allele (codominance) each forming different type of sugar polymer on the surface of RBC , while allele ' i ' is recessive and does not produce any sugar = ½ + ½

I^A I^A , I^A i	—	A group = ½
I^B I^B , I^B i	—	B group = ½
I^A I^B	——	AB group = ½
ii	—	O group = ½

(iii) Since humans are diploid / each person possesses any two of three ' I ' gene alleles , resulting into six different genotypic combination and four phenotypic expression = ½ + ½

[5 Marks]

OR

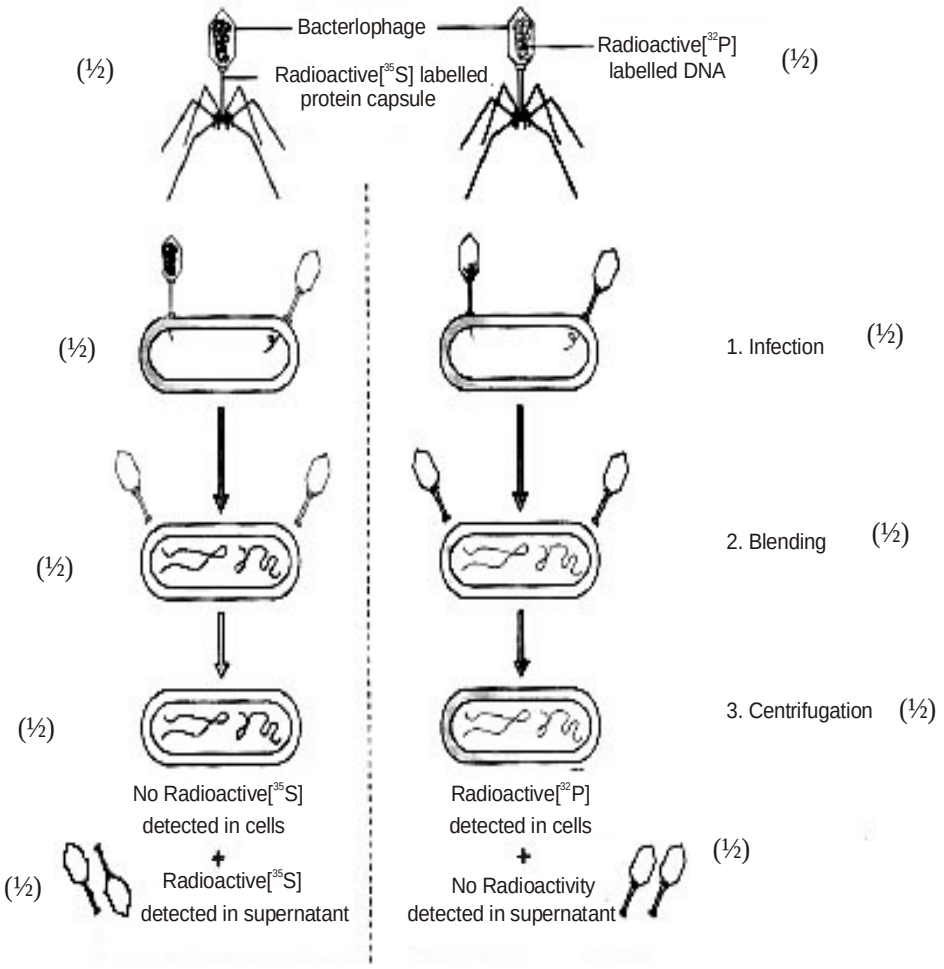
How did Hershey and Chase established that DNA is transferred from virus to bacteria ?

Ans.
- Some bacteriophage were grown in a medium that contained ^{32}P / radioactive phosphorus , while some were grown in a medium that contained ^{35}S / radioactive sulphur = ½ × 2
- the labelled bacteriophage from both media were allowed to infect E. coli = 1
- In both the cases viral coats were removed from the bacteria by agitating them in a blender = 1
- The virus particles were separated from the bacteria by spinning them in a centrifuge = 1
- No radioactivity was detected in cells (E. coli) but detected in supernatant in case where bacteriophage were labelled with radioactive sulphur = ½
- Radioactivity detected in cells (E. coli) while no radioactivity detected in supernatant in another case where bacteriophage were labelled with radioactive phosphorus = ½

(Phosphorus being a constituent of DNA indicates that DNA is the genetic material that is passed from virus to bacteria)

[5 Marks]

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



[½ × 10 = 5 Marks]

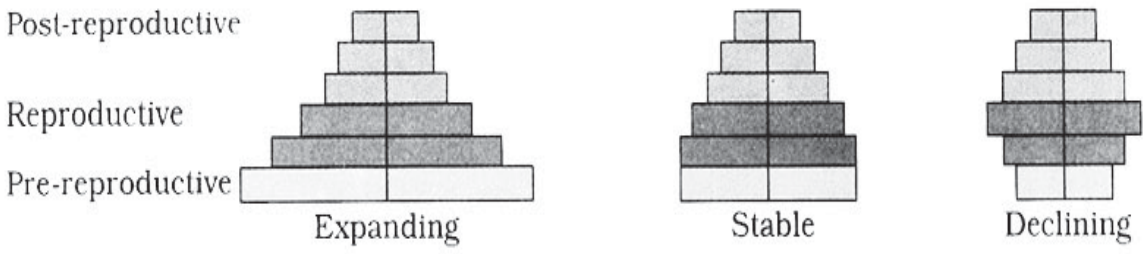
26. "Analysis of age-pyramids for human population can provide important inputs for long-term planning strategies." Explain.

Ans. Age pyramids show age distribution of males and females in a combined diagram = 1

The shape of the pyramid reflects the growth status of the population whether it is growing or stable or declining = 1

Pyramids also indicate the ratio of pre-reproductive , reproductive and post reproductive individuals in a population =1

//



= 1 = 1 = 1

Planing 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 with proper explanation) = 1 + 1

[5 Marks]

OR

Describe the advantages for keeping the ecosystems healthy.

Ans. (i) Purify air / purify water

(ii) Mitigates drought / mitigates flood

(iii) Cycle nutrients

(iv) Generate fertile soil

(v) Provide wildlife habitat

(vi) Maintain biodiversity

(vii) Pollinate crop

(viii) Provide storage site for carbon

(ix) Provide aesthetic value / provide cultural value / provide spiritual value

(x) Provide stable food chain

(xi) Provide economically useful forest produces

(xii) Provide sustainable biological legacy to future generations

(Description of any five advantages) = 1 × 5

[5 Marks]

Question Paper Code 57/1/2

SECTION – A

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

l. What is Biopiracy ?

Ans. Illegal / non-authorized / non-compensated use of bioresources by organisations (MNC)

[1 Mark]

2. State a reason for the increased population of dark coloured moths coinciding with the loss of lichens (on tree barks) during industrialization period in England.

Ans. Natural selection / survival of fittest / escaped predators due to camouflage

[1 Mark]

3. Indiscriminate diagnostic practices using X-rays etc., should be avoided. Give one reason.

Ans. (Act as) Carcinogen / (harmful) mutation / chromosomal aberration / damage to DNA / normal cells converted to neoplastic

[1 Mark]

4. Name the transcriptionally active region of chromatin in a nucleus.

Ans. Euchromatin / Exon

[1 Mark]

5. A geneticist interested in studying variations and patterns of inheritance in living beings prefers to choose organisms for experiments with shorter life cycle. Provide a reason.

Ans. Many generations can be obtained (in a short time)

// variations can be exhibited / selected faster

[1 Mark]

SECTION-B

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

6. Many fresh water animals can not survive in marine environment. Explain.

Ans. High salt concentration outside / hypertonic surroundings = 1

Loss of water from body / exosmosis from animal body / animal suffers osmotic problems = 1

[2 Marks]

OR

How are productivity, gross productivity, net primary productivity and secondary productivity interrelated ?

Ans. Productivity is rate of biomass production = ½

GPP - R = NPP = 1

NPP - biomass available to consumers for secondary productivity = ½

[½ + 1 +½ = 2 Marks]

7. Name any two common Indian millet crops. State one characteristic of millets that has been improved as a result of hybrid breeding so as to produce high yielding millet crops.

Ans. Maize , jowar , bajra (Any two) = ½ + ½

Resistant to water stress = 1

[2 Marks]

8. Mention a product of human welfare obtained with the help of each one of the following microbes:

(a) LAB

(b) Saccharomyces cerevisiae

(c) Propionibacterium sharmanii

(d) Aspergillus niger

Ans. a) Milk to curd = ½

b) Bread / ethanol / alcoholic drinks / whiskey / brandy / beer / rum = ½

c) Swiss cheese = ½

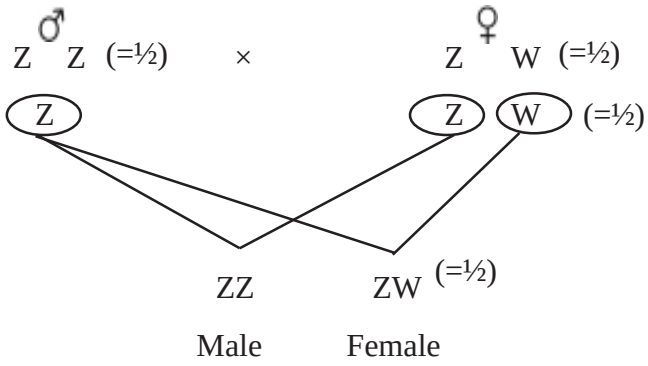
d) Citric acid = ½

[½ × 4 =2 Marks]

9. Explain mechanism of sex-determination in birds.

Ans. Females have one Z sex chromosome and one W sex chromosome , males have a pair of Z sex chromosome , if Z sperm fertilises Z ovum a male offspring is produced , if Z sperm fertilises W ovum a female offspring is produced = ½ × 4

//



[2 Marks]

10. After a brief medical examination a healthy couple came to know that both of them are

unable to produce functional gametes and should look for an 'ART' (Assisted Reproductive Technique). Name the 'ART' and the procedure involved that you can suggest to them to help them bear a child.

Ans. Test tube baby programme = ½

Collection of ova and sperm from donor = ½

(Corresponding procedure correctly explained)= ½ + ½

Explanation:

IVF - Fertilisation outside the body in almost similar conditions as that in the body

ICSI - Sperm is directly injected into the ovum

ET - Embryo is transferred into reproductive tract / uterus

ZIFT - Zygote or early embryos (upto eight blastomeres) transferred into fallopian tube

IUT - Early embryos (with more than eight blastomeres) transferred into uterus

[2 Marks]

SECTION - C

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

11. What is adaptive radiation ? When can adaptive radiation be referred to as convergent evolution ? Give an example.

Ans. Adaptive Radiation - The process of evolution of different species in a given geographical area starting from a point and literally radiating to other geographical areas (habitats) , = 1

When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats) , then this can referred to as convergent evolution = 1

Example :	Placental mammals	Australian marsupials
	Wolf	Tasmanian wolf
	Mole	Marsupial mole
	Anteater	Numbat (anteater)
	Mouse	Marsupial mouse
	Lemur	Spotted cuscus
	Flying squirrel	Flying phalanger
	Bobcat	Tasmanian tiger cat

Any one pair of example = 1

[3 Marks]

12. A teacher wants his/her students to find the genotype of pea plants bearing purple coloured flowers in their school garden. Name and explain the cross that will make it possible.

Ans. Test cross = 1

Purple flower to be crossed with white (homozygous recessive) flower = 1

If all flowers of F_1 are purple then genotype is homozygous dominant / PP = ½

If 50% are purple and 50% are white then genotype is heterozygous dominant / Pp = ½

or (same thing can be shown with the help of crosses)

[3 Marks]

13. (a) A DNA segment has a total of 1,500 nucleotides, out of which 410 are Guanine containing nucleotides. How many pyrimidine bases this segment possesses ?

(b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer.

Ans. (a) 750 = ½

(i) Calculation

G = C , G = 410 hence C = 410

G + C = 410 + 410 = 820

so A + T = 1500 - 820 = 680

$A = T$, so $T = \frac{680}{2} = 340$

so pyrimidines = C + T

= 410 + 340 = 750

(ii) Purine A and G always pair with T and C respectively

(iii) $\frac{A}{G} = \frac{T}{C} = 1$ (Chargaff rule) = ½

(b)

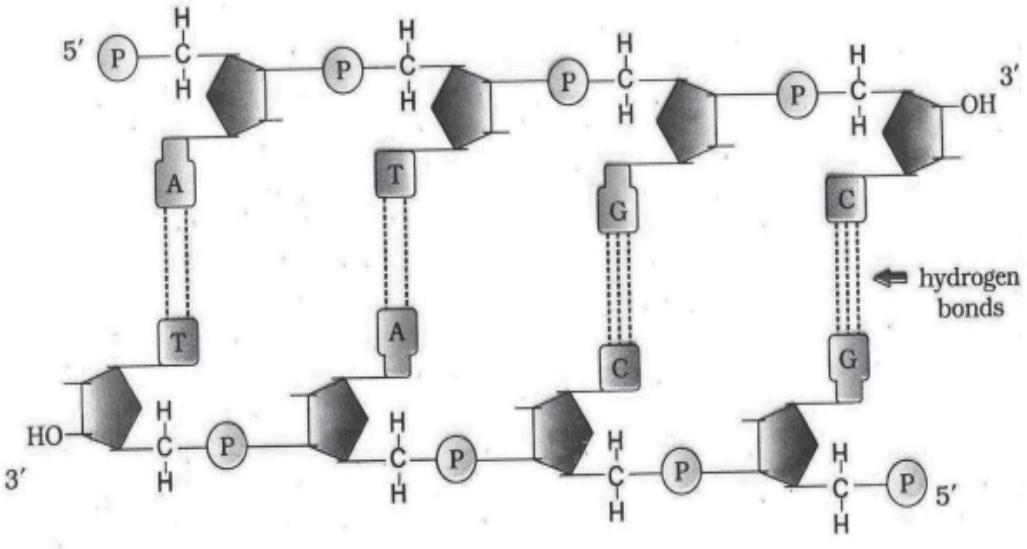


Diagram showing polarity = ½

A-T = ½

G-C= ½

H-bond = ½

[1 + 2 = 3 Marks]

14. Name the stage of human embryo at which it gets implanted. Explain the process of implantation.

Ans. Blastocyst = 1

The trophoblast layer of the blastocyst get attached to the endometrium and the inner cell mass gets differentiated as the embryo , after attachment the uterine cell , divide rapidly and covers the blastocyst , as a result the blastocyst become embedded in the endometrium of the uterus = ½ × 4 = 2

[3 Marks]

15. A non biology person is quite shocked to know that apple is a false fruit, mango is a true fruit and banana is a seedless fruit. As a biology student how would you satisfy this person ?

Ans. Apple - Thalamus (along with ovary) contribute to fruit = 1

Mango - Develops only from the ovary = 1

Banana - Develops from ovary but without fertlization / Parthenocarpy = 1

[3 Marks]

16. Enlist the steps involved in inbreeding of cattle. Suggest two disadvantages of this practice.

Ans. Inbreeding involves mating of closely related individuals within the same breed for 4-6 generations = ½

Superior males and superior females are identified and mated in pairs , the progeny are evaluated , superior males and females among them are selected for further mating = ½ × 3

Disadvantages : Inbreeding depression , reduction in fertility , reduction in productivity (any two) = ½ × 2

[3 Marks]

17. Choose any three microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen.

Mycorrhiza; Monascus; Anabaena; Rhizobium; Methanobacterium; Trichoderma.

Ans. Mycorrhiza : (Fungal symbiont of the association) Abosrb phosphorus from soil

Anabaena : Fix atmospheric nitrogen / Adds organic matter to the soil

Rhizobium : Fix atmospheric nitrogen (in leguminous plants)

Methanobacterium : They digest cellulosic material and the product / spent slurry can be used as fertiliser

Trichoderma : Biocontrol agent for several plant pathogens

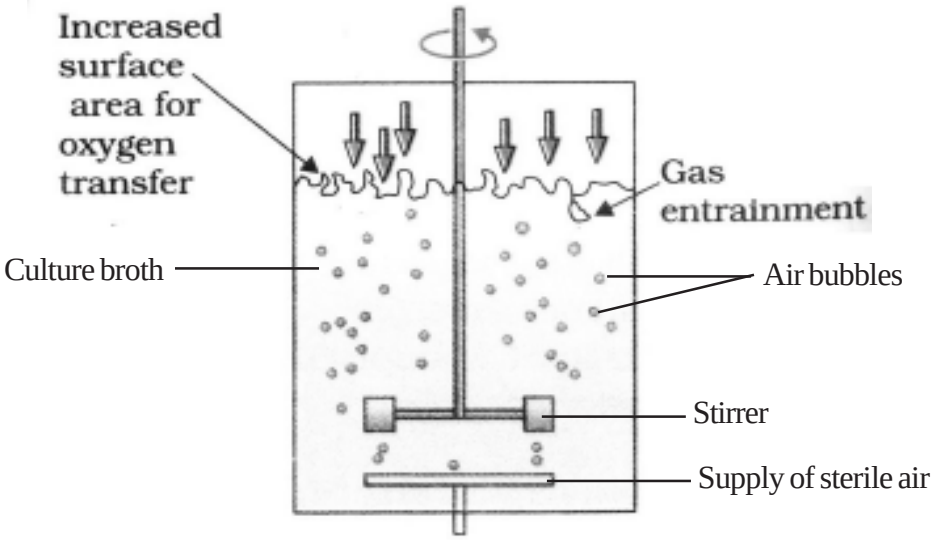
(Any 3 microbes = ½ × 3 = 1½)

(Any 3 corresponding roles = ½ × 3 = 1½)

[3 Marks]

18. Draw a labelled sketch of sparged-stirred-tank bioreactor. Write its application.

Ans.



Correct diagram = 1

Any two correct labellings = ½ + ½

Application = Produces larger biomass leading to higher yields of desired protein / recombinant protein / processing large volume of culture / conversion of raw materials into specific product biologically = 1

[3 Marks]

19. Following the collision of two trains a large number of passengers are killed. A majority of them are beyond recognition. Authorities want to hand over the dead to their relatives. Name a modern scientific method and write the procedure that would help in the identification of kinship.

Ans. DNA fingerprinting (analysis) = ½

- Isolation and digestion of DNA by restriction endonuclease
- Separation of DNA fragments by electrophoresis and transferring them to synthetic membranes / nitrocellulose / nylon
- Hybridisation using labelled VNTR probe
- Detection of hybridised DNA fragments by autoradiography
- Matching banding pattern of DNA / DNA fingerprints / autoradiograms of the passengers killed and that of relatives = ½ × 5

[3 Marks]

20. Recombinant DNA-technology is of great importance in the field of medicine. With the help of a flow chart, show how this technology has been used in preparing genetically engineered human insulins.

Ans. Insulin consists of two (short) polypeptide chains (A and B) , linked by disulphide bonds , two DNA sequences corresponding to chain A and B prepared (by Eli Lily company) , introduced them into plasmids of E. coli , chain A and B produced separately , extracted and combined by creating disulphide bonds = ½ × 6

[3 Marks]

21. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans. As a biology student what method would you suggest along with its advantages that can protect such threatened species from getting extinct ?

Ans. Ex-situ conservation = 1

Threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care = 1

Botanical garden / tissue culture / micro propagation / seed bank = ½

Zoological park / wild life safari park / cryopreservation = ½

[3 Marks]

OR

"Determination of Biological Oxygen Demand (BOD) can help in suggesting the quality of a water body." Explain.

Ans. High BOD of a water body indicates more number of micro-organisms in water , resulting in bad quality of water / death of aquatic creatures , more polluting potential 1 × 3

// Lower BOD of water body indicates less number of micro-organisms in water , good quality of water / aquatic life flourishes , less polluting potential = 1 × 3

[3 Marks]

22. A team of students are preparing to participate in the interschool sports meet. During a practice session you find some vials with labels of certain cannabinoids.

(a) Will you report to the authorities ? Why ?

(b) Name a plant from which such chemicals are obtained.

(c) Write the effect of these chemicals on human body.

Ans. (a) Yes = ½

May be abused by sports person = ½

(b) *Cannabis (sativa)* /any other relevant plant = 1

(c) Effects cardiovascular system of the body = 1

[1+ 1 + 1 = 3 Marks]

SECTION - D

Q. Nos. 23 is four marks

23. Since October 02,2014 "Swachh Bharat Abhiyan" has been launched in our country.

(a) Write your views on this initiative giving justification.

(b) As a biologist name two problems that you may face while implementing the programme in your locality.

(c) Suggest two remedial methods to overcome these problems.

Ans. (a) Value point conveying importance of clean environment / surrounding = 1

(b) Social attitude / co-ordination / financial issues / disposal of collected garbage / separation of biodegradable and non-degradable waste / lack of awareness / any other relevant problem (any two) = 1 + 1

(c) Campaigning / creating awareness / organising competitions / giving incentives / provision of imposing penalty / complaining to appropriate authority / publicity through mass media / using masks or gloves for separation and disposal of various categoriers of garbage or any other relevant point (Any two) = ½ + ½

[1 + 2 + 1 = 4 Marks]

SECTION-E

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

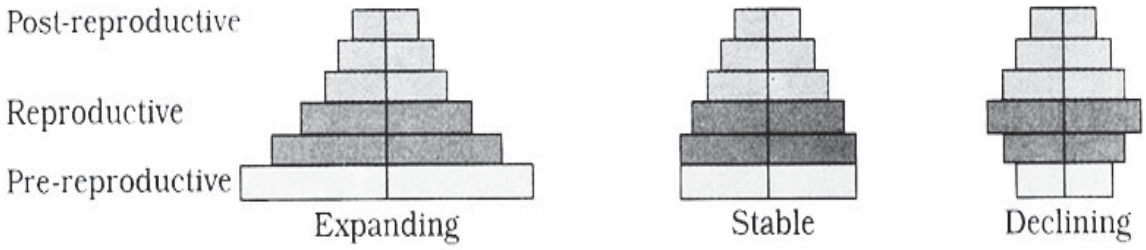
24. "Analysis of age-pyramids for human population can provide important inputs for long-term planning strategies." Explain.

Ans. Age pyramids show age distribution of males and females in a combined diagram = 1

The shape of the pyramid reflects the growth status of the population whether it is growing or stable or declining = 1

Pyramids also indicate the ratio of pre-reproductive , reproductive and post reproductive indidviduals in a population =1

//



= 1 = 1 = 1

Planing 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 with proper explanation) = 1 + 1

[5 Marks]

OR

Describe the advantages for keeping the ecosystems healthy.

Ans. (i) Purify air / purify water

(ii) Mitigates drought / mitigates flood

(iii) Cycle nutrients

(iv) Generate fertile soil

(v) Provide wildlife habitat

(vi) Maintain biodiversity

(vii) Pollinate crop

(viii) Provide storage site for carbon

(ix) Provide aesthetic value / provide cultural value / provide spiritual value

(x) Provide stable food chain

(xi) Provide economically useful forest produces

(xii) Provide sustainable biological legacy to future generations

(Description of any five advantages) = 1 × 5

[5 Marks]

25. A flower of brinjal plant following the process of sexual reproduction produces 360 viable seeds.

Answer the following questions giving reasons :

(a) How many ovules are minimally involved ?

(b) How many megaspore mother cells are involved ?

(c) What is the minimum number of pollen grains that must land on stigma for pollination ?

(d) How many male gametes are involved in the above case ?

(e) How many microspore mother cells must have undergone reduction division prior to dehiscence of anther in the above case ?

Ans. (a) 360 , one ovule after fertilisation forms one seed = ½ + ½

(b) 360 , each MMC forms four megaspores out of which only one remains functional = ½ + ½

(c) 360 , one pollen grain participates in fertilisation of one ovule = ½ + ½

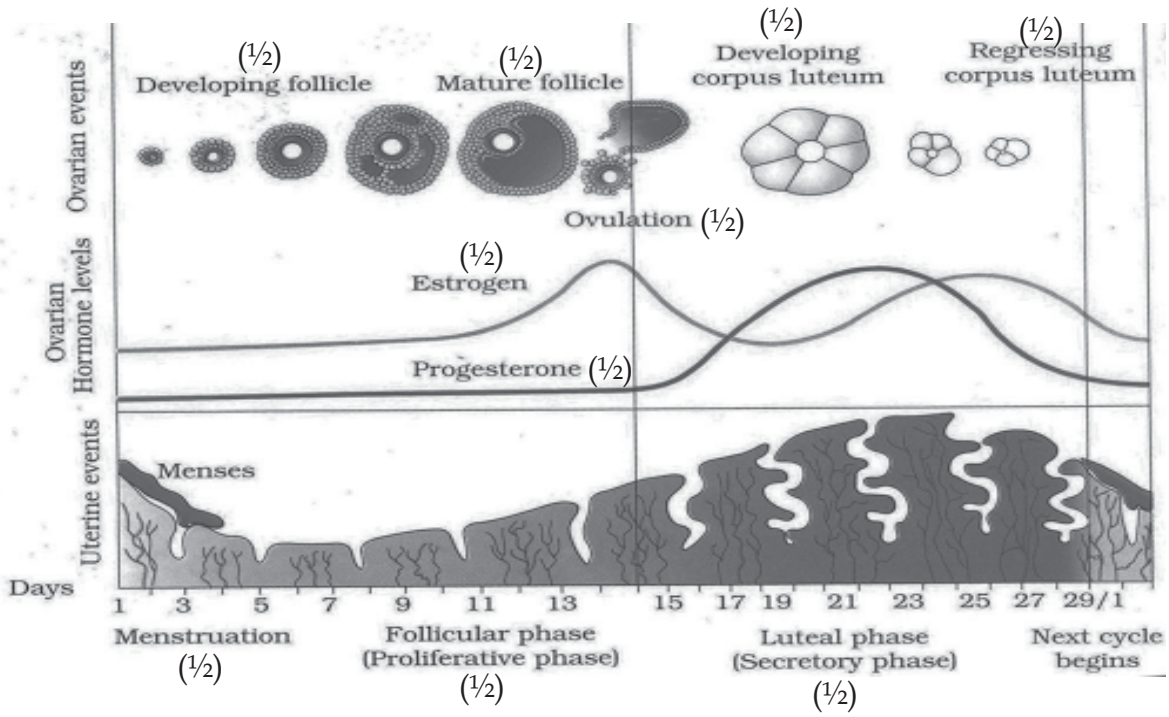
(d) 720 , each pollen grain carries two male gametes (which participate in double fertilisation) (360 × 2 = 720) = ½ + ½

(e) 90 , each microspore mother cell meiotically divides to form four pollen grains (360 /4 = 90) = ½ + ½

OR

Describe the changes that occur in ovaries and uterus in human female during the reproductive cycle.

Ans.



Same value points described in an explanation = ½ × 10

[5 Marks]

26. Explain the genetic basis of blood grouping in human population.

Ans. (i) Blood group in human population determined by gene ' I ' , which has three allele I^A and I^B and i (multiple allelism) =½ + ½

(ii) I^A I^B are dominant allele (codominance) each forming different type of sugar polymer on the surface of RBC , while allele ' i ' is recessive and does not produce any sugar = ½ + ½

I^A I^A , I^A i	—	A group = ½
I^B I^B , I^B i	—	B group = ½
I^A I^B	——	AB group = ½
ii	—	O group = ½

(iii) Since humans are diploid / each person possesses any two of three ' I ' gene alleles , resulting into six different genotypic combination and four phenotypic expression = ½ + ½

[5 Marks]

OR

How did Hershey and Chase established that DNA is transferred from virus to bacteria ?

Ans. • Some bacteriophage were grown in a medium that contained ^{32}P / radioactive phosphorus , while some were grown in a medium that contained ^{35}S / radioactive sulphur = ½ × 2

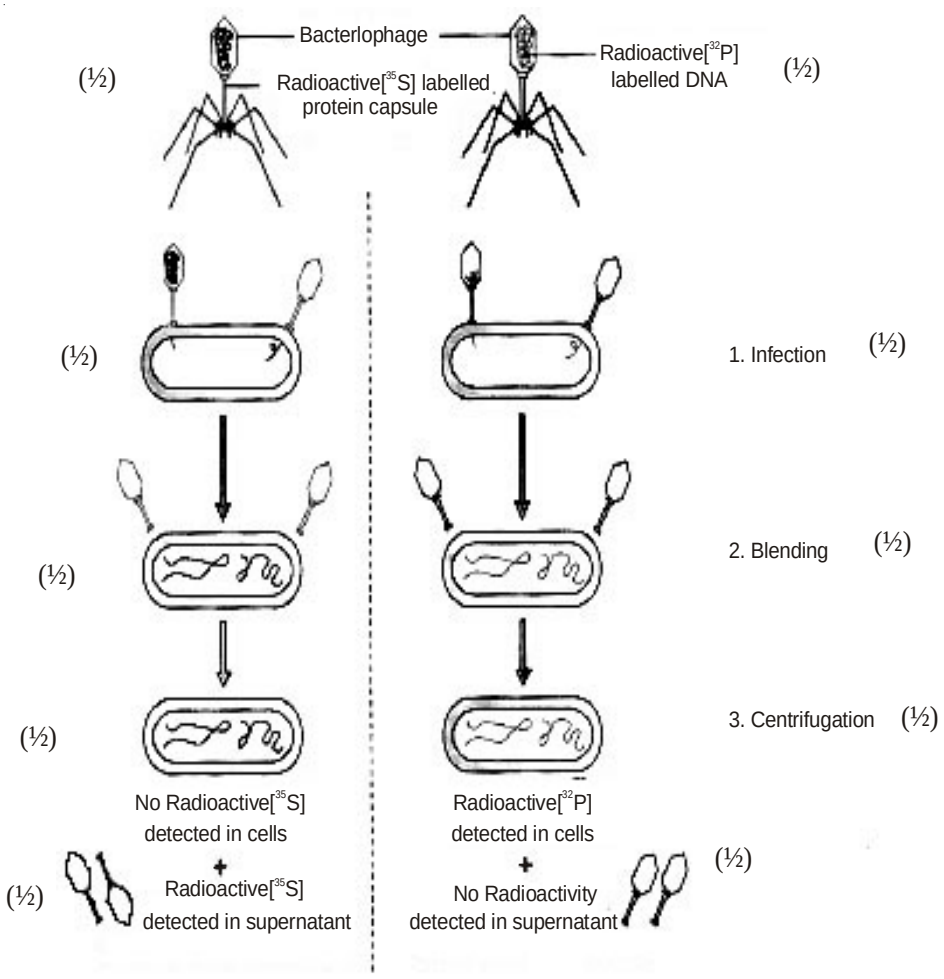
• the labelled bacteriophage from both media were allowed to infect E. coli = 1

- In both the cases viral coats were removed from the bacteria by agitating them in a blender = 1
- The virus particles were separated from the bacteria by spinning them in a centrifuge = 1
- No radioactivity was detected in cells (E. coli) but detected in supernatant in case where bacteriophage were labelled with radioactive sulphur = ½
- Radioactivity detected in cells (E. coli) while no radioactivity detected in supernatant in another case where bacteriophage were labelled with radioactive phosphorus = ½

(Phosphorus being a constituent of DNA indicates that DNA is the genetic material that is passed from virus to bacteria)

[5 Marks]

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



[½ × 10 = 5 Marks]

Question Paper Code 57/1/3

SECTION – A

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

1. Name the transcriptionally active region of chromatin in a nucleus.

Ans. Euchromatin / Exon

[1 Mark]

2. A geneticist interested in studying variations and patterns of inheritance in living beings prefers to choose organisms for experiments with shorter life cycle. Provide a reason.

Ans. Many generations can be obtained (in a short time)

// variations can be exhibited / selected faster

[1 Mark]

3. What is Biopiracy ?

Ans. Illegal / non-authorized / non-compensated use of bioresources by organisations (MNC)

[1 Mark]

4. State a reason for the increased population of dark coloured moths coinciding with the loss of lichens (on tree barks) during industrialization period in England.

Ans. Natural selection / survival of fittest / escaped predators due to camouflage

[1 Mark]

5. Indiscriminate diagnostic practices using X-rays etc., should be avoided. Give one reason.

Ans. (Act as) Carcinogen / (harmful) mutation / chromosomal aberration / damage to DNA / normal cells converted to neoplastic

[1 Mark]

SECTION-B

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

6. Differentiate between 'ZZ' and 'XY' type of sex-determination mechanisms.

Ans. ZZ - males (birds) homogametic (females heterogametic) , sex is determined by the type of egg getting fertilised = ½ + ½

XY male (human being) heterogametic (females homogametic) , sex is determined by the type of sperm fertilising the ovum = ½ + ½

[2 Marks]

7. An infertile couple is advised to adopt test-tube baby programme. Describe <u>two</u> principle procedures adopted for such technologies.

Ans. IVF / In vitro fertilisation - Fertilisation outside the body in almost similar conditions as that in the

body /

ICSI / Intra cytoplasmic sperm injection- A sperm is directly injected in to the ovum , = 1

ET / Embryo transfer - Embryo is transferred into reproductive tract or uterus /

ZIFT / Zygote intra fallopian transfer - Zygote or early embryos (upto eight blastomeres) transferred into fallopian tube /

IUT / Intra uterine insemination - Early embryos (with more than eight blastomeres) transferred into uterus =1

[2 Marks]

8. Many fresh water animals can not survive in marine environment. Explain.

Ans. High salt concentration outside / hypertonic surroundings = 1

Loss of water from body / exosmosis from animal body / animal suffers osmotic problems = 1

[2 Marks]

OR

How are productivity, gross productivity, net primary productivity and secondary productivity interrelated ?

Ans. Productivity is rate of biomass production = ½

GPP - R = NPP = 1

NPP - biomass available to consumers for secondary productivity = ½

[½ + 1 +½ = 2 Marks]

9. Enumerate four objectives for improving the nutritional quality of different crops for the health benefits of the human population by the process of "Biofortification".

Ans. Improving protein content and quality , oil content and quality , vitamin content and quality , micronutrient or mineral content = ½ × 4

[2 Marks]

10. Mention a product of human welfare obtained with the help of each one of the following microbes:

(a) LAB

(b) Saccharomyces cerevisiae

(c) Propionibacterium sharmanii

(d) Aspergillus niger

Ans. a) Milk to curd = ½

b) Bread / ethanol / alcoholic drinks / whiskey / brandy / beer / rum = ½

c) Swiss cheese = ½

d) Citric acid = ½

[½ × 4 =2 Marks]

SECTION - C

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

11. Describe the process of Parturition in humans.

Ans. - Signals originate from the fully developed foetus and placenta ,

- Induce mild uterine contractions (foetal ejection reflex) ,
- Triggers release of oxytocin (from maternal pituitary) ,
- Oxytocin acts on uterine muscles and cause stronger uterine contractions ,
- Stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contraction
- Expel the baby from the uterus = ½ × 6

[3 Marks]

12. Describe the development of endosperm after double fertilization in an angiosperm. Why does endosperm development precedes that of zygote ?

Ans. Following fertilisation the PEN (primary endosperm nucleus) divides repeatedly to give rise to free nuclei, subsequent cell wall formation leading to formation of endosperm = 1 + 1

Cells of endosperm are filled with reserved food materials to be used for nutrition of the developing embryo / for providing food to the developing embryo = 1

[3 Marks]

13. Explain the interpretation of Charles Darwin when he observed a variety of small black birds on Galapagos Islands.

Ans. Darwin conjectured that all varieties are evolved on the Galapagos island itself , from original seed eating features , many other forms with altered beaks arose , became insectivorous , and vegetarian finches , adaptive radiation = ½ × 6

[3 Marks]

14. A teacher wants his/her students to find the genotype of pea plants bearing purple coloured flowers in their school garden. Name and explain the cross that will make it possible.

Ans. Test cross = 1

Purple flower to be crossed with white (homozygous recessive) flower = 1

If all flowers of F_1 are purple then genotype is homozygous dominant / PP = ½

If 50% are purple and 50% are white then genotype is heterozygous dominant / Pp = ½

or (same thing can be shown with the help of crosses)

[3 Marks]

15. (a) A DNA segment has a total of 2,000 nucleotides, out of which 520 are adenine containing nucleotides. How many purine bases this DNA segment possesses ?

(b) Draw a diagrammatic sketch of a portion of DNA segment to support your answer.

Ans. (a) 1000 purines = ½

(i) Calculation

A = T , A = 520 hence T = 520

A + T = 520 + 520 = 1040

so G + C = 2000 - 1040 = 960

G = C , so $C = \frac{960}{2} = 480$

so pyrimidines = C + T

= 480 + 520 = 1000

(ii) Purine A and G always pair with T and C respectively

iii) $\frac{A}{G} = \frac{T}{C} = 1$ (Chargaff rule)

= ½

(b)

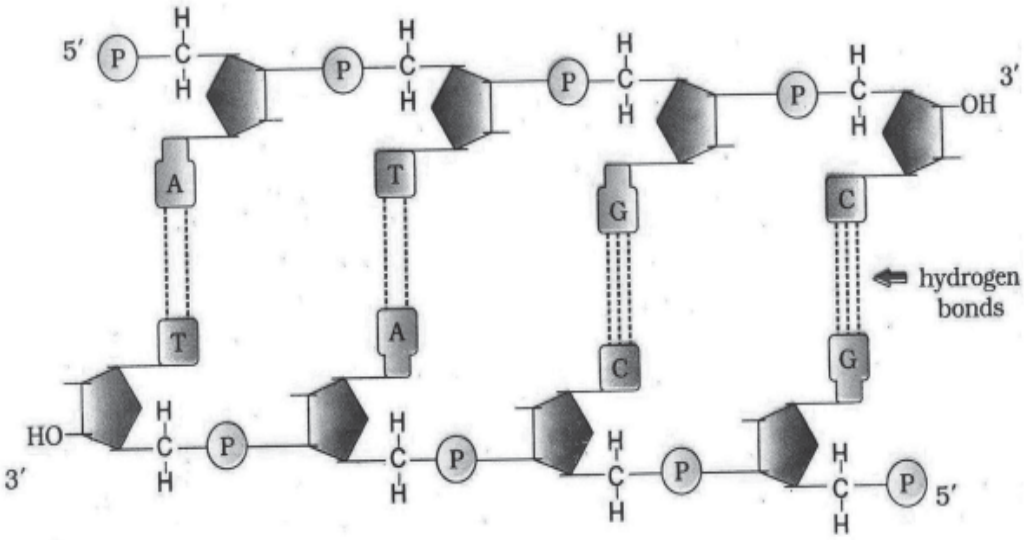


Diagram showing polarity = ½

N- base = ½

H - bond = ½

Deoxyribose sugar = ½

[1 + 2 = 3 Marks]

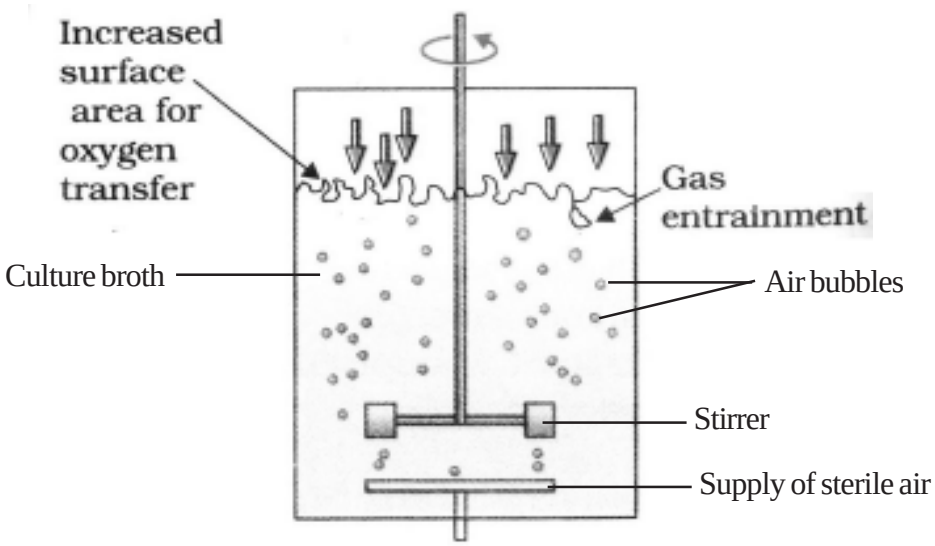
16. Recombinant DNA-technology is of great importance in the field of medicine. With the help of a flow chart, show how this technology has been used in preparing genetically engineered human insulins.

Ans. Insulin consists of two (short) polypeptide chains (A and B) , linked by disulphide bonds , two DNA sequences corresponding to chain A and B prepared (by Eli Lily company) , introduced them into plasmids of E. coli , chain A and B produced separately , extracted and combined by creating disulphide bonds = ½ × 6

[3 Marks]

17. Draw a labelled sketch of sparged-stirred-tank bioreactor. Write its application.

Ans.



Correct diagram = 1

Any two correct labellings = ½ + ½

Application = Produces larger biomass leading to higher yields of desired protein / recombinant protein / processing large volume of culture / conversion of raw materials into specific product biologically = 1

[3 Marks]

18. Following the collision of two trains a large number of passengers are killed. A majority of them are beyond recognition. Authorities want to hand over the dead to their relatives. Name a modern scientific method and write the procedure that would help in the identification of kinship.

Ans. DNA fingerprinting (analysis) = ½

- Isolation and digestion of DNA by restriction endonuclease
- Separation of DNA fragments by electrophoresis and transferring them to synthetic membranes / nitrocellulose / nylon
- Hybridisation using labelled VNTR probe
- Detection of hybridised DNA fragments by autoradiography
- Matching banding pattern of DNA / DNA fingerprints / autoradiograms of the passengers killed and that of relatives = ½ × 5

[3 Marks]

19. A team of students are preparing to participate in the interschool sports meet. During a practice session you find some vials with labels of certain cannabinoids.

(a) Will you report to the authorities ? Why ?

(b) Name a plant from which such chemicals are obtained.

(c) Write the effect of these chemicals on human body.

Ans. (a) Yes = ½

May be abused by sports person = ½

(b) *Cannabis (sativa)* /any other relevant plant = 1

(c) Effects cardiovascular system of the body = 1

[1+ 1 + 1 = 3 Marks]

20. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans. As a biology student what method would you suggest along with its advantages that can protect such threatened species from getting extinct ?

Ans. Ex-situ conservation = 1

Threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care = 1

Botanical garden / tissue culture / micro propagation / seed bank = ½

Zoological park / wild life safari park / cryopreservation = ½

[3 Marks]

OR

"Determination of Biological Oxygen Demand (BOD) can help in suggesting the quality of a water body." Explain.

Ans. High BOD of a water body indicates more number of micro-organisms in water , resulting in bad quality of water / death of aquatic creatures , more polluting potential 1 × 3

// Lower BOD of water body indicates less number of micro-organisms in water , good quality of water / aquatic life flourishes , less polluting potential = 1 × 3

[3 Marks]

21. Enlist the steps involved in inbreeding of cattle. Suggest two disadvantages of this practice.

Ans. Inbreeding involves mating of closely related individuals within the same breed for 4-6 generations = ½

Superior males and superior females are identified and mated in pairs , the progeny are evaluated , superior males and females among them are selected for further mating = ½ × 3

Disadvantages : Inbreeding depression , reduction in fertility , reduction in productivity (any two) = ½ × 2

[3 Marks]

22. Choose any three microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen. Mycorrhiza; Monascus; Anabaena; Rhizobium; Methanobacterium; Trichoderma.

Ans. Mycorrhiza : (Fungal symbiont of the association) Abosrb phosphorus from soil

Anabaena : Fix atmospheric nitrogen / Adds organic matter to the soil

Rhizobium : Fix atmospheric nitrogen (in leguminous plants)

Methanobacterium : They digest cellulosic material and the product / spent slurry can be used as fertiliser

Trichoderma : Biocontrol agent for several plant pathogens

(Any 3 microbes = ½ × 3 = 1½)

(Any 3 corresponding roles = ½ × 3 = 1½)

[3 Marks]

SECTION - D

Q. Nos. 23 is of four marks

23. Since October 02,2014 "Swachh Bharat Abhiyan" has been launched in our country.

(a) Write your views on this initiative giving justification.

(b) As a biologist name two problems that you may face while implementing the programme in your locality.

(c) Suggest two remedial methods to overcome these problems.

Ans. (a) Value point conveying importance of clean environment / surrounding = 1

(b) Social attitude / co-ordination / financial issues / disposal of collected garbage / separation of biodegradable and non-degradable waste / lack of awareness / any other relevant problem (any two) = 1 + 1

(c) Campaigning / creating awareness / organising competitions / giving incentives / provision of imposing penalty / complaining to appropriate authority / publicity through mass media / using masks or gloves for separation and disposal of various categoriers of garbage or any other relevant point (Any two) = ½ + ½

[1 + 2 + 1 = 4 Marks]

SECTION-E

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

24. Explain the genetic basis of blood grouping in human population.

Ans. (i) Blood group in human population determined by gene ' I ' , which has three allele I^A and I^B and i (multiple allelism) =½ + ½

(ii) I^A I^B are dominant allele (codominance) each forming different type of sugar polymer on the surface of RBC , while allele ' i ' is recessive and does not produce any sugar = ½ + ½

I^A I^A , I^A i — A group = ½

$I^B I^B$, $I^B i$ — B group = ½

$I^A I^B$ —— AB group = ½

ii — O group = ½

(iii) Since humans are diploid / each person possesses any two of three ' I ' gene alleles , resulting into six different genotypic combination and four phenotypic expression = ½ + ½

[5 Marks]

OR

How did Hershey and Chase established that DNA is transferred from virus to bacteria ?

Ans. • Some bacteriophage were grown in a medium that contained ^{32}P / radioactive phosphorus , while some were grown in a medium that contained ^{35}S / radioactive sulphur = ½ × 2

• the labelled bacteriophage from both media were allowed to infect E. coli = 1

• In both the cases viral coats were removed from the bacteria by agitating them in a blender = 1

• The virus particles were separated from the bacteria by spinning them in a centrifuge = 1

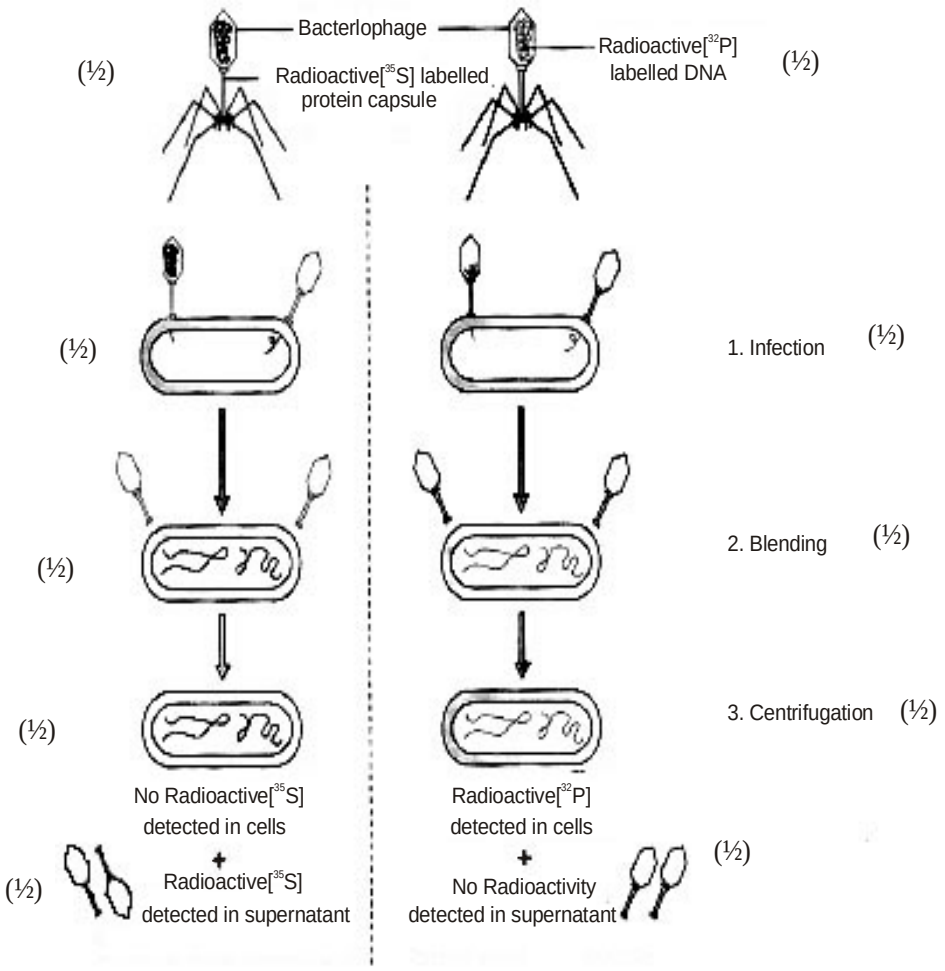
• No radioactivity was detected in cells (E. coli) but detected in supernatant in case where bacteriophage were labelled with radioactive sulphur = ½

• Radioactivity detected in cells (E. coli) while no radioactivity detected in supernatant in another case where bacteriophage were labelled with radioactive phosphorus = ½

(Phosphorus being a constituent of DNA indicates that DNA is the genetic material that is passed from virus to bacteria)

[5 Marks]

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



[½ × 10 = 5 Marks]

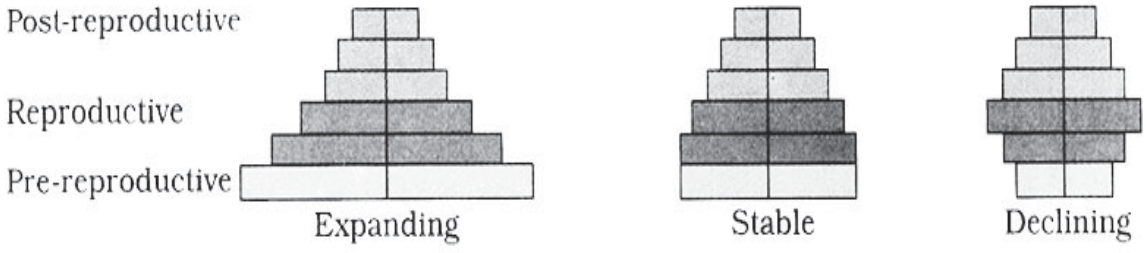
25. "Analysis of age-pyramids for human population can provide important inputs for long-term planning strategies." Explain.

Ans. Age pyramids show age distribution of males and females in a combined diagram = 1

The shape of the pyramid reflects the growth status of the population whether it is growing or stable or declining = 1

Pyramids also indicate the ratio of pre-reproductive , reproductive and post reproductive indidviduals in a population =1

//



= 1 = 1 = 1

Planing 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 with proper explanation) = 1 + 1

[5 Marks]

OR

Describe the advantages for keeping the ecosystems healthy.

Ans. (i) Purify air / purify water

(ii) Mitigates drought / mitigates flood

(iii) Cycle nutrients

(iv) Generate fertile soil

(v) Provide wildlife habitat

(vi) Maintain biodiversity

(vii) Pollinate crop

(viii) Provide storage site for carbon

(ix) Provide aesthetic value / provide cultural value / provide spiritual value

(x) Provide stable food chain

(xi) Provide economically useful forest produces

(xii) Provide sustainable biological legacy to future generations

(Description of any five advantages) = 1 × 5

[5 Marks]

26. A flower of tomato plant following the process of sexual reproduction produces 200 viable seeds.

Answer the following questions giving reasons :

(a) What would have been the minimum number of ovules present in pre-pollinated pistil ?

(b) How many microspore mother cells would minimally be required to produce requisite number of pollen grains ?

(c) How many pollen grains must have minimally pollinated the carpel ?

(d) How many male gametes would have used to produce these 200 viable seeds ?

(e) How many megaspore mother cells were required in this process ?

Ans. (a) 200 , one ovule after fertilisation forms one seed = ½ + ½

(b) 50 , each microspore mother cell meiotically divides to form four pollen grains (200 /4 = 50) = ½ + ½

(c) 200 , one pollen grain participates in fertilisation of one ovule = ½ + ½

(d) 400 , each pollen grain carries two male gametes which (participate in double fertilisation) (200 × 2 = 400) = ½ + ½

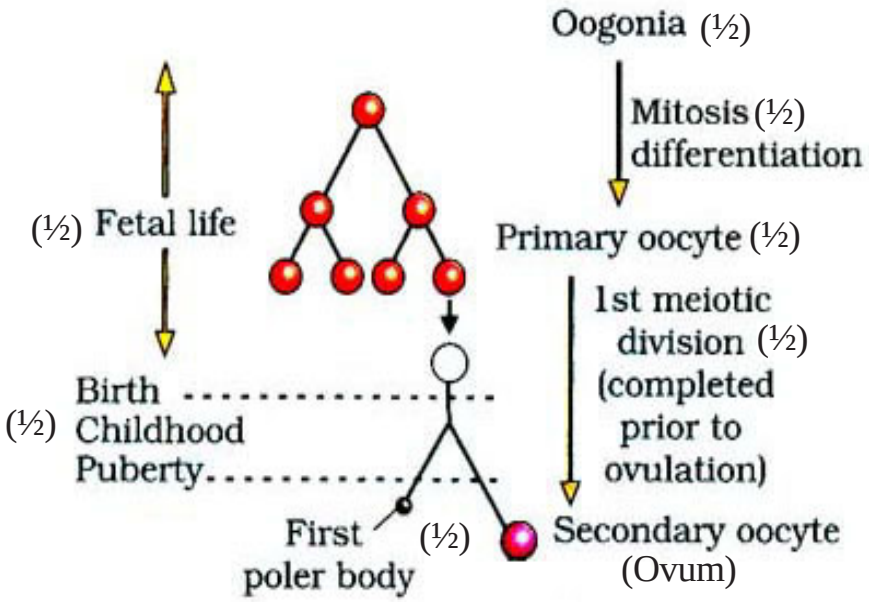
(e) 200 , each MMC forms four megaspores out of which only one remains functional = ½ + ½

[1 × 5 = 5 Marks]

OR

Explain the development of a secondary oocyte (ovum) in a human female from the embryonic stage upto its ovulation. Name the hormones involved in this process.

Ans.



(½ × 7 = 3½)

Hormones :
- LH / Luteinising hormone = ½
- FSH / Follicle stimulating hormone = ½
- Estrogen = ½

[3½ + 1½ = 5 Marks]