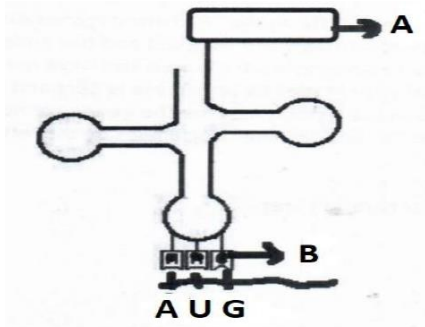
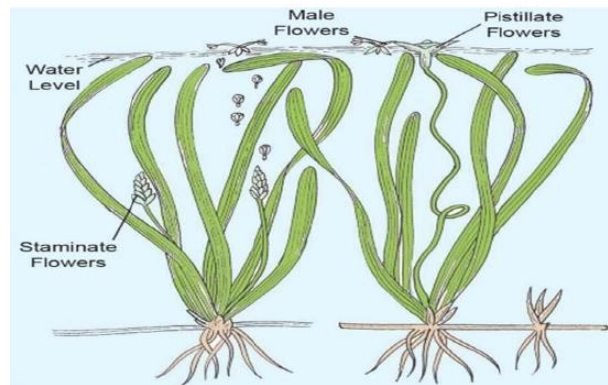


[illegible]

3	12	<p>Q 3. AUG on the mRNA will result in the activation of which of the following RNA having correct combination of amino acids:</p> <div></div> <table><tr><td></td><td>Site A</td><td>Site B</td></tr><tr><td>A.</td><td>UAC</td><td>Methionine</td></tr><tr><td>B.</td><td>Methionine</td><td>UAC</td></tr><tr><td>C.</td><td>Methionine</td><td>AUG</td></tr><tr><td>D.</td><td>AUG</td><td>Methionine</td></tr></table> <p><b>B. Methionine UAC</b></p>		Site A	Site B	A.	UAC	Methionine	B.	Methionine	UAC	C.	Methionine	AUG	D.	AUG	Methionine	1
	Site A	Site B																
A.	UAC	Methionine																
B.	Methionine	UAC																
C.	Methionine	AUG																
D.	AUG	Methionine																
4	9	<p>Q 4. Nematode specific genes were introduced into the tobacco host plant using a vector</p> <p>(a) pBR 322 (b) Plasmid (c) <i>Bacteriophage</i> (d) <b><i>Agrobacterium</i></b></p>	1															
5	8	<p>Q 5. Meselson and Stahl carried out centrifugation in CsCl<sub>2</sub> density gradient to separate:</p> <p>(a) DNA from RNA (b) DNA from protein (c) <b>The normal DNA from 15N-DNA</b> (d) DNA from tRNA</p>	1															
6	6	<p>Q 6. In the dioecious aquatic plant shown, identify the characteristics of the male flowers that reach the female flowers for pollination:</p>																



	Size of the flower	Colour of flower	Characteristic feature of pollengrain
A	small	brightly coloured	Light weight and non-sticky
B	large	colourless	large and sticky
C	small	white	small, covered with mucilage
D	large	colourless	non sticky

**C – small, white, small, covered with mucilage**

1

**SET A1**

Q 7. The organism used in construction of the first artificial recombinant DNA by Cohen and Boyer in 1972 was:

- (a) *E. coli*
- (b) *Salmonella typhimurium*
- (c) *Agrobacterium tumefaciens*
- (d) *Bacillus thuringiensis*

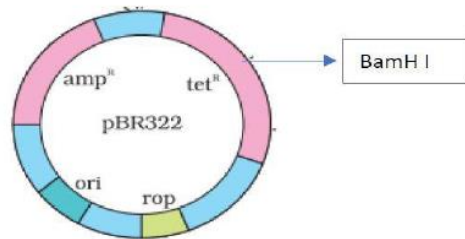
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7

7

**SET A2**

The figure below shows the structure of a plasmid.



A foreign DNA was ligated at BamHI. The transformants were then grown in a medium containing antibiotics tetracycline and ampicillin.

Choose the correct observation for the growth of bacterial colonies from the given table

	<i>Medium with Tetracycline</i>	<i>Medium with Ampicillin</i>
(a)	Growth	No growth
(b)	No growth	Growth
(c)	No growth	No Growth
(d)	Growth	Growth

**(b) No growth \_\_\_\_\_ Growth**

1

Q 8. Given below are four contraceptive methods and their modes of action. Select the correct match:

<i>S. No.</i>	<i>Method</i>	<i>S. No</i>	<i>Mode of action</i>
a)	Condom	(i)	Ovum not able to reach Fallopian tube
b)	Vasectomy	(ii)	Prevents ovulation
c)	Pill	(iii)	Prevents sperm reaching the cervix
d)	Tubectomy	(iv)	Semen contains no sperms

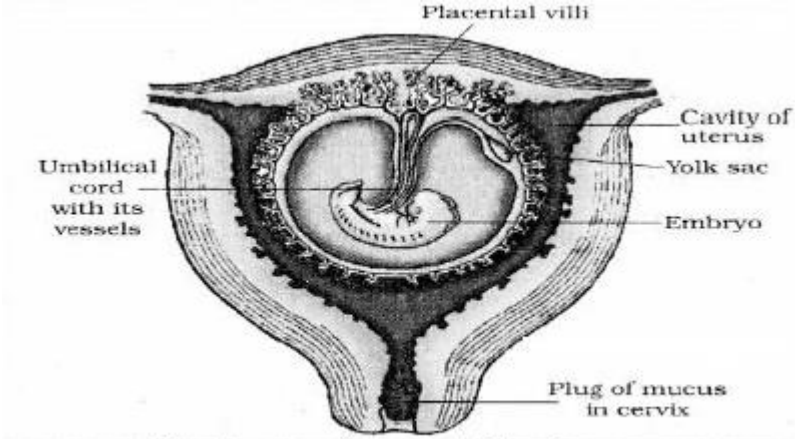
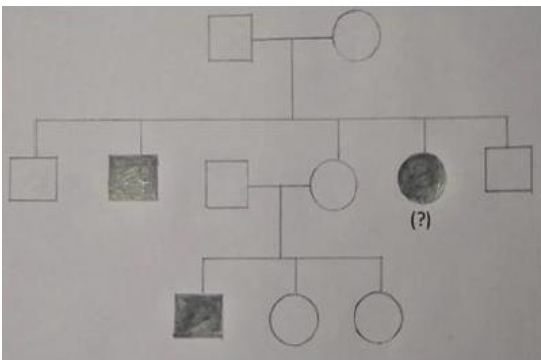
(a) a)–(i) b)–(ii) c)–(iii) d)–(iv)

(b) a)–(ii) b)–(iii) c)–(iii) d)–(i)

**(c) a)–(iii) b)–(iv) c)–(ii) d)–(i)**

(d) a)–(iv) b)–(i) c)–(iii) d)–(ii)

1

9	4	<p>Q 9. Concentration of which of the following substances will decrease in the maternal blood as it flows from embryo to placenta through the umbilical cord?</p>  <p>i. Oxygen ii. Amino Acids iii. Carbon dioxide iv. Urea</p> <p>(a) i and ii (b) ii and iv (c) iii and iv (d) i and iv</p>	1
10	3	<p>Q 10. What should be the genotype of the indicated member?</p> 	

		(a) AA (b) Aa (c) XY (d) aa	1										
11	2	<p>Q 11. Given below are two columns. In Column I is the list of four enzymes and in Column II is the list of functions of the given enzymes. Which one of the following options shows the enzymes matched with their respective functions correctly ?</p> <table><thead><tr><th>Column I (Enzyme)</th><th>Column II (Function)</th></tr></thead><tbody><tr><td>P. DNA Ligase</td><td>i. Removes nucleotides from ends of DNA</td></tr><tr><td>Q. Restriction exonuclease</td><td>ii. Extends primer on a DNA template</td></tr><tr><td>R. Taq polymerase</td><td>iii. Joins the DNA fragments</td></tr><tr><td>S. Restriction endonuclease</td><td>iv. Cuts DNA at a specific position</td></tr></tbody></table> <p>Options : (a) P-i, Q-ii, R-iv, S-iii (b) P-iv, Q-iii, R-ii, S-i (c) P-i, Q-iv, R-iii, S-ii (d) <b>P-iii, Q-i, R-ii, S-iv</b></p>	Column I (Enzyme)	Column II (Function)	P. DNA Ligase	i. Removes nucleotides from ends of DNA	Q. Restriction exonuclease	ii. Extends primer on a DNA template	R. Taq polymerase	iii. Joins the DNA fragments	S. Restriction endonuclease	iv. Cuts DNA at a specific position	1
Column I (Enzyme)	Column II (Function)												
P. DNA Ligase	i. Removes nucleotides from ends of DNA												
Q. Restriction exonuclease	ii. Extends primer on a DNA template												
R. Taq polymerase	iii. Joins the DNA fragments												
S. Restriction endonuclease	iv. Cuts DNA at a specific position												
12	1	<p>Q 12. Which of the following amino acid substitution is responsible for causing sickle cell anemia?</p> <p>(a) Valine is substituted by Glutamic acid in the <math>\alpha</math> globin chain at the sixth position</p> <p>(b) Valine is substituted by Glutamic acid in the <math>\beta</math> globin chain at seventh position</p> <p>(c) Glutamic acid is substituted by Valine in the <math>\alpha</math> globin chain at the sixth position</p> <p>(d) <b>Glutamic acid is substituted by Valine in the <math>\beta</math> globin chain at the sixth position.</b></p>	1										

13	16	<p>Q 13. <b>Assertion:</b> Parturition is induced by a complex neuro endocrine mechanism.</p> <p><b>Reason:</b> At the end of gestation period, the maternal pituitary releases prolactin which causes uterine contractions.</p> <p>A. Both assertion and reason are true, and the reason is the correct explanation of the assertion.</p> <p>B. Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</p> <p><b>C. Assertion is true but reason is false.</b></p> <p>D. Both assertion and reason are false.</p>	1
14	15	<p>Q 14. <b>Assertion:</b> Functional ADA cDNA genes must be inserted in the lymphocytes at the early embryonic stage.</p> <p><b>Reason:</b> Cells in the embryonic stage are mortal, differentiated and easy to manipulate.</p> <p>A. Both assertion and reason are true, and the reason is the correct explanation of the assertion.</p> <p>B. Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</p> <p><b>C. Assertion is true but reason is false.</b></p> <p>D. Both assertion and reason are false.</p> <p>Q 15. <b>Assertion:</b> Both the strands of DNA are not copied during the process of transcription.</p> <p><b>Reason:</b> The two molecules of RNA complementary to each other form the double stranded RNA and this would prevent RNA from being translated into protein.</p> <p><b>A. Both assertion and reason are true, and the reason is</b></p>	1

15	14	<p><b>the correct explanation of the assertion.</b></p> <p>B. Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</p> <p>C. Assertion is true but reason is false.</p> <p>D. Both assertion and reason are false.</p>	1
16	13	<p>Q 16. <b>Assertion:</b> Statins reduce the blood cholesterol level. <b>Reason:</b> They competitively inhibit the enzyme responsible for synthesis of cholesterol.</p> <p><b>A. Both assertion and reason are true, and the reason is the correct explanation of the assertion.</b></p> <p>B. Both assertion and reason are true, but the reason is not the correct explanation of the assertion.</p> <p>C. Assertion is true but reason is false.</p> <p>D. Both assertion and reason are false.</p>	1
17	21	<p><b><u>SET A1</u></b></p> <p>Q 17. Write the contributions of the following scientists in deciphering the genetic code. George Gamow; Har Gobind Khorana</p> <p><b>George Gamow - He suggested that in order to code for all the amino acids, the code should be made up of three nucleotides.</b></p> <p><b>Har Gobind Khorana - He developed the chemical method which was instrumental in synthesizing RNA molecules with a defined combination of bases (homopolymers and copolymers).</b></p> <p><b><u>SET A2</u></b></p> <p>Write the contributions of the following scientists in deciphering the genetic code. Marshall Nirenberg; Severo Ochoa</p> <p><b>Marshall Nirenberg - His cell-free system for protein synthesis finally helped the code to be deciphered.</b></p>	1 + 1



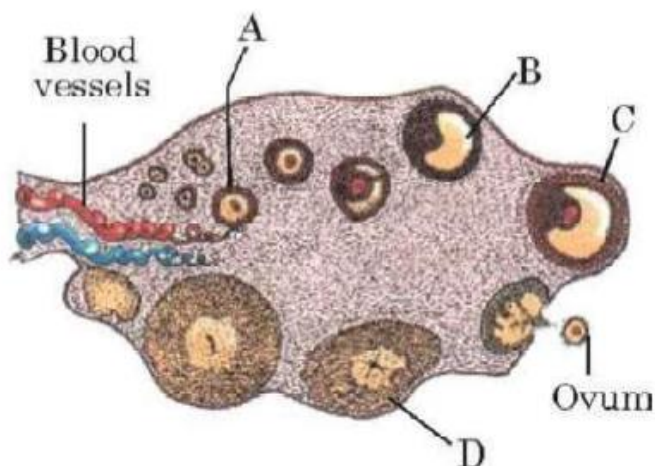
		<p><b>Severo Ochoa - Severo Ochoa enzymes (polynucleotide phosphorylase) was helpful in polymerizing RNA with defined sequences in a template-independent manner. (Enzymatic synthesis of RNA).</b></p>	1 + 1
18	19	<p><b><u>SET A1</u></b></p> <p>Q 18. Mention the kind of interaction mycorrhizae exhibit. How is <i>Glomus</i> in mycorrhizal association beneficial to the plants?</p> <p><b>Symbiotic relationship / mutualism</b>  <b>It absorbs phosphorus from the soil, provides resistance to the root borne pathogens, tolerance to salinity and drought, overall increase in the plant growth.</b></p> <p style="text-align: right;"><b>(Any three)</b></p> <p><b><u>SET A2</u></b></p> <p>Micro-organisms play an important role for the biological treatment of sewage.” Justify.</p> <p><b>Primary effluent passed into aeration tanks, constantly agitated and air is pumped in, allows growth of useful aerobic microbes into flocs / (masses of bacterial and fungal filaments), these microbes consume organic matter and reduce Biochemical oxygen demand (BOD) of effluent.</b></p>	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2} \times 3</math></p> <p><math>\frac{1}{2} \times 4</math></p>
19	20	<p>Q 19. Name and explain the technique that can be used in developing improved crop varieties in plants bearing female flowers only.</p> <p><b>Artificial hybridization</b>  <b>The female flower buds are bagged before the flower open, when stigma becomes receptive pollination is carried out using the desired pollen, and flower is rebagged (and fruits are allowed to develop).</b></p>	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2} \times 3</math></p>

		<p style="text-align: center;"><b>OR</b></p> <p>List the three hormones produced in women only during pregnancy. What happens to the levels of estrogen and progesterone during pregnancy?</p> <p><b>Human chorionic gonadotropin / hCG</b> <b>Human placental lactogen / hPL</b> <b>Relaxin</b></p> <p><b>The level of progesterone &amp; estrogen) increases.</b></p>	<p style="text-align: right;"><math>\frac{1}{2} \times 4</math></p>
20	18	<p>Q 20. The cytological observations made in a number of insects led to the development of the concept of genetic/chromosomal basis of sex-determination mechanism. Honey bee is an interesting example to study the mechanism of sex-determination. Study the schematic cross between the male and the female honey bees given below and answer the questions that follow:</p> <div style="text-align: center;"> <p><b>Parent</b></p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Female honey bee</b> 32 chromosomes</p> <p>A ← ↓</p> <p><b>Gametes</b></p> <p>↓</p> <p>C ← ↓</p> <p><b>Offspring</b></p> </div> <div style="text-align: center;"> <p><b>Male honey bee</b></p> <p>↓ → B</p> <p><b>Gametes</b></p> <p>↓</p> <p><b>Female honey bee</b> 32 chromosomes</p> </div> </div> <p style="text-align: center;"><b>Fertilisation</b></p> </div> <p>(a) Identify the cell divisions 'A' and 'B' that lead to gamete formation in female and male honey bees respectively. (b) Name the process 'C' that leads to the development of male honey bee (drone).</p> <p><b>(a) 'A' - meiosis</b> <b>'B' - Mitosis</b></p>	<p style="text-align: right;"><math>\frac{1}{2} + \frac{1}{2}</math></p>

		<b>(b) 'C'-Parthenogenesis</b>	1
21	17	<p>Q 21. (a) Explain how is the separated DNA visualized in the technique of Gel electrophoresis.</p> <p>(b) DNA fragments of size 500 bp, 1600 bp and 2000 bp are separated by Gel electrophoresis. Which fragment will migrate fast &amp; why?</p> <p><b>(a) Since DNA fragments are negatively charged molecules, they can be separated by forcing them to move towards the anode, under the electric field through a medium /matrix / Agarose. The DNA fragments separate as per their size, smaller fragments move the farthest.</b></p> <p><b>(b) DNA fragment of size 500 bp will migrate faster as smaller fragments move the farthest.</b></p>	<p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p>
22	28	<p>Q 22. Name the group of bacteria involved in setting milk into curd. Explain the process they carry in doing so. Write another beneficial role of such bacteria.</p> <p><b><i>Lactobacillus</i> or lactic acid bacteria (LAB) are involved in setting milk into curd. A small amount of curd that contains <i>Lactobacillus</i> are added in milk, bacteria that grow produce lactic acid that cause coagulation of protein in milk to form curd. LAB also increase vitamin B<sub>12</sub> along with other vitamins in the curd.</b></p>	1 + 1 + 1
23	27	<p>Q 23. F<sub>1</sub> progeny of pea plant bearing violet flowers and Snapdragon plant bearing red flowers were selfed to produce their respective F<sub>2</sub> progeny. Compare the phenotypes, the genotypes and the pattern of inheritance of their respective F<sub>2</sub> progeny.</p>	

		<p>F<sub>1</sub> Violet flower of Pea</p> <p>Ww    Ww                      /    WW    WW</p> <p>Selfing                      Selfing</p> <p>Case 1                      /                      Case 2</p> <table> <tr> <td></td> <td>W</td> <td>w</td> </tr> <tr> <td>W</td> <td>WW</td> <td>Ww</td> </tr> <tr> <td>w</td> <td>Ww</td> <td>ww</td> </tr> </table> <p>Phenotypic ratio</p> <p>100% WW /</p> <p>Phenotypic ratio</p> <p>100% WW /</p> <p>Violet : White</p> <p>3        : 1</p> <p>Genotypic Ratio</p> <p>1 : 2 : 1</p> <p>Pattern of inheritance</p> <p>Pea plant</p> <p>Snapdragon</p> <p>F<sub>1</sub> Red flower of snapdragon</p> <p>RR    RR</p> <p>Selfing</p> <table> <tr> <td></td> <td>R</td> <td>R</td> </tr> <tr> <td>R</td> <td>RR</td> <td>RR</td> </tr> <tr> <td>R</td> <td>RR</td> <td>RR</td> </tr> </table> <p>Phenotypic ratio</p> <p>Phenotypic ratio</p> <p>Red</p> <p>100%</p> <p>Genotypic Ratio</p> <p>RR (100%)</p> <p>Complete dominance</p> <p>Incomplete dominance</p>		W	w	W	WW	Ww	w	Ww	ww		R	R	R	RR	RR	R	RR	RR	<p><math>\frac{1}{2} \times 2</math></p> <p><math>\frac{1}{2} \times 2</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>
	W	w																			
W	WW	Ww																			
w	Ww	ww																			
	R	R																			
R	RR	RR																			
R	RR	RR																			
24	26	<p>Q 24. Name any two natural cloning vectors. Give reasons that make them act as cloning vectors. Write the two characteristics the engineered vectors are made to possess.</p> <p><b>Plasmids, bacteriophages.</b></p> <p><b>Reasons - ability to replicate within bacterial cells, high copy number within the bacterial cells.</b></p> <p><b>Characteristics of engineered Vectors: easy linking of foreign DNA, Selection of recombinants from non- recombinants /selectable marker.</b></p>	<p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p>																		

Q 25. Study the transverse section of human ovary given below and answer the questions that follow:



- (a) Name the hormone that helps in the growth of  $A \rightarrow B \rightarrow C$ .  
 (b) Name the hormone secreted by A and B.  
 (c) State the role of the hormone produced by D.

25

25

a) Gonadotropins / FSH and LH

b) Estrogen

c) Maintenance of uterine endometrium

$1 \times 3$

OR

Explain three different modes of pollination that can occur in a chasmogamous flower.

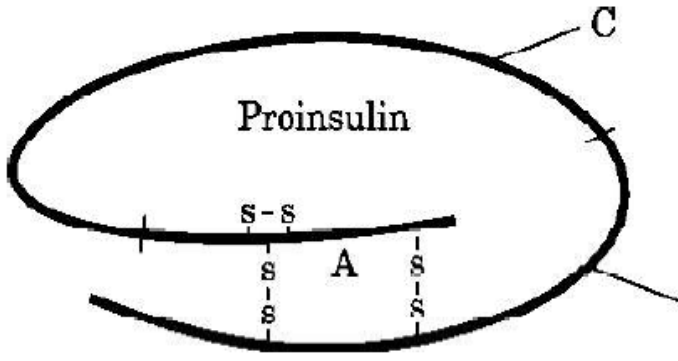
**(Autogamy / Self-pollination)** - Pollination is achieved within the same flower / transfer of pollen grains from the anther to the stigma of the same flower.

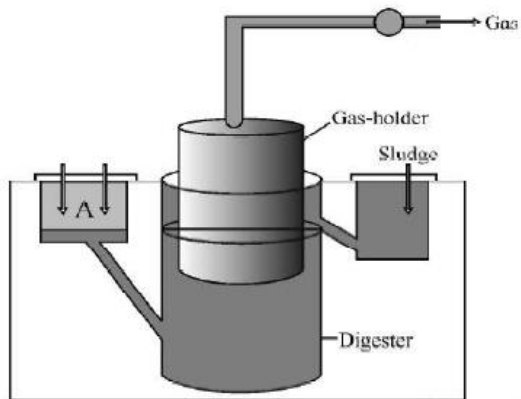
**(Geitonogamy)** - Transfer of pollen grains from the anther to the stigma of another flower of the same plant.

**(Xenogamy / Cross pollination)** - Transfer of pollen grains from anther to the stigma of flowers of a different plant.

**(Anemophily)** - Transfer of pollen grains from anther to stigma of same / another flower through wind.

$1 \times 3$

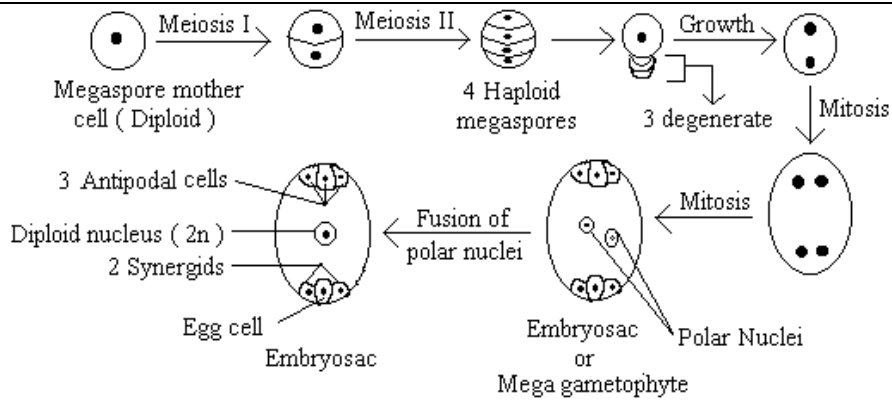
		<p><b>(Zoophily) - Transfer of pollen grains from anther to stigma of same / another flower through animals.</b></p> <p><b>(Chiropterophily) - Transfer of pollen grains from anther to stigma of same / another flower through bats.</b></p> <p><b>(Hydrophily) - Transfer of pollen grains from anther to stigma of same / another flower through water.</b></p> <p><b>(Entomophily) - Transfer of pollen grains from anther to stigma of same / another flower through insects.</b></p> <p><b>(Ornithophily) - Transfer of pollen grains from anther to stigma of same / another flower through birds.</b></p> <p><b>(Malacophily) - Transfer of pollen grains from anther to stigma of same / another flower through snails.</b></p> <p style="text-align: right;"><b>(Any three)</b></p>	
26	24	<p>Q 26. Name the different types of RNA polymerases in a eukaryotic cell. Write their roles in transcription.</p> <ul style="list-style-type: none"> <li>• <b>RNA polymerase I, transcribes rRNAs(28S/18S/5.8S).</b></li> <li>• <b>RNA polymerase II, transcribes precursor of mRNA/hn RNA/heterogenous nuclear RNA.</b></li> <li>• <b>RNA polymerase III, transcribes tRNA/ 5srRNA/ snRNAs / small nuclear RNAs.</b></li> </ul>	½ x 6
27	23	<p>Q 27. Insulin in the human body is secreted by pancreas as prohormone/proinsulin. The schematic polypeptide structure of proinsulin is given below. This proinsulin needs to undergo processing before it becomes functional in the body. Answer the questions that follow:</p> 	

		<p>a) State the change the proinsulin undergoes at the time of its processing to become functional.</p> <p>b) Name the technique the American company Eli Lilly used for the commercial production of human insulin.</p> <p>c) How are the two polypeptides of a functional insulin chemically held together?</p> <p><b>a) 'C' Peptide is removed.</b>  <b>b) r-DNA technology / Recombinant DNA Technology.</b>  <b>c) Disulphide bonds.</b></p>	1+1+1
28	26	<p>Q 28. (a) Explain the mode of action of <math>\text{Cu}^{2+}</math> releasing IUDs as a good contraceptive. How is hormone releasing IUD different from it?</p> <p>(b) Why is 'Saheli' a preferred contraceptive by women (Any two reasons)?</p> <p><b>(a) <math>\text{Cu}^{++}</math> releasing IUDs - Suppress sperm motility / suppress the fertilizing capacity of sperms.</b>  <b>Hormone releasing IUDs - Make the uterus unsuitable for implantation / the cervix hostile to the sperms.</b>  <b>(b) It is a 'once a week' pill / oral contraceptive / with very few side effects / high contraceptive value/ non-steroidal / easy to use / not expensive.</b></p> <p style="text-align: right;"><b>(Any two)</b></p>	<p>1</p> <p>1</p> <p><math>\frac{1}{2} \times 2</math></p>
29	30	<p>Q 29. Study the picture of biogas plant given below and answer the questions that follow :</p> 	

		<p>(a) Name the components gaining entry from A into the chamber.</p> <p>(b) Mention the group of bacteria and the condition in which they act on the component that entered from A in the digester.</p> <p>(c) Name the components that get collected in gas holder.</p> <p><b>(a) Slurry of dung / dung and water</b>  <b>(b) Methanogens / <i>Methanobacterium</i>, grow anaerobically</b>  <b>(c) Methane/ CO<sub>2</sub>/ H<sub>2</sub> (any one).</b></p> <p style="text-align: center;"><b>OR</b></p> <p>(c) Write any two advantages of Biogas.</p> <p><b>(c) The biogas thus produced is used for cooking and lighting, less emission of the greenhouse gasses methane, CO<sub>2</sub> and nitrous oxide, environmentally friendly recirculation of organic waste from industry and households.</b></p> <p style="text-align: right;"><b>(Any two)</b></p>	<p>1 1 + 1 1</p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p>
30	29	<p>Q 30. Infertility is a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse. Infertility affects millions of people and has an impact on their families and communities. The cause of infertility may be difficult to determine but may include inadequate levels of certain hormones in both men and women. The main symptom is an inability to get pregnant. In many cases, there are no additional symptoms.</p> <p>Many treatments significantly improve the chances of getting pregnant. They include hormone treatments, fertility drugs</p>	



		<p>and surgery. In addition, assisted reproduction uses various medical techniques to fertilize an egg.</p> <p>Answer the following questions based on the above information:</p> <p>(a) List any two reasons other than physical and congenital disorders for causing infertility in couples.</p> <p>(b) Explain how IVF as a technique helped childless couples in having children.</p> <p>(c) Describe GIFT.</p> <p><b>(a) Diseases / drugs / immunological / psychological (any two)</b></p> <p><b>(b) In in-vitro fertilisation, the fertilisation takes place outside the body followed by embryo transfer. In this method ova from wife / donor and sperms from husband / donor are collected and induced to form zygote in the lab, zygote / early embryo is transferred into the fallopian tube, embryos with more than 8 blastomeres, are transferred into the uterus for further development.</b></p> <p><b>(c) GIFT - Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one.</b></p> <p style="text-align: center;"><b>OR</b></p> <p>(c) Describe ICSI.</p> <p><b>(c)ICSI - Specialised procedure to form embryo by injecting sperm directly into the ovum.</b></p>	<p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p><math>\frac{1}{2} \times 4</math></p> <p>1</p> <p>1</p>
31	33	<p>Q 31. (a) Describe the process of megasporogenesis, in an angiosperm by schematic representation only.</p> <p>(b) Draw a diagram of a mature embryo sac of an angiosperm labeling six parts.</p>	



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

Diagram of  
embryo sac  
 $\frac{1}{2} \times 6 = 3$

OR

- (a) Name the three different parts of a human sperm and write their involvement in the process of fertilization.
- (b) Mention the pituitary hormones involved in the process of spermatogenesis. State their functions.

(a)

- **Acrosome-filled with enzyme which helps the sperm to enter into the ovum (through zona pellucida).**
- **Nucleus-containing chromosomal material / genetic material.**
- **Mitochondria / Middle piece-energy source for swimming.**
- **Tail-it helps in movement / motility.**
- **Plasma membrane-sperm is enveloped by it.**

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

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

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

(Any three)

(b) **Pituitary hormones: Luteinising hormone (LH) , follicle stimulating hormone (FSH)**

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

**(LH) acts at the leydig cells and stimulates synthesis and secretion of androgens**

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

**(FSH) acts on sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis.**

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

Q 32. (a) Differentiate between pleiotropy and polygenic inheritance by taking one example of each.

(b) Generally, it is observed that human males suffer from haemophilia more than human females, who rarely suffer from it. Explain giving reasons.

Pleiotropy	Polygenic Inheritance
a single gene can exhibit multiple phenotypic expression = 1	Inheritance which are generally controlled by three or more genes = 1
eg.- Phenylketonuria / mutation of a gene coding for phenylalanine hydroxylase can manifests multiple phenotypic expression (mental retardation and a reduction in hair and skin pigmentation) / a single gene in garden pea control the size of starch grain and seed shape = $\frac{1}{2}$	eg.- Human skin colour controlled by three genes (A,B,C) = $\frac{1}{2}$

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

**This is a sex linked / X chromosome linked recessive disease, the heterozygous female / carrier for haemophilia may transmit the disease to sons (male progeny). The possibility of haemophilic female/daughter is rare because mother of such a female has to be at least carrier and the father should be haemophilic.**

$$1 + 1$$

32

31

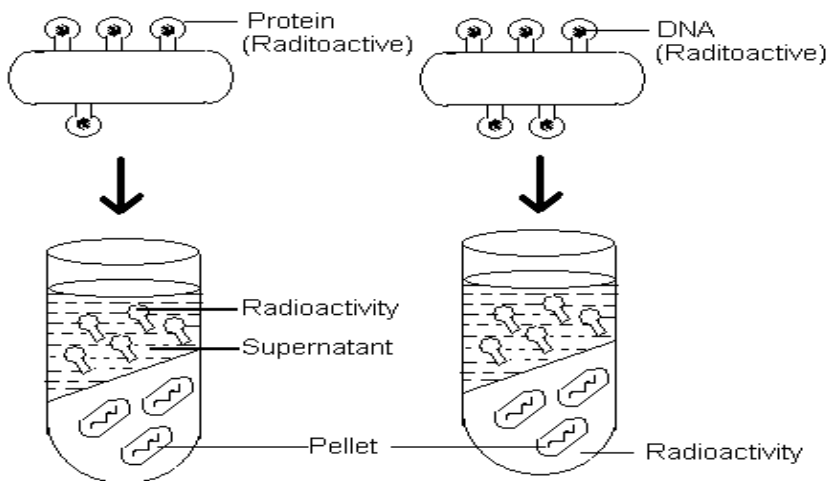
**OR**

Explain the discovery made by Hershey and Chase using radioactive sulphur and phosphorus in their experiment.

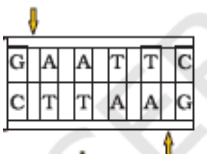
**Hershey & Chase performed Blender's Experiment.**

**Objective** – It's objective was to find out whether DNA or protein is the genetic material.

- This experiment was devised by Hershey and Chase with two preparations of T<sub>2</sub> phage.
- In one preparation, the protein part was made radioactive and in the other, nucleic acid (DNA) was made radioactive.
- These two phage preparations were allowed to infect the culture of *E.coli*.
- Soon after infection, before lysis of cells, the *E.coli* cells were gently agitated in a blender, to loosen the adhering phage particles and the culture was centrifuged.
- The heavier infected bacterial cells pelleted to the bottom and the lighter viral particles were present in the supernatant.

		<ul style="list-style-type: none"> <li>• It was found that when, T2 phage containing radioactive DNA was used to infect <i>E.coli</i>, and the supernatant contained most of the radioactivity.</li> <li>• This suggests that during infection by the virus, the viral DNA enters the bacterial cell and that has the information for the production of more viral particles.</li> <li>• It proves that DNA and not proteins, is the genetic material in bacteriophages.</li> </ul>  <p style="text-align: center;"><b>Blender's Experiment</b></p>	3
33	32	<p>Genetic engineering has played a very important role in the field of agriculture. Perhaps the most significant being the development of transgenic crops, resistance to herbicides, insect pests, pathogens and environmental stresses.</p> <p>The attack of insects, pests and many other pathogens have greatly reduced our crop's yield and quality. To overcome these losses transgenic technology provides an alternative method to improve pest control management and thus helped in increasing the yield and quality of crops.</p> <p>Answer the following questions based on transgenic technology:</p> <p>(a) List the two important benefits of using transgenic technology over the use of chemical pesticides or use of conventional breeding methods.</p> <p>(b) Write the scientific name of the organism from where Bt genes</p>	Diagram = 2

	<p>are isolated.</p> <p>(c) Explain how the specific Bt gene gets isolated and incorporated into the cotton plant and provides resistance against bollworm.</p> <p>(a)</p> <ul style="list-style-type: none"> <li>• <b>Traditional hybridization procedures used in plant and animal breeding, very often lead to inclusion and multiplication of undesirable genes along with the desired genes. Transgenic technology overcomes this limitation and allows us to isolate and introduce only one or a set of desirable genes without introducing undesirable genes into the target organism.</b></li> <li>• <b>Further increases in the yield with the existing varieties of crops are not possible using conventional methods of breeding.</b></li> <li>• <b>Agrochemicals cause pollution of soil and water and are too expensive for the farmers.</b></li> </ul> <p style="text-align: right;">(Any two)</p> <p>(b) <i>Bacillus thuringiensis</i></p> <p>(c) Once a bollworm feeds on Bt cotton plant the inactive protoxin produced by <i>Bacillus thuringiensis</i>, is converted into an active form of toxin, due to the alkaline pH of the gut which solubilise the crystals, the activated toxin binds to the surface of its midgut epithelial cells, create pores that cause cell swelling and lysis, and eventually cause death of the insect.</p>	<p>1 + 1</p>
	<p style="text-align: center;">OR</p> <p>a) Describe the technique that is very effectively used in Biotechnology to get a large amount of desired DNA for research and detailed investigation.</p> <p>b) Name a specific restriction endonuclease and write the palindromic nucleotide sequence in the DNA recognised by this enzyme. Also, indicate the site at which it makes the cut.</p>	<p>1</p> <p><math>\frac{1}{2} \times 4</math></p>

	<p>a)</p> <ul style="list-style-type: none"> <li>• By using PCR (polymerase chain reaction)</li> <li>• denaturation of desired DNA</li> <li>• separate into 2 strands where each acting as template</li> <li>• for each strand a separate set of primer used (two primers)</li> <li>• with the help of deoxyribonucleotides and Taq polymerase (DNA polymerase isolated from <i>Thermus aquaticus</i>)</li> <li>• results in extension of DNA primer.</li> </ul> <p>b)</p> <p>EcoRI</p> <p>5' — GAATTC — 3'</p> <p>3' — CTTAAG — 5'</p> 	<p><math>\frac{1}{2} \times 6</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p>
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