

# Senior School Certificate Examination

March 2008

Marking Scheme - Biology (Theory) *Outside DEPN*

Expected Answers/Value Points

## General Instructions :

### *The Marking Scheme and mechanics of marking*

1. In the marking scheme the marking points are separated by commas, one oblique line (/) indicates acceptable alternative, two obliques (//) indicate complete acceptable alternative set of marking points.
2. Any words/phrases given within brackets do not have marks.
3. Allow spelling mistakes unless the misspelt word has another biological meaning. Ignore plurals unless otherwise stated in the marking scheme.
4. In any question exclusively on diagram no marks on any description. But in questions on descriptions, same value points may be marked on the diagrams as a substitute.
5. All awarded marks are to be written in the left hand margin at the end of the question or its part.
6. Place a tick (✓) in red directly on the key/operative term or idea provided it is in correct context. Place "Half-tick" ½ wherever there is ½ mark in the marking scheme. (Do not place tick indiscriminately just to show that you have read the answer).
7. If no marks are awarded to any part or question put a cross (×) 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

## SECTION A

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

1. Name any two vertebrate body parts that are homologous to human forelimbs.

Ans. Forelimbs of horse / cow / dog / cat ....

Wings of bird / bat.

Flippers of dolphins / whale / seal .....

(Any two)

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

2. When and why do some animals like snails go into aestivation ?

Ans. Summer,

To survive from heat / to escape from desiccation.

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

3. What is the economic value of *Spirulina* ?

Ans. Food rich in proteins // single cell protein // reduces pollution if grown in large quantities in waste waters.=1

[1 mark]

4. What was the speciality of the milk produced by the transgenic cow Rosie ?

Ans. Contains human alpha lactalbumin,

More balanced nutritionally than normal cow milk.

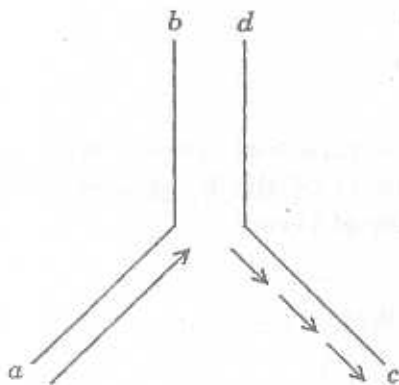
[ $\frac{1}{2} + \frac{1}{2} = 1$  mark]

5. How do neutrophils act as a cellular barrier to pathogens in humans ?

Ans. Phagocytose / kill / destroy microbes.

[1 mark]

6. Mention the polarity of the DNA strands a - b and c - d shown in the replicating fork given below.



Ans. a-b = 3' - 5'

c - d = 5' - 3'

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

7. **Mention any two significant roles predation plays in nature.**

Ans. Conduits of energy transfer to the next trophic level / prey population is kept under control / helps in biological control / maintains species diversity. (Any two)

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

8. **Why is the polar region not a suitable habitat for tiny humming birds ?**

Ans. When volume is considered surface area is large, loss of heat is more in cooler regions / difficult to generate more heat.

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

### SECTION B

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

9. (a) **Expand IUD.**

(b) **Why is hormone releasing IUD considered a good contraceptive to space children ?**

Ans. (a) Intra Uterine Device.

(b) Increases phagocytosis of sperms, reduces sperm mobility, makes uterine unsuitable for implantation, makes cervix hostile to sperms (Any two)

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

10. **Name the interaction in each of the following :**

(a) ***Cuscuta* growing on a shoe flower plant**

(b) **Mycorrhizae living on the roots of higher plants**

(c) **Clown fish living among the tentacles of sea anemone**

(d) **Koel laying her eggs in crow's nest**

Ans. (a) Parasitism.

(b) Mutualism

(c) Commensalism

(d) Brood parasitism.

[ $\frac{1}{2} \times 4 = 2$  marks]

11. **A plant of *Antirrhinum majus* with red flowers was crossed with another plant of the same species with white flowers. The plants of the  $F_1$  generation bore pink flowers. Explain the pattern of inheritance with the help of a cross.**

Ans. Parents - Red Flower                      x                      White Flower

RR

rr

Gametes -

(R)

(r)

=  $\frac{1}{2}$

$F_1$

Rr - Pink =  $\frac{1}{2}$

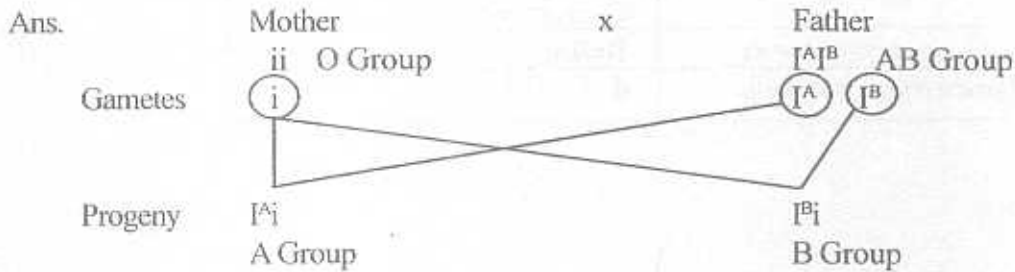
Because gene for red colour is not completely dominant over the recessive gene =  $\frac{1}{2}$

Pattern of inheritance - Incomplete dominance =  $\frac{1}{2}$

[ $\frac{1}{2} \times 4 = 2$  marks]

OR

A woman with blood group O married a man with AB group. Show the possible blood groups of the progeny. List the alleles involved in this inheritance.



Possible blood groups - A =  $\frac{1}{2}$   
B =  $\frac{1}{2}$

Alleles -  $I^A, I^B, i$  - (All three = 1  
Any two =  $\frac{1}{2}$   
Any one = 0)

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

12. Why do sportspersons often fall a victim to cocaine addiction ?

Ans. Cocaine being a stimulant, enhances performance.

[1 + 1 = 2 marks]

13. State the difference between the first trophic levels of detritus food chain and grazing food chain.

Ans. DFC - Dead and decaying organic matter / Dead remains of plants and animals = 1  
GFC - Living green plants / producers = 1

[1 + 1 = 2 marks]

14. Coconut palm is monoecious while date palm is dioecious. Why are they called so ?

Ans. Coconut palm - produces (unisexual) male and female flowers in the same plant,  
Date palm - produces (unisexual) male and female flowers in separate plants.

[1 + 1 = 2 marks]

15. How can DNA segments, separated by gel electrophoresis, be visualised and isolated ?

Ans. Visualised by staining the DNA fragments with ethidium bromide, exposing them to UV radiation (appear as bright orange bands). =  $\frac{1}{2} + \frac{1}{2} = 1$

Bands are cut out from agarose gel, extracted from gel piece (by elution) =  $\frac{1}{2} + \frac{1}{2} = 1$

[1 + 1 = 2 marks]

16. How do Darwin's finches illustrate adaptive radiation ?

Ans. Original stock of seed eating finches migrated to different habitats (of Galapagos Islands), adapted to different feeding methods, by altered beak structure, evolved into different types of finches. =  $\frac{1}{2} \times 4 = 2$

[2 marks]

17. Name the blank spaces a, b, c and d from the table given below:

Type of Microbe	Scientific name	Commercial product
Bacterium	a	Lactic acid
Fungus	b	Cyclosporin A
c	<i>Monascus purpureus</i>	Statin
Fungus	<i>Penicillium notatum</i>	d

Ans. a - *Lactobacillus*

b - *Trichoderma polysporum*

c - Yeast

d - Penicillin

[ $\frac{1}{2} \times 4 = 2$  marks]

18. DDT content in the water of a lake that supplies drinking water to the nearby villages, is found to be 0.003 ppm. The kingfishers of that area are reported to have 2 ppm of DDT. Why has the concentration increased in these birds? What harm will this cause to the bird population? Name the phenomenon.

Ans. DDT neither excreted nor metabolised, interferes with Calcium metabolism, decline in bird population/ due to thinning of egg shell / premature breaking of eggs, bio-magnification.

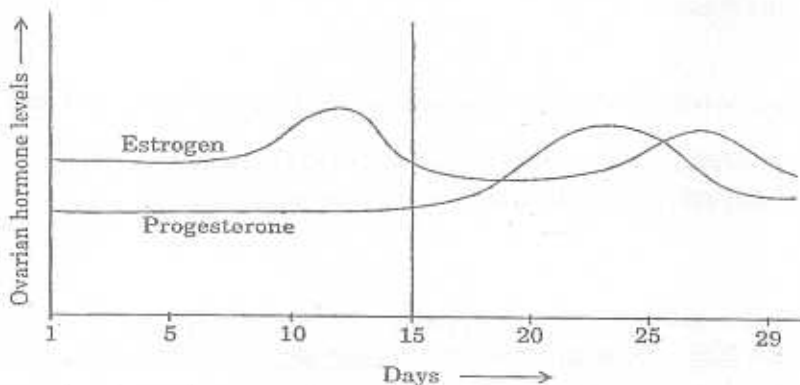
=  $\frac{1}{2} \times 4 = 2$ .

[2 marks]

### SECTION C

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

19.(a)



Read the graph given above and correlate the uterine events that take place according to the hormonal levels on

(i) 6-15 days

(ii) 16 - 25 days

(iii) 26 - 28 days (if the ovum is not fertilised)

(b) Specify the sources of the hormones mentioned in the graph.

Ans. (a)(i) Regeneration of endometrium. =  $\frac{1}{2}$

(ii) Uterus gets highly vascularised, ready for embryo implantation =  $\frac{1}{2} + \frac{1}{2} = 1$

(iii) Disintegration of the endometrium =  $\frac{1}{2}$

( $\frac{1}{2} + 1 + \frac{1}{2} = 2$ )

- (b) Estrogen - by ovarian follicle. =  $\frac{1}{2}$   
 Progesterone - Corpus luteum =  $\frac{1}{2}$

( $\frac{1}{2} + \frac{1}{2} = 1$ )  
 [2+1=3 marks]

20. Explain the role of baculoviruses as biological control agents. Mention their importance in organic farming.

Ans. Baculoviruses produce narrow spectrum insecticides to kill insects and other arthropods which are species specific, does not affect non target organisms / no negative impact on other insects, mammals, birds, or fish. = 1+1=2

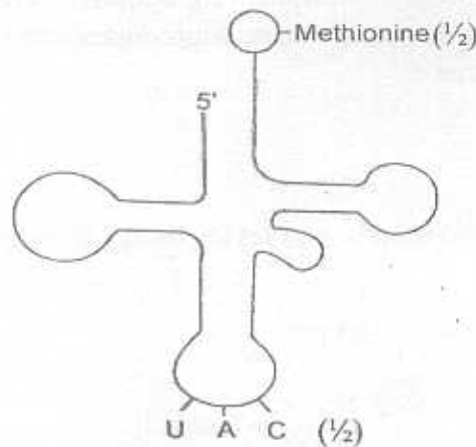
Eliminates the use of chemical pesticides. / conserves beneficial insects / integrated pest management = 1

[2+1=3 marks]

21. (a) Draw the structure of the initiator tRNA adaptor molecule.

(b) Why is tRNA called an adaptor molecule ?

Ans. (a)

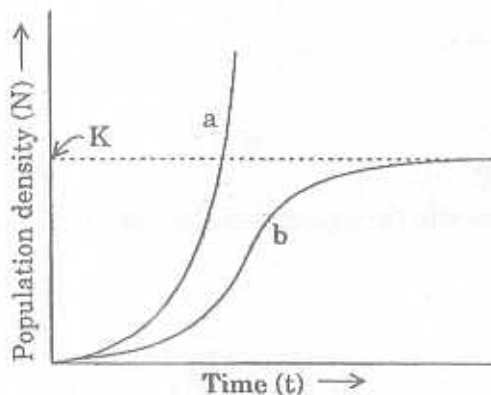


Clover leaf shape = 1.

- b. On one hand it reads the code =  $\frac{1}{2}$ .  
 On the other hand it binds to specific amino acid =  $\frac{1}{2}$ .

[2+1=3 marks]

22.



Study the population growth curves shown above.

- Identify curves 'a' and 'b'.
- Mention the conditions responsible for the curves 'a' and 'b' respectively.
- Give the necessary equation for the curve 'b'.

- Ans. (i) a - exponential curve =  $\frac{1}{2}$   
 b - logistic curve =  $\frac{1}{2}$
- (ii) a - unlimited food resource / responses are not limiting the growth. =  $\frac{1}{2}$   
 b - limited food resource / responses are limiting the growth. =  $\frac{1}{2}$
- (iii)  $\frac{dN}{dt} = rN \left( \frac{K - N}{K} \right)$

[1+1+1=3 marks]

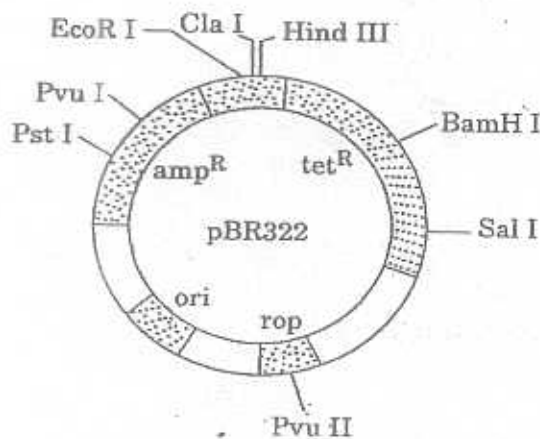
23. Why is *Agrobacterium tumefaciens* a good cloning vector? Explain.

Ans. If any desired / foreign gene is linked with, Ti plasmid of *Agrobacterium tumefaciens*, the bacterium is modified into non-pathogenic, plasmid is cloned into multiple copies, can be delivered into a variety of plants, desired chemical will be produced.

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

OR

Explain the importance of (a) ori, (b) amp<sup>R</sup> and (c) rop in the E. coli vector shown below :



- Ans. (a) ori - origin of replication.  
 (b) amp<sup>R</sup> - ampicillin antibiotic resistant gene  
 (c) rop - gene to produce the proteins involved in the replication of the plasmid.

[1x3 = 3 marks]



Study the mRNA segment given above which is complete to be translated into a polypeptide chain.

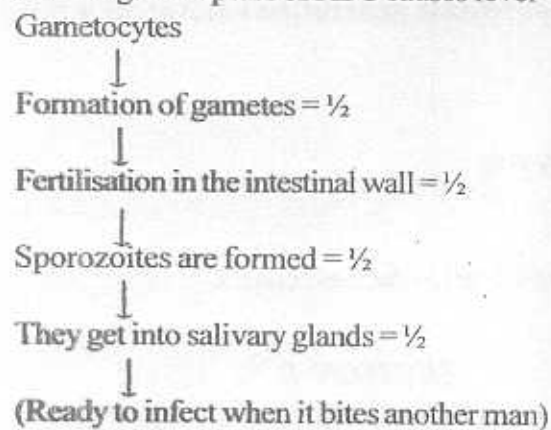
- (i) Write the codons 'a' and 'b'  
 (ii) What do they code for ?  
 (iii) How is peptide bond formed between two amino acids in the ribosome ?

- Ans. (i) a - AUG =  $\frac{1}{2}$   
 b - UAA / UAG / UGA =  $\frac{1}{2}$   
 (ii) AUG codes for Methionine. =  $\frac{1}{2}$   
 UAA / UAG / UGA - Stop codon / Nonsense codon / Does not code for any amino acid =  $\frac{1}{2}$   
 (iii) Charged tRNAs are brought closer together on mRNA in the ribosomes, ribosome acts as a catalyst (ribozyme) forming peptide bond. =  $\frac{1}{2} + \frac{1}{2} = 1$ .

[1+1+1=3 marks]

25. (a) Name the infective stage of *Plasmodium* which *Anopheles* mosquito takes in along with the blood meal from an infected human.  
 (b) Why does the infection cause fever in humans ?  
 (c) Give a flow chart of the part of the life-cycle of this parasite passed in the insect.

- Ans. (a) Gametocyte =  $\frac{1}{2}$   
 (b) Haemozoin released during the rupture of RBC causes fever =  $\frac{1}{2}$   
 (c)



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

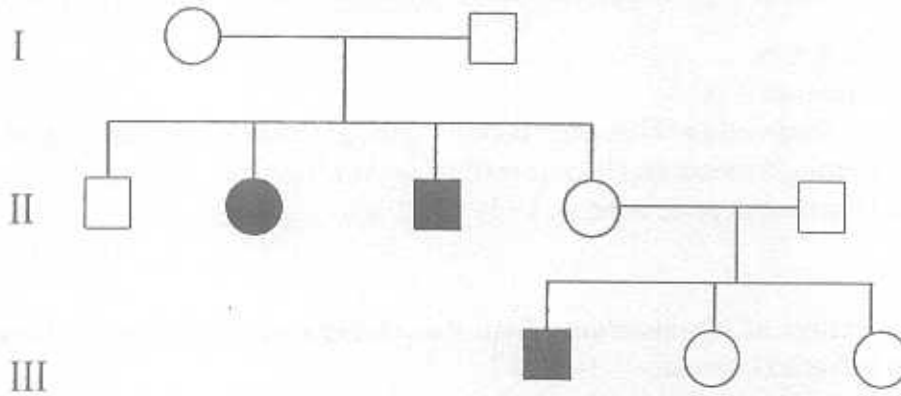
26. A factory drains its waste water into the nearby lake. It has caused algal bloom.  
 (a) How was the algal bloom caused ?  
 (b) What would be the consequences ?  
 (c) Name the phenomenon that caused it.

- Ans. (a) Nutrients in the waste water causes / extensive growth or proliferation of planktonic or free floating algae. =  $\frac{1}{2}$   
 (b) Algae use  $O_2$ , BOD value goes high, deterioration of water quality, high fish mortality, scum and unpleasant odour / lake gets choked / faces death (any four) =  $\frac{1}{2} \times 4 = 2$   
 (c) Eutrophication =  $\frac{1}{2}$

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



27. Study the given pedigree chart and answer the questions that follow.



- (a) Is the trait recessive or dominant ?  
 (b) Is the trait sex-linked or autosomal ?  
 (c) Give the genotypes of the parents in generation I and of their third and fourth child in generation II.

Ans. (a) a - Recessive =  $\frac{1}{2}$   
 (b) b - Autosomal =  $\frac{1}{2}$   
 (c) c- Parents - Aa and Aa =  $\frac{1}{2} + \frac{1}{2}$   
 Third child - aa =  $\frac{1}{2}$   
 Fourth child - Aa =  $\frac{1}{2}$   
 Any other alphabet can be taken in place of A and a.

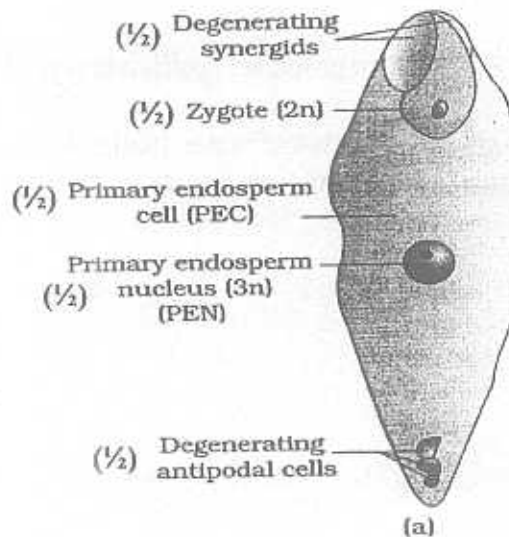
[ $\frac{1}{2} + \frac{1}{2} + 2 = 3$  marks]

### SECTION D

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

28. (a) Draw a schematic labelled diagram of a fertilised embryo sac of an Angiosperm.  
 (b) Describe the stages in embryo development in a dicot plant.

Ans. (a)



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

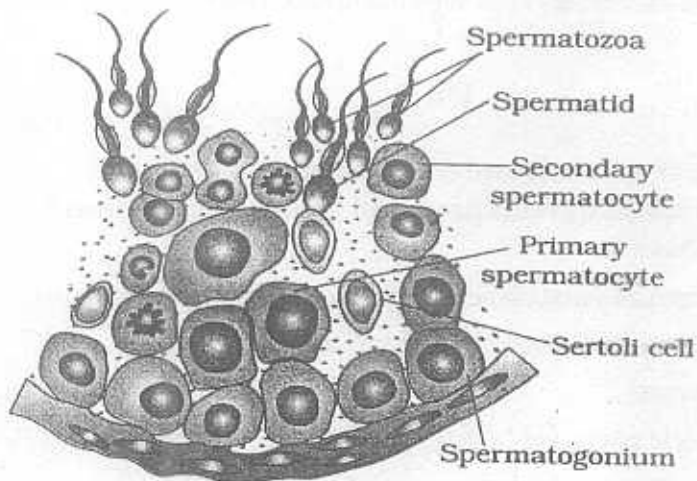
- (b) The zygote divides unequally to form two cells,  
 The smaller cell divides repeatedly to produce a row of 4-8 cells,  
 The terminal cell divides to produce a cluster of cells called the globular embryo / proembryo  
 The remaining cells constitute the suspensor,  
 A few cells of the proembryo nearest of the suspensor develop into hypocotyl and radicle while other cells give rise to epicotyl, plumule and cotyledons. ( $\frac{1}{2} \times 5 = 2\frac{1}{2}$ )

[ $2\frac{1}{2} + 2\frac{1}{2} = 5$  marks]

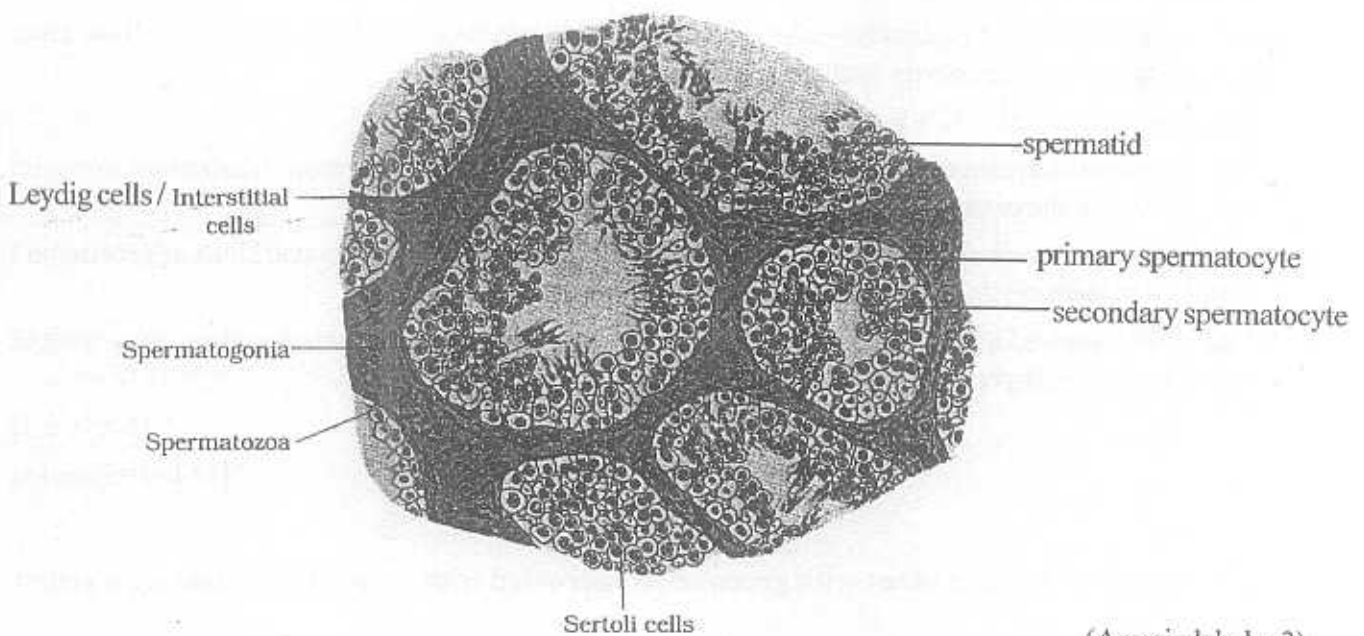
OR

- (a) Draw a labelled diagram of a sectional view of human seminiferous tubule.  
 (b) Differentiate between gametogenesis in human males and females on the basis of  
 (i) time of initiation of the process.  
 (ii) products formed at the end of the process.

Ans. (a)



OR



(Any six labels=3)

- (b) (i) Male - puberty  
 Female - foetal / embryonic stage
- (ii) Male - sperm / spermatozoan  
 Female - ovum

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

[3+2=5 marks]

29. Explain the steps involved in the production of genetically engineered insulin.

Ans. Gene for chain A and gene for chain B of insulin are prepared, inserted into plasmid, of *E. coli* separately, *E. coli* cultured and chains extracted, combined by disulphide bonds (to produce human insulin).

[1x5=5 marks]

OR

- (a) Name the nematode that infests and damages tobacco roots.  
 (b) How are transgenic tobacco plants produced to solve this problem ?

Ans. (a) *Meloidogyne incognita* = 1

- (b) Nematode specific genes isolated cloned and introduced into tobacco plants, ds RNA are produced and RNAi interference initiated, mRNA translation silenced, survival of the nematode not possible in the host plant. =  $1 \times 4 = 4$

[1+4=5 marks]

30. What is 'semi-conservative' DNA replication ? How was it experimentally proved and by whom ?

Ans. After the completion of replication (of one DNA molecule into two) each DNA molecule will have one parental strand and one newly synthesised strand = 1.

Messelson and Stahl =  $\frac{1}{2} + \frac{1}{2} = 1$

\* *E. coli* grown in medium containing  $^{15}\text{NH}_4\text{Cl}$  ( $^{15}\text{N}$  - heavy Nitrogen), for many generations to ensure that all DNA in the bacteria were heavy,

\* Heavy *E. coli* transferred to a medium with normal  $^{14}\text{NH}_4\text{Cl}$ , (after 20 minutes) DNA of generation I extracted to measure their densities, they were of intermediate density,

\* After 40 minutes DNA of II generation were extracted and tested for their densities, they were of equal amounts of (hybrid) intermediate DNA, and light DNA /  $^{14}\text{NH}_4\text{Cl}$ .

$(6 \times \frac{1}{2} = 3)$

[1+1+3=5 marks]

OR

A homozygous tall pea plant with green seeds is crossed with a dwarf pea plant with yellow seeds.

- (i) What would be the phenotype and genotype of  $F_1$  ?  
 (ii) Work out the phenotypic ratio of  $F_2$  generation with the help of a Punnett square.

Ans. (i) Phenotype of  $F_1$  - Tall and Yellow =  $\frac{1}{2}$   
 Genotype of  $F_1$  - TtYy =  $\frac{1}{2}$

(ii)  $F_1$  TtYy x TtYy  
 $F_2$

	TY	Ty	tY	ty
TY	TTYy Tall & Yellow	TTYy Tall & Yellow	TtYY Tall & Yellow	TtYy Tall & Yellow
Ty	TTYy Tall & Yellow	Ttyy Tall & Green	TtYy Tall & Yellow	Ttyy Tall & Green
tY	TtYY Tall & Yellow	TtYy Tall & Yellow	ttYY Dwarf & Yellow	ttYy Dwarf & Yellow
ty	TtYy Tall & Yellow	Ttyy Tall & Green	ttYy Dwarf & Yellow	ttty Dwarf & Green

Tall & Yellow : Tall & Green : Dwarf & Yellow : Dwarf & Green  
 9 : 3 : 3 : 1

Male gametes =  $\frac{1}{2}$

Female gametes =  $\frac{1}{2}$

Punnett square =  $\frac{1}{2}$

Four phenotypes = 2

Ratio =  $\frac{1}{2}$

[1+4=5 marks]