Strictly Confidential: (For Internal and Restricted use only)
Senior Secondary &Secondary School Examination
Comptt.Examination, 2021
Marking Scheme – SUBJECT NAME (SUBJECT CODE 0 44)

(PAPER CODE 57/1/1

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. **Evaluation is a timed mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. **"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its' leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/ document to anyone, publishing in any magazine and printing in News Paper/ Website etc may invite action under IPC."**

3. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them.**
4. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
5. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled.
6. Evaluators will mark(") wherever answer is correct. For wrong answer 'X" be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
8. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
10. A full scale of marks 70 (example 0-80) has to be used. Please do not hesitate to award full marks if the answer deserves it.

11. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).
12. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    - Leaving answer or part thereof unassessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - Marks in words and figures not tallying.
    - Wrong transfer of marks from the answer book to online award list.
    - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.

14. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

15. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

16. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.

17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

SECTION – A

1. Write the possible genotypes of a person with blood group 'B'.

Ans. I^BI^B, I^Bi = ½ × 2

[1 mark]

2. Write the scientific name of the causative agent of pneumonia in humans and mention one specific symptom of the disease.

Ans. *Streptococcus pneumoniae* / *Haemophilus influenzae* = ½

Lips / finger tips turns gray to bluish in colour = ½

[1 mark]

3. Why do cattle and goats generally not browse on *Calotropis* plants growing in an abandoned field ? Give any one reason.

Ans. They are highly poisonous , contain cardiac glycosides = ½ + ½

[1 mark]

4. Expand MALT and mention any one location of it in the human body.

Ans. Mucosa Associated Lymphoid Tissue = ½

Lining of respiratory / digestive / urinogenital tract = ½

[1 mark]

5. Write the dominant traits in pea plants observed by Mendel with respect to :

(a) colour of pea pod.

(b) flower position.

Ans. a) green= ½

b) axial = ½

[1 mark]

6. After separation of DNA fragments by gel electrophoresis and staining with ethidium bromide, a student placed the gel in the UV chamber under the UV light. State a reason for doing so.

Ans. DNA fragments will not be seen in visible light , and without staining = ½ × 2

// DNA segment will be visible only after staining with ethidium bromide , only visible under UV light = ½ × 2

[1 mark]

7. What for are Cyclosporin A and Streptokinase bioactive molecules prescribed by a doctor ?

Ans. Cyclosporin A – immunosuppressive agent / used in organ transplant = ½
Streptokinase- clot buster / for removing clots from blood vessels of patients = ½

[1 mark]

8. Write the symbolic representation used in a pedigree chart showing (i) a carrier mother and (ii) a sufferer son, with respect to haemophilia.

Ans. i) Carrier mother - XX^C, ii) sufferer son – X^CY = ½ × 2

[½ + ½ = 1 mark]

9. Write the full name of the technique used for the transfer of early embryos in the uterus of the mother for further development. Write the minimum number of blastomeres the embryo must have before being transferred.

Ans. IUT/ Intra uterine transfer, embryo with eight or more cells = ½ × 2

[1 mark]

10. For early detection of cancer, 3-D images of tissues are essential. Name the technique and the basis on which it can generate three-dimensional image of changes in the living tissue.

Ans. MRI / Magnetic Resonance Imaging = ½

Uses strong magnetic fields / non ionising radiations = ½

[1 mark]

11. (a) ***Assertion:*** **Statutory ban on amniocentesis for sex-determination is to legally check increasing female foeticide.**

Reason: **In amniocentesis, some of the amniotic fluid that has the developing foetus is taken to analyse the chromosomes in the foetal cells.**

(A) Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

(B) Both Assertion and Reason are true, but Reason is *not* the correct explanation of the Assertion.

(C) Assertion is true, but Reason is false.

(D) Both Assertion and Reason are false.

Ans. B // Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion.

[1 mark]

OR

(b) ***Assertion :*** **Our laws permit legal adoption and it is as yet, one of the best methods for childless couples looking for parenthood.**

Reason: **Emotional, religious and social factors are also no deterrents in the legal adoption of orphaned and destitute children in India.**

(A) Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

(B) Both Assertion and Reason are true, but Reason is *not* the correct explanation of the Assertion.

(C) Assertion is true, but Reason is false.

(D) Both Assertion and Reason are false.

Ans. B // Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion. = 1

[1 mark]

12. ***Assertion :*** **When DNA from two different sources are cut by the same restriction enzyme, the resultant DNA fragments have different kinds of'sticky ends'.**

Reason : **These can be joined together end-to-end using DNA ligases.**

(A) Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

(B) Both Assertion and Reason are true, but Reason is *not* the correct explanation of the Assertion.

(C) Assertion is true, but Reason is false.

(D) Both Assertion and Reason are false.

Ans. D) // Both assertion and reason are false =1

[1 mark]

13. ***Assertion:*** **Large holes in 'Swiss cheese' are due to the production of a large amount of carbon dioxide by specific microbe.**

Reason : **The specificity of characteristic texture, flavour and taste of 'Swiss cheese' is due to the use of bacterium *Propionibacterium shermanii. 1***

(A) Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

(B) Both Assertion and Reason are true, but Reason is *not* the correct explanation of the Assertion.

(C) Assertion is true, but Reason is false.

(D) Both Assertion and Reason are false.

Ans. A) // Both assertion and reasoning is true and reason is the explanation of assertion =1

[1 mark]

14. ***Assertion :*** **The progenies of a test cross can be easily analysed to predict the genotype of the test organism.**

Reason : **In a typical test cross, an organism showing a recessive phenotype is crossed with a recessive parent instead of self-crossing.**

(A) Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

(B) Both Assertion and Reason are true, but Reason is *not* the correct explanation of the Assertion.

(C) Assertion is true , but Reason is false.

(D) Both Assertion and Reason are false.

Ans. B) // Both Assertion and Reason are true, but Reason is not the correct explanation of the Assertion. =1

[1 mark]

15 Read the following passage and answer any four questions from 15(i) to 15(v) :

Acacia plants are particularly common in drier tropical and subtropical environments in the world. The swollen thorn acacias, which form obligate mutualisms with *Pseudomyrmex,* a species of ants, are restricted to the New World. Swollen thorn acacias show several characteristics related to their obligate association with ants, including enlarged thorns with a soft, easily excavated pith; year-round leaf production; enlarged foliar nectaries; and leaflet tips modified into concentrated food sources called Beltian bodies. The thorns provide living space, while the foliar nectaries provide a source of

sugar and liquid. Beltian bodies are a source of oils and protein. Resident ants vigorously guard these resources against encroachment by nearly all comers, including other plants.

(i) The association between the genus of *Acacia* and *Pseudomyrmex* species of ants depict population interactions, known as :

(A) Competition

(B) Amensalism

(C) Mutualism

(D) Predation

Ans. i) C // Mutualism

(ii) In exchange for food and shelter, ants protect *Acacias* from the attacks of:

(A) Fungi

(B) Bacteria

(C) Herbivores

(D) Carnivores

Ans. ii) C // Herbivores

(iii) The above interaction suggests that the relationship between the two species is an example of:

(A) Competitive release

(B) Competitive exclusion

(C) Co-evolution

(D) Resource partitioning

Ans. iii) C // Co-evolution

(iv) The removal of resident ants from the *Acacias* will lead to :

I. Reduced growth of *Acacias*

II. Increased growth of *Acacias*

III. Reduced population of ant species

IV. Increased population of ant species

Choose the correct alternative from the above statements :

(A) Only I is true

(B) I and III are true

(C) III and IV are true

(D) I and IV are true

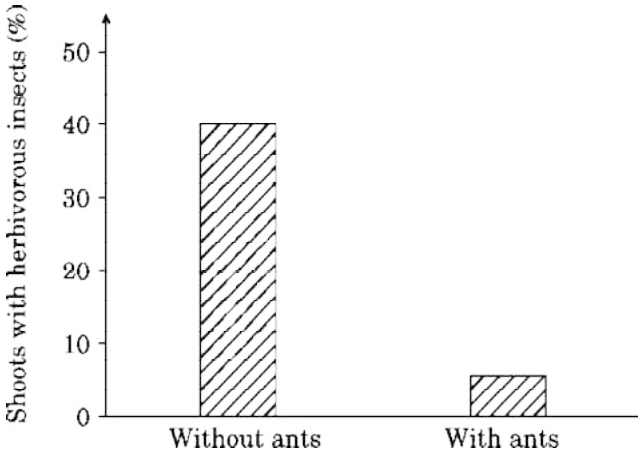
Ans. iv) B // I and III are true

(v) Given below is a graphical representation of ants and the *Acacia* shoots with abundance of herbivorous insects :

Ans. v) A // Acacia shoots will have higher rates of growth with resident ant species

(Any four attempted) = 1 × 4 = 4

[1 × 4 = 4 marks]



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The conclusion drawn from the above data is :

(A) ***Acacia*** **shoots will have higher rates of growth with resident ant species.**

(B) ***Acacia*** **shoots will have neutral effect on growth with or without resident ants species.**

(C) ***Acacia*** **shoots will have higher rates of growth without resident ant species.**

(D) Growth of *Acacia* shoots is independent of resident ant species.

16 Read the following passage and answer any four questions from 16 (i) to 16 (v) :

Experiments involving cloning genes and expressing proteins require the use of host cells to receive the foreign cloned gene. In some experiments, prokaryotes such as *E. coli* and *Bacillus subtilis,* and eukaryotes such as the budding yeast (*Saccharomyces cerevisiae)* are used as host cells for DNA cloning. These host cells are relatively easy to grow in the laboratory and have been studied extensively for decades. Their genetics have been well-understood and therefore can be manipulated to make them appropriate hosts. Many types of cells can be converted into biochemical factories using r-DNA technology to produce various kinds of biomolecules. *E. coli* and *B. subtilis* are both commonly used as host cells for DNA cloning. Fortunately, humans have become very experienced at cultivating microbes cheaply and efficiently on large and small production scales. Over the centuries, brewers and bakers have learned to employ yeast cells to manufacture beer, bread and related food products. In terms of impact on the human health, probably the most important product made by bacteria are antibiotics.

(i) The most commonly used eukaryotic microorganism used in biotechnology is :

(A) ***E. coli***

(B) ***Bacillus subtilis***

(C) ***Saccharomyces cerevisiae***

(D) ***Drosophila***

Ans. i) *C // Saccharomyces cerevisae*

(ii) **Over the centuries, brewers and bakers have learned to employ yeast cells to manufacture many household products. Select the option with all the correct answers from the given list:**

(A) **Bread, Idli, Roquefort cheese**

(B) **Bread, Toddy, Swiss cheese**

(C) **Dosa, Idli, Bread**

(D) **Lipases, Pectinases, Zymase**

Ans. ii) C // Dosa, Idli, Bread

(iii) **The most common product made by certain bacteria having a great impact on human health is :**

(A) **Antibiotics**

(B) **Bioactive molecules**

(C) **Enzymes**

(D) **Fermented drinks**

Ans. iii) A // Antibiotics

(iv) **The best known host cells for DNA cloning and producing various kinds of biomolecules is :**

(A) ***Agrobacterium tumefaciens***

(B) ***Escherichia coli***

(C) **Bacteriophage lambda**

(D) **Bacteriophage**

Ans. iv) B // *Escherichia coli*

(v) **The enzyme that is *not* required to manipulate the genetics of the microrganism so as to convert them into biochemical factories is :**

(A) **Restriction endonuclease**

(B) **DNA polymerase**

(C) **Lactase**

(D) **Ligase**

Ans. v) C // Lactase

(Any four attempted) = 1 × 4 = 4

[1 × 4 = 4 marks]

SECTION B

17. **(a)** **Write the two crucial changes the seeds undergo while reaching maturity that enable them to be in a viable state until the onset of favourable conditions.**

(b) **Name the oldest viable seed excavated from Arctic Tundra as per the records.**

Ans. (a) Dehydration ,

Dormancy / a state of inactivity = ½ × 2

(b) Lupine / *Lupinus arcticus* = 1

[1 + 1 = 2 marks]

18. Describe the two basic processes which contribute to an increase in population density of an area.

Ans. Natality = ½

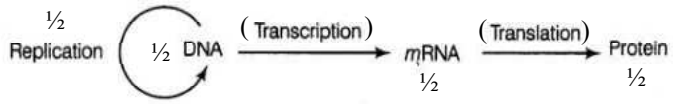
Number of births dring a given period (added in a population to the initial density) / per capita birth = ½

Immigration = ½

Number of individual (of the same species) that have come to the habitat from elsewhere during the time period = ½

[½ × 4 = 2 marks]

19. Draw a labelled schematic representation of the Central Dogma of Molecular Biology as proposed by Francis Crick.



Four labels = ½ × 4

[2 marks]

20. Explain commensalism with the help of an example from the animal world.

Ans. Interaction in which one species benefits and other is neither harmed nor benefitted = 1

eg. Barnacles growing on the back of the whale / Cattle egret and growing cattle / Sea anemone and clown fish (or any other correct example from the animal world) *(Any one)* = 1

[2 marks]

21. (a) Write two closely linked genes that control α-Thalassemia.

(b) Differentiate between Thalassemia and Sickle cell anaemia on the basis of their effect on globin molecule of haemoglobin.

Ans. (a) HBA1 , HBA2 = ½ × 2

(b)

Thalassemia		Sickle cell anaemia
Synthesis of too less haemoglobin	,	Incorrectly functioning globin = ½ + ½

[1 + 1 = 2 marks]

22. (a) Explain the mechanism of pollination in marine sea-grasses like *Zostera.*

Ans. Female flowers remain submerged in water , the pollen grains are released inside the water , pollen grains are long and ribbon like , they are carried passively inside the water and some of them reach the stigma and achieve pollination

[½ × 4 = 2 marks]

OR

(b) Name and state the function of interstitial cell present in the human testes.

Ans. Leydig cells =1

Secrete Androgens / testosterone = 1 (if testicular hormones mentioned =½)

[2 marks]

23. Write the different components of activated sludge. Explain the different ways it can be used further in sewage treatment process.

Ans. Made up of bacterial 'flocs' / masses of bacteria associated with fungal filament to form mesh like structures = 1

Small part pumped back into aeration tank , to serve as inoculum = ½ + ½

[2 marks]

24. State any four salient observations drawn from the Human Genome Project.

Ans. (i) The human genome contains 3164.7 million nucleotide bases.

(ii) The average gene consists of 3000 bases, but sizes vary greatly, with the largest known human gene being dystrophin at 2.4 million bases.

(iii) The total number of genes is estimated at 30,000–much lower than previous estimates of 80,000 to 1,40,000 genes. Almost all (99.9 per cent) nucleotide bases are exactly the same in all people.

(iv) The functions are unknown for over 50 per cent of the discovered genes.

(v) Less than 2 per cent of the genome codes for proteins.

(vi) Repeated sequences make up very large portion of the human genome.

(vii) Repetitive sequences are stretches of DNA sequences that are repeated many times, sometimes hundred to thousand times. They are thought to have no direct coding functions, but they shed light on chromosome structure, dynamics and evolution.

(viii) Chromosome 1 has most genes (2968), and the Y has the fewest (231).

(ix) Scientists have identified about 1.4 million locations where singlebase DNA differences (SNPs – single nucleotide polymorphism, pronounced as 'snips') occur in humans. This information promises to revolutionise the processes of finding chromosomal locations for disease-associated sequences and tracing human history.

(Any four) = ½ × 4

[2 marks]

25. (a) How is the use of "microinjection" different from using the 'method of biolistics' in biotechnology ? Explain.

Ans.

	Microinjection		Biolistics / Gene Gun
(i)	Suitable for animal cell	(i)	Suitable for plants cell
(ii)	Recombinant DNA is directly injected / into the nucleus (of an animal cell)	(ii)	Cells are bombarded with high velocity micro-particles of gold or tungsten / coated with DNA

= (1 + 1)

[2 marks]

OR

(b) Name the Indian crop variety for which in 1997 an American company got patent right through the US Patent and Trademark Office. Why did the company claim it to be an invention or a novelty ?

Ans. Basmati Rice = 1

As Indian Basmati was crossed with semi - dwarf varieties (therefore claimed as an or a novelty) = 1

[1 + 1 = 2 marks]

SECTION C

26. Answer the following questions with reference to "opioids", the commonly abused drug :

(a) Where in our body are the specific opioid receptors present ?

(b) What is heroin chemically known as ?

(c) Write the scientific name of the plant from which opioids are extracted.

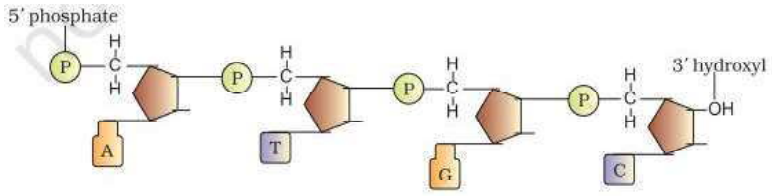
Ans. (a) Central nervous system , Gastrointestinal tract = ½ + ½

(b) Diacetyl morphine = 1

(c) *Papaver somniferum = 1*

[1 ×3 = 3 marks]

27. (a) Draw a polynucleotide chain (four nucleotides long) of DNA having four variable nitrogenous bases.

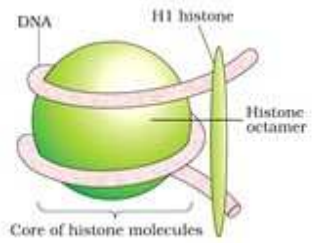


(5' polarity = ½ , 3' polarity = ½ , A and T = ½ , G and C = ½ , phosphodiester bond = ½ , de-oxyribose sugar = ½) = ½ × 6

[3 marks]

OR

(b) Draw a neat labelled diagram of a nucleosome. Name the two basic amino acid residues present mainly in the nucleosome.



= ½ × 4

lysines , arginines = ½ × 2

[2 + 1 = 3 marks]

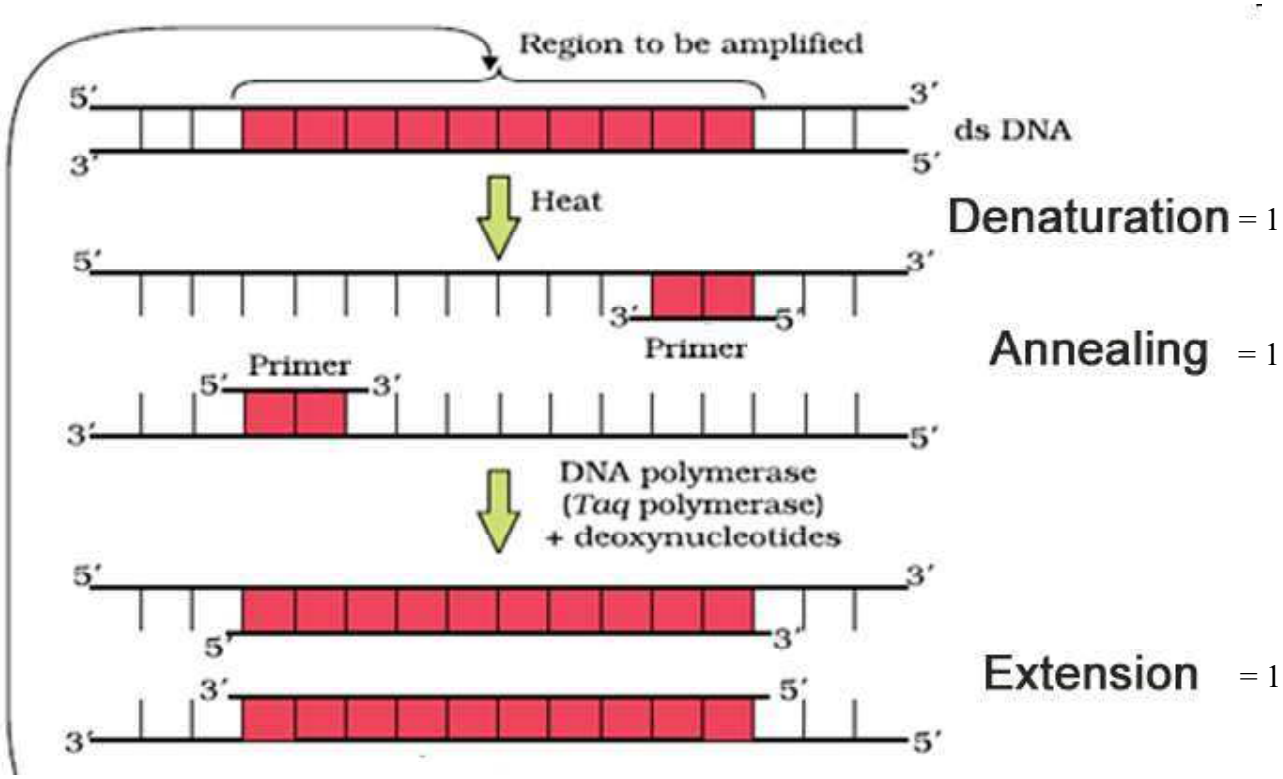
28. Explain the uterine changes taking place during the follicular phase of the menstrual cycle in a human female. Name and explain the role of hormones that bring about these changes.

Ans. The endometrium of uterus regenerates through proliferation = 1

The changes in the uterus are induced by changes in the levels of pituitary / LH , ovarian hormones / progesterone = 1 + 1

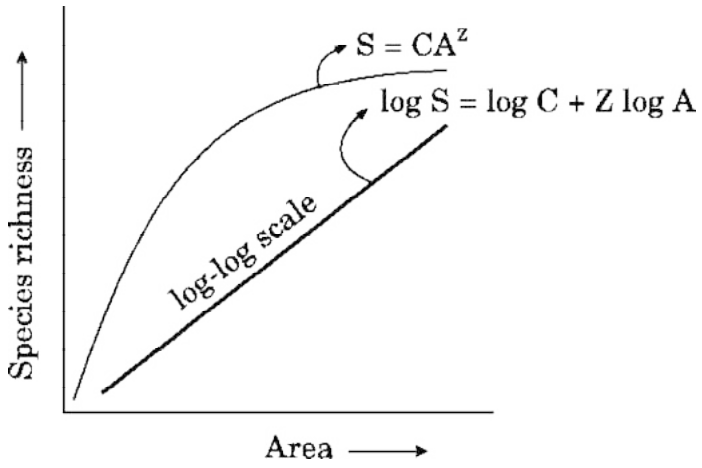
[3 marks]

29. Explain only with the help of self-explanatory diagram, the three basic steps of Polymerase Chain Reaction (PCR).



[1 × 3 = 3 marks]

30. Study the graphical representation of Species richness - Area relationship given below and answer the questions that follow :



(a) What do S, C, Z and A represent in the given graph ?

(b) What will be the range value of 'Z line' if we analyse the species - area relationship among very large areas like entire continent ?

30. (a) S= Species richness ,

A= Area ,

Z = slope of the line / regression coefficient ,

C = Y-intercept = ½ × 4 = 2

(b) Z values in the range of 0.6 to 1.2 = 1

[2 + 1 = 3 marks]

31. (a) How did Matthew Meselson and Franklin Stahl experimentally prove that DNA replication is semiconservative ? Explain.

OR

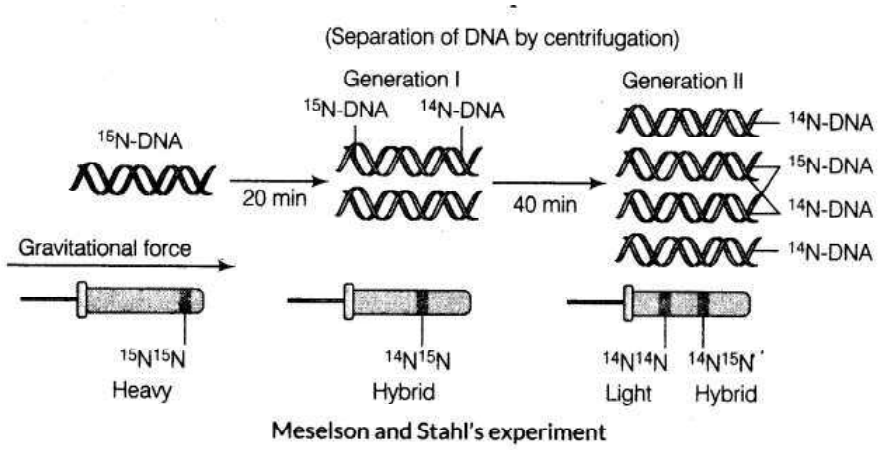
(b) (i) Name and describe the technique which is an important tool of forensic science.

(ii) Mention any two applications of this technique other than its use in forensic studies.

Ans. They grew *E. coli* in a medium containing $^{15}NH_4Cl$ (^{15}N is the heavy isotope of nitrogen) as the only nitrogen source for many generations, the result was that ^{15}N was incorporated into newly synthesised DNA (as well as other nitrogen containing compounds), this heavy DNA molecule could be distinguished from the normal DNA by centrifugation (in a cesium chloride (CsCl) density gradient) , then they transferred the cells into a medium with normal $^{14}NH_4Cl$, and took samples at various definite time intervals as the cells multiplied, and extracted the DNA that remained as double-stranded helices, the various samples were separated independently on CsCl gradients to measure the densities of DNA, thus the DNA that was extracted from the culture one generation after the transfer from ^{15}N

to ^{14}N medium [that is after 20 minutes], DNA extracted from the culture after another generation [that is after 40 minutes II generation], was composed of equal amounts of this hybrid DNA , and of 'light' DNA = ½ x 10

//



(Value points same as given in explanation) = ½ × 10 = 5

[5 marks]

OR

i) DNA fingerprinting = 1

ii) Technique involved

- isolation of DNA,

- digestion of DNA by restriction endonucleases,

- separation of DNA fragments by electrophoresis,

- transferring (blotting) of separated DNA fragments to synthetic membranes such as nitrocellulose or nylon,

-hybridisation using labelled VNTR probe,

- detection of hybridised DNA fragments by autoradiography = ½ × 6

Applications: determining population and genetic diversities, paternity testing = ½ × 2

[1 + 3 + 1 = 5 marks]

32. (a) Explain the three different approaches used in the treatment of a person suffering from Adenosine Deaminase (ADA) Deficiency.

OR

(b) Explain how does an antibiotic resistance gene in a cloning vector (plasmid pBR 322) help in selecting the recombinants from the non-recombinants.

Ans. i) Bone marrow transplantation = 1

ii) Enzyme replacement therapy / functional ADA is given to the patient by injection = 1

iii) Gene therapy / lymphocytes from the blood of the patient are grown in a culture outside the

body, a functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes , which are subsequently returned to the patient, these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes, however if the gene isolate from marrow cells producing ADA is introduced into cells at early embryonic stages = ½ × 6

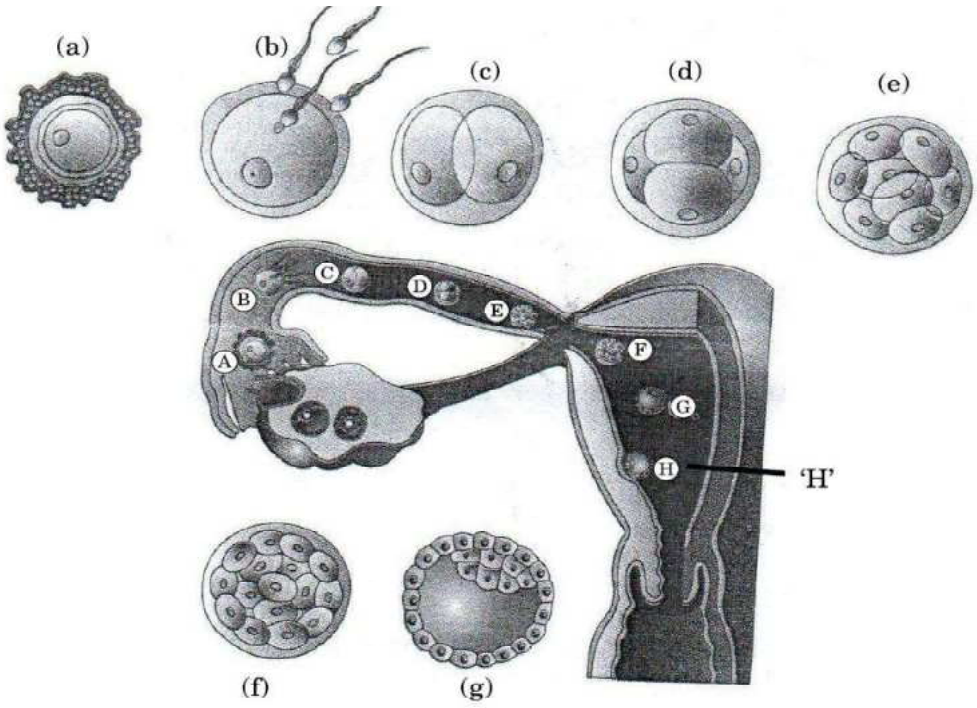
[5 marks]

OR

The ligation of alien DNA is carried out at a restriction site present in one of the two antibiotic resistance genes, for example ligation of foreign DNA at the BamH I site, of tetracycline resistance gene in the vector pBR322, the recombinant plasmids will lose tetracycline resistance due to insertion of foreign DNA, but can still be selected out from non-recombinant ones by plating the transformants on tetracycline containing medium, the transformants growing on ampicillin containing medium are then transferred on a medium containing tetracycline, the recombinants will grow in ampicillin containing medium but not on that containing tetracycline, but non- recombinants will grow on the medium containing both the antibiotics, one antibiotic resistance gene helps in selecting the transformants, whereas the other antibiotic resistance, gene gets inactivated due to insertion of alien DNA and helps in selection of recombinants = ½ × 10

[5 marks]

33. (a) Study the figure given below of a human female reproductive tract showing the transport of ovum, its fertilisation and growing embryo moving through the fallopian tube and answer the questions that follow :



(i) Identify the embryonic stages 'e' and 'g' and differentiate between them.

(ii) Describe the process of implantation as shown in figure 'H'

Ans. a) i) 'e' = morula / embryo with 8 - 16 blastomeres = 1, g = blastocyst = 1
= ½ × 2

stage 'e'	stage 'g'
- Morula	- Blastocyst
- 8 - 16 blastomeres are present in morula	- Blastomeres are arranged into an outer layer and inner cell mass
- Develops in oviduct	- Develops in uterus

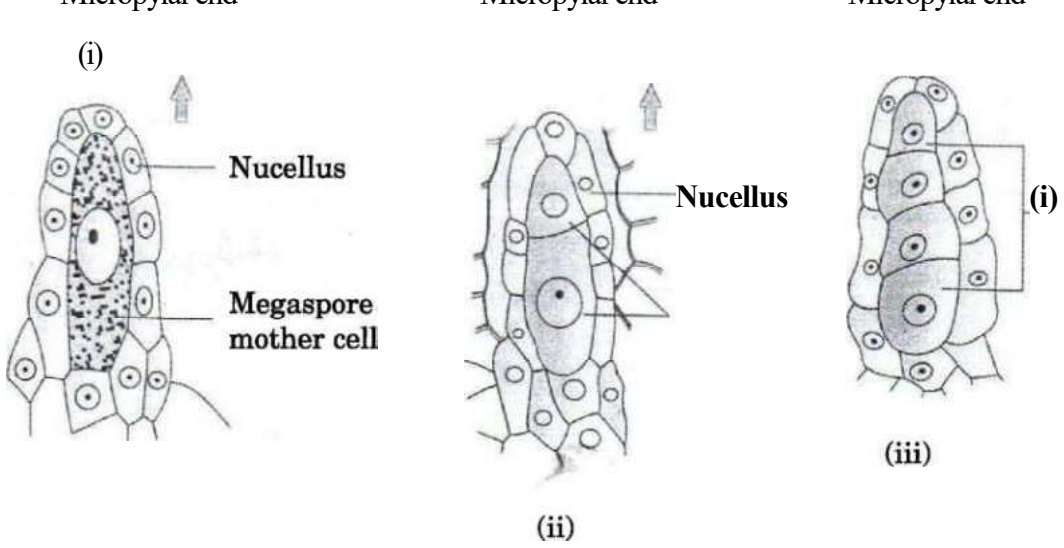
(Any one difference) = ½ + ½

ii) (trophoblast layer gets attached to the endometrium, uterine cell divide rapidly and covers the blastocyst = 1 + 1

[3 + 2 = 5 marks]

OR

(b) Study the figures given below of the development of megaspore in an angiosperm and answer the questions that follow :



(i) Describe the developmental events in the nucellus of the ovule. What is this type of development of megaspore referred to as ?

(ii) How many free nuclear mitotic divisions will the functional megaspore undergo to form a mature embryo sac ?

(iii) Describe the structure of a typical female gametophyte of a flowering plant.

OR

i) Monosporic development = ½

A single large cell MMC (with densed cytoplasm and a prominent nucleus) of the nucellus undergoes meiotic division , resulting in 4 megaspores , one remains functional other three degenerate , (functional megaspore develops into female gametophyte) = ½ × 3

ii) Three mitotic divisions = ½

iii) A typical angiosperm embryo sac is 8-nucleate and 7-celled ,

Three cells are grouped together at the micropylar end and constitute the egg apparatus, the egg apparatus consists of two synergids and one egg cell , three cells are at the chalazal end and are called the antipodals , the large central cell has two polar nuclei six of the eight nuclei are surrounded by cell walls and organised into cells = ½ × 5

[2 + ½ + 2½ = 5 marks]