

**Marking Scheme**  
**Strictly Confidential**  
**(For Internal and Restricted use only)**  
**Senior School Certificate Supplementary Examination, 2023**  
**SUBJECT NAME: BIOLOGY (SUBJECT CODE 044) (PAPER CODE 57/B)**

**General Instructions: -**

<b>1</b>	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.
<b>2</b>	<b>“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 various rules of the Board and IPC.”</b>
<b>3</b>	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. <b>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 due marks be awarded to them. In class-XII, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.</b>
<b>4</b>	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
<b>5</b>	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. If there is any variation, the same should be zero after deliberation and discussion. 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.
<b>6</b>	Evaluators will mark( ✓ ) wherever answer is correct. For wrong answer CROSS ‘X’ be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. <b>This is most common mistake which evaluators are committing.</b>
<b>7</b>	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. This may be followed strictly.
<b>8</b>	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note “ <b>Extra Question</b> ”.
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.
12	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).
13	<p>Ensure that you do not make the following common types of errors committed by the Examiner in the past:-</p> <ul style="list-style-type: none"> <li>● Leaving answer or part thereof unassessed in an answer book.</li> <li>● Giving more marks for an answer than assigned to it.</li> <li>● Wrong totalling of marks awarded on an answer.</li> <li>● Wrong transfer of marks from the inside pages of the answer book to the title page.</li> <li>● Wrong question wise totalling on the title page.</li> <li>● Wrong totalling of marks of the two columns on the title page.</li> <li>● Wrong grand total.</li> <li>● Marks in words and figures not tallying/not same.</li> <li>● Wrong transfer of marks from the answer book to online award list.</li> <li>● 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.)</li> <li>● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.</li> </ul>
14	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.
15	Any un assessed portion, non-carrying over of marks to the title page, or totalling 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.
16	The Examiners should acquaint themselves with the guidelines given in the “ <b>Guidelines for spot Evaluation</b> ” before starting the actual evaluation.
17	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

**MARKING SCHEME**  
**Senior Secondary School Supplementary Examination, 2023**  
**BIOLOGY (Subject Code-044)**  
**[Paper Code: 57(B)]**

**Maximum Marks: 70**

	<b>EXPECTED ANSWER / VALUE POINTS</b>	<b>Marks</b>	<b>Total Marks</b>
<b>Q.No.</b>	<b>SECTION-A</b>		
<b>1.</b>	(c) / reversible and effective	1	1
<b>2.</b>	(a) / A-II, B-I, C-IV, D-III	1	1
<b>3.</b>	(a) / M. Wilkins and R. Franklin	1	1
<b>4.</b>	(d) / Oxidising atmosphere	1	1
<b>5.</b>	(d) / Malaria chills and high fever	1	1
<b>6.</b>	(c) / vaccines	1	1
<b>7.</b>	(d) / Dough for bread CO <sub>2</sub>	1	1
<b>8.</b>	1 Mark to be awarded if attempted	1	1
<b>9.</b>	(a) / $N_{t+1} = N_t + [(B+I)-(D+E)]$	1	1
<b>10.</b>	(a) / The cactus spread rapidly into a large area.	1	1
<b>11.</b>	(b) / Phytoplankton- Zooplankton- Whales- Inverted	1	1
<b>12.</b>	(c) / Fishes	1	1
<b>13.</b>	(c) / Assertion (A) is true, but Reason (R) is false.	1	1
<b>14.</b>	(c) / Assertion (A) is true, but Reason (R) is false.	1	1
<b>15.</b>	(b) / Assertion (A) is true, but Reason (R) is True.	1	1
<b>16.</b>	(c) / Assertion (A) is true, but Reason (R) is false.	1	1
	<b>SECTION-B</b>		
<b>17.</b>	<ul style="list-style-type: none"> <li>• Leydig cells are located in the region outside seminiferous tubules / interstitial spaces.</li> <li>• Leydig cells synthesise testicular hormones (androgens) / secrete testicular hormones (androgens)</li> </ul>	1  1	  2
<b>18.</b>	<p>Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome , as a measure of distance between genes and map their position on the chromosomes.</p> <p style="text-align: center;">//</p> <p>Loosely linked genes showed higher recombination frequency /tightly linked genes showed very low recombination frequency, was used to map the position on the chromosome.</p>	1+1    1+1	    2

19.	<ul style="list-style-type: none"> <li>Innate immunity</li> <li>Certain types of leukocytes- PMNL- Polymorphonuclear leukocytes/Neutrophils, monocytes, natural killer, macrophages (Any two examples)</li> </ul>	1 $\frac{1}{2} + \frac{1}{2}$	2
20.	<p>(a) Gel electrophoresis</p> <p>(b)</p> <ul style="list-style-type: none"> <li>DNA fragments are negatively charged molecules</li> <li>DNA fragments can be separated by forcing them to move towards anode under an electric field through sieving effect of agarose gel.</li> </ul>	1 $\frac{1}{2} + \frac{1}{2}$	2
21.	<p>(a) (i) Each trophic level has certain mass of living material, at a particular time called as standing crop/Biomass in each trophic level, at a particular time.</p> <p>(ii) It is measured as the mass of living organisms (biomass) or, number in a unit area.</p> <p style="text-align: center;">OR</p> <p>(b)(i) Detritus Food Chain begins with dead organic matter. Decomposers secrete digestive enzymes, that break down dead organic matter or detritus into simple inorganic material.</p> <p>(ii) They meet their energy requirements by degrading dead organic matter/detritus and absorbing them.</p>	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ 1	2
	<ul style="list-style-type: none"> <li>SECTION C</li> </ul>		
22.	<ul style="list-style-type: none"> <li>Funnel shaped <b>infundibulum</b>, collects ovum after ovulation.</li> <li>Wider part of oviduct called <b>ampulla</b>, site for fertilization.</li> <li><b>Isthmus</b> has a narrow lumen, joins the uterus.</li> </ul>	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$	3
23	<p>(a) Biotic agents/bees</p> <p>(b)</p> <ul style="list-style-type: none"> <li>Stamens are well exposed so that the pollen grains are easily dispersed into wind currents.</li> <li>Pollen grains are light / non sticky.</li> <li>Stigma is large and often feathery to easily trap the air borne pollen grains.</li> </ul>	$\frac{1}{2}$ 1 $\frac{1}{2}$ 1	3
24	<p>(a) By multiplying the total number of base pairs with distance between two consecutive base pairs /</p> <p>Length of DNA = Total no. of base pairs X 0.34nm</p> <p>b)</p> <ul style="list-style-type: none"> <li>In Prokaryotes-Negatively charged DNA is held with some positively charged proteins in nucleoid region which is organised in large loops held by proteins.</li> <li>In Eukaryotes-The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome (nucleosome contains 200 bp of DNA helix) which</li> </ul>	1 1 1	

	are repeating units of chromatin and packaging of chromatin at higher level require Non Histone Chromosomal proteins.		3
25.	<p>-Different-aged rock sediments contain fossils of different life-forms who probably died during the formation of the particular sediment.</p> <p>-A study of fossils in different sedimentary layers indicates the geological period in which they existed.</p> <p>-The study showed that life-forms varied over time and certain life forms are restricted to certain geological timespans.</p>	1X3	3
26.	<p>(a)</p> <ul style="list-style-type: none"> <li>• Prepared antigenic proteins of pathogen /inactivated pathogen /weakened pathogen.</li> <li>• Small pox</li> <li>• Diphtheria, pneumonia , tetanus ,polio (or any other correct disease)</li> </ul> <p style="text-align: right;"><b>(Any three)</b></p> <p style="text-align: center;"><b>OR</b></p> <p>(b) The most common warning signs of drug and alcohol abuse among youth are –</p> <ul style="list-style-type: none"> <li>-drop in academic performance</li> <li>- unexplained absence from school/college</li> <li>- lack of interest in personal hygiene</li> <li>- withdrawal</li> <li>- Isolation</li> <li>- Depression</li> <li>- Fatigue</li> <li>- aggressive and rebellious behaviour</li> <li>- deteriorating relationships with family and friends</li> <li>- loss of interest in hobbies</li> <li>- change in sleeping and eating habits</li> <li>- fluctuations in weight/ appetite, etc.</li> </ul> <p style="text-align: right;"><b>(Any Six correct warning signs)</b></p>	<p>1 ½</p> <p>½ + ½ + ½</p> <p>½X 6</p>	3
27.	<ul style="list-style-type: none"> <li>• Nuclease</li> <li>• HindII, EcoRI, PstI,BamHI (or any other correct restriction enzyme)</li> </ul> <p>(Any two)</p> <ul style="list-style-type: none"> <li>• They make a cut at specific palindromic site within the DNA.</li> </ul>	<p>1 ½ + ½</p> <p>1</p>	3
28.	<p>(a)Mutualism-This interaction confers benefits to both the interacting species.</p> <p>Example- Lichens represent mutualistic relationship between photosynthesising algae and fungus providing shelter and helping in absorption of water and mineral/ <i>mycorrhizae</i>-relationship between fungi and roots of higher plants.The fungi help the plant in the</p>	<p>½</p> <p>½</p>	

	<p>absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates/ plant -animal relationship where plants provide pollen and nectar for pollinators and nutritious fruits for seed dispersers whereas animals help plant for pollinating their flowers and dispersing their seeds/ any other relevant example with correct explanation.</p> <p>(b) Commensalism- This is the interaction in which one species benefits and the other is neither harmed nor benefited.</p> <p>Example- An orchid growing as an epiphyte on mango branch-Epiphyte gets place to grow while the mango tree derives no apparent benefit/Barnacles growing on the back of a whale-Barnacle gets place to live while the whale derives no apparent benefit/Egret and grazing cattle-When cattle move they stir up and flush out insects from the vegetation that otherwise might be difficult for the egrets to find and catch whereas cattle derive no benefit/ sea anemone and clown fish-Clown fish gets protection from predators which stay away from the stinging tentacles whereas anemone does not appear to derive any benefit by hosting the clown fish /any other relevant example with correct explanation</p> <p>(c)Ectoparasitism- This is the interaction in which one species living on the external surface of the host organisms(parasite)benefits and the other (host)is harmed/ In this type of parasitism the parasite feeds on the external surface of the host organism.</p> <p>Example- Lice on humans- Lice sucks blood/ticks on dogs- Ticks sucks blood /copepods on marine fishes- Copepods sucks blood /cuscuta growing on hedge plants has lost its chlorophyll and leaves in the course of evolution derives its nutrition from the host plant which it parasitises /any other relevant example with correct explanation</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>	<p>3</p>
<p>29.</p>	<p>(i) (a)</p> <ul style="list-style-type: none"> <li>• Hybrid DNA/Intermediate DNA/ <math>^{15}\text{N}^{14}\text{N}</math> DNA</li> <li>• As after completion of replication each DNA molecule would have one parental and one newly synthesized strand/Semi conservative DNA replication.</li> </ul> <p>(b)</p> <ul style="list-style-type: none"> <li>• 50% Light DNA and 50% Hybrid DNA / 50% <math>^{14}\text{N}^{14}\text{N}</math> DNA and 50% <math>^{15}\text{N}^{14}\text{N}</math> DNA</li> <li>• As after completion of replication each DNA molecule would have one parental and one newly synthesized strand/Semi conservative DNA replication</li> </ul> <p>(ii) <i>E. coli</i> divides in 20 minutes consuming <math>^{14}\text{N}</math> from medium therefore adding <math>^{14}\text{NH}_4\text{Cl}</math> as a source of <math>^{14}\text{N}</math> at definite interval of time was required.</p> <p>(iii) (a) That DNA replicates semi conservatively</p> <p style="text-align: center;">OR</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p> <p>1</p>	

	(b) Cesium Chloride gradient centrifugation was used to separate and distinguish light DNA from Heavy and Hybrid DNA molecules /to separate the DNA samples on the basis of their densities.	1	4
30.	(i) Typhoid, Amoebiasis/Amoebic dysentery, Ascariasis ( any other relevant diseases) <b>(Any two)</b>	$\frac{1}{2} + \frac{1}{2}$	4
	(ii) <b>Typhoid-</b> Sustained high fever (39° to 40°C), weakness, stomach pain, constipation, headache and loss of appetite	$\frac{1}{2} + \frac{1}{2}$	
	<b>Amoebiasis</b> constipation, abdominal pain and cramps, stools with excess mucous and blood clots	$\frac{1}{2} + \frac{1}{2}$	
	<b>Ascariasis</b> internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage. <b>(Any two specific symptoms of any two diseases mentioned in the answer (i))</b>	$\frac{1}{2} + \frac{1}{2}$	
	(iii) (a) Typhoid - <i>Salmonella typhi</i> , Amoebiasis- <i>Entamoeba histolytica</i> , Ascariasis- <i>Ascaris</i> <b>(Any two as per the answer (i))</b> <b>OR</b>		
(b)			
		$\frac{1}{2}$	
		$\frac{1}{2}$	
<b>SECTION-E</b>			
31.		<b>OVARY</b>	<b>UTERUS</b>
	(i) Menstruation	Developing primary follicles.	Breakdown of endometrial lining of the uterus and its blood vessels.
	(ii) Follicular Phase	The primary follicles in the ovary grow to become a fully mature Graafian follicle.	The endometrium of uterus regenerates through proliferation.
	(iii) Luteal Phase	Formation of corpus luteum (which secretes large amounts of progesterone)	Endometrium further proliferates or thickens.
		<b>OR</b>	
(b)			
(i)			
		$\frac{1}{2} + 1$	
		1 + 1	
		1 + $\frac{1}{2}$	

	Parthenocarpy	Apomixis	Polyembryony						
	<ul style="list-style-type: none"> <li>• Development of fruits without fertilisation.</li> <li>• Example- Banana/ Any other correct example</li> </ul>	<ul style="list-style-type: none"> <li>• Development of seeds without fertilisation.</li> <li>• Example- grasses/ Any other correct example</li> </ul>	<ul style="list-style-type: none"> <li>• Occurrence of more than one embryo in a seed.</li> <li>• Example-Citrus /mango/ Any other correct example</li> </ul>	1/2 x6					
	(ii) Significance-When hybrids are made into apomicts there is no segregation of characters in the hybrid progeny, then the farmers can keep using the seeds from these apomicts year after year which in turn is cost effective.			1+1	5				
32.	<p>(a) (i)</p> <ul style="list-style-type: none"> <li>-Communication was not easy (as it is now) in those days and his work could not be widely publicised.</li> <li>-His concept of genes (or factors, in Mendel's words) as stable and discrete units that controlled the expression of traits and, of the pair of alleles which did not 'blend' with each other, was not accepted by his contemporaries as an explanation for the apparently continuous variation seen in nature.</li> <li>-Mendel's approach of using mathematics to explain biological phenomena was totally new and unacceptable to many of the biologists of his time.</li> <li>-Mendel's work suggested that factors (genes) were discrete units, he could not provide any physical proof for the existence of factors or say what they were made of.</li> </ul> <p>(ii) Advancements in microscopy helped scientists to observe chromosomes during cell division.</p> <p style="text-align: center;">OR</p> <p>(i) DNA Fingerprinting</p> <p>(ii) Steps followed in this technique are: -</p> <ul style="list-style-type: none"> <li>-Isolation of DNA,</li> <li>-digestion of DNA by restriction endonucleases,</li> <li>-separation of DNA fragments by electrophoresis,</li> <li>-transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon,</li> <li>-hybridisation using labelled VNTR probe, and</li> <li>-detection of hybridised DNA fragments by autoradiography.</li> </ul> <p style="text-align: center;">Matching the DNA fingerprints with the parents to know the identity of his biological parents.</p>			1X4	1	1	1/2 x6	1	5
33.	<p>(a)</p> <p>(i) Analysis of Serum, urine, blood, stool (or any other correct conventional method)</p> <p style="text-align: right;"><b>(Any two)</b></p> <p>(ii)</p>			1/2 + 1/2					

	<ul style="list-style-type: none"> <li>Recombinant DNA technology, Polymerase Chain Reaction (PCR), Enzyme Linked Immuno-Sorbent Assay (ELISA) <b>(Any two)</b></li> <li>ELISA is based on the principle of antigen-antibody interaction. Infection by pathogen can be detected by the presence of antigens (proteins, glycoproteins, etc.) or by detecting the antibodies synthesised against the pathogen</li> <li>PCR is used for amplification of the nucleic acid of the pathogens. It is being used to detect mutations in genes in suspected cancer patients too. It is a powerful technique to identify many other genetic disorders. <b>(Any one explanation)</b></li> </ul> <p>(iii)</p> <ul style="list-style-type: none"> <li>Early diagnosis</li> <li>Presence of a pathogen (bacteria, viruses, etc.) is normally suspected only when the pathogen has produced a disease symptom. By this time the concentration of pathogen is already very high in the body. However very low concentration of a bacteria or virus (at a time when the symptoms of the disease are not yet visible) can be detected by amplification of their nucleic acid by PCR.</li> </ul> <p style="text-align: center;"><b>OR</b></p> <p>(b)</p> <p>(i) Eli Lilly an American company using rDNA technology prepared two DNA sequences corresponding to A and B peptide chains of human insulin, and introduced them in plasmids of <i>E. coli</i> to produce insulin chains, chains A and B were produced separately, extracted, and combined by creating disulfide bonds to form human insulin.</p> <p>(ii) Specific Bt toxin gene has been isolated from the bacteria <i>Bacillus thuringiensis</i> and introduced in plants, to provide resistance to insects without the need for insecticides, The toxin is coded by a gene named <i>cry</i>, The activated toxin produced by this gene causes the death of the insect, For example - Bt cotton. / RNA interference (RNAi) is used to prevent pest infestation, introduction of DNA was such that it produced both sense and anti-sense RNA in the host, this two RNA's being complementary to each other formed a double stranded (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the pest, the consequence is that the pest cannot survive in a transgenic plant example tobacco expressing specific interfering RNA.</p>	<p><math>\frac{1}{2} + \frac{1}{2}</math></p> <p>1</p> <p>1</p> <p>1</p> <p><math>\frac{1}{2} \times 5</math></p> <p><math>\frac{1}{2} \times 5</math></p>	<p>5</p>
--	---	--	----------

