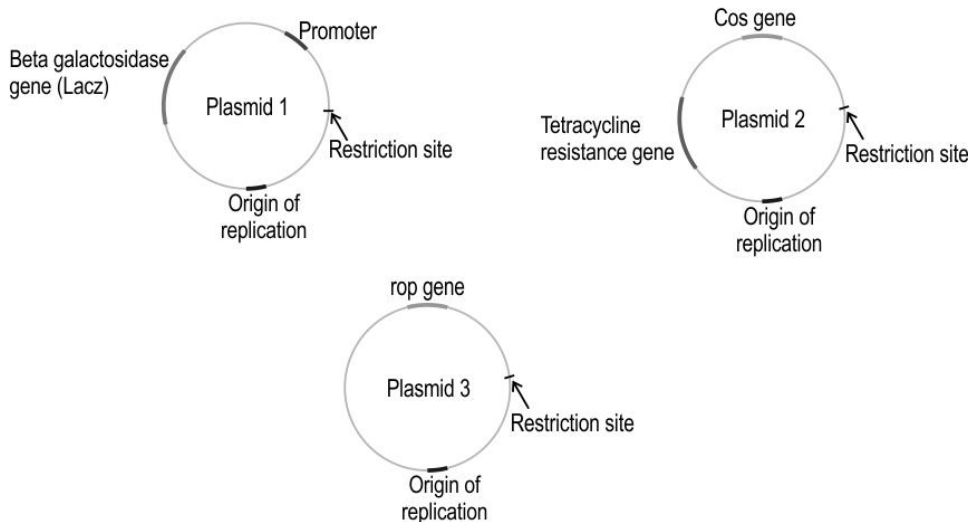
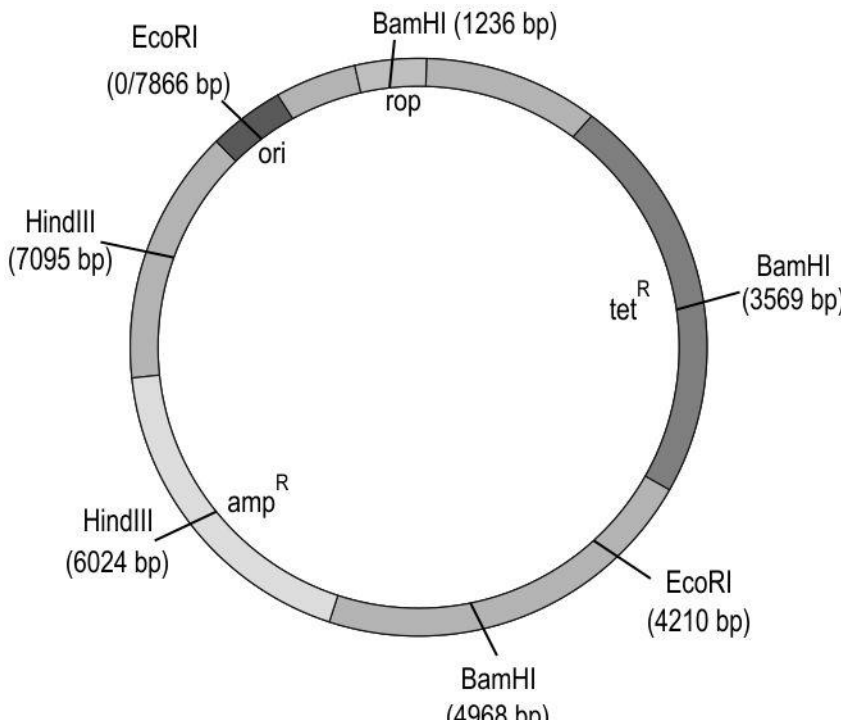
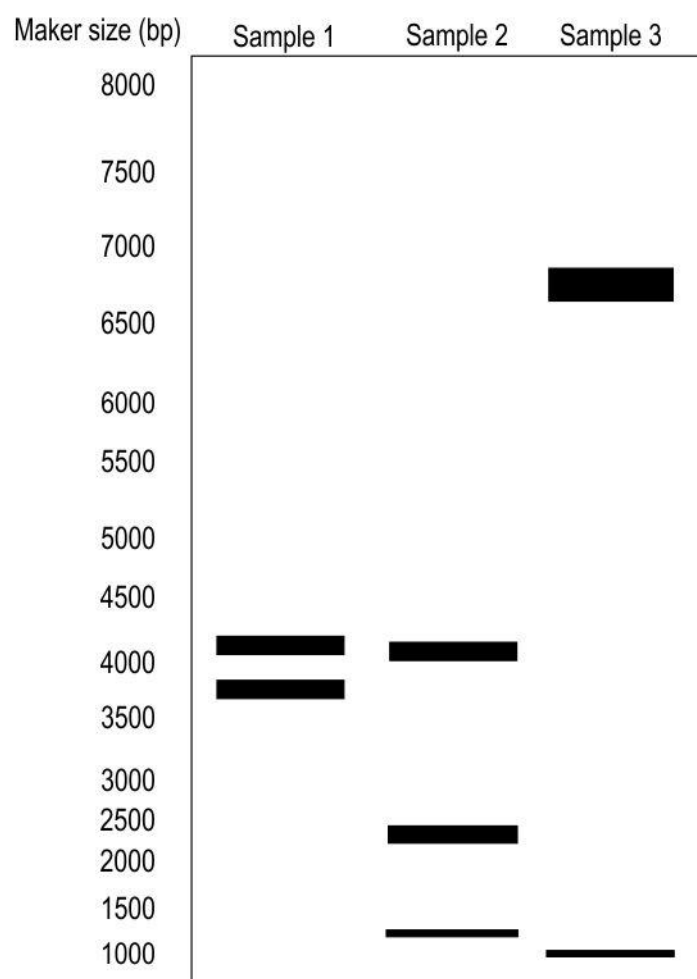


BIOTECHNOLOGY AND ITS APPLICATIONS

Q.No	Question	Marks
Multiple Choice Question		
Q.205	<p>Transgenic mice are being developed to replace the use of monkeys for laboratory testing of vaccines or drugs meant for humans.</p> <p>Which of the following is/are POSSIBLE reasons for this move?</p> <p>P) Mice and humans have similar physiology.</p> <p>Q) The reproduction rate is faster in mice.</p> <p>A. only P B. only Q C. both P and Q D. neither P nor Q</p>	1
Q.206	<p>There are two statements given below marked as Assertion (A) and Reason (R). Read the statements and choose the correct option.</p> <p>Assertion (A): A single-stranded DNA probe tagged with a radioactive molecule does not appear in an autoradiogram.</p> <p>Reason (R): Complementarity with DNA obtained from cloned cells forms the basis of probing using tagged DNA molecules in autoradiography.</p> <p>A. Both A and R are true, but R is not the correct explanation for A. B. Both A and R are true, and R is the correct explanation for A. C. A is true, but R is false. D. A is false, but R is true.</p>	1
	<p>Questions 207 and 208 are based on the following information.</p> <p>Meera wanted to study a cytoskeletal protein called MAP2. To do so, she needed to clone the gene to obtain a recombinant MAP2 protein. She had identified the gene for this specific protein and had the cloned DNA sequence ready for further processing.</p>	
Q.207	<p>Which of the following is crucial for getting E. coli cells to produce the recombinant MAP2 protein from the cloned DNA?</p> <p>A. inserting the DNA sequence directly into the E. coli cells B. cutting the DNA sequence using restriction enzymes like EcoRI C. inserting the DNA into a plasmid that can be expressed in the host E. coli cells</p>	1

	D. isolating the DNA sequence from the host E. coli cells and performing a polymerase chain reaction	
Q.208	<p>In the sequence of producing recombinant MAP2 protein, Meera had to perform gel electrophoresis immediately after a PCR (Polymerase Chain Reaction).</p> <p>What could have been Meera's primary goal for performing gel electrophoresis?</p> <p>A. Separating the positively and negatively charged MAP2 DNA fragments. B. Separating the cloned MAP2 DNA from other DNA fragments. C. Separating recombinant MAP2 protein from other proteins. D. Separating cloned MAP2 DNA from MAP2 protein.</p>	1
Q.209	<p>Shown below are three plasmids.</p>  <p><i>Cos</i> gene initiated packaging of virus particles and <i>rop</i> gene keeps a check on the copy number of the plasmid in a bacterial cell.</p> <p>Which of these is ideal to be used for rDNA technology?</p> <p>A. only plasmid 1 B. only plasmids 1 and 2 C. only plasmids 2 and 3 D. all - plasmids 1, 2 and 3</p>	1
Q.210	<p>There are two statements given below marked as Assertion (A) and Reason (R). Read the statements and choose the correct option.</p> <p>Assertion (A): Transposons cause insertional mutations that can be treated using gene silencing.</p>	1

	<p>Reason (R): Transposons are mobile genetic elements that self-replicate via an RNA intermediate.</p> <p>A. Both A and R are true, and R is the correct explanation for A. B. Both A and R are true, but R is not the correct explanation for A. C. A is true, but R is false. D. A is false, but R is true.</p>	
Free Response Questions/Subjective Questions		
Q.211	<p>(a) How is the model organism modified before being used for chemical safety testing?</p> <p>(b) What is the benefit of the modification identified in (a)?</p>	2
Q.212	<p>The plasmid shown below is 7866 base pairs in length and contains genes that confer resistance to antibiotics tetracycline and ampicillin. The bp at which the restriction site is present is also shown.</p>  <p>(a) While working in the lab, Reema took three individual samples of the plasmid. She added different restriction enzymes, EcoRI, HindIII, and BamHI, separately in each of the samples. But she forgot to label the samples in a hurry. She ran the three digested samples on an agarose gel electrophoresis to see the fragments. The results are shown below:</p>	5



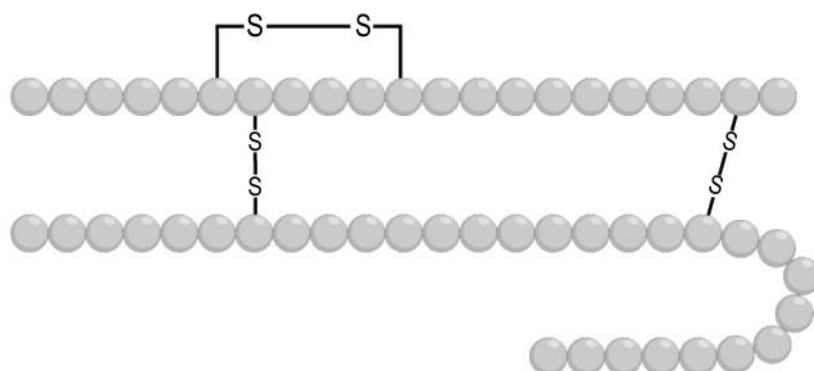
Considering complete restriction digestion had happened, help her identify which sample is digested by what enzyme.

(b) Next, Seema digested a target DNA with HindIII, and ligated it with plasmids digested with the same enzyme and transferred them into a bacterial cell. How will she distinguish the transformant with recombinant plasmid from non-transformant? Give a reason to support your answer.

Q.213

Given below is an image of a hormone which is required for the treatment of a disease.

5



(a) Identify the hormone and the disease that is caused due to its insufficient secretion.

	<p>(b) State whether the following statement about this hormone is true or false. Justify if true, correct if false.</p> <p>'The structure in the image is a protein and is the precursor form of the hormone.'</p> <p>(c) Which characteristic helped you arrive at your answer in (b)?</p> <p>(d) Describe the challenge in large scale production of this hormone using rDNA techniques and how it was overcome.</p>	
Q.214	<p>(a) What are genetically modified organisms?</p> <p>(b) Transgenic mice models are preferred over human models to study several human diseases such as Alzheimer's. Is this statement TRUE? Give a reason to support your answer.</p>	3
Q.215	<p>According to recent reports, MIT engineers have embedded genes from fireflies into watercress plants inducing them to give dim light for nearly four hours. To create these plants, the MIT team turned to luciferase, the enzyme that gives fireflies their glow. Luciferase acts on a molecule called luciferin, causing it to emit light. Another molecule called co-enzyme A helps the process by enhancing luciferase activity. None of these molecules are naturally produced by plants.</p> <p><i>[Sourced and edited from: https://www.dailymail.co.uk/sciencetech/article-5178531/MIT-creates-bioluminescent-trees-glow-like-fireflies.html]</i></p> <p>(a) Describe briefly, the step-by-step process that should be followed in creating these plants.</p> <p>(b) Draw a diagram of the possible vector used in (a).</p>	5

Answer key and Marking Scheme

Q.No	Answers	Marks
Q.205	C. both P and Q	1
Q.206	B. Both A and R are true, and R is the correct explanation for A.	1
Q.207	C. inserting the DNA into a plasmid that can be expressed in the host E. coli cells	1
Q.208	B. Separating the cloned MAP2 DNA from other DNA fragments.	1
Q.209	B. only plasmids 1 and 2	1
Q.210	A. Both A and R are true, and R is the correct explanation for A.	1
Q.211	(a) Genes that make the model organism more sensitive to the chemical being tested are introduced in them creating transgenic model organisms. (b) Since the organism is more sensitive it helps to study the effect of the chemical in a shorter duration as compared to a non-transgenic organism.	2
Q.212	(a) 1 mark for correctly identifying: Sample 1: EcoRI Sample 2: BamHI Sample 3: Hind III (b) 1 mark for each of the following: - She can grow the culture on a media plate containing ampicillin and tetracycline. - Since cutting with HindIII will disrupt the ampicillin resistance gene and not the tetracycline resistance gene, only cells containing the plasmid ligated with the target DNA will grow.	5
Q.213	(a) 0.5 marks each for the following: Hormone - insulin Disease - diabetes (b) False [0.5 marks] Correct statement - The structure in the image is a protein and is the final/active/mature form of the hormone. [0.5 marks] (c) The c-peptide which is part of the precursor form is missing in the structure shown, indicating that it is the final form. (d) Challenge - getting insulin assembled into a mature form without c-peptide sequence. [1 mark]	5

	Overcome - chains A and B were produced separately by rDNA technology in <i>E.coli</i> cells, extracted and combined by creating disulphide bonds to form human insulin. [1 mark]	
Q.214	<p>(a) Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms.</p> <p>(b) 1 mark for each of the following:</p> <ul style="list-style-type: none"> - The statement is true. - Transgenic mice allow for studying the progression of diseases in a shorter time than in humans due to the short life span of the mice. <p>[Accept any other valid answer]</p>	3
Q.215	<p>(a) 0.5 marks each for the following:</p> <ul style="list-style-type: none"> - DNA from the fireflies needs to be isolated. - This DNA and a suitable vector need to be digested by a restriction enzyme, electrophoresed and eluted from the gel. - The required gene sequences for the three genes need to be amplified using PCR. - The vector and the genes of interest need to be ligated together to create recombinant vectors and cells containing the recombinant vector can be selected using the appropriate marker. - These vectors can be transformed into a plant embryo through the use of micro-particles. <p>(b) Marks to be awarded for a neatly labelled diagram with the following parts shown:</p> <ul style="list-style-type: none"> - the origin of replication [0.5 marks] - restriction site/cloning site [0.5 marks] - selectable marker [0.5 marks] - three genes of interest coding for luciferase enzyme, luciferin, co-enzyme A [1 mark] 	5