



Student Name ..... University Number .....

**PART I:** Circle the letter of the **most appropriate** answer of each of the following:

<p>The cloning vector that is useful for cloning the largest possible DNA fragments:</p> <ul style="list-style-type: none"><li>a. <math>\lambda</math> phage</li><li>b. pBR322 plasmid</li><li>c. Cosmid</li><li>d. YAC</li><li>e. BAC</li></ul>
<p>The process of making multiple, identical DNA copies is called</p> <ul style="list-style-type: none"><li>a. Monoclonal antibody production</li><li>b. DNA ligation</li><li>c. DNA sequencing</li><li>d. DNA cloning</li><li>e. DNA digestion</li></ul>
<p>Select the restriction enzyme that is isolated from <i>Bacillus amyloliquefaciens</i>.</p> <ul style="list-style-type: none"><li>a. <i>Sau3A</i></li><li>b. <i>SmaI</i></li><li>c. <i>BamHI</i></li><li>d. <i>EcoRI</i></li><li>e. <i>HindIII</i></li></ul>
<p>Biotransformation includes</p> <ul style="list-style-type: none"><li>a. Converting a chemical into another important chemical using purified enzymes.</li><li>b. Converting a chemical into another important chemical using microorganisms.</li><li>c. Example is converting cholesterol into therapeutic drugs.</li><li>d. All of the above.</li></ul>
<p>All of the followings are considered transcription <b>except</b></p> <ul style="list-style-type: none"><li>a. Synthesis of mRNA using DNA template.</li><li>b. Synthesis of tRNA using DNA template.</li><li>c. Synthesis of rRNA using DNA template.</li><li>d. Synthesis of protein from mRNA.</li><li>e. Synthesis of microRNA using DNA template.</li></ul>
<p>All of the followings are considered selectable markers <b>except</b></p> <ul style="list-style-type: none"><li>a. Blue/white</li><li>b. Antibiotic resistance in bacteria.</li><li>c. Insertion inactivation.</li><li>d. Origin of replication.</li><li>e. Herbicide resistance in production of transgenic plants</li></ul>
<p>Assume you need <math>10^5</math> plaques to cover <u>one</u> human genome. What is the number of total plaques in a genomic library to insure complete coverage of the human genome?</p> <p>a. 1000      b. <math>10^5</math>      c. <math>2 \times 10^5</math>      d. <math>5 \times 10^5</math>      e. none of the above</p>
<p>All the followings are methods used in labelling hybridization probe <b>except</b></p> <ul style="list-style-type: none"><li>a. Visible colour dye</li><li>b. Fluorescence dye.</li><li>c. Replica plating.</li><li>d. Chemoluminescence</li><li>e. Radioactive</li></ul>

The correct order of steps in Southern hybridization is

- blotting, isolate DNA, restriction digest, electrophoresis, hybridization, label detection
- label detection, isolate DNA, restriction digest, blotting, electrophoresis, hybridization,
- restriction digest, isolate DNA, electrophoresis, blotting, hybridization, label detection
- electrophoresis, isolate DNA, restriction digest, blotting, hybridization, label detection
- isolate DNA, restriction digestion, electrophoresis, blotting, hybridization, label detection

The correct order of the 3 steps in each PCR cycle is

- DNA denaturation, DNA synthesis, primer annealing
- primer annealing, DNA denaturation, DNA synthesis
- DNA denaturation, primer annealing, DNA synthesis
- DNA synthesis, primer annealing, DNA denaturation
- primer annealing, DNA synthesis, DNA denaturation

All the followings are generally true about protein electrophoresis except

- The used gel is vertical.
- Polyacrylamide is used in the gel.
- Can be stained by coomasie blue.
- Can be stained by ethidium bromide.
- Can be stained by silver.

Fermentation is break down of organic compounds to

- produce biomass.
- produce microbial metabolites.
- biotransformation.
- all of the above.

Which of the followings is not considered bioremediation?

- Degradation of chemical pollutants by microorganisms.
- Cleaning crude oil spill by encouraging growth of microorganisms.
- Genetic engineering of bacteria to produce a new economically important metabolite.
- Cleaning heavy element contamination by introducing a new microorganism.
- Waste water treatment.

Engineered ice-nucleating bacteria decrease freezing damage on plants because the bacteria

- contain ice-nucleating protein that decreases ice formation.
- lack ice-nucleating protein that decreases ice formation.
- produce antifreeze chemicals that decrease ice formation.
- produce heat to warm plants.
- produce primary metabolites that decrease ice formation.

Biotechnology can be defined as any technique that uses living organisms or substances from those organisms to:

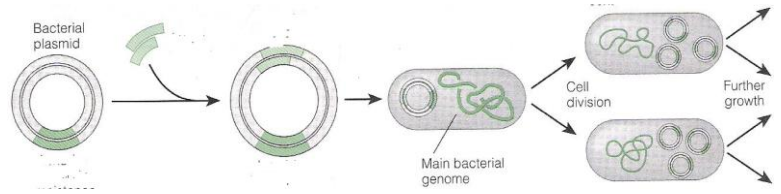
- Make or modify a product.
- Improve a plant using recombinant DNA.
- Improve an animal using recombinant DNA technology.
- Develop a microorganism for a specific use.
- All of the above.

Which of the followings has the highest amount of fluorescence emission at the visible light range:

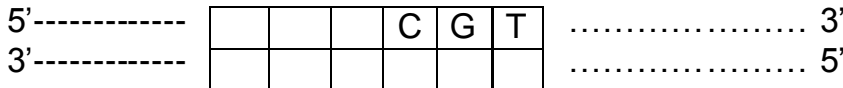
- DNA
- RNA
- Ethidium bromide
- Ethidium bromide intercalating dsDNA
- Ethidium bromide intercalating ssDNA

**Briefly answer the following questions:**

1. Is the cloned DNA insert in the shown Figure contains blunt-ends or sticky-ends? Why?

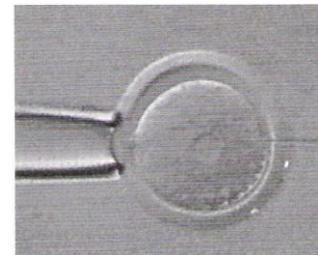


2. The following is the restriction site of *Sam*I enzyme. Complete all remaining bases in the site?



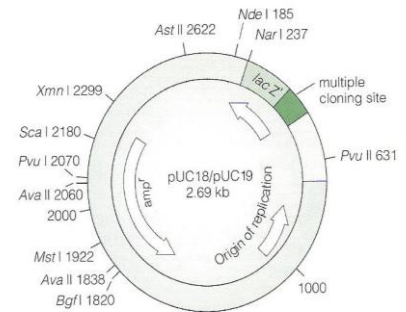
3. Name the protein or gene used in selection by  $\alpha$ -complementation in pUC18 vector?

4. Name the method shown in the picture and used for human or animal cell transformation?



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5. In the shown plasmid map, mark precisely by arrow the location of cloning a DNA insert?



6. Direction of DNA synthesis in the growing DNA strand is .....

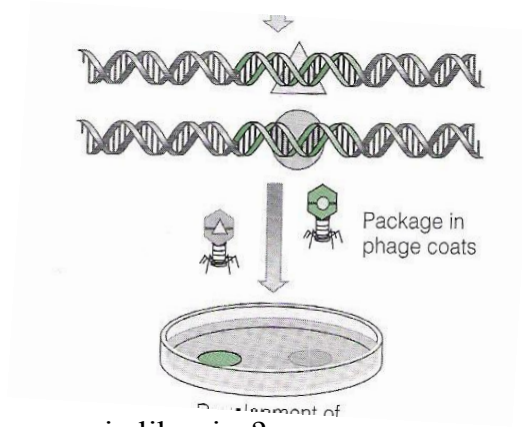
7. DNA electrophoresis separate DNA molecules based on their .....

8. The inducer (natural or synthetic) of Lac operon is .....

9. Ends of eukaryotic chromosome are called .....

10. Name the enzyme that is encoded by retroviruses and can be used to synthesize cDNA using RNA template?

11. Using the shown Figure. What is the name of the phage growth shown in the cultured bacterial lawn (name of the two small circles on the plate)?



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12. What “package in phage coats” means?

13. Name one source of hybridization probe used to screen genomic libraries? .....

14. RFLP stands for R..... F..... L..... P.....

15. Name the PCR method with a continuous detection of the PCR product and is not followed by electrophoresis for PCR product detection?

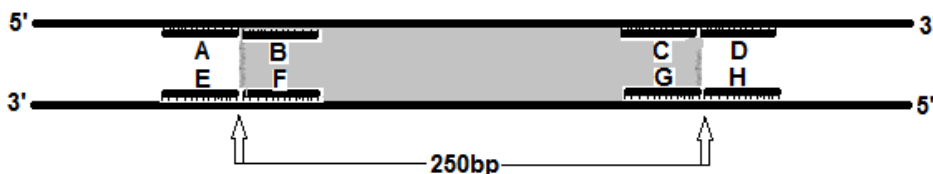
16. The name of the DNA labeling method used in automated DNA sequencing is .....

17. Name one microbial enzyme used in biotechnology and its function?.....

18. One example of substrate used fro solid fermentation is .....

19. Why bioplastic is preferred in some applications compared to plastic produced from petroleum?

20. You need to find primers to amplify the shown 250 bp DNA fragment using PCR. Select the name of the primers that can be used for PCR (primers are named A, B, C, D, E, F, G and H)?.....



Circle the letter T for true statement and the letter F for the false statement for each (0.5 point for each)

T F	We can use cDNA library to isolate gene promoters.
T F	Screening of protein expression libraries is by using DNA hybridization probe.
T F	Northern blot hybridization can be used to study mRNA gene expression.
T F	RNAi is used to study promoter expression.
T F	Direction of new DNA strand synthesis is always from 3' to 5'.
T F	In DNA sequencing, the last nucleotide used in each fragment synthesis is dATP, dCTP, dGTP or dTTP.
T F	The probes in microarrays are the small spots on the slide.
T F	Expressing a human protein in bacteria is considered as a protein engineering.
T F	Antibiotics produced by microorganisms are considered as secondary metabolites.
T F	Batch production in bioreactor is continuous collection of product during growth.

**Match the most appropriate answer from column B to the corresponding statement in Column A:**

Answer Number	Column A	Column B
	Source of Ti plasmid used for plant transformation	1. DNA ligase
	Breakdown of organic compounds by organisms in the absence of oxygen	2. Clone
	Genetically identical population derived by asexual division	3. Fermentation
	Media to separate DNA during electrophoresis	4. Restriction endonucleases
	A pure strain of yeast used in modern bread	5. <i>Saccharomyces cerevisiae</i>
	Extra-chromosomal DNA	6. Insertional inactivation
	A powerful way to determine whether the vector contains a DNA insert.	7. Ethidium bromide
	Enzymes that cut DNA internally at a specific sequence.	8. Protoplast
	Enzyme that join DNA fragments that have complementary sticky ends or blunt ends	9. <i>Agrobacterium tumefaciens</i>
	Cells after cell-wall removal	10. Transformation
	Intercalate between the bases causing DNA to fluoresce when a gel is illuminated with UV light.	11. Plasmid
	Uptake of DNA into a cell	12. Agarose

Good Luck