



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

**SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN CELL AND MOLECULAR BIOLOGY**

SML 213: MOLECULAR AND CELL BIOLOGY

DATE: Wednesday, 4th April, 2012

TIME: 2.00 p.m. – 4.00 p.m.

SECTION A: Answer all 20 questions (each question is 1 mark)

1. Animals that harbor a foreign gene as a result of recombinant gene manipulation are called
 - a) transgenic.
 - b) All of the above
 - c) mutants.
 - d) None of the above
 - e) aliens
2. Genes can be inserted into eukaryotic cells by
 - a) viruses.
 - b) All of the above.
 - c) chemical treatment
 - d) (E) None of the above
 - e) microinjection
3. What do Southern, Northern, and Western blots detect, respectively?
 - a) DNA, RNA, and protein
 - b) (D) protein, DNA, and RNA
 - c) DNA, protein, and RNA
 - d) (E) RNA, protein, and DNA
 - e) RNA, DNA, and protein
4. Plasmids used in recombinant DNA technology typically
 - a) possess a gene for antibiotic resistance.
 - b) (D) all of the above.
 - c) replicate independently of the host genome.
 - d) (E) a and b
 - e) are circular double stranded molecules.
5. Which of the following enzymes can be used to synthesize cDNA from an mRNA template?
 - a) DNA-directed RNA polymerase
 - b) DNA-directed DNA polymerase

- c) restriction endonuclease
 - d) DNA ligase
 - e) reverse transcriptase
6. Which of the following terms best describes the procedure in which DNA fragments are separated on an agarose gel, transferred onto a nylon membrane, and screened with a labeled hybridization probe?
- a) dot blotting
 - b) dash blotting
 - c) Southern blotting
 - d) Northern blotting
 - e) Western blotting
7. Manufacturing recombinant DNA molecules involves cutting a gene from its normal location, inserting it into a circular piece of DNA from a bacterial cell, and then transferring the circle of DNA to cells of another species. Which of the tools below is used to cut the gene from its normal location?
- a) restriction enzyme
 - b) plasmid
 - c) bacteriophage
 - d) vector
8. Manufacturing recombinant DNA molecules involves cutting a gene from its normal location, inserting it into a circular piece of DNA from a bacterial cell, and then transferring the circle of DNA to cells of another species. Which of the below describe the circular piece of DNA from a bacterial cell?
- a) restriction enzyme
 - b) plasmid
 - c) bacteriophage
 - d) vector
9. Which gene transfer technique involves a tiny needle which is used to inject DNA into a cell lacking that DNA sequence?
- a) electroporation
 - b) liposome transfer
 - c) microinjection
 - d) particle bombardment
10. The process of _____ involves the introduction of a gene into a cell where it exchanges places with its counterpart in the host cell.
- a) transgenic technology
 - b) gene targeting
 - c) knockout technology
 - d) recombinant DNA technology
11. Genetic engineering manipulates gene products at the level of the
- a) protein.
 - b) amino acid.
 - c) DNA.
 - d) RNA.
12. Which is found in RNA but not in DNA?
- a) adenine
 - b) cytosine
 - c) guanine
 - d) uracil
 - e) phosphate groups

13. Which statement about DNA is false?
- a) The sugar in DNA has one less oxygen molecule than that in RNA.
 - b) DNA is a double stranded molecule.
 - c) In DNA, the base uracil replaces thymine.
 - d) DNA is a polymer made of nucleotide subunits.

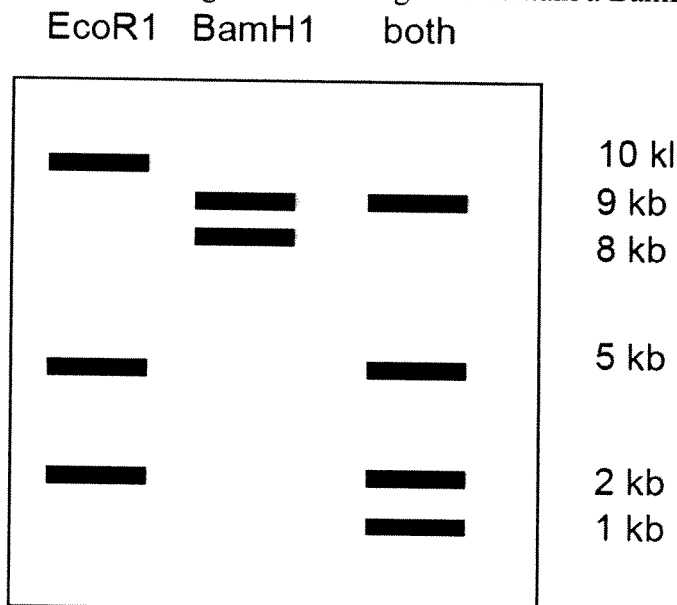
In questions 14 and 15 below, a segment of DNA has one strand with the following sequence
A G C G C A T A G C A A
of bases.

14. The complementary strand of DNA is
- a) U C G C G U A U C G U U
 - b) T C G C C G A T C G T T
 - c) T C G C G T A T C G T T
 - d) T C G C A T T A C A U U
 - e) T C G W R O N G A C U U
15. The mRNA molecule coded for by the original strand is
- a) T C G C G T A T C G T T
 - b) U C G C G U A U C G U U
 - c) T C A C M R N A T C C C
 - d) U A C A T T U C A G G G
 - e) U C G G C A T T U G G C
16. Which statement about DNA replication is **not** correct?
- a) Unwinding of the DNA molecule occurs as hydrogen bonds break.
 - b) Replication occurs as each base is paired with another exactly like it.
 - c) The process is known as semiconservative replication because one old strand is conserved in the new molecule.
 - d) The enzyme that catalyzes DNA replication is DNA polymerase.
 - e) Complementary base pairs are held together with hydrogen bonds.
17. In what direction can a DNA polymerase work when catalyzing the addition of nucleotide monomers to build a strand of DNA?
- a) from the 5' toward the 3' end of the new strand being assembled
 - b) from the replication centers in two directions called replication forks
 - c) from the 3' to the 5' end of the strand being assembled
 - d) in both directions if DNA ligase is present
18. The DNA of all organisms replicates by
- a) dispersive replication
 - b) reverse replication
 - c) semi-conservative replication
 - d) conservative replication
19. The two sides of the DNA molecule are held together at their bases by:
- a) covalent bonds
 - b) peptide bonds
 - c) James Bonds
 - d) ionic charges
 - e) hydrogen bonds
20. Which is **not** a form of ribonucleic acid, or RNA?
- a) messenger RNA
 - b) ribosomal RNA

- c) transfer RNA
- d) translation RNA

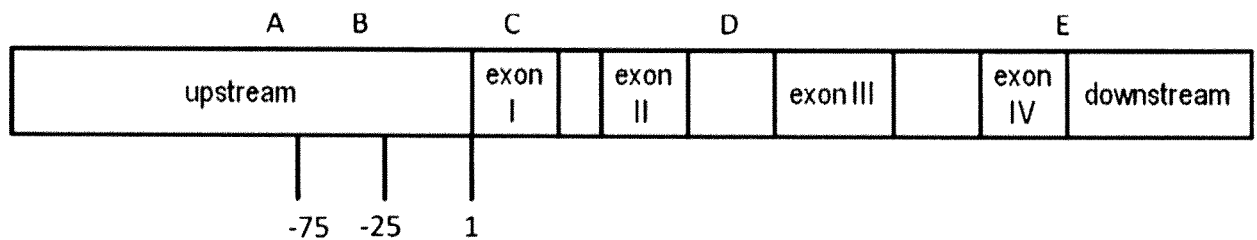
SECTION B – 5 marks each. Answer all questions

1. A chromatographic column in which oligo-dT is linked to an inert substance is useful in separating eukaryotic mRNA from other RNA molecules. On what principle does this column operate?
2. Identify the following consensus sequences (what process or system they're used in and their basic function...you don't need to list names of factors that bind unless you want to).
 - a. TATAAA
 - b. AAUAAA
 - c. CAAT
3. A linear DNA molecule is subjected to complete restriction digestion by (1) EcoRI alone, (2) BamHI alone, and (3) both enzymes together. The fragments are run on a gel. Results are shown below.
 - (a) How long is the original DNA molecule?
 - (b) How many EcoRI recognition sites does it have?
 - (c) Does the longest EcoRI fragment contain a BamHI restriction site?



4. What are the key features of a plasmid vector when considering their use in recombinant clone production?
5. Describe photoreactivation reaction as used in DNA repair

6. This diagram represents regions around a gene encoding a mRNA. Exon I of the mRNA contains the translation initiation AUG codon. Exon IV contains the UGA termination codon. The letters A through E above the diagram refer to areas of the gene and its transcript located directly below them.



- What region of the primary transcript is removed by a spliceosome?
- What region of the DNA contains the TATA box?
- Where is the poly (A) tail added to the transcript?
- Where is the 5' cap added to the transcript?
- Which region is generally called the gene promoter?

SECTION C – 10 marks each. Chose any TWO questions

- (a) What is the purpose of gene expression microarrays? (b) What do the probes represent on a gene expression microarray? (c) What type of molecules are bound / detected by the probes? (d) When measuring differential gene expression between yeast populations grown aerobically vs. anaerobically, what labeling method allows us to distinguish the expression levels of genes between the two different populations of yeast?
- Describe nucleotide excision repair mechanism
- You just learn that a bacteria strain is not dying on treatment with antibiotics. Explain why this could be because of transposition.

