

PLNT2530 PLANT BIOTECHNOLOGY

MID-TERM EXAMINATION

11:30 am to 12:20 pm

Monday, February 11, 2013

Answer any combination of questions totalling to exactly 100 points. If you answer questions totalling more than 100 points, answers will be discarded at random until the total points equal 100. This exam is worth 20% of the course grade.

Hand in these question sheets along with your exam book. Question sheets will be shredded.

Ways to write a readable and concise answer:

- i. Just answer the question. Save time by specifically addressing what is asked. Don't give irrelevant background if it doesn't contribute to the question that was asked.
 - ii. Avoid stream of consciousness. Plan your answer by organizing your key points, and then write a concise, coherent answer. Make your point once, clearly, rather than repeating the same thing several times with no new information.
 - iii. Point form, diagrams, tables, bar graphs, figures are welcome. Often they get the point across more clearly than a long paragraph.
 - iv. Your writing must be legible. If I can't read it, I can't give you any credit.
-

1. (10 points) Fill in the blanks. In plant tissue culture, a low auxin to cytokinin ratio ($A < C$) leads to _____ a _____. High auxin to cytokinin ratio ($A > C$) leads to _____ b _____. If auxin and cytokinin are roughly equal, or are not provided, _____ c _____ is seen in culture.

In the early cell divisions of plant embryonic development, the embryo differentiates into the _____ d _____, which gives rise to most of the plant, and the _____ e _____ which is primarily a storage organ, providing nutrition to the plant until it can make its own food by photosynthesis.

2. (10 points) Which would absorb more UV light at a wavelength of 260 nm:

- a cuvette containing 100 μg of double-stranded DNA
- a cuvette containing 100 μg of nucleotides

Explain your answer. Make sure to include the name for this effect.

3. (5 points) *E. coli* DNA polymerase I contains three enzymatic activities, _____a_____, _____b_____, and _____c_____. The Klenow enzyme is a preparation of DNA polymerase in which the _____d_____, activity has been deleted. If DNA fragments with either 3' or 5' overhangs are incubated with Klenow and dNTPs, the result will be _____e_____.

4. (10 points) Draw a simple diagram to illustrate the activity of alkaline phosphatase. As a substrate, show a double-stranded, linear DNA. Explain why alkaline phosphatase is useful in cloning experiments.

5. (20 points) Draw a simple diagram illustrating the process of gene expression in eukaryotes. Make sure to include the following: Transcription of the gene (DNA) to pre-mRNA, processing of the pre-mRNA to mRNA, and translation of mRNA into protein. Make sure to label 5' and 3' ends, and amino terminal and carboxy terminal ends.

6. (15 points) Describe the main differences between plastid and mitochondrial genomes versus nuclear genomes. You may use point form or a table to organize your answer.

7. (10 points) Raw RNA extracted from plant cells will contain mRNA, tRNA and rRNA, with rRNA making up the vast majority of the RNA population. Describe the technique, used in cDNA cloning, for removing tRNA and rRNA from an RNA sample.

8. (10 points) What are the differences between cDNA libraries and genomic libraries? (You may use a table or point form to organize your answer.)

9. (10 points) Suppose two cDNA libraries were made from the same mRNA population. In both cases, an expression vector is used, containing a promoter to drive expression, and a lacZ gene with a multiple cloning. Library A was made using a single restriction enzyme for cloning the cDNA. Library B was made by directional cloning, using two restriction enzymes.

For any given clone, what are the chances that it will correctly express the protein coded for by the cDNA, in Library A, and in Library B? Explain your reasoning.

10. (5 points) Explain the distinction between transposons and retrotransposons.

11. (10 points) Define the word 'clone'. Explain how this concept relates to colonies, plaques, and libraries.