

C

Sample Tests

SAMPLE TEST FOR THIS BOOK

Question 1 (50 points)

The DNA synthesis facility sends you a 20-nucleotide primer as a dry powder; this oligonucleotide has a molecular weight of 6600. You dissolve the oligonucleotide in 1 ml of sterile distilled water; this is your “concentrated primer stock.” You pipette 5 μl of the “concentrated primer stock” into 495 μl of water and measure the absorbance at 260 nm; the reading is 0.61. A spectrophotometer reading of 1 absorbance (OD) unit at 260 nm indicates a concentration of 33 $\mu\text{g}/\text{ml}$ for a short single-stranded oligonucleotide.

What is the concentration of the “concentrated primer stock”?

Please show your calculations. You may express the answer as $\mu\text{g}/\text{ml}$, or you may give the μM concentration.

How much must you dilute the “concentrated primer stock” to make a 10 μM solution for use in PCR?

Please show your calculations.

Question 2 (30 points)

You have a PCR primer 25 nucleotides long that contains 50% G + C. This primer is 100% complementary to the template DNA, and your PCR reaction contains 100 mM NaCl. What is the melting temperature (T_m) of the duplex DNA formed between this primer oligonucleotide and the template DNA under these conditions?

$T_m = 16.6 \log [\text{Na}] + 0.41 (\%G + C) + 81.5 - 500/\text{bp}$, where % G + C = percentage expressed as a whole number (for example, 50, not 0.5, indicates 50%), [Na] = **molar** salt concentration, and bp indicates length of DNA:DNA hybrid in base pairs.

Question 3 (70 points)

Restriction endonuclease digests of plasmid pMB311 produced these fragments:

EcoRI: 6.0 kb

PstI: 3.5, 2.0, 0.5 kb

EcoRI and *PstI*: 2.5, 2.0, 1.0, 0.5 kb

SalI: 3.8, 2.2 kb

SalI and *PstI*: 1.8, 1.7, 1.5, 0.5, 0.5 kb (two 0.5 kb fragments)

Use this information to draw a circular restriction map of pMB311. Put the cleavage sites for *EcoRI*, *PstI*, and *SalI* on a single map.

Question 4 (25 points)

Improve the following sentences:

Both the crude and purified PCR products were determined to be 560 base pairs in length.

It was estimated that the crude product was two times brighter than the ladder.

Identification of the unknown environmental organism was identified as being *Escherichia coli*.

DNA was extracted as described for *Agrobacterium* above.

Ends of restriction fragments produced by *Pst*I cleavage contain four unpaired bases that can hydrogen bond to the complimentary bases on the end of another *Pst*I fragment.

Question 5 (10 points)

$T_m = 16.6 \log [\text{Na}] + 0.41 (\%G + C) + 81.5 - 500/\text{bp}$, where % G + C = percentage expressed as a whole number (for example, 50, not 0.5, indicates 50%), [Na] = **molar** salt concentration, and bp indicates length of DNA:DNA hybrid in base pairs. You have a radiolabeled single-stranded DNA probe 250 nucleotides long that contains 50% G + C. You hybridize this probe to a Southern blot in a hybridization solution that contains $2 \times \text{SSC}$; note that $20 \times \text{SSC}$ contains 3M NaCl. Assume that the probe is 100% complementary to the target DNA on the Southern blot. What is the melting temperature (T_m) of the hybrid formed between this probe and the target DNA under these conditions?

Question 6 (10 points)

In experiment 3, you cultured unidentified bacteria, isolated genomic DNA from the cultured cells, and used this DNA as template for PCR. The authors of the paper on bacterial diversity in the Amazon isolated bacterial DNA directly from soil samples without growing the bacteria in culture. In one sentence, please explain why the authors chose this approach.

Question 7 (15 points)

List three parameters that affect the melting temperature (T_m) of annealed primer:template duplex DNA in a PCR reaction.

Notes

STUDY QUESTIONS FROM DAY AND GASTEL

The instructor will include some of these questions on the test. Read the chapters in *How to Write and Publish a Scientific Paper* to find the answers.

Chapter 1

"The best English is that which

Chapter 2

Define IMRAD.

Chapter 3

List ten questions you should ask when revising your writing.

a.

b.

c.

d.

e.

f.

g.

h.

i.

j.

Chapter 4

What is the difference between a scientific paper and a review paper?
A scientific paper must enable peers to

a.

b.

c.

Chapter 5

What does the term “salami science” mean?

If your paper contains ideas that are not your own, you must

Chapter 6

What is the “impact factor” of a journal?

Chapter 7

Day and Gastel define a good title as

What is wrong with this title: “Action of Antibiotics on Bacteria”?

Chapter 8

A scientific paper should list as authors those who

Chapter 9

What word limit do many journals set for abstracts?

The abstract should

a.

b.

c.

d.

What is the shortest abstract ever written?

Chapter 10

A good introduction should

a.

b.

c.

d.

e.

Chapter 11

What is the one rule for a properly written materials and methods section of a paper?

Chapter 12

What tense should you use to write the results section?

Two ingredients of the results section are

a.

b.

Chapter 13

A well-structured discussion may

a.

b.

c.

Chapter 14

Should an author obtain permission before mentioning someone in the acknowledgment?

Chapter 15

Two rules for preparing the references are

a.

b.

Chapter 16

Should a table present data vertically or horizontally?

Chapter 17

When should you use a graph instead of a table?

Chapter 24

Should an editorial acknowledge other viewpoints?

Chapter 26

When you write for the public you must

a.

b.

Chapter 30

List the ten commandments of good writing.

a.

b.

c.

d.

e.

f.

g.

h.

i.

j.

Which voice is usually better, active or passive?

What tense should you use to state previously published findings?

When you describe your work in a paper, what tense should you use?

Chapter 31

Define jargon.

a.

b.

c.

Chapter 33

Which sentence is better?

“There is another method that is gaining acceptance.”

“Another method is gaining acceptance.”

Chapter 37

A grant proposal must convince the funding agency that

a.

b.

c.

d.

e.

f.

Chapter 40

If you review an early draft of a paper, focus on

and

If you review a nearly final draft of a paper, focus on
