

*Campbell's Biology, 9e (Reece et al.)*  
**Chapter 20 Biotechnology**

The new questions in Chapter 20 cover all of the chapter's concepts and are primarily at the higher skill levels. In addition, the chapter presents several scenarios that are accompanied by a series of questions.

**Multiple-Choice Questions**

1) Assume that you are trying to insert a gene into a plasmid. Someone gives you a preparation of genomic DNA that has been cut with restriction enzyme X. The gene you wish to insert has sites on both ends for cutting by restriction enzyme Y. You have a plasmid with a single site for Y, but not for X. Your strategy should be to

- A) insert the fragments cut with restriction enzyme X directly into the plasmid without cutting the plasmid.
- B) cut the plasmid with restriction enzyme X and insert the fragments cut with restriction enzyme Y into the plasmid.
- C) cut the DNA again with restriction enzyme Y and insert these fragments into the plasmid cut with the same enzyme.
- D) cut the plasmid twice with restriction enzyme Y and ligate the two fragments onto the ends of the DNA fragments cut with restriction enzyme X.
- E) cut the plasmid with restriction enzyme X and then insert the gene into the plasmid.

Answer: C

Topic: Concept 20.1

Skill: Application/Analysis

2) How does a bacterial cell protect its own DNA from restriction enzymes?

- A) by adding methyl groups to adenines and cytosines
- B) by using DNA ligase to seal the bacterial DNA into a closed circle
- C) by adding histones to protect the double-stranded DNA
- D) by forming "sticky ends" of bacterial DNA to prevent the enzyme from attaching
- E) by reinforcing the bacterial DNA structure with covalent phosphodiester bonds

Answer: A

Topic: Concept 20.1

Skill: Knowledge/Comprehension

3) What is the most logical sequence of steps for splicing foreign DNA into a plasmid and inserting the plasmid into a bacterium?

- I. Transform bacteria with a recombinant DNA molecule.
- II. Cut the plasmid DNA using restriction enzymes.
- III. Extract plasmid DNA from bacterial cells.
- IV. Hydrogen-bond the plasmid DNA to nonplasmid DNA fragments.
- V. Use ligase to seal plasmid DNA to nonplasmid DNA.

- A) I, II, IV, III, V
- B) II, III, V, IV, I
- C) III, II, IV, V, I
- D) III, IV, V, I, II
- E) IV, V, I, II, III

Answer: C

Topic: Concept 20.1

Skill: Knowledge/Comprehension

4) A principal problem with inserting an unmodified mammalian gene into a BAC, and then getting that gene expressed in bacteria, is that

- A) prokaryotes use a different genetic code from that of eukaryotes.
- B) bacteria translate polycistronic messages only.
- C) bacteria cannot remove eukaryotic introns.
- D) bacterial RNA polymerase cannot make RNA complementary to mammalian DNA.
- E) bacterial DNA is not found in a membrane-bounded nucleus and is therefore incompatible with mammalian DNA.

Answer: C

Topic: Concept 20.1

Skill: Synthesis/Evaluation

5) A gene that contains introns can be made shorter (but remain functional) for genetic engineering purposes by using

- A) RNA polymerase to transcribe the gene.
- B) a restriction enzyme to cut the gene into shorter pieces.
- C) reverse transcriptase to reconstruct the gene from its mRNA.
- D) DNA polymerase to reconstruct the gene from its polypeptide product.
- E) DNA ligase to put together fragments of the DNA that code for a particular polypeptide.

Answer: C

Topic: Concept 20.1

Skill: Application/Analysis

6) Why are yeast cells frequently used as hosts for cloning?

- A) They easily form colonies.
- B) They can remove exons from mRNA.
- C) They do not have plasmids.
- D) They are eukaryotic cells.
- E) Only yeast cells allow the gene to be cloned.

Answer: D

Topic: Concept 20.1

Skill: Knowledge/Comprehension

- 7) The DNA fragments making up a genomic library are generally contained in
- A) BACs.
  - B) recombinant viral RNA.
  - C) individual wells.
  - D) DNA-RNA hybrids.
  - E) radioactive eukaryotic cells.

Answer: A

Topic: Concept 20.1

Skill: Knowledge/Comprehension

- 8) Yeast artificial chromosomes contain which of the following elements?
- A) centromeres only
  - B) telomeres only
  - C) origin of replication only
  - D) centromeres and telomeres only
  - E) centromeres, telomeres, and an origin of replication

Answer: E

Topic: Concept 20.1

Skill: Knowledge/Comprehension

- 9) Which of the following best describes the complete sequence of steps occurring during every cycle of PCR?

1. The primers hybridize to the target DNA.
2. The mixture is heated to a high temperature to denature the double-stranded target DNA.
3. Fresh DNA polymerase is added.
4. DNA polymerase extends the primers to make a copy of the target DNA.

- A) 2, 1, 4
- B) 1, 3, 2, 4
- C) 3, 4, 1, 2
- D) 3, 4, 2
- E) 2, 3, 4

Answer: A

Topic: Concept 20.1

Skill: Knowledge/Comprehension

- 10) A researcher needs to clone a sequence of part of a eukaryotic genome in order to express the sequence and to modify the polypeptide product. She would be able to satisfy these requirements by using which of the following vectors?

- A) a bacterial plasmid
- B) BAC to accommodate the size of the sequence
- C) a modified bacteriophage
- D) a human chromosome
- E) a YAC with appropriate cellular enzymes

Answer: E

Topic: Concept 20.1

Skill: Application/Analysis