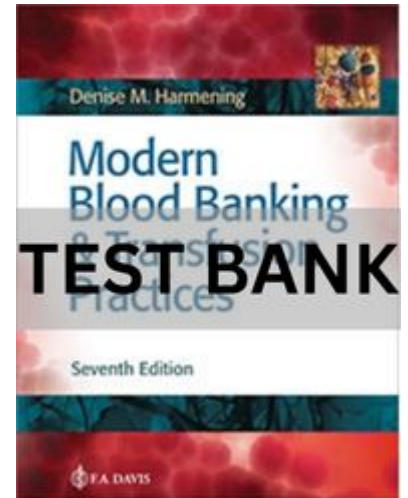


Chapter 1. Red Blood Cells and Platelet Preservation: Historical Perspectives and Current Trends



Multiple Choice

Identify the choice that best completes the statement or answers the question.

- _____ 1. Which metabolic pathway is responsible for generating 90% of the ATP for the RBC?
- a. Pentose phosphate shunt
 - b. Luebering-Rapoport shunt
 - c. Glycolysis
 - d. Methemoglobin reductase
- _____ 2. A unit of blood was returned to the blood bank before it was spiked. Apparently the patient's IV failed. The unit of blood was outside the blood bank for 35 minutes. Which of the statements below is most accurate?
- a. The unit of blood should be discarded immediately.
 - b. The unit of blood can be returned to inventory.
 - c. The unit of blood must be transfused within 4 hours or be discarded at the end of that time.
 - d. The unit of blood must be transfused with 24 hours.
- _____ 3. What effect does storage have on platelets?
- a. Shrinking
 - b. Lysis
 - c. Repulsion
 - d. All of these.
- _____ 4. In the normal hemoglobin-oxygen dissociation curve, what percentage of oxygen is released to the tissues when PO₂ averages 40 mm Hg?
- a. 75%
 - b. 25%
 - c. 100%
 - d. 50%
- _____ 5. What factors are known to influence platelet metabolism and function?
- a. Storage temperature
 - b. Initial pH
 - c. Platelet count
 - d. All of the above
- _____ 6. Which of the following red blood cell morphologies may be present on the peripheral blood smear as a result of loss of RBC membrane?
- a. Spherocytes
 - b. Target cells
 - c. Burr cells
 - d. Schistocytes
- _____ 7. What does the term *autologous* transfusion refer to?
- a. A parent donating blood for his or her child
 - b. An individual donating blood for a friend
 - c. An individual donating blood for a relative
 - d. An individual donating blood for his or her own transfusion
- _____ 8. What is the primary function of hemoglobin?
- a. Iron metabolism
 - b. Porphyrin synthesis
 - c. Oxygen transport
 - d. Signal transduction

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- _____ 9. All of the following areas of red blood cell biology are crucial for normal erythrocyte survival *except*:
- cellular metabolism.
 - RBC membrane.
 - site of the ABO antigen attachment.
 - hemoglobin structure.
- _____ 10. What is the correct biochemical composition of the RBC membrane?
- 52% protein, 40% lipid, 8% carbohydrate
 - 40% protein, 8% lipid, 52% carbohydrate
 - 8% protein, 52% lipid, 40% carbohydrate
 - 8% lipid, 40% carbohydrate, 52% protein
- _____ 11. All of the following biochemical changes are associated with loss of red blood cell viability upon storage *except*:
- decreased pH.
 - loss of red blood cell function.
 - increased ATP level.
 - decreased glucose consumption.
- _____ 12. Which red blood cell preservative has a storage time of 35 days?
- ACD
 - CPDA-1
 - AS-1
 - CPD
- _____ 13. The RBC membrane is relatively permeable to all of the following *except*:
- chloride.
 - sodium.
 - bicarbonate.
 - water.
- _____ 14. Red blood cells frozen using the high-concentration glycerol technique are usually stored at
- 0°C
 - 20°C
 - 65°C
 - 80°C
- _____ 15. What is the major biochemical consideration in platelet storage?
- Glucose metabolism
 - Oxygen supply
 - Production of carbon dioxide
 - Regulation of pH
- _____ 16. What would the hemoglobin-oxygen dissociation curve depict in a patient exhibiting clinical signs of alkalosis?
- Normal
 - Shift to the left
 - Shift to the right
 - None of the above
- _____ 17. Name the main lipid components of a red blood cell membrane.
- Phospholipid
 - Sphingomyelin
 - Glycolipid
 - Glycophorin A
- _____ 18. The ABO blood groups were discovered in 1901 by whom?
- Charles Drew
 - Karl Landsteiner
 - Loutit and Mollison
 - Edward Lindeman
- _____ 19. A standing order of platelets was shipped to your facility by your supplier. It was inadvertently left in the corner of the department until discovered 36 hours later. What would the appropriate action be for the blood banker?
- If the temperature in the box was $22 \pm 2^\circ\text{C}$ and the platelet swirl seemed OK, it would be OK to accept the unit into inventory.
 - The platelets have fallen outside the supplier's quality assurance. The unit should be discarded because the pH has probably dropped too low and platelet activation has been compromised.
 - If the temperature was 1°C to 6°C and the platelet swirl seemed OK, it would be OK to accept the unit into inventory.
 - If the platelets appeared OK and passed the platelet swirl test after being placed on the agitator, they could be accepted into the inventory.

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- _____ 20. Which metabolic pathway permits the accumulation of 2,3 diphosphoglycerate (2,3-DPG)?
- Glycolysis
 - Luebering-Rapoport shunt
 - Pentose phosphate shunt
 - Methemoglobin reductase
- _____ 21. All of the following are consistent with a "shift to the right" of the hemoglobin-oxygen dissociation curve *except*:
- increased 2,3-DPG.
 - 50% O₂ saturation to tissues.
 - decreased 2,3-DPG.
 - decreased hemoglobin affinity for O₂.
- _____ 22. Why are platelet transfusions performed?
- Therapeutically to stop bleeding
 - Prophylactically to prevent bleeding
 - Both reasons.
 - Neither reason.
- _____ 23. What cryoprotective agent is added to red blood cells upon freezing?
- Dextrose
 - Adsol
 - Glycerol
 - All of the above
- _____ 24. If platelets are to be stored for 5 days on a rotator, what is the optimal storage temperature?
- 1°C to 6°C
 - 20°C to 24°C
 - 35°C to 37°C
 - 1°C to 10°C
- _____ 25. Platelets are transfused to play which role in hemostasis?
- Maintenance of vascular integrity
 - Initial arrest of bleeding by platelet plug formation
 - Stabilization of the hemostatic plug
 - All of the above
- _____ 26. Which of the following best describes "integral" membrane proteins?
- Reside at the cytoplasmic surface of membrane
 - Span the entire membrane surface
 - Form the red blood cell cytoskeleton
 - None of the above
- _____ 27. How is stroma-free hemoglobin solution prepared?
- Outdated red blood cells are concentrated, and stroma is removed.
 - Outdated red blood cells are diluted with saline, and stroma is removed.
 - Outdated red blood cells are lysed, and stroma is removed.
 - None of the above
- _____ 28. What is the normal life span of an RBC?
- 100 days
 - 120 days
 - 120 hours
 - 2 days
- _____ 29. Regarding loss of RBC membrane deformability, all of the following are true *except*:
- increase in ATP level.
 - decrease in ATP level.
 - increase in calcium level.
 - decrease in spectrin phosphorylation level.
- _____ 30. One of the most important controls of hemoglobin's affinity for oxygen is:
- glucose.
 - 2,3-diphosphoglycerate (2,3-DPG).
 - K⁺.
 - Ca⁺⁺.
- _____ 31. The normal position of the oxygen dissociation curve depends on three ligands normally found within the RBC. Which one of the following is *not* one of these ligands?
- H⁺ ions
 - 2,3-diphosphoglycerate (2,3-DPG)

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- a. important because when not agitated properly the platelets will stick together and not perform properly when transfused.
- b. important because the pH of the stored platelets will increase and the platelets will lose functionality.
- c. important because the pH of the stored platelets will decrease and the platelets will lose functionality.
- d. not important because it has been deemed unnecessary by the FDA.

_____ 42. Which of the following is *not* a commercial system approved by the FDA for screening for bacterial contamination in platelet collections?

- a. BacT/ALERT
- b. eBDS
- c. BACTEC
- d. Scansystems

_____ 43. Which of the following is a possible future method in pathogen reduction to treat platelet components?

- a. UV light and amotosalen
- b. Amphotericin B
- c. Vitamin B₁₂ and UV light
- d. Penicillin

_____ 44. Which of the following is licensed additive solutions approved for the storage of red blood cells for 42 days?

- a. Adsol (AS-1)
- b. Nutricel (AS-3)
- c. Optisol (AS-5)
- d. All of the above

Chapter 1. Red Blood Cells and Platelet Preservation: Historical Perspectives and Current Trends

Answer Section

MULTIPLE CHOICE

- | | | | |
|------------|--------|------------------------|----------|
| 1. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-3 |
| 2. ANS: C | PTS: 1 | KEY: Taxonomy Level: 3 | LO: 1-6 |
| 3. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-14 |
| 4. ANS: B | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-4 |
| 5. ANS: D | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-14 |
| 6. ANS: A | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-7 |
| 7. ANS: D | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-1 |
| 8. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-2 |
| 9. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-2 |
| 10. ANS: A | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-2 |
| 11. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-7 |
| 12. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-9 |
| 13. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-2 |
| 14. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-6 |
| 15. ANS: D | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-14 |
| 16. ANS: B | PTS: 1 | KEY: Taxonomy Level: 3 | LO: 1-5 |
| 17. ANS: A | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-2 |
| 18. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-1 |
| 19. ANS: B | PTS: 1 | KEY: Taxonomy Level: 3 | LO: 1-16 |
| 20. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-8 |
| 21. ANS: C | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-4 |
| 22. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-15 |
| 23. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-11 |
| 24. ANS: B | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-16 |
| 25. ANS: D | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-15 |
| 26. ANS: B | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-2 |
| 27. ANS: C | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-10 |
| 28. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-2 |
| 29. ANS: A | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-3 |
| 30. ANS: B | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-4 |
| 31. ANS: D | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-4 |
| 32. ANS: A | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-5 |
| 33. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-5 |
| 34. ANS: A | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-9 |
| 35. ANS: B | PTS: 1 | KEY: Taxonomy Level: 3 | LO: 1-12 |
| 36. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-13 |
| 37. ANS: A | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-13 |
| 38. ANS: C | PTS: 1 | KEY: Taxonomy Level: 3 | LO: 1-15 |
| 39. ANS: D | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-19 |
| 40. ANS: B | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-18 |

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- | | | | |
|------------|--------|------------------------|----------|
| 41. ANS: C | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-17 |
| 42. ANS: C | PTS: 1 | KEY: Taxonomy Level: 1 | LO: 1-19 |
| 43. ANS: A | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-19 |
| 44. ANS: D | PTS: 1 | KEY: Taxonomy Level: 2 | LO: 1-20 |

Chapter 2. Basic Genetics

Multiple Choice

Identify the choice that best completes the statement or answers the question.

- _____ 1. When 1,000 donors were tested, 75% were positive for C and 25% were negative for C; the gene frequency of C is:
- 10.
 - 1.
 - 0.5.
 - 25.
- _____ 2. All of the following may cause an alteration in DNA, *except*:
- ultraviolet light.
 - alkylating agents.
 - antibodies.
 - enzymes.
- _____ 3. How is it genetically possible for a child to type Rh-negative?
- Both parents are Dd.
 - Both parents are DD.
 - Mom is DD and Dad is Dd.
 - Sibling is Rh-positive.
- _____ 4. All of the following are included in transcription *except*:
- mRNA terminates at the 5' end.
 - RNA polymerase II binds to a promoter.
 - it proceeds from the 3' end to the 5' end.
 - the 5' end is capped with a methyl residue.
- _____ 5. Which of the following best describes the structure of human chromosomes?
- Linear strands of DNA wound around histones
 - Linear strands of RNA wrapped around histones
 - Tertiary structure of DNA wound around histones
 - Quaternary structure of DNA wound around histones
- _____ 6. In Mendel's law of separation, the first-filial generation is:
- recessive.
 - homozygous.
 - heterozygous.
 - autologous.
- _____ 7. A father carries the Xg^a trait and passes it on to all of his daughters but none of his sons. What type of inheritance does this represent?
- Autosomal dominant
 - X-linked dominant
 - X-linked recessive
 - Autosomal recessive
- _____ 8. Methods to isolate intact DNA in order for it to be studied include all of the following *except*:
- pH changes.
 - enzyme activation.
 - detergent lysis.
 - heat treatment.
- _____ 9. Point mutations include which of the following?
- Substitutions
 - Insertions
 - Deletions
 - Substitutions, insertions, and deletions

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- _____ 10. Which of the following best describes the process of mitosis?
- Cell division by which only one-half of the daughter cells produced are identical to the parent cell
 - Cell division of germ cells by which two successive divisions of the nucleus produce cells that contain half the number of chromosomes of somatic cells
 - Cell division that produces two daughter cells having the same number of chromosomes as the parent
 - Cell division that produces four daughter cells (4n)
- _____ 11. All of the following processes occur in replication, *except*:
- the two DNA strands separate via helicase.
 - DNA polymerase acts on the 5' to 3' parent strand to produce an anticomplementary duplicate strand.
 - DNA polymerase acts on the 3' to 5' parent strand to produce an anticomplementary duplicate strand.
 - replication of the 3' to 5' parent strand is initiated by the enzyme primase, which anneals to the parent strand.
- _____ 12. Which type of genetic change (mutation) is incapable of reverting back to the original phenotype?
- Duplication
 - Deletion
 - Recombination
 - Insertion
- _____ 13. In the MN blood group system, a person who inherits an "M" allele and an "N" allele expresses both M and N antigens on the RBCs. Which of the following is true?
- M is dominant to N.
 - N is dominant to M.
 - M and N are codominant alleles.
 - M and N are located on the same chromosome.
- _____ 14. A gene, such as the *O* gene, that produces no detectable product is called:
- an amorph.
 - a trait.
 - an allele.
 - recessive.
- _____ 15. What blood group is the best example of codominantly inherited blood group genes?
- Rh
 - MN
 - Lewis
 - ABO
- _____ 16. When an individual is said to have blood group A, it refers to the individual's:
- alleles on the chromosome.
 - genotype.
 - phenotype.
 - haplotype.
- _____ 17. The two strands of DNA are: _____; one runs in a 5' to 3' direction, and the other runs in a 3' to 5' direction.
- parallel
 - antiparallel
 - somatic
 - zigzag
- _____ 18. In what stage of mitosis is DNA *not* actively dividing?
- Interphase
 - Prophase
 - Metaphase
 - Anaphase
- _____ 19. How many chromosomes do somatic cells of humans have?
- 46
 - 50
 - 23
 - 100

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- _____ 20. The diploid chromosome number in humans is:
a. 12
b. 23
c. 46
d. 92
- _____ 21. Which constituent in the Hardy-Weinberg equation represents the total number of alleles?
a. q
b. p
c. $2pq$
d. q^2
- _____ 22. In which of the following circumstances will Hardy-Weinberg's principle fail?
a. Mutation
b. Genetic drift
c. Nonrandom mating
d. All the above
- _____ 23. What amino acid initiates translation by attaching to tRNA?
a. Glycine
b. Alanine
c. Methionine
d. Lysine
- _____ 24. What is meant by the term *autosomal*?
a. Trait is not carried on the sex chromosomes
b. Trait is carried on sex chromosomes
c. Trait is not expressed in the parents
d. Organism possesses different alleles for a given characteristic
- _____ 25. Which of the following best describes classical genetics?
a. DNA alteration that is caused by a physical or chemical agent
b. Transmission of characteristics from parents to offspring
c. Possessing a pair of identical alleles
d. The synthesis of RNA from DNA requiring RNA polymerase
- _____ 26. How is RNA different from DNA?
a. RNA usually exists as one strand
b. Ribose is substituted for deoxyribose
c. RNA incorporates uracil
d. All of the above
- _____ 27. Using the Hardy-Weinberg equation, if a total random population carried the dominant allele E and 20% carried the recessive allele e, what would the total percentage be for the recessive trait ee?
a. 64%
b. 4%
c. 16%
d. 0.4%
- _____ 28. A triple set of nucleotides is a:
a. helix.
b. base.
c. codon.
d. template.
- _____ 29. A human gamete (egg or sperm) contains how many chromosomes?
a. 23 pairs
b. 46 pairs
c. 23 chromosomes
d. 46 chromosomes
- _____ 30. How do restriction endonucleases function?
a. Disrupt hydrogen bonding in DNA structure
b. Promote digestion of RNA
c. Cut DNA into smaller fragments
d. Terminate translation of mRNA
- _____ 31. DNA is composed of all of the following *except*:
a. adenine.
b. thymine.
c. cytosine.
d. guanine.

