Test Bank for Clinical Hematology and Fundamentals of Hemostasis 1st Harmening

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1. Proteins that extend from the outer surface and traverse the entire RBC membrane to the inner cytoplasmic side are termed:

A) Integral
B) Peripheral
C) Cytoplasmic
D) Spectrin
Correct Answer: A
L.O.: 2-1
Taxonomy: 1

2. RBC membrane proteins that are limited to the cytoplasmic surface of the membrane are called:

A) Integral
B) Peripheral
C) Cytoplasmic
D) Glycophorin
Correct Answer: B
L.O.: 2-1
Taxonomy: 1

3. Which of the following abnormal RBC morphologies is associated with abetalipoproteinemia?

A) Schistocytes
B) Target cells
C) Spherocytes
D) Acanthocytes
Correct Answer: D
L.O.: 2-1
Taxonomy: 1

4. Which of the following abnormal RBC morphologies is associated with hemoglobinopathies?

A) Schistocytes
B) Target cells
C) Spherocytes
D) Acanthocytes
Correct Answer: B
L.O.: 2-1
Taxonomy: 1

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5. Normal hemoglobin production is dependent upon all the following processes **except**:
A) Adequate globin synthesis
B) Adequate iron delivery and supply
C) Adequate synthesis of protoporphyrins
D) Adequate RBC membrane surface-to-volume ratio
Correct Answer: D
L.O.: 2-4
Taxonomy: 2

6. Which integral membrane protein contains approximately 60% carbohydrate and accounts for most of the membrane sialic acid that gives the RBC its negative charge?
A) Spectrin
B) Actin
C) Glycophorin
D) Ankyrin
Correct Answer: C
L.O.: 2-1, 2-2
Taxonomy: 1

7. Most proteins that carry RBC antigens and are receptors are:
A) Spectrin
B) Actin
C) Glycophorin
D) Ankyrin
Correct Answer: C
L.O.: 2-2
Taxonomy: 1

8. Which membrane protein is principally responsible for the skeleton of microfilaments on the inner surface of the RBC membrane?
A) Spectrin
B) Actin
C) Glycophorin
D) Ankyrin
Correct Answer: A
L.O.: 2-2
Taxonomy: 2

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9. What is the normal lifespan of the RBC in circulation?
A) 60 days
B) 12 days
C) 120 days
D) 80 days
Correct Answer: C
L.O.: 2-12
Taxonomy: 1

10. A loss of RBC membrane deformability is **not** associated with which of the following?
A) Increase in membrane calcium
B) Gain of ATP
C) Decrease in the phosphorylation of spectrin
D) Increase in surface area
Correct Answer: B
L.O.: 2-3
Taxonomy: 2

11. A loss of RBC membrane results in the formation of which abnormal RBC morphology that represents a reduced surface-to-volume ratio?
A) Target cells
B) Spherocytes
C) Acanthocytes
D) Sickle cells
Correct Answer: B
L.O.: 2-3
Taxonomy: 2

12. The RBC membrane is freely permeable to which of the following?
A) Na^+
B) HCO_3^-
C) K^+
D) Ca^{2+}
Correct Answer: B
L.O.: 2-3
Taxonomy: 1

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13. The RBC membrane is relatively impermeable to which of the following?
A) Na^+
B) HCO_3^-
C) H_2O
D) Cl^-
Correct Answer: A
L.O.: 2-3
Taxonomy: 1

14. Which of the following is the RBC intracellular-to-extracellular ratio for sodium?
A) 25:1
B) 1:12
C) 12:1
D) 1:25
Correct Answer: B
L.O.: 2-3
Taxonomy: 1

15. Which of the following is the RBC intracellular-to-extracellular ratio for potassium?
A) 25:1
B) 1:12
C) 12:1
D) 1:25
Correct Answer: A
L.O.: 2-3
Taxonomy: 1

16. The RBCs generate their energy (ATP) almost exclusively through which metabolic pathway?
A) Krebs cycle
B) Embden-Meyerhof glycolytic pathway
C) Phosphogluconate pathway
D) Luebering–Rapoport pathway
Correct Answer: B
L.O.: 2-11
Taxonomy: 1

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17. Normal adult hemoglobin A does **not** consist of:
A) Two alpha chains
B) Two beta chains
C) Four hemoglobin groups
D) Four heme groups
Correct Answer: C
L.O.: 2-5
Taxonomy: 2

18. Hemoglobin A_2 is defined biochemically as:
A) $\alpha_2\beta_2$
B) $\alpha_2\gamma_2$
C) $\alpha_2\delta_2$
D) $\alpha_2\varepsilon_2$
Correct Answer: C
L.O.: 2-5
Taxonomy: 1

19. Hemoglobin F (fetal hemoglobin) is defined biochemically as:
A) $\alpha_2\beta_2$
B) $\alpha_2\gamma_2$
C) $\alpha_2\delta_2$
D) $\alpha_2\varepsilon_2$
Correct Answer: B
L.O.: 2-5
Taxonomy: 1

20. Which of the following represents embryonic hemoglobin?
A) $\alpha_2\beta_2$
B) $\alpha_2\gamma_2$
C) $\alpha_2\delta_2$
D) $\alpha_2\varepsilon_2$
Correct Answer: D
L.O.: 2-5
Taxonomy: 1

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21. Which of the following types of hemoglobin is **not** found in adult RBCs?
A) 95%–97% HbF
B) 2%–3% HbA_2
C) 2% or less HbF
D) 95%–97% HbA
Correct Answer: A
L.O.: 2-5
Taxonomy: 1

22. A shift to the left of the hemoglobin oxygen dissociation curve can occur as a result of:
A) Hypoxia
B) Alkalosis
C) Increased amounts of carbon dioxide
D) Anemia
Correct Answer: B
L.O.: 2-8
Taxonomy: 2

23. The storage form of iron is termed:
A) Haptoglobin
B) Ferritin
C) Transferrin
D) Hemopexin
Correct Answer: B
L.O.: 2-4
Taxonomy: 1

24. Which of the following is the transport protein for iron?
A) Haptoglobin
B) Ferritin
C) Transferrin
D) Hemopexin
Correct Answer: C
L.O.: 2-4
Taxonomy: 1

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25. Which of the following is the protein carrier for the alpha–beta dimers of the dissociated hemoglobin molecule during intravascular hemolysis?
A) Haptoglobin
B) Ferritin
C) Transferrin
D) Hemopexin
Correct Answer: A
L.O.: 2-13
Taxonomy: 1

26. Two-thirds of the total body iron is bound to:
A) Globin
B) Transferrin
C) Heme
D) Hemopexin
Correct Answer: C
L.O.: 2-4
Taxonomy: 1

27. Which state of hemoglobin has a high affinity for oxygen?
A) Oxyhemoglobin
B) Deoxyhemoglobin
C) Sulfhemoglobin
D) Methemoglobin
Correct Answer: A
L.O.: 2-6
Taxonomy: 2

28. In the fetus, most of the hemoglobin is:
A) HbA
B) HbA_2
C) HbF
D) HbD
Correct Answer: C
L.O.: 2-4
Taxonomy: 1

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29. Which of the following stains iron in the bone marrow?
A) Wright stain
B) Giemsa stain
C) Prussian blue
D) Hematoxylin and eosin
Correct Answer: C
L.O.: 2-4
Taxonomy: 1

30. A ringed sideroblast in the bone marrow is diagnostic for what defect?
A) Deficient iron absorption
B) Deficient globin synthesis
C) Deficient RBC metabolic pathways
D) Deficient protoporphyrin synthesis
Correct Answer: D
L.O.: 2-9
Taxonomy: 2

31. The function of hemoglobin is to:
A) Deliver oxygen to the tissues
B) Consume oxygen
C) Deliver carbon dioxide to the tissues
D) Consume carbon dioxide
Correct Answer: A
L.O.: 2-6
Taxonomy: 1

32. The dissociation and binding of oxygen by hemoglobin is not directly proportional to the pO_2 of its environment but instead exhibits a sigmoid-curve relationship termed:
A) The Embden–Meyerhof pathway
B) The phosphogluconate pathway
C) The hemoglobin oxygen dissociation curve
D) The Luebering–Rapoport pathway
Correct Answer: C
L.O.: 2-6
Taxonomy: 1

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33. Which of the following can shift the hemoglobin–oxygen dissociation curve to the left?
A) Increases in 2,3-biphosphoglycerate (2,3-BPG)
B) Acidosis
C) Increase in body temperature (fever)
D) Increase in abnormal hemoglobin
Correct Answer: D
L.O.: 2-8
Taxonomy: 2

34. Which of the following can shift the hemoglobin–oxygen dissociation curve to the right?
A) Increase in body temperature (fever)
B) Abnormal Hb (methemoglobin and carboxyhemoglobin)
C) Decreases in 2,3-BPG
D) Alkalosis
Correct Answer: A
L.O.: 2-7
Taxonomy: 2

35. Which of the following is **not** an abnormal hemoglobin that cannot either transport or deliver oxygen?
A) Carboxyhemoglobin
B) Methemoglobin
C) Deoxyhemoglobin
D) Sulfhemoglobin
Correct Answer: C
L.O.: 2-9
Taxonomy: 2

36. As seen in chronic smoking and other conditions, the result in the binding of an abnormal molecule to heme is 200 times tighter than the binding of oxygen to heme resulting in the formation of which abnormal hemoglobin?
A) Carboxyhemoglobin
B) Methemoglobin
C) Oxyhemoglobin
D) Sulfhemoglobin
Correct Answer: A
L.O.: 2-9
Taxonomy: 1

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37. This abnormal hemoglobin forms when the iron is oxidized to the ferric (Fe^{3+}) state, and normally, less than 1% of the total circulatory hemoglobin is in this form in the normal individual.
A) Carboxyhemoglobin
B) Methemoglobin
C) Oxyhemoglobin
D) Sulfhemoglobin
Correct Answer: B
L.O.: 2-9
Taxonomy: 1

38. This abnormal hemoglobin can form as a result of chronic constipation and represents an irreversible change to the hemoglobin molecule which cannot carry oxygen and will persist until the RBCs carrying this abnormal hemoglobin are removed from the circulation.
A) Carboxyhemoglobin
B) Methemoglobin
C) Oxyhemoglobin
D) Sulfhemoglobin
Correct Answer: D
L.O.: 2-9
Taxonomy: 1

39. Adequate ATP levels are crucial to RBC survival and function by maintaining each of the following **except**:
A) Oxygen binding to heme
B) Membrane deformability
C) RBC volume
D) Adequate amounts of reduced pyridine nucleotides
Correct Answer: A
L.O.: 2-10
Taxonomy: 1

40. What percentage of ATP needed by the RBC is generated by the Embden–Meyerhof glycolytic pathway?
A) 10%
B) 50%
C) 5%
D) 90%
Correct Answer: D

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L.O.: 2-10, 2-11
Taxonomy: 1

41. Which of the following RBC metabolic pathways produces the pyridine nucleotide NADPH from $NADP^+$ along with reduced glutathione to provide the main line of defense against oxidative injury?
A) Embden–Meyerhof
B) Hexose monophosphate (phosphogluconate)
C) Methemoglobin reductase
D) Luebering–Rapoport
Correct Answer: B
L.O.: 2-11
Taxonomy: 1

42. Which of the following RBC metabolic pathways is important in maintaining the heme iron in the reduced ferrous functional state?
A) Embden–Meyerhof
B) Hexose monophosphate (phosphogluconate)
C) Methemoglobin reductase
D) Luebering–Rapoport
Correct Answer: C
L.O.: 2-11
Taxonomy: 1

43. Which of the following RBC metabolic pathways is responsible for the production of the organic phosphate 2,3-BPG, which is important in delivering oxygen to the tissues?
A) Embden–Meyerhof
B) Hexose monophosphate (phosphogluconate)
C) Methemoglobin reductase
D) Luebering–Rapoport
Correct Answer: D
L.O.: 2-11
Taxonomy: 1

44. Why is it essential that the RBC metabolic pathways to gain ATP are anaerobic?
A) Function of RBC is to deliver carbon dioxide and not consume it
B) Function of RBC is to deliver oxygen, not to use it for energy production
C) Function of RBC is to protect from oxidative energy in aerobic processes with glutathione

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D) Function of RBC is to increase hemoglobin affinity for oxygen with 2,3-DPG
Correct Answer: B
L.O.: 2-10, 2-11
Taxonomy: 3

45. Each day, what percentage of old RBCs in circulation is taken out by a system of fixed macrophages in the body known as the reticuloendothelial system (RES)?
A) 1%
B) 20%
C) 50%
D) 80%
Correct Answer: A
L.O.: 2-12
Taxonomy: 1

46. What percentage of the destruction of senescent RBCs occurs by the processing of extravascular hemolysis?
A) 90%
B) 50%
C) 5%–10%
D) 25%
Correct Answer: A
L.O.: 2-13
Taxonomy: 1

47. What percentage of normal RBC destruction occurs through the process of intravascular hemolysis?
A) 90%
B) 50%
C) 5%
D) 25%
Correct Answer: C
L.O.: 2-13
Taxonomy: 1

48. What is the normal level of plasma haptoglobin?
A) 50–200 mg/dL
B) 5 g/L

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C) 2–5 mg/dL
D) 50–100 mg/dL
Correct Answer: A
L.O.: 2-13
Taxonomy: 1

49. What is the normal level of plasma hemoglobin?
A) 50–200 mg/dL
B) 5 g/L
C) 2–5 mg/dL
D) 50–100 mg/dL
Correct Answer: C
L.O.: 2-13
Taxonomy: 1

50. Circulating methemalbumin gives plasma or blood what color?
A) Purple
B) Red
C) Brown
D) Black
Correct Answer: C
L.O.: 2-13
Taxonomy: 1

51. In hemoglobinuria, oxyhemoglobin predominates in alkaline urine and gives it what color?
A) Purple
B) Red
C) Brown
D) Black
Correct Answer: B
L.O.: 2-13
Taxonomy: 1

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52. In hemoglobinuria, methemoglobin predominates in acidic urine and gives it what color?
A) Purple
B) Red
C) Brown
D) Black
Correct Answer: C
L.O.: 2-13
Taxonomy: 1

53. A shift to the right of the hemoglobin oxygen dissociation curve can occur as a result of:
A) Hypoxia
B) Alkalosis
C) Increased quantity of methemoglobin
D) Increased quantity of hemoglobin F
Correct Answer: A
L.O.: 2-7
Taxonomy: 2

54. Decreased cellular deformability leads to:
A) Increased RBC survival
B) No change in RBC survival
C) Decreased RBC survival
D) Normal RBC survival
Correct Answer: C
L.O.: 2-3
Taxonomy: 2

55. What change is **not** associated with the aging of the RBC?
A) Increased spheroidal shape
B) Decreased mean corpuscular volume (MCV)
C) Depletion of cholesterol
D) Increased glycolytic enzymatic activity
Correct Answer: D
L.O.: 2-12
Taxonomy: 2

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