

# Practice Questions in Blood Physiology

L.D. Lord

# Question 1

**Which of the following is/are consistent with end-stage liver disease?**

- A) Decreased EPO production
- B) Acquired hemophilia
- C) Increased transport of fat-soluble molecules
- D) Peripheral edema
- E) Two choices correct

# Question 1

Which of the following is/are consistent with end-stage liver disease?

- A) Decreased EPO production
- B) Acquired hemophilia
- C) Increased transport of fat-soluble molecules
- D) Peripheral edema
- E) Two choices correct

# Question 1: Key

- A) EPO made by kidneys, not liver
- B) yes! liver produces nearly all clotting factors
- C) Liver produces majority of transport proteins in the body, thus reduced transport in disease
- D) yes! Underproduction of plasma proteins → loss of oncotic pressure → edema
- E) correct answer (B & D correct)

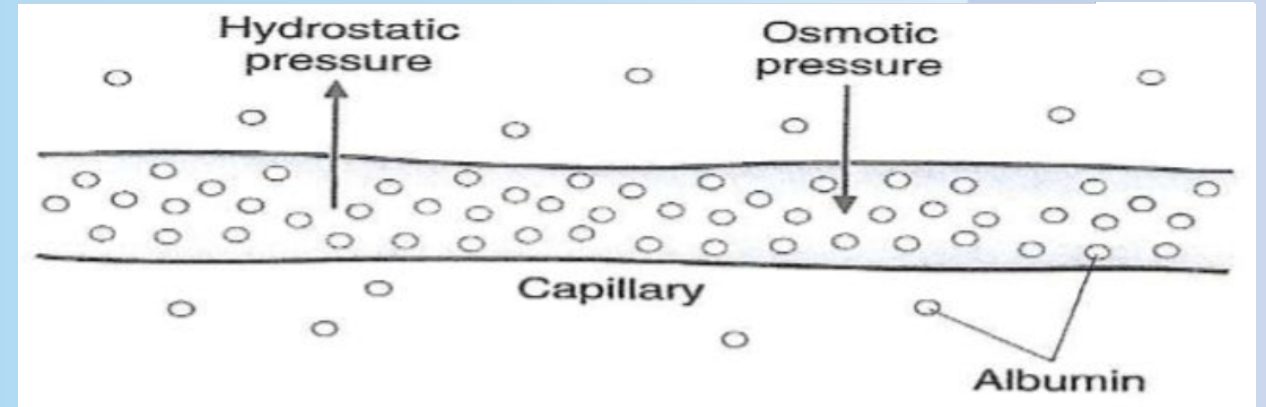


Table 1

The liver's role in coagulation: coagulation factors synthesized by the liver

Procoagulants	Anticoagulants	Profibrinolysis	Antifibrinolysis
<ul style="list-style-type: none"><li>• Fibrinogen</li><li>• Prothrombin</li><li>• Factor V</li><li>• Factor VII</li><li>• Factor VIII</li><li>• Factor IX</li><li>• Factor X</li><li>• Factor XI</li><li>• Factor XII</li><li>• Factor XIII</li><li>• Thrombopoietin</li></ul>	<ul style="list-style-type: none"><li>• Protein C</li><li>• Protein S</li><li>• Tissue factor pathway inhibitor</li><li>• Antithrombin</li></ul>	<ul style="list-style-type: none"><li>• Factor XIIIa</li><li>• Plasminogen</li></ul>	<ul style="list-style-type: none"><li>• Plasminogen activator inhibitor-1</li><li>• Alpha-antiplasmin</li><li>• Tissue activatable fibrinolysis inhibitor</li></ul>

# Question 2

**Which of the following occurs a patient with metabolic acidosis (i.e. low blood pH)?**

- A) Hemoglobin has increased affinity for oxygen
- B) The heme group of hemoglobin is in a ferric (Fe 3+) state
- C) p50 of the O<sub>2</sub>/Hgb dissociation curve is increased
- D) The patient is hypoxemic due to decreased Hgb levels

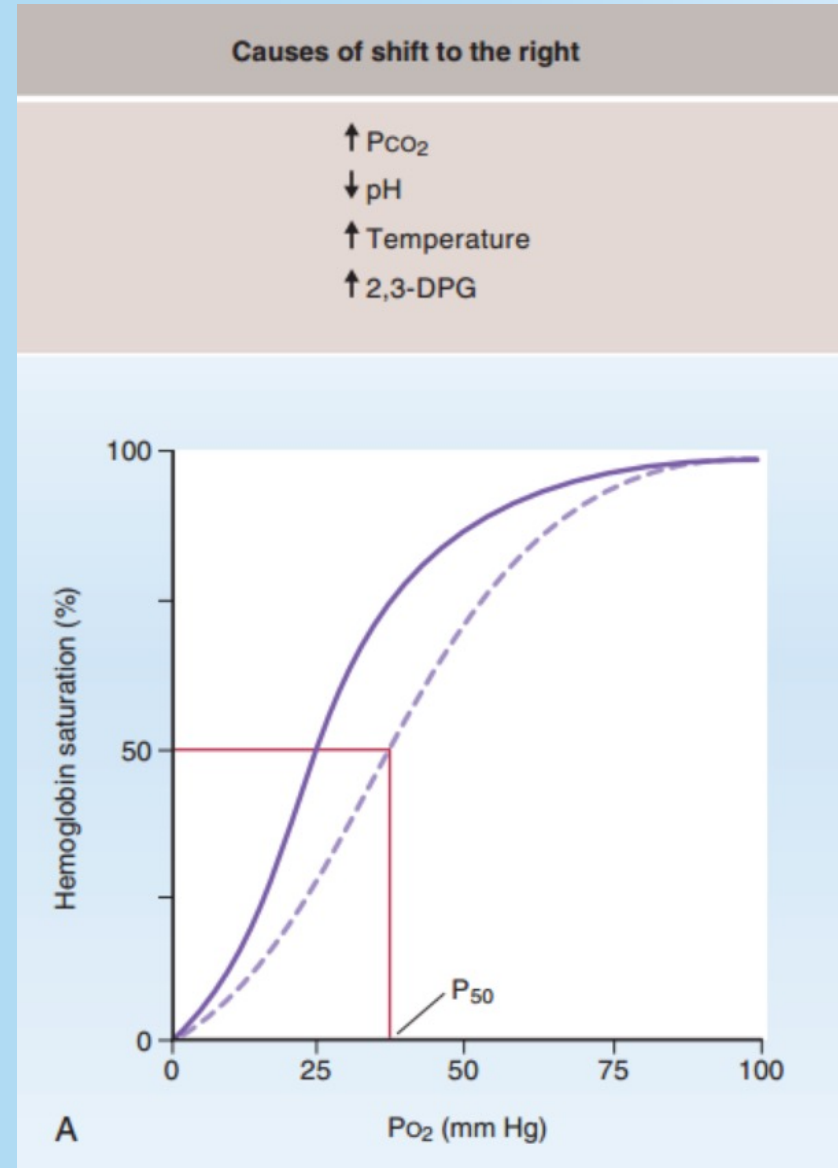
# Question 2

Which of the following occurs a patient with metabolic acidosis (i.e. low blood pH)?

- A) Hemoglobin has increased affinity for oxygen
- B) The heme group of hemoglobin is in a ferric (Fe 3+) state
- C) p50 of the O<sub>2</sub>/Hgb dissociation curve is increased
- D) The patient is hypoxemic due to decreased Hgb levels

# Question 2: Key

- A) acidic pH will decrease Hgb affinity for oxygen
- B) no change in oxidation state of Hgb/heme moiety
- C) correct! Higher p50 reflects decreased affinity of Hgb for O<sub>2</sub>
- D) the Bohr shift does not impact Hgb levels



# Question 3

**Which of the following is true regarding methemoglobinemia?**

- A) hemoglobin saturation is decreased
- B) Met-Hgb levels are reduced in lung disease
- C) hemoglobin heme group is in a reduced state
- D) hemoglobin heme group is methylated



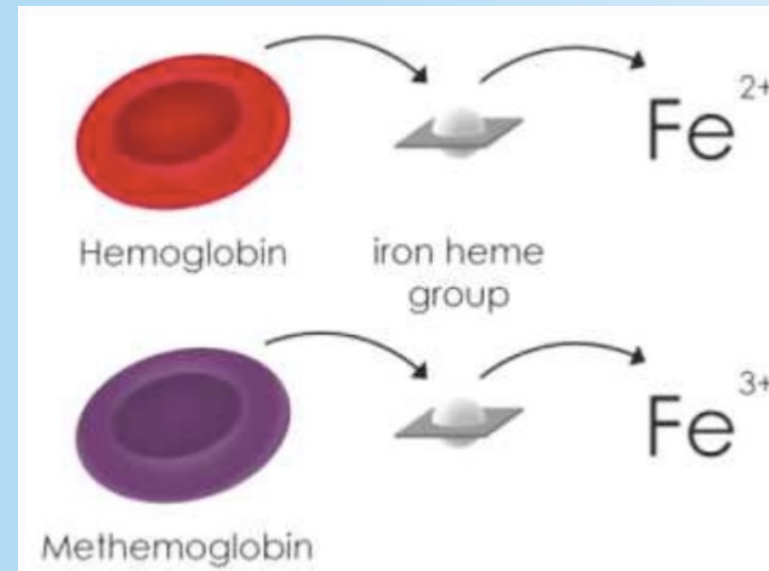
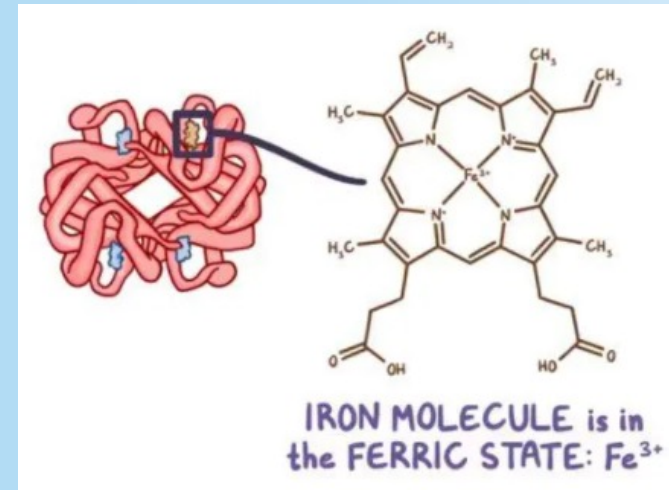
# Question 3

Which of the following is true regarding methemoglobinemia?

- A) hemoglobin saturation is decreased
- B) Met-Hgb levels are reduced in lung disease
- C) hemoglobin heme group is in a reduced state
- D) hemoglobin heme group is methylated

# Question 3: Key

- A) True! Since  $\text{Fe}^{3+}$  in Hgb heme group cannot bind  $\text{O}_2$ , saturation will decrease
- B) Met-Hgb may be increased in lung disease, not decreased
- C) Heme group is oxidized in Met-Hgb, not reduced
- D) methylation is not involved



# Question 4

**Which is/are possible effect(s) of a drug inhibiting the differentiation of myeloid progenitors?**

- A) Anemia
- B) Immunosuppression
- C) Internal bleeding
- D) All correct

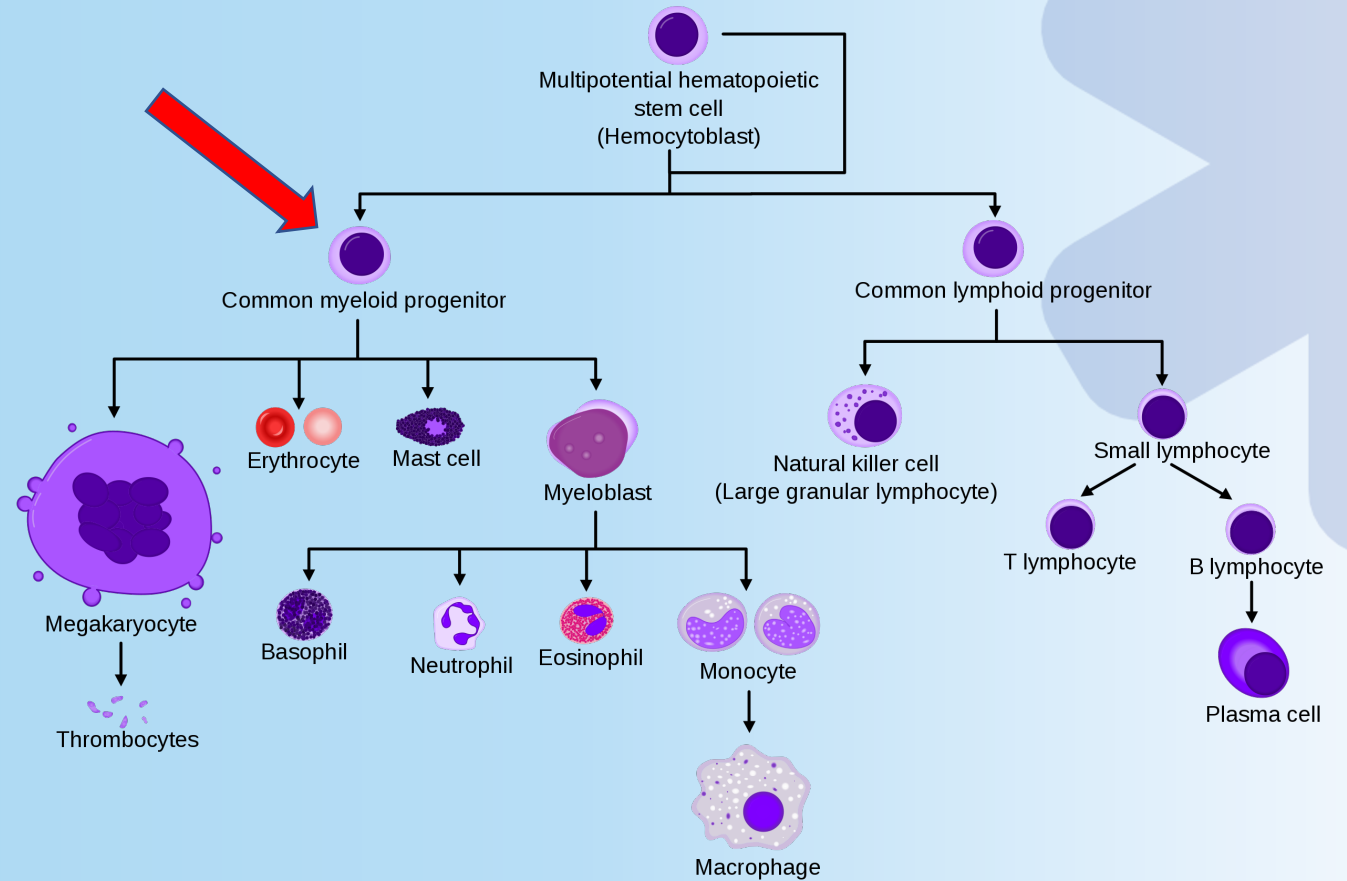
# Question 4

Which is/are possible effect(s) of a drug inhibiting differentiation of myeloid progenitors?

- A) Anemia
- B) Immunosuppression
- C) Internal bleeding
- D) All correct

# Question 4: Key

- A) true, due to impaired erythropoiesis
- B) true, due to agranulocytosis & decreased levels of monocytes
- C) true, due a thrombocytopenia
- D) **All correct**



# Question 5

**Which of the following is true regarding carbon monoxide (CO) effects on hemoglobin?**

- A) CO and CO<sub>2</sub> bind to the same site on Hgb
- B) The patient's Hgb saturation should be relatively unaffected by CO
- C) Carboxyhemoglobin (CO-Hgb) may be up to 2% of Hgb in a non-smoker
- D) The affinity of CO for Hgb is 5x higher than that of O<sub>2</sub>

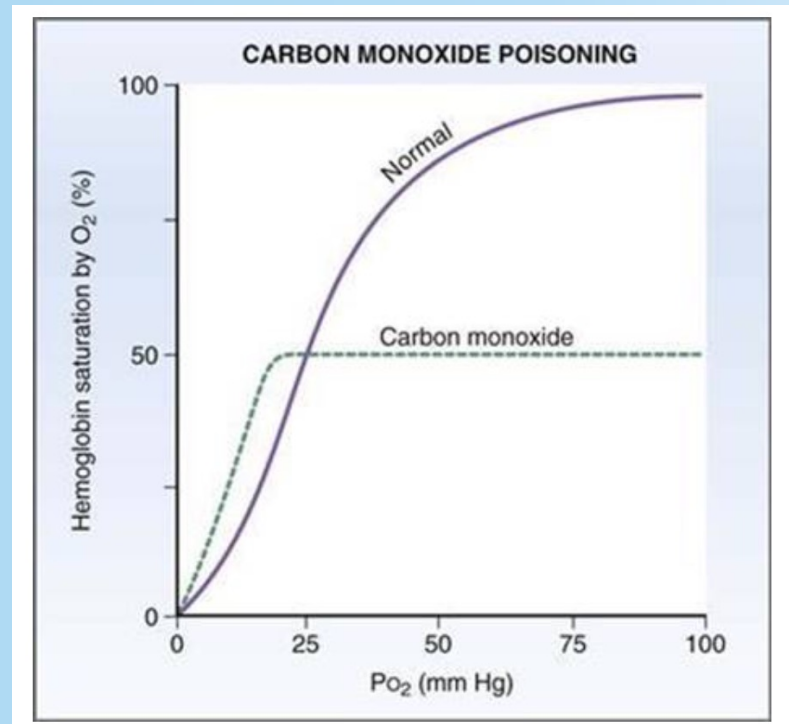
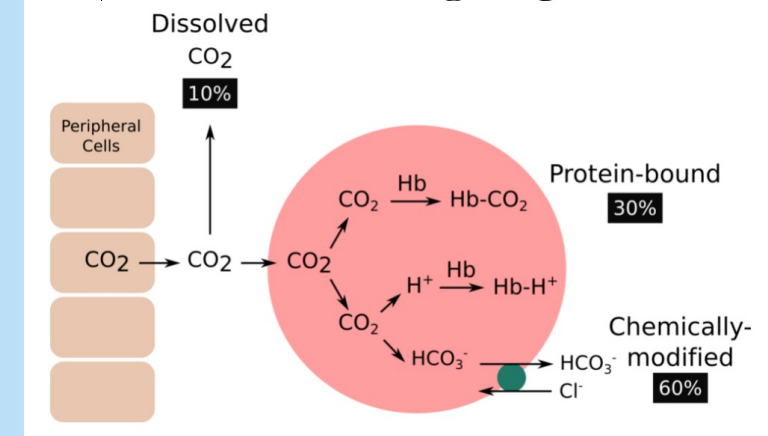
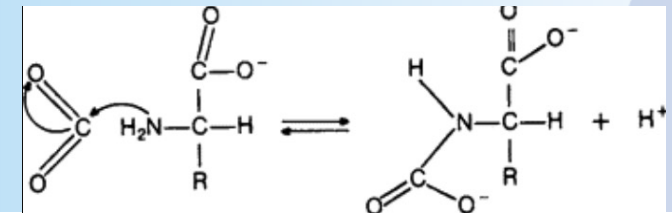
# Question 5

Which of the following is true regarding carbon monoxide (CO) effects on hemoglobin?

- A) CO and CO<sub>2</sub> bind to the same site on Hgb
- B) The patient's Hgb saturation should be relatively unaffected by CO
- C) Carboxyhemoglobin (CO-Hgb) may be up to 2% of Hgb in a non-smoker
- D) The affinity of CO for Hgb is 5x higher than that of O<sub>2</sub>

# Question 5: Key

- A) CO competes directly with O<sub>2</sub> for heme group, while CO<sub>2</sub> binds globin chains
- B) big drop in saturation
- C) True! Normal range CO-Hgb is 0-3% for non-smoker
- D) 250x higher affinity!





# Question 6

**Which of the following is true regarding the drug tissue-plaminogen activator (t-PA)?**

- A) t-PA promotes the conversion of fibrinogen to fibrin
- B) t-PA may be beneficial in the treatment of intracranial hemorrhage
- C) t-PA degrades blood clots within minutes via oxidation
- D) None correct

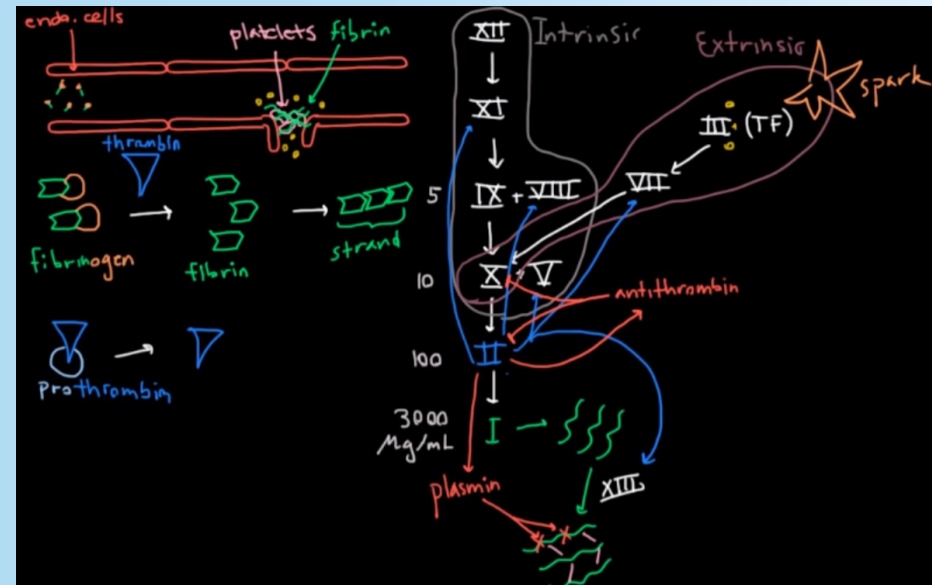
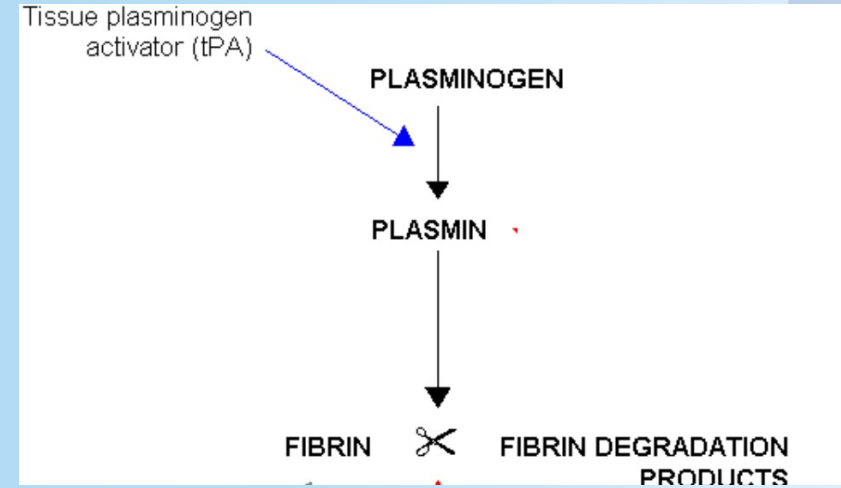
# Question 6

Which of the following is true regarding the drug tissue-plaminogen activator (t-PA)?

- A) t-PA promotes the conversion of fibrinogen to fibrin
- B) t-PA may be beneficial in the treatment of intracranial hemorrhage
- C) t-PA degrades blood clots within minutes via oxidation
- D) None correct

# Question 6: Key

- A) this is what thrombin does
- B) t-PA is contraindicated when active bleeding present
- C) the action is slower, and oxidation is not involved
- **D) none correct**



# Question 7

**Which of the following is most likely to result in an increased hematocrit?**

- A) Bone marrow insufficiency
- B) High-grade fever due to influenza
- C) Heat stroke
- D) Chronic kidney disease

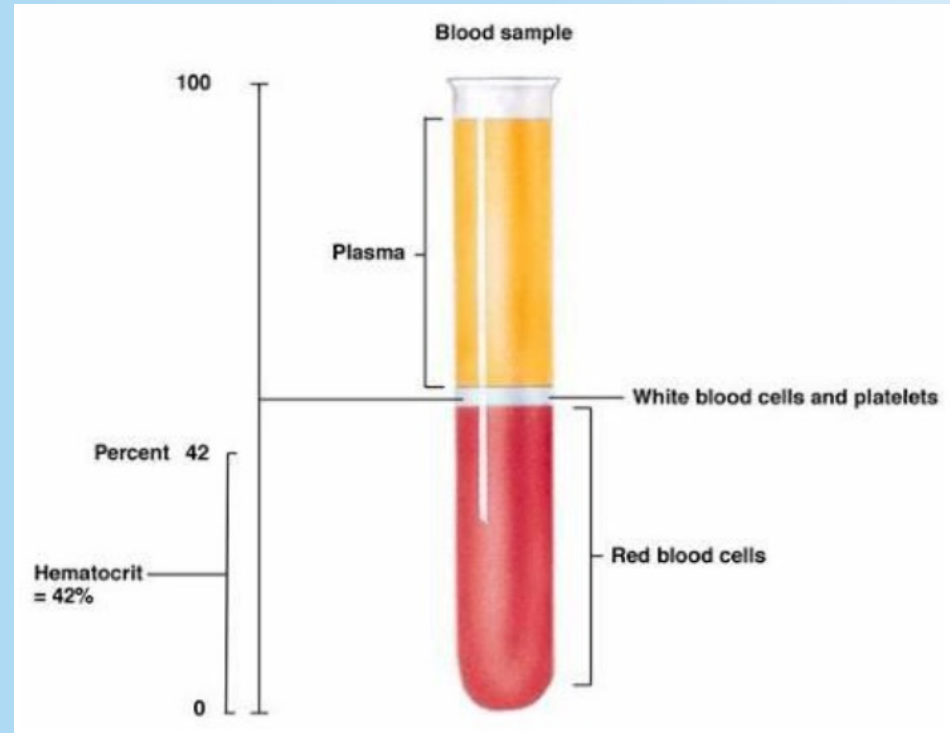
# Question 7

Which of the following is most likely to result in an increased hematocrit?

- A) Bone marrow insufficiency
- B) High-grade fever due to influenza
- C) Heat stroke
- D) Chronic kidney disease

# Question 7: Key

- A) would *decrease* hematocrit since less RBCs produced
- B) fever would lead to a right-shift in O<sub>2</sub>/Hgb dissociation curve, but not have a significant effect on hematocrit
- C) correct! Severe dehydration will increase the hematocrit due to decrease in plasma volume
- D) reduced EPO would decrease the hematocrit (as would hypervolemia)



Dehydration = plasma vol ↓

Htc ↑

# Question 8

**Which of the following statements is true regarding blood gases?**

- A) carbanimohemoglobin stabilizes the relaxed state of Hgb
- B) CO<sub>2</sub> is less soluble in blood than O<sub>2</sub>
- C) pO<sub>2</sub> of plasma = pO<sub>2</sub> of whole-blood
- D) most CO<sub>2</sub> is transported in blood in gaseous form

# Question 8

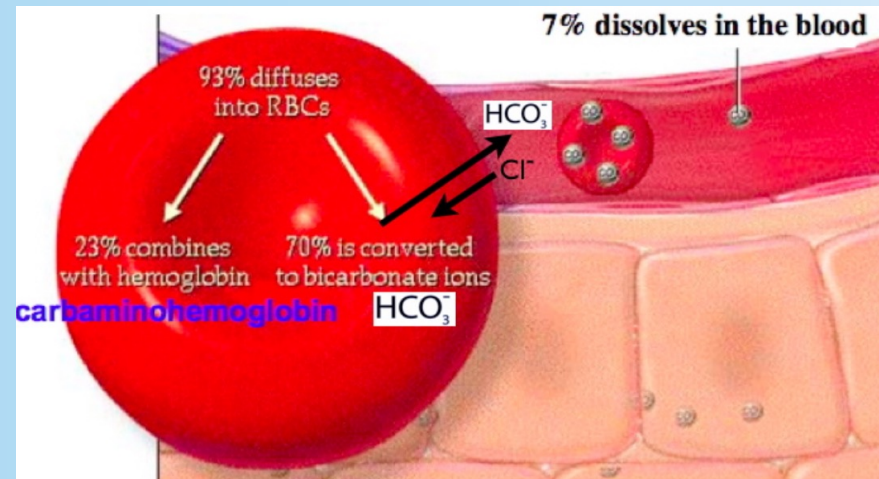
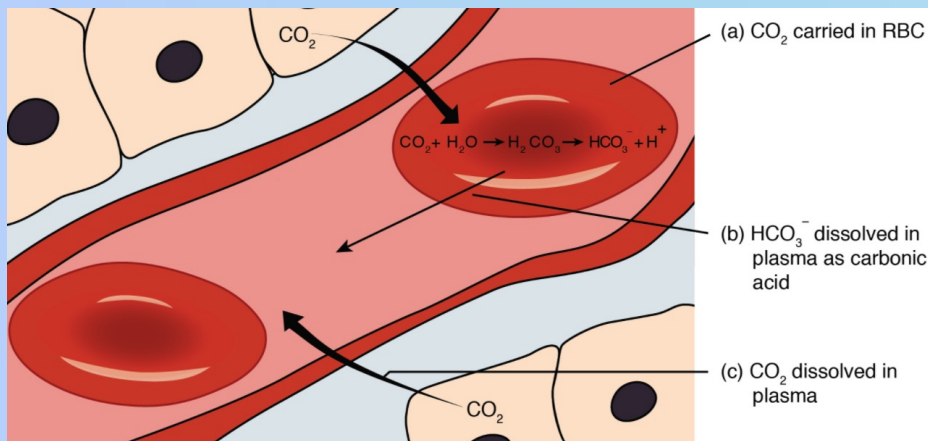
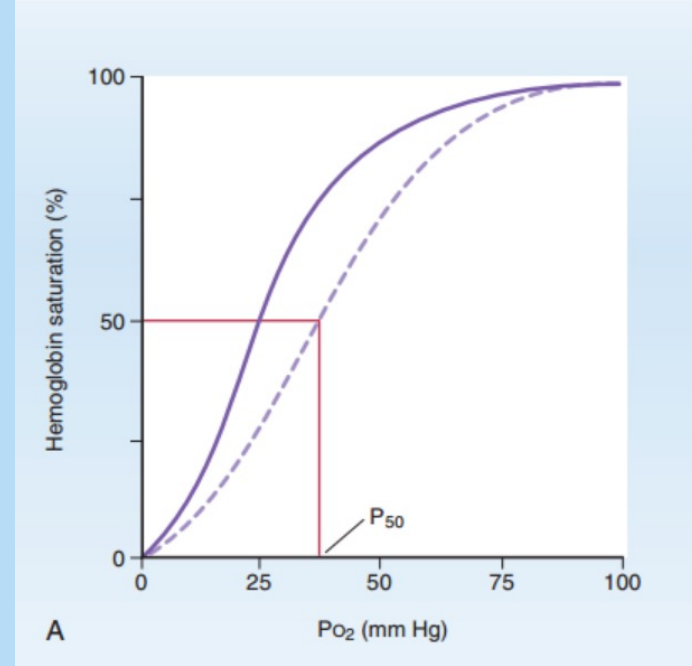
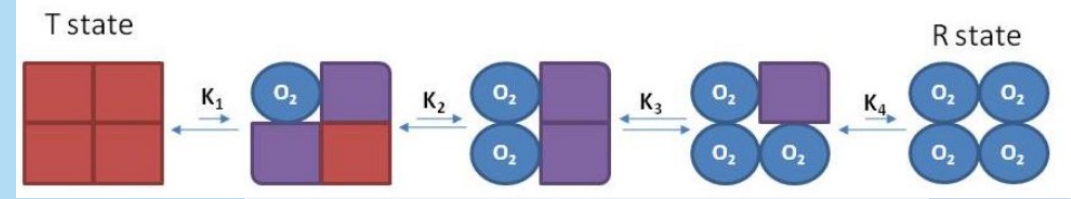
Which of the following statements is true regarding blood gases?

- A) carbanimohemoglobin stabilizes the relaxed state of Hgb
- B) CO<sub>2</sub> is less soluble in blood than O<sub>2</sub>
- C) pO<sub>2</sub> of plasma = pO<sub>2</sub> of whole-blood
- D) most CO<sub>2</sub> is transported in blood in gaseous form



# Question 8: Key

- A) CO<sub>2</sub>-Hgb stabilizes the tense state of Hgb
- B) CO<sub>2</sub> is more polar, therefore more soluble than O<sub>2</sub>
- C) correct! PO<sub>2</sub> of whole-blood is only due to “free” O<sub>2</sub>, which is 100% found in plasma
- D) most (~70%) CO<sub>2</sub> transported as bicarbonate anions (HCO<sub>3</sub><sup>-</sup>)



# Question 9

Which of the following laboratory values is abnormal in a 25 year old man?

- A) RBC count = 4.9 million cells / mcL
- B) 75% Hgb saturation in mixed venous blood
- C) reticulocytes = 7% of Hct
- D) Methemoglobin (Met-Hgb) fraction = 1.5% of Hgb

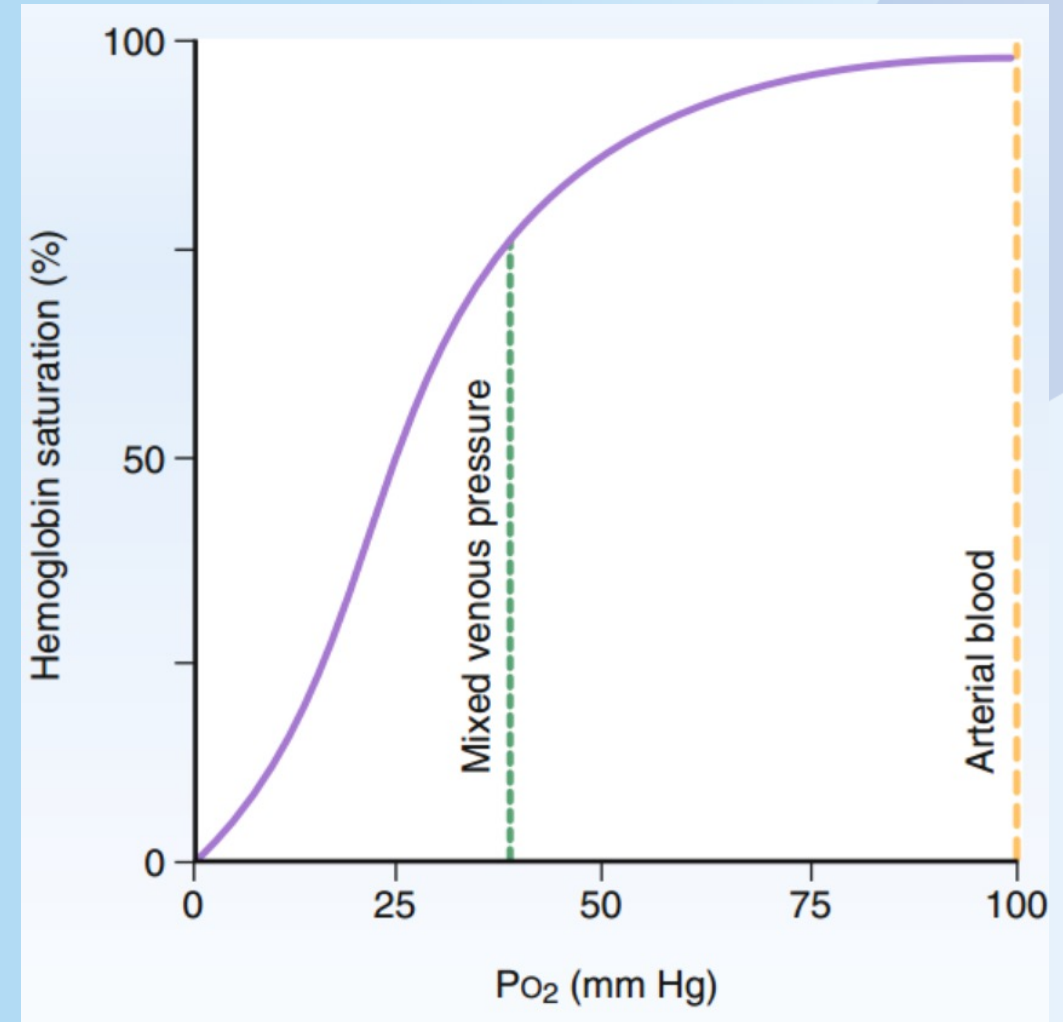
# Question 9

Which of the following laboratory values is abnormal in a 25 year old man?

- A) RBC count = 4.9 million cells / mcL
- B) 75% Hgb saturation in mixed venous blood
- C) reticulocytes = 7% of Hct
- D) Methemoglobin (Met-Hgb) fraction = 1.5% of Hgb

# Question 9: Key

- A) within normal range
- B) 70% saturation in mixed venous blood is a normal value. *But remember that saturation values in the clinic almost always refer to arterial blood*
- C) 7% reticulocytes is far too high. Should be 0.5-2.5% of Hct
- D) Met-Hgb 1.5% is within normal range of methemoglobin fraction (0-3%)



# Question 10

**Which of the following is true regarding primary hemostasis?**

- A) platelet plug formation terminates the coagulation process
- B) the damaged endothelium secretes nitric oxide (NO)
- C) activated platelets secrete ADP
- D) von Willebrand deficiency reduces bleeding time

# Question 10

Which of the following is true regarding primary hemostasis?

- A) platelet plug formation terminates the coagulation process
- B) the damaged endothelium secretes nitric oxide (NO)
- C) activated platelets secrete ADP
- D) von Willebrand deficiency reduces bleeding time

# Question 11

**Which of the following procedures is used to prevent hemolytic disease of the newborn?**

- A) Active immunization in Rh (-) mother carrying Rh (+) fetus
- B) Passive immunization with anti-Rh antibodies in Rh (+) mother carrying Rh (+) fetus
- C) Passive immunization with anti-Rh antibodies in Rh (-) mother carrying Rh (+) fetus
- D) None of the above

# Question 11

Which of the following procedures is used to prevent hemolytic disease of the newborn?

- A) Active immunization in Rh (-) mother carrying Rh (+) fetus
- B) Passive immunization with anti-Rh antibodies in Rh (+) mother carrying Rh (+) fetus
- C) Passive immunization with anti-Rh antibodies in Rh (-) mother carrying Rh (+) fetus
- D) None of the above



# Question 11: Key

- A) correct mother / fetus serology, but wrong immunization method
- B) bad idea
- C) correct! prevents formation of maternal anti-Rh IgG if came into contact with Rh+ blood during delivery, so future pregnancies safe
- D) C is correct 😊

<b>Hemolytic disease of the newborn</b>	Also known as erythroblastosis fetalis.
	<b>Rh hemolytic disease of the newborn</b>
INTERACTION	Rh $\ominus$ mother; Rh $\oplus$ fetus.
MECHANISM	First pregnancy: mother exposed to fetal blood (often during delivery) $\rightarrow$ formation of maternal anti-D IgG. <b><math>\rightarrow</math></b> Subsequent pregnancies: anti-D IgG crosses the placenta $\rightarrow$ HDN in the fetus.
PRESENTATION	Jaundice shortly after birth, kernicterus, hydrops fetalis.
TREATMENT/PREVENTION	Prevent by administration of anti-D IgG to Rh $\ominus$ pregnant women during third trimester and early postpartum period (if fetus Rh $\oplus$ ). Prevents maternal anti-D IgG production.

# Question 12

Which of the following is true regarding blood types?

- A) Rh-factor is inherited in autosomal recessive pattern
- B) Type AB blood is in high demands at blood banks
- C) Type O blood has anti-A and anti-B antibodies
- D) Type AB blood has the anti-A and anti-B antibodies

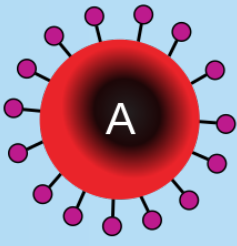
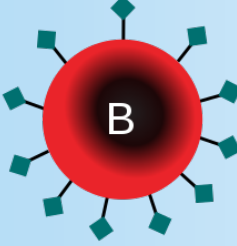
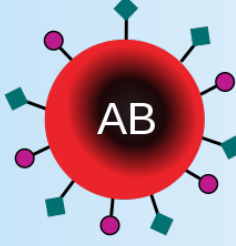
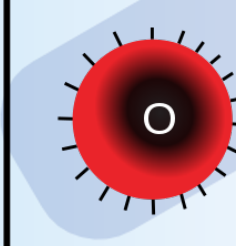
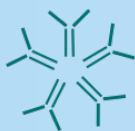

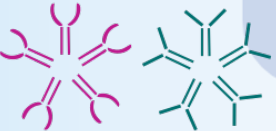



# Question 12

Which of the following is true regarding blood types?

- A) Rh-factor is inherited in autosomal recessive pattern
- B) Type AB blood is in high demands at blood banks
- C) Type O blood has anti-A and anti-B antibodies
- D) Type AB blood has the anti-A and anti-B antibodies

# Question 12: Key

- A) False, Rh factor follows autosomal dominant inheritance
- B) universal donor is type O blood, as it lacks A & B antigens
- C) True. Type O blood recognizes types A & B as foreign and has the corresponding anti-A & anti-B antibodies.
- D) Type AB blood has A and B antigens, not anti-A / anti-B antibodies

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in red blood cell	 A antigen	 B antigen	 A and B antigens	None