Scrub In:

- Which blood type is the universal donor?
  a. A
  b. B
  c. AB
  d. O

- Which structure of the blood serves as the body’s natural defense against injury and disease:
  a. Plasma
  b. Erythrocytes
  c. Leukocytes
  d. Thrombocytes
2.02 Understand the functions and disorders of the circulatory system
2.02 Understand the functions and disorders of the circulatory system

Essential questions:

- What are the functions of blood?
- What are some disorders of the blood?
- How are blood disorders treated?
- How do you relate the body’s use of nutrients to the blood?

- What are the functions of the circulatory system?
- What are some disorders of the circulatory system?
- How are disorders of the circulatory system treated?
- How do you relate the body’s use of nutrients to the circulatory system?
What are the functions of blood?

Transportation

- Blood transports nutrients, oxygen, cellular waste and hormones
What are the functions of blood?

Regulation

- Aids in distribution of heat
- Regulates acid/base balance

2.02 Understand the functions and disorders of the circulatory system
What are the functions of blood?

Protection

- Helps protect the body against infection
Functions of the blood components

- Plasma
- Erythrocytes
- Leukocytes
- Thrombocytes
Plasma

- Carries blood cells and other components throughout the body

- Aids in blood clotting; maintains the body’s osmotic pressure; absorbs nutrients from the digestive tract; aids in electrolyte balance; carries waste products to excretory organs; contains hormones, vitamins and enzymes.
Erythrocytes

- Function of RBC’s
  - Carry O2 to the tissues
  - Picks up CO2 and carries back to lungs

- hemo = blood
- globin = protein

- Hemoglobin - aids in carrying O2 to tissues and CO2 away from cells. Gives red color to blood.
Erythrocytes

**HEMOLYSIS:**

- Is a rupture of the RBC.
- Can occur due to a blood transfusion reaction or disease process.
- Old erythrocytes rupture and are broken down by the spleen and liver.
Hemolytic anemia

- Premature destruction of RBC’s

- Treatment: blood transfusions, medication (steroids)
Leukocytes

- Serve as the body’s natural defense against injury and disease.
Leukocytes

- **AGRANULOCYTES**
  - Lymphocytes – help to form antibodies at a site of inflammation.
  - Monocytes – aids in phagocytosis of harmful bacteria
    - Phagocytosis – process when WBC’s surround, engulf and digest harmful bacteria
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**Leukocytes**

- **GRANULOCYTES**
  - Neutrophils – aids in phagocytosis and contributes to pus formation
  - Eosinophils – aid in phagocytosis by digesting the remains of antibody-antigen reactions
  - Basophils – releases Heparin (anticoagulant) and histamine
Inflammation

- Body’s reaction to chemical or physical trauma
- Symptoms: redness, local heat, swelling and pain
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Thrombocytes

- Smallest of solid components of blood.
- Not cells – fragments of magakaryocytes
- Necessary for the blood clotting process
Thrombocytes

2.02 Understand the functions and disorders of the circulatory system
Blood types

- A
- B
- AB – UNIVERSAL RECIPIENT
- O – UNIVERSAL DONOR
Rh factor/Erythroblastosis fetalis

- Is a hemolytic disease of a newborn
- (1st pregnancy) Rh- mom pregnant with Rh+ fetus = anti-Rh antibodies for mom; (2nd pregnancy) antibodies in mom’s blood may cross the placenta and attack the fetus RBC’s.
- Immunoglobulin (RHO Gam) can be given to Rh- mom within 72 hours after delivery
Bellringer:

- What condition causes a deficiency in the number of RBC’s and the amount of Hgb in the blood?
  a. Anemia
  b. Leukemia
  c. Hemophilia
  d. Septicemia

- What is the formation of a blood clot in a blood vessel called:
  a. Thrombosis
  b. Embolism
  c. Contusion
  d. Hematoma
Blood Disorders

- **Anemia** — is a deficiency in the number of RBC’s and the amount of Hgb in the blood.

  Symptoms: dyspnea, pallor, palpitation, fatigue

  Symptoms occur due to hemoglobin deficiency so there is not enough O2 transported to the cells.

Blood Disorders

- **Anemia** — is a deficiency in the number of RBC’s and the amount of Hgb in the blood.

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Blood disorders

- Thrombosis – formation of a blood clot in a blood vessel
  - Blood clot is a Thrombus

- Embolism – air, blood clot, cancer cells, fat, etc. that is carried by the bloodstream until it reaches an artery to small for passage.
  - Also known as a ‘moving blood clot’
Blood disorders

- Contusion – injury causing soft tissue damage resulting in pain and discoloration.

- Hematoma – localized clotted mass of blood found in an organ, tissue or space.
Blood disorders

- Hemophilia – blood clots slow or abnormally due to a missing clotting factor.
  - Hereditary
    - Sex-linked – transmitted genetically from mothers to sons
  - Symptoms: prolonged bleeding even with minor cuts and bumps
  - Treatment: avoid trauma and treat with missing clotting factor.
Blood disorders

- **Leukemia**
  - Over production of immature WBC’s
  
  - Symptoms: fevers, night sweats, fatigue, headaches, bruising of skin, bone and joint pain, decreased appetite, weight loss
  - Symptoms are due to immature WBC’s replacing RBC’s which interferes with the transport of O2 to the tissues. Also hinders the synthesis of new RBC’s from bone marrow.
  - Treatment: drug therapy, bone marrow transplants and radiation therapy
Multiple myeloma-

- Malignant neoplasm of plasma cells or B-lymphocytes
- Symptoms: fractures, bone pain, fatigue, kidney failure
- Treatment: prognosis is fair; chemotherapy and radiation are not effective
Polycythemia -

- Too many red blood cells are formed. May be a temporary condition that occurs at high altitudes.
- Symptoms: thickening of the blood with possible blood clot formation
- Treatment: phlebotomy – removal of approx. 1 pint of blood or drug therapy
Blood disorders

Septicemia –

- Disease-producing organisms or toxins in the blood
- Treatment: fluids, antibiotics, blood transfusions
2.02 Understand the functions and disorders of the circulatory system

Blood disorders

- **Sickle cell anemia** –
  - Chronic blood disease inherited from both parents that causes the RBC’s to form an abnormal sickle shape
  - Symptoms: sudden attack of pain in bones and joints
  - Treatment: blood transfusions

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**Did You Know?**

Sickle cell anemia may be the result of a genetic mutation that happened in malaria-prone regions like Africa thousands of years ago. People with sickle cell trait may have been more likely to survive malaria epidemics - and because they survived when others did not, this allowed the trait to be passed down through generations.
What are the functions of the heart?
Functions of the heart

DID YOU KNOW?

At rest, 2 ounces of blood is circulated with each heart beat.
Functions of the heart

**IT'S A PUMP:**

It circulates blood to all parts of the body.
Hear the beat!

WHAT MAKES THE LUBB DUPP SOUND?

- The valves make a sound when they close referred to as the lubb dupp sounds.
  - The lubb sound is heard first. It is made by the tricuspid and bicuspid valves closing. This is referred to as the S1 sound and is heard loudest at the apex of the heart.
  - The dupp sound is caused by the pulmonary and aortic semilunar valves closing. This is referred to as the S2 sound.
Blood Pressure FYI

- Blood pressure - the surge of blood filling the arteries creates pressure against their walls

**SYSTOLIC PRESSURE**
- Measured during the contraction phase

**DIASTOLIC PRESSURE**
- Measured when the ventricles are relaxed

**The normal range of blood pressure for an adult is 120/80.**
Functions of the heart

It's a pump

What makes the pump work?

It's electric!
Conduction system of heart beats

- Electrical impulse originating in the heart causes the myocardium to contract in a cyclic manner.
  - SA node (sinoatrial node) – is known as the ‘pacemaker’ and sends out an electrical impulse that begins and regulates the heart causing the atria to contract.
  - AV node (atrioventricular node) – receives the impulse from the SA node and is located between the atria and ventricle.
  - Bundle of His – nerve fibers in the septum. Receives the impulse from the AV node. Is divided into a right and left branch and carry the impulse down through the ventricles.
  - Purkinje fibers – final fibers on the conductive pathway. Spread electrical impulses to all the muscle tissue in the ventricles. Ventricles then contract.
2.02 Understand the functions and disorders of the circulatory system

Electrocardiogram

- EKG or ECG is used to record the electrical activity of the heart.
  - **SYSTOLE = CONTRACTION PHASE**
  - **DIASTOLE = RELAXATION PHASE**

Baseline of an EKG is a flat line:
- P = Atrial contraction
- QRS = Ventricular contraction
- T = Ventricular relaxation
Functions of the heart

**TRANSPORTATION:**

The heart transports blood throughout the body.
The transportation process

Systemic circulation:

Blood is transported from the heart to the tissues and cells and back to the heart.
The transportation process

- Cardiopulmonary circulation:
  - Blood is transported from the heart to the lungs and back to the heart.
2.02 Understand the functions and disorders of the circulatory system

**ARTERIES**

- **Functions of arteries:**
  - Carry oxygenated blood away from the heart to the capillaries
  - Transport blood under very high pressure
2.02 Understand the functions and disorders of the circulatory system

- **VEINS**

  - **Functions of veins:**
    - Carry deoxygenated blood away from capillaries to the heart
    - Veins have valves that permit flow of blood only in direction of the heart
Capillaries

- Allow oxygen and nutrients to pass through to the cells
  - At the same time, carbon dioxide and metabolic products from the cells enter the capillaries
Bellringer:

- What disease causes hardening or thickening of walls of arteries?
  a. Arteriosclerosis
  b. Atherosclerosis
  c. Coronary artery disease
  d. Hypertension

- What condition causes severe chest pain radiating to the left shoulder, arm, neck and jaw; nausea, diaphoresis, dyspnea
  a. Myocardial infarction
  b. Hypertension
  c. Heart failure
  d. Pulmonary edema
Circulatory disorders

- Aneurysm – ballooning of an artery, thinning and weakening

  Causes – disease, congenital defects, injuries
  Symptoms – some cause pain and pressure, some have no symptoms
  Treatment – surgical removal of damaged area and replacement with plastic graft
  If ruptures, hemorrhage can occur causing death
Circulatory disorders

- **Angina pectoris** – severe chest pain occurring when the heart does not receive enough O2
  - Is a symptom of an underlying problem with coronary circulation. May be brought on by stress or physical exhaustion.
  - Symptoms: chest pain radiating to left shoulder and down arm
  - Treatment: Nitroglycerin – helps to dilate coronary arteries to improve blood flow to the heart
Circulatory disorders

- **Arrhythmia**: Is any change from normal heart rate or rhythm

- **Bradycardia**
  - Slow heart rate (<60 beats per minute)

- **Tachycardia**
  - Rapid heart rate (>100 beats per minute)
Circulatory disorders

- Arteriosclerosis - hardening or thickening of walls of arteries. Causes loss of elasticity and contractibility
- Commonly occurs as result of aging
- Causes hypertension and can lead to aneurysm or cerebral hemorrhage
Circulatory disorders

- Atherosclerosis - fatty plaques, frequently cholesterol, deposited on walls of arteries
  - Causes narrowing of opening, which reduces or eliminates the flow of blood
  - If plaque breaks loose, it can circulate through the blood stream as emboli
  - Treatment: low-cholesterol diet, exercise and sometimes surgery
2.02 Understand the functions and disorders of the circulatory system

Circulatory disorders

- Coronary artery disease (CAD)/Heart disease
  - Narrowing of the arteries that O2 and blood can’t get to the heart
Circulatory disorders

- **Hypertension** – 140/90 or higher
  - High blood pressure (known as the ‘silent killer’ because there is usually no symptoms)
  - Risk factors: smoking, overweight, stress, high fat diet, family history
  - Treatment: relaxation, low fat diet, exercise, weight loss, medication
Circulatory disorders

- Heart failure
  - When the ventricles of the heart are not able to contract effectively and blood starts to pool in the heart
  - Symptoms: dyspnea, edema, ascites (accumulation of fluid in abdominal cavity), lung congestion, coughing.
Circulatory disorders

- **Murmurs** – is an extra or unusual sound heard during a heartbeat.
  - Is usually detected with a stethoscope during a physical exam.
  - Can also be diagnosed with an EKG/ECG or echocardiogram.
Circulatory disorders

- **Myocardial Infarction**
  - MI or heart attack
  - Lack of blood supply to myocardium causes damage
  - Due to blockage of coronary artery or blood clot
    - Symptoms: severe chest pain radiating to left shoulder, arm, neck and jaw. Also nausea, diaphoresis, dyspnea
    - Amount of damage depends on size of area deprived of oxygen.
    - Immediate medical care is critical
    - Treatment: bedrest, O2, medication (morphine for pain, TPA to dissolve clot, anticoagulant to prevent further clots), angioplasty and by-pass surgery may be needed
Circulatory disorders

- **Peripheral vascular disease**
  - Blockage of the arteries (usually in the legs)
  - Symptoms – pain/cramping in legs or buttocks while walking
  - Can lead to amputation if not treated
  - Treatment – medication and diet modification to lower cholesterol
Circulatory disorders

- Pulmonary edema
  - Excess fluid in the lungs
  - Causes: CAD, heart valve disease, hypertension
  - Symptoms: dyspnea, wheezing, restlessness, palpitations, pale skin
  - Treatment: O2, medications
Circulatory disorders

- Transient ischemic attack (mini-stroke)- temporary interruptions of blood to the brain

- Caused by narrowing of carotid artery due to fat accumulation

- Symptoms: dizziness, weakness or temporary paralysis
Varicose veins –

- Swollen veins that come from slow blood flow back to heart
- Causes: hereditary weakness in vein structure
- Prevention:
  - Elevate legs when resting
  - Wear elastic support stockings
  - Exercise
Circulatory disorders

Leading Causes of Death: The Impact of Circulatory Disorders

- CVD: 41%
- Other: 29%
- Cancer: 29%
- HIV/AIDS: 2%
- Accidents: 4%

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Relevance of nutrients to the blood and circulatory system

- The circulatory system plays a vital role in homeostasis

- Absorption and transport of nutrients to cells, tissues, organs, and systems

Did you know???

- Vitamin K - prevents hemorrhage
- Vitamin B12 - prevents anemia
- Vitamin E - prevents hemolysis