Composed of the cardiovascular and respiratory sytems providing the tissues of the kinetic chain with oxygen, nutrients, protective agents and a means to remove wate by-products.
The Cardio Respiratory System

Composed of the heart, the blood it pumps and the blood vessels.
The Cardiovascular System

A muscle that rhythmically contracts to push blood throughout the body.
The Heart

The size and weight of a typical adult heart.
The size of a typical adult fist weighing roughly 300 g.

Mediastinum
The space in the chest between the lungs that contains all the internal organs of the chest, except the lungs.

Typical heart rate
70 - 80 beats per minute.

The Sinoatrial (SA) Node
Located in the right atrium, is termed the pacemaker for the heart because it initiates the heartbeat.

The Atrioventrical (AV) Node
Delays the impulse from the SA before moving on to the ventricals

The superior chamber of the heart that receives blood from the viens and forces it into the ventricles.
The Atrium

The inferior chamber of the heart that receives blood from its corresponding atrium and , in turn, forces blood into the arteries.
The Ventricles

The side of the heart that receives deoxygenated blood.
The right side

The side of the heart that receives oxygenated blood.
The left side

Antioventricular and Semilunar Valves
Valves preventing a backflow or spillage of blood back into the chambers

Stroke Volume (SV)
The amount of blood that is pumped out with each contraction of the ventricle.

Typical Adult Stroke Volume
75 - 80 mL per beat

The combination of beats per minute and stroke volume
Cardiac Output

The fluid that circulates in the heart, arteries, capillaries and veins which carries nutrients and oxygen to all parts of the body and also rids the body of waste products
Blood

Average amount of blood the average person holds
5 L or roughtly 1.5 gallons

Three support mechnisms of the blood
- Transportation (Nutrients, Hormones)
- Regulation (Body Temp)
- Protection (Clotting, immune Cells)

A network of hollow tubes that circulates blood throughout the body.
Blood Vessels

Vessels that carry blood away from the heart
Arteries

Vessels that carry blood from the capillaries toward the heart
Veins

Small terminal branches of an artery, which end in capillaries
Arterioles

The smallest blood vessels, which connect venules with arterioles
Capillaries

The very small veins that connect capillaries to the larger veins
Venules

The Respiratory System

A system of organs that collects oxygen from the external environment and transports it to the blood stream.

What is the Pulmonary System?
Another name for the respiratory system.

The process of actively contracting inspiratory muscles to move air into the body.
Inspiration

Expiration
The process of actively or passively relaxing inspiratory muscles to move air out of the body.

Located in the thorax or the thoracic cavity composed of skeletal structure and soft tissue.
The Respiratory Pump

What are the structures of the respiratory passageways?
- Conduction
- Respiratory

Alveolar Sacs
The sacs in the lungs that collect oxygen and carbon dioxide through inhilation and exhilation

Requires Oxygen
Aerobic

Does not require oxygen
Anaerobic

The biology of energy transformations and exchanges within the body, and between it and the environment
Bioenergetics

A cellular structure that supplies energy for many biochemical cellular processes.
Adenosine Triphosphate (ATP)

Pathways for the Bioengergetic Continuum
- ATP-CP
- Glycolysis
- Oxidative

Which pathway(s) are Aerobic?

Oxidative

Which Pathway (s) are Anaerobic?
- ATP-CP
- Glycolysis

Muscular pump that rhythmically contracts to push blood throughout the body
Heart

Acts as a medium to deliver and collect essential products to and from the tissues of the body.
Blood

A system comprised of the cardiovascular and respiratory systems
Cardiorespiratory system

A hollow tube that allows blood to be transported to and from the heart
Blood Vessel

The smallest blood vessel that is the location where substances such as oxygen, nutrients, hormones, and waste products are exchanged between tissues
Capillaries

Vessels that transport blood back to the heart
Veins

Comprised of the heart, the blood it pumps, and the blood vessels that transport the blood from the heart to the tissues of the body
Cardiovascular system

Vessels that transport blood away from the heart
Arteries

The _____ is comprised of four hollow chambers that are delineated into interdependent pumps on either side.
Heart

_____ are chambers located inferiorly on either side of the heart.
Ventricles

The heart rate of the typical person is approximately _____.
70-80 beats per minute

The _____ is comprised of the heart, the blood it pumps, and the blood vessels that transport the blood from the heart to the tissues of the body.
Cardiovascular system

The exhalation of air during the process of breathing
Expiration

Looks at how chemical energy is converted into mechanical energy
Bioenergetics

An action that occurs in the presence of oxygen
Aerobic

Cellular structure that serves as a storage and transfer unit within the cells of the body for energy
Adenosine triphosphate

A system including the lungs and their nervous and circulartory supply that collects oxygen from the external environment and transports it to the blood stream
Respiratory system

The inhalation of air during the process of breathing
Inspiration

An action that is not dependent on oxygen for proper execution
Anaerobic

How does the cardiorespiratory system relate to human movement?
The cardiorespiratory system provides the kinetic chain with essential elements such as oxygen to help sustain activity or recover from it.

How is oxygen related to energy expenditure?
Oxygen is the necessary catalyst for aerobic activity that is prolonged for periods >30 seconds allowing for greater caloric expenditure.

How can dysfunctional breathing (chest breathing) have ill effects on the kinetic chain?
Dysfuncational breathing associated with stress and/or anxiety becomes shallower and utilizes more secondary muscles more predominantly than the diaphragm. These secondary muscles all connect directly to the cervical and cranial portions of the body. Their increased activity leads to the restriction of the joints in that region, which leads to improper movement and further dysfunction.

sinoatrial node
right atrium

atrioventricular node
delays impulse before moving on to ventricles; passes impulse to ventricles via left and right bundle branches of purkinje fibers

stroke volume
amount of blood pumped out with each contraction; 75-80 ml/beat

cardiac output
combination of how many times the heart beats per minute and how much blood is being pumped out per beat

muscles of inspiration
diaphragm, external intercostals, scalenes, scm, pec minor

mm of expiration
internal intercostals, abdominals

VO2
at rest 3.5 mm oxygen per kg body weight per minute

1 MET
3.5 mm o2/kg/min

VO2=
Q x a - VO2 difference

Q
cardiac output

Q
hrxsv

a-Vo2 difference
difference in oxygen content between blood in arteries and blood in vv

vo2max
highest rate of oxygen transport and utilization achieved at max physical exertion. ranges from 40-80 ml/kg/min or 11-23 mets

aerobic
over 30 seconds

anaerobic
a few seconds

bioenergetics
how food is converted into work

energy yielding
chemical bonds broken and release energy

atp
adenine (nitrogen based) ribose (5 carbon sugar) and three phosphates. energy stored in chemical bonds of phosphates. undergoes enzymatic hydrolysis.

three main bioenergetic pathways that produce atp
atp-cp; glycolysis (lactic acid); (both anaerobic); oxydative/aerobic. bioenergetic continuum.

atp-cp. phosphagens, phosphagen system.
anaerobic, high intensity short duration; heavy weights. up to ten seconds. myosin ATPase, creatine kinase.

glycolysis/lactic acid
anaerobic; moderate to high intensity; moderate duration ex 8-12 reps; lasts 30-50 seconds

oxidative/aerobic
lower intensity longer duration ex treadmill 20-30 minutes. over 2 minutes.

myosin ATPase
breaks off one of phosphate bonds from ATP--> ADP.

glycolysis
breakdown of carbs to rapidly produce atp; one glucose--> two ATP anaerobic glycolysis. most typical workouts.

pyruvate
by product of glycolysis

lactic acid

builds up if pyruvate can't be used fast enough by muscle cell. increases acidity of muscle cell ;interferes with contraction.

oxidative
uses carbs, fats . slowest. takes a while to elevate respiration rate to consume appropriate amounts of oxygen; gives more atp. somewhat similar to anaerobic glycolysis; glucose broken down but no pyruvate is converted to lactic acid; pyruvate becomes a usable substrate for atp production.

oxidative; each glucose produces how much atp?
one glucose produces 36 atp. up to 38.

shallow breathing
secondary muscles more predominant than diaphragm; shallow upper chest breathing; scalenes, scm, levators, upper traps overused; causes lightheadedness, headaches, dizziness.anxiety, pain, inadequate oxygen, retention of metabolic waste, fatigued stiff mm. joints stiff.

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cardiorespiratory system
composed of cardiovascular and respiratory systems. Together they deliver the tissues of the kinetic chain with oxygen, nutrients, protective agents, and means to remove waste

cardiovascular system
composed of the heart, the blood it pumps, and the blood vessel that transport the blood from the hear to the tissues of the body

mediastinum
The space in the chest between the lungs that contain all the internal organs of the chest, except the lungs

sinoatrial node
the pacemaker for the heart
initiates heartbeat
located in right atrium

Atrioventricular node
the av node delays the impulse from the SA node before moving onto the ventricles

Atria
the superior chamber of the heart that receives blood from the veins and forces it into the ventricles

Right artrium
gather deoxygenated blood returning to the heart from the entire body

left atrium
gathers reoxygenated blood coming to the heard from the lungs

ventricles
the inferior chambers of the heart that receives blood from its corresponding atrium and in turn, forces blood into arteries

Right Ventricle
receives deoxygenated blood from the right atrium and proceeds to pump it into the lungs to be oxygentated

left ventricle
receive the reoxygenated blood front the lungs and proceeds to pump it through the entire body

Stroke volume
The amount of blood that is pumped out with each contraction of a ventricle.
for a typical adult approx 75-80ml/beat

Heart Rate
The rate at which the heart pumps
for typical adult 70-80 bpm

cardiac output
the combination of how many times the heart beast per minute and how much blood is pumped out with each beat.

Blood
fluid that circulates in the heart, arteries, capillaries, and veins, which carries nutrients and oxygen to all parts of the body and also rids the body of waste products

blood constitutes ____% of total body weight
8%

The average person holds ___L of blood in his/her body
5L, roughly 1.5 gallons

Support mechanisms of blood
Transportation
-transports oxygen and nutrients to tissues

-transports wast product from tissues
-transports hormones to organs and tissues
-carries heat through body
Regulation
-regulates body temperature and acid balance in the body
Protection
-protect the body from excessive bleeding by clotting
-contains specialized immune calls to fight disease and sickness

Blood vessels
network of hollow tubes that circulate blood throughout the body

Arteries
Vessels that carry blood away form the heart

Veins
Vessels that carry blood from the capillaries toward the heart

Arterioles
small terminal branches of and arteries which end in capillaries

Capillaries
the smallest blood vessel, which connect venues, which connect venules with arterioles

Venules
The very small veins that connects capillaries to the larger veins

Respiratory System
A system of organs that collects oxygen from the external environment and transports it to the blood stream

inspiration
the process of actively contracting inspiratory muscles to move air into the body

expiration
the process of actively relaxing inspiratory muscles to move air out of the body

Structure of the Respiratory Pump
Bones:
-Sternum
-Ribs
-Vertebrae
Muscles:

Inspirations
-Diaphragm
-External intercostals
-scalenes
-sternocleidomastroid
-pectoralis minor
Expiration
-Internal intercostals
-Abdominals

conduction passage way
all of the structure air passes through before entering the respiratory passageway
-nasal cavity
-oral cavity
-pharynx
-larynx
-trachea
-right and left pulmonary bronchi
-bronchioles

Respiratory passageway
collects channeled sir coming from the conducting passageway
-alveoli
alveolar sacs - where gasses such as oxygen a carbon dioxide are transported in and out of the body

oxygen uptake/oxygen consumption
the usage of oxygen by the body

at rest VO2 or oxygen consumption is estimated to be
3.5ml of oxygen per kilogram of bodyweight per minute. Typically termed 1 met

Vo2 max
the best means of gauging cardiorespiratory fitness. It is the highest rate of oxygen transport and utilization achieve at maximal physical exertion

bioenergetic
the biology of energy transformation and exchanges within the body, and between it and the environment. Look at how food in converted in energy.

Adenosine triphosphate
A cellular structure that supplies energy for many biocellular processes by undergoing enzymatic hydrolysis. It transfers and store the energy that is broken down from food.

ATP-CP
Anaerobic system
used fro high intensity, short duration activity such as weight training.
Used for approx. 10 sec of activity

Glycolysis
Anaerobic
Energy pathyway for moderate to high intensity, moderate duration activities such as a typical set of 8-12 reps
Used for approx 30-50 sec of activity

Oxidative
Aerobic
Energy pathway fro lower intensity, longer duration activities
for activities greater than 2 min

What is the area that houses the heart and lungs?

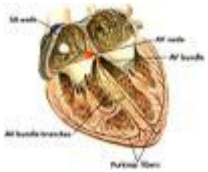
MEDIASTINUM
p. 40 (NASM)

Approximately how much a typical heart weigh?
10 OZ (300 grams)
p. 40 (NASM)

TRUE or FALSE?
Cardiac muscle fibers are longer and less tightly connected than skeletal muscle, thus enabling the contraction of one fiber to stimulate the others to contract sequentially.
FALSE
Cardiac muscle fibers are SHORTER and MORE tightly connected than skeletal muscle, thus enabling the contraction of one fiber to stimulate the others to contract SYNCHRONOUSLY.
p. 41 (NASM)

Cardiac muscle fibers with the highest _____ determine the heartbeat or heart rate.
CONTRACTION RHYTHM
p. 41 (NASM)

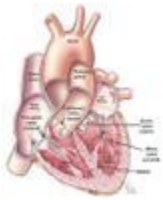
This is called the "pacemaker" because it initiates the heartbeat.



SINOATRIAL (SA) NODE
p. 41 (NASM)

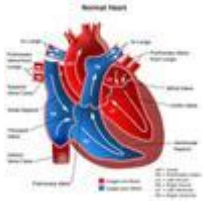
The atrioventricular (AV) node _____ the impulse from the _____ before moving on to the ventricles.
- DELAYS
- SINOATRIAL (SA) NODE
p. 41 (NASM)

How chambers does the heart have?



FOUR:
- right/left atriums
- right/left ventricles
p. 41 (NASM)

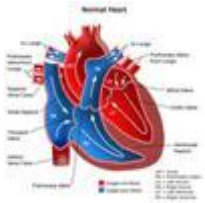
Which part of the heart receives de-oxygenated blood returning to the heart from the body?



RIGHT ATRIUM
p. 41 (NASM)

The right atrium receives _____ from _____.
- DE-OXYGENATED BLOOD
- THE BODY
p. 41 (NASM)

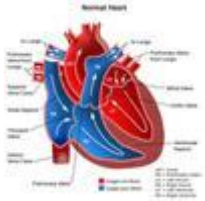
Which part of the heart receives re-oxygenated blood returning to the heart from the lungs?



LEFT ATRIUM
p. 41 (NASM)

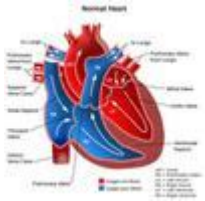
The left atrium receives _____ from _____.
- RE-OXYGENATED BLOOD
- THE LUNGS
p. 41 (NASM)

Which are the larger chambers in the heart: atriums or ventricles?



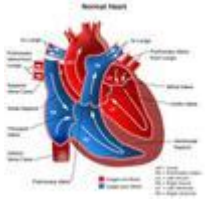
VENTRICLES
They are the main pumps in the heart, pumping blood out to the lungs (right ventricle) and to the rest of the body (left ventricle).
p. 42 (NASM)

The left ventricle receives _____ from the _____ and then pumps it to the _____.



- RE-OXYGENATED BLOOD
- LEFT ATRIUM
- REST OF THE BODY
p. 42 (NASM)

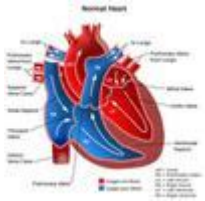
The aortic and pulmonary valves are in which heart chambers?



VENTRICLES
- AORTIC: left ventricle > leaving the heart to the body thru the aorta

- PULMONARY: right ventricle > leaving the heart to the lungs thru the pulmonary artery
p. 42 (NASM)

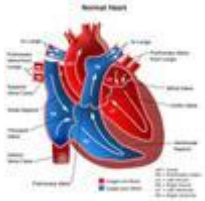
The tricuspid and mitral valves are in which heart chambers?



TRICUSPID: from right ATRIUM to right VENTRICLE
MITRAL: from the left ATRIUM to the left VENTRICLE
p. 42 (NASM)

Place the following components of the heart in the correct order of flow, from receiving de-oxygenated blood from the body to resupplying the body with re-oxygenated blood.

1. Lungs
2. Right atrium
3. Left ventricle
4. Right ventricle
5. Aorta out to body
6. Superior vena cava
7. Left artrium



1. SUPERIOR VENA CAVA
2. RIGHT ATRIUM (receiving de-oxygenated blood)
3. RIGHT VENTRICLE
4. LUNGS (via pulmonary arteries)
5. LEFT ATRIUM (via pulmonary veins, receiving re-oxygenated blood)
6. LEFT VENTRICLE
7. AORTA (out to body)
p. 42 (NASM)

The amount of blood pumped out with each ventricle contraction is called the ...
STROKE VOLUME
p. 42 (NASM)

_____ during exercise provides a good gauge for the fitness professional to determine the amount of work the heart is doing at any given time.

MONITORING HEART RATE
p. 43 (NASM)

Blood constitutes approximately __ % of total body weight.
8%
p. 43 (NASM)

The average person holds about ___ of blood in their body at any given time.
1.5 GALLONS
p. 43 (NASM)

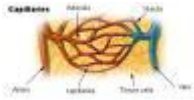
For a typical adult, the stroke volume of the heart is apoproximately ...
75 to 80 ML/BEAT
p. 43 (NASM)

De-oxygenated blood is pumped from the _____ to the lungs through the _____.
- RIGHT VENTRICLE
- PULMONARY ARTERIES
pp. 42, 50 (NASM)

Re-oxygenated blood returns from the lungs to the _____ through the _____.
- LEFT ATRIUM
- PULMONARY VEINS
pp. 42, 50 (NASM)

_____ pump blood away from the heart, whereas _____ pump blood back to the heart.
- ARTERIES - away from
- VEINS - return to
p. 45 (NASM)

Substances such as oxygen, nutrients, hormones and waste products are exchanged between tissues in the _____.



CAPILLARIES
p. 46 (NASM)

The primary & secondary respiratory muscles for inspiration include ...

- DIAPHRAGM
- EXTERNAL INTERCOSTALS
- SCALENES
- STERNOCLEIDOMASTOID
- PECTORALIS MAJOR

p. 47 (NASM)

What type of ventilation requires active contraction of muscles?
INSPIRATION (inhalation)
p. 47 (NASM)

Expiration requires what type of ventilation?
EITHER ACTIVE OR PASSIVE
p. 47 (NASM)

What is cardiac output (Q)?
THE COMBINATION OF HOW MANY TIMES THE HEART BEATS PER MINUTE AND HOW MUCH BLOOD IS BEING PUMPED OUT WITH EACH BEAT
p. 43 (NASM, Table 3.1)

What is stroke volume (SV)?
THE AMOUNT OF BLOOD THAT IS PUMPED OUT WITH EACH CONTRACTION OF A VENTRICLE
p. 43 (NASM, Table 3.1)

What does blood transport?
- OXYGEN & NUTRIENT TO TISSUES
- WASTE PRODUCTS FROM TISSUES
- HORMONES TO ORGANS/TISSUES
- HEAT THROUGHOUT THE BODY

p. 43 (NASM, Table 3.2))

What does blood regulate?
- BODY TEMPERATURE
- ACID BALANCE

p. 43 (NASM, Table 3.2)

From what does blood protect?
- FROM EXCESSIVE BLEEDING VIA CLOTTING MECHANISM
- AGAINST DISEASE VIA SPECIALIZED IMMUNE CELLS

p. 43 (NASM, Table 3.2)

What are the 2 forms of inspiratory breathing?
- NORMAL RESTING STATE (quiet)
- DEEP HEAVY BREATHING (forced)
Both forms of inspiration are ACTIVE.

p. 47 (NASM)

TRUE OR FALSE?
Conduction consists of channeling air coming from the respiratory passageway.

FALSE
Respiration consists of channeling air coming from the conducting passageway.

The conduction passageway consists of all structures that air travels through before entering the respiratory passageway.
The respiratory passageway begins at the alveoli.

p. 48 (NASM)

In what specific location in the respiratory system are gases such as oxygen and carbon dioxide transported in and out of the bloodstream through diffusion?
ALVEOLAR SACS
p. 48 (NASM)

What is diffusion?
ITHE PROCESS BY WHICH OXYGEN IS TRANSPORTED (IN THE ALVEOLAR SACS) FROM THE OUTSIDE ENVIRONMENT TO THE BODY'S TISSUES.
p. 48 (NASM)

MET stands for ...
METABOLIC EQUIVALENT TASK
A MET indicates (and estimates) the amount of oxygen the body uses at rest and during exercise.

p. 51 (NASM)

Define each constituent of the formula to calculate METs:

$VO2 = Q \times a - v\ O2$ difference

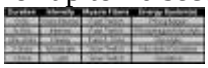
(no subscripts available, sorry)
- VO2: oxygen consumption
- Q: cardiac output (HR x SV)
- a: blood in the arteries
- v: blood in the veins
p. 51 (NASM)

What is the highest rate of oxygen transport and utilization achieved at maximum physical exertion?
VO2 MAX
p. 51 (NASM)

VO2 max values can range anywhere between ...
11 TO 23 METS
p. 51 (NASM)

While protocols such as the Rockport Fitness Walk Test and the Step Test provide a general estimate of a client's cardiorespiratory fitness level, they are based on _____ and can contribute to _____.
- ASSUMPTIONS THAT ARE RARELY MET
- ESTIMATE ERRORS
Given repeatedly during a period of weeks/months, protocols used to estimate VO2 max may show a cardiorespiratory TREND.

p. 51 (NASM)

Which bio-energetic pathway is the major energy producer for high-intensity activities for up to 10 seconds?

ATP-CP (PHOSPHAGEN)
(anaerobic system)
p. 52 (NASM)

Which bio-energetic pathway is the major energy producer for moderate to high intensity activities for up to 30 to 60 seconds?

GLYCOLYSIS
(anaerobic system)
p. 52 (NASM)

Which bio-energetic pathway is the major energy producer for low intensity, long duration activities that exceed 2 to 3 minutes?

OXIDATIVE
(aerobic system)
p. 52 (NASM)

Which bio-energetic pathway provides energy through the interaction of ATP and creatine phosphate (CP) with enzymes (such as myosin ATPase and creatine kinase)?
ATP-CP (PHOSPHAGEN)
p. 52 (NASM)

Which bio-energetic pathway provides energy by using the breakdown of carbohydrates to rapidly produce ATP?
GLYCOLYSIS
p. 52 (NASM)

Which bio-energetic pathway relies mostly on carbohydrates and fats to provide energy (ATP) and allows pyruvate to be used for ATP production?
OXIDATIVE
p. 52 (NASM)

Which bio-energetic pathway is the slowest, but produces the greatest amount of ATP per glucose molecule?
OXIDATIVE
Produces approximately 36 to 38 ATP per glucose molecule.
pp. 52-53 (NASM)

Which bio-energetic pathway is the fastest, but produces only 1 ATP per glucose molecule?
ATP-CP (PHOSPHAGEN)
Limited in its capacity to sustain energy production because it must rely on the minimal storage of ATP and CP in the cells.
p. 52 (NASM)

On which bio-energetic pathway will most fitness workouts typically place the most stress?
GLYCOLYSIS
Since a typical repetition range of 8 to12 reps falls within the time frame of 30 to 50 seconds.
p. 52 (NASM)

Weightlifting and similar activities that stress power and strength such as short sprints use predominantly which bio-energetic pathway to produce energy?
ATP-CP (PHOSPHAGEN)
(anaerobic system)

p. 52 (NASM)

A typical set of 8 to 12 repetitions during weight training uses predominantly which bio-energetic pathway to produce energy?
GLYCOLYSIS
(anaerobic system)
p. 52 (NASM)

Long distance, long-duration activities such as marathons, triathlons, and running on treadmills use predominantly which bio-energetic pathway to produce energy?
OXIDATIVE
(aerobic system)
p. 52 (NASM)

In which bio-energetic pathway is glucose absorbed from the blood and glycogen in muscle tissue converted to ATP and lactic acid?
GLYCOLYSIS
(anaerobic system)
p. 52 (NASM)

Which bio-energetic pathway produces from 36 to 38 ATP per glucose molecule?
OXIDATIVE
(aerobic system)
p. 52 (NASM)

Which bio-energetic pathway produces from 2 to 3 ATP per glucose molecule?

GLYCOLYSIS
(anaerobic system)
p. 52 (NASM)

What precaution would you give regarding the use of METs applied to an individual's fitness program?
METS WERE DESIGNED TO BE A GENERALIZATION WITH CERTAIN (AND OFTEN UNMET) ASSUMPTIONS. USE THEM MORE FOR DETERMINING OVERALL TRENDS THAN AS A DAILY TARGET.
p. 51 (NASM)

List at least 5 things that breathing dysfunction can result in.

- MORE SHALLOW BREATHING
- OVERUSE OF SECONDARY RESPIRATORY MUSCLES
- POSTURAL ISSUES
- EXCESS TENSION
- ALTERED CO2 AND O2 BLOOD CONTENT
- FEELINGS OF ANXIETY
- INADEQUATE O2/RETENTION OF METABOLIC WASTE > FATIGUED STIFF MUSCLES
- RESTRICTED JOINTS

p. 53 (NASM)

Breathing dysfunction is a very common predecessor to ...
KINETIC CHAIN DYSFUNCTION
p. 53 (NASM)

Cardiorespiratory system:
a system of the body composed of the cardiovascular and respiratory systems.

the cardiorespiratory system provides tissues with?
- oxygen (O2)

- nutrients

- protective agents

- means to remove waste by-products

cardiovascular system:

a system of the body composed of the heart, blood, and blood vessels.

heart:
a hallow muscular organ that pumps a circulation of blood through the body by means of rhythmic contraction.

- positioned obliquely in the center of the chest (thoracic cavity), lying anteriorly to the spine and posteriorly to the sternum.

typical size of adult heart:

approx. size of a typical adult fist and wt. roughly 300g. (approx. 10 oz)

mediastinum:
the space in the chest between the lungs that contains all the intrenal organs of the chest, except the lungs.

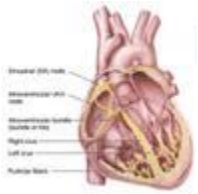
What is heart muscle (cardiac muscle) made from?
- myofibrils containing actin and myosin

- form crossbridges to cause contractions

- surrounded by a sarcolemma

- are shorter and more tightly connected than skeletal muscle

Specialized conduction system of cardiac muscles that provide the rhythm for heart rate include:



- sinoatrial (SA) node

- atriovenricular (AV) node

sinoatrial (SA) node:
- located in the right atrium

- the pacemaker for the heart because it initiates the heart beat.

atrioventricular (AV) node:
- delays impulse before moving on to the ventricles

- bundle passes the impulse to the ventricles for contraction via the left and right bundle branches of the purkinje fibers.

structure of the heart

- 4 hollow chambers

delineated into two interdependent pumps on either side.

- each side of the heart has two chambers:
- atrium

- ventricle

Atrium:
- gathers blood coming to the heart

- the superior chamber of the heart that recieves blood from the veins and corces it into the ventricles.

- right side:
gathers deoxygenated blood returning to the heart from the entire body

- left side:
gathers reoxygenated blood coming to the heart form the lungs.

Ventricles:
- the inferior chambers of the heart that recieves blood from its corresponding atrum and, in turn, forces blood into the arteris.

- main pumps in the heart

- pump blood out to the rest of the body.

- right side:
receives the deoxygenated blood from teh right atrium and then pumps it to the lungs to be saturated with incoming oxygen

- left side:
receives the reoxygenated blood from the left atrium and proceeds to pump it to the entires body.

stroke volume (SV):
the amount of blood that is pumped out with each contraction of a ventricle

what is the typical stroke vol. of an adult?
75 to 80 ml per beat.

heart rate (HR):
the rate the heart pumps;

cardiac output (Q):

the combination of how many times the heart beats per min. and how much blood is being pumped out with each beat.

function of the heart

blood:
fluid that circulates in teh heart, arteries, capillaries, and veins, which carries nutrients and oxygen to all parts of the body and also rids the body of waste products.

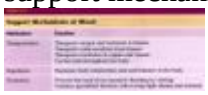
- consists of 8% of total body wt.

- vital support mechanism
- provides an interal transportioatn

- regulation

- protection system.

support mechanisms of blood



how to manually monitor heart rate:

blood transportation:
- transports life-giving oxygen to all tissues

- collects waste from all tissues

- transports hormones that act as chemical messengers to various organs and tissues in teh body

- nutrients from the gastrointestinal tract are delivered to specific tissues by way of the bloodstream as well.

- conducts heat throughout the body.

blood regulation:
- regulates body temperature.

- as blood travesl close to the skin it can give off heat or it can be cooled depending on the enviornment

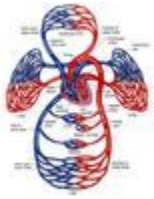
- regulation of pH levels

- regulates water content of bodily cells.

blood protection:
- provides protection from excessive blood loss through its clotting mechanism sealing off damage tissue

- provides specialized immune cells to fight against foreign toxins within th body, decreasing disease and sickness.

blood vessels



network of hollow tubes that circualtes blood thorughout the body.

arteries:
- vessels that carry blood away from the heart.

- are initially large and elastic

NOTE::

arteries -----> medium sized muscular artiers (extend to various areas throughout the body) ------> arterioles -------> capillaries (microsopic vessels)
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arterioles:
small terminal branches of an artery, which end in capillaires.

capillaries:
the smallest blood vessels, which connect venules with arterioles.

- where substances such as oxygen, nutrients, hormones, and waste products are exhanged between tissues.

veins:
vessels that carry blood from the capillaries toward the heart. (transport blood from body to heart)

venules:
the very small veins that connect capillaries to the larger veins.

- merge with others to form veins.

Respiratory system:

a system of organs (lungs and respiratory passageways) that collects oxygen from the external environment and transports it to the bloodstream.

- aka: pulmonary system

primary role of the respiratory system:
the ensure proper cellular function.

Where is the respiratory pump located?
in the thorax

What is the respiratory pump composed of?
skeletal structures (bones) and soft tissue (muscles and pleural membranes)

breathing (ventilation):
- the process of moving air in and out of the body.

- divided into two phases:
- inspiration (inhalation)

- expiration (exhalation)

inspiration:
the process of actively contracting inspiratory muscles to move air into the body.

- occurs in two forms:

- normal resting state (quiet) breathing

- heavy (deep, forced) breathing

Expiration:
the process of actively or passively relaxing inspiratory muscles to move air out of the body.

- can be both passive and active

when is expiratory ventilation passive?
during relaxation of the contracting inspiratory muscles

when is the expiraotyr ventilation active?
during heavy/ forced breathing

- forces air out of lungs.

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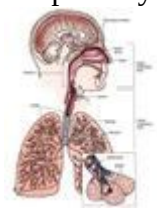
Respiratory passageways:



Respiratory passageways is divided into what two categories?
- conduction

- respiratory

conduction passageway consist of what?
- all structures that air travels through before entering the respiratory passageway:
- nasal and oral cavities
- mouth
- pharynx
- larynx
- trachea
- bronchioles

- gathering station for air and oxygen to be funneled into body

- allow incoming air to be purifed, humidified (or moisture added) & warmed/cooled to match body temperature.

respiratory passageway:
- collects the channeled air coming from teh conducting passasgeway.

- at end of bronchioles are alveoli (made up of clusters of alveolar sacs)

- gases such as oxygen and carbon dioxide are transported in and out of bloodstream through diffusion.

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what two systems make up the cardiorespiratory system?
- cardiovascular system

- respiratory system

what is the function of the cardiorespiratory system?
form a vital support to provide the kinetic chain with many essential elements, while removing waste products that can cause dysfunction in the body.

what is the primary element for proper body function?
oxygen

the respiratory process:

what is carbon dioxide and how it is released from the body?
- is the waste by-product of oxygen as oxygen is being used by the body.

- transported from tissues back to the heart and eventually to the lungs in the deoxygenated blood.
in alveolar sacs, its diffused into pulmonary capillaries and released through exhalation.

the usage of oxygen by the body is know as?
oxygen uptake (oxygen consumption VO2)

at rest VO2 is estimated at?
$(3.5\ mL \cdot kg^{-1} \cdot min^{-1})$,
approx. 3.5mL of oxygen per kg of body wt. per min.

VO2 Max:
the highest rate of oxygen transport and utilization achieved at maximal physical exertion.

Aerobic
requires oxygen

anaerobic:
doesn't require oxygen

bioenergetics
the biology of energy transformations and exchanges within the body, and between it and the environment.

Adenosine triphosphate (ATP):
a cellular structure that supplies energy for many biochemical cellular processes by undergoing enzymatic hydrolysis.

ATP is composed of?
- nigrogen-based compound

- adenine

- ribose (5 carbon sugar)

- 3 phosphates

ATP has the ability to what?
store large amounts of energy in the chemical bonds of the phosphates.

ATP is the energy for essentially what?
muscle contractions

what are the 3 primary systems that produce ATP?

The Bioenergetic Continuum

ATP-CP pathway is also known as?
Phosphagen system

what are phosphagens?
ATP and CP together

ATP = adenosine triphosphate

CP= creatine phosphate

What does ATP-CP provide?
energy for primarily high-intensity, short-duration bouts of exercise or activity.

ATP-CP usage is seen in what types of exercises?
power and strength forms of training, heavy loads used for only few reps, during short sprinting events.

describe the production of energy in ATP-CP pathway?
the enzyme myosin ATPase causes the breaking off of one of the phosphate bonds from ATP.
- results in ADP (adenosine diphosphate) meaning that there are now two phosphates instead of 3.
- energy is therefore released.

system is limited in its capacity to sustain energy production (approx. 10 sec) b/c it must rely on teh minimal storage of ATP and CP within the cells.

How does glycolysis provide ATP?
uses the breakdown of carbohydrates (glucose) to rapidly produce ATP.

one glucose molecule will produce 2 ATP through anaerobic glycolysis.
- one by-product is pyruvate which if not used fast will affect the contraction of muscles due to buildup of lactic acid.

although it can produce much more ATP than the ATP-CP pathway, it is limited to approx. 20-50 sec. durations. typically 8-12 reps)

how does Oxidative pathway produce ATP?
- relies primarily on carbohydrates and fats for the produciton of ATP.

- slowest producing of the 3 systems b/c it requires increased amounts of oxygen to match the muscular reqirement of the exercise.

- oxygen must be supplied through respiration, takes a while to elevate the respiration rate to consume appropriate amounts of oxygen.

- glucose supplied from teh glycogen stored within the body is broken down in the presence of oxygen.
- pyruvate is not converted to lactic acid and becomes unstable substance for ATP production.

- one glucose molecule will produce 36 ATP.

more involved in activities of longer than 30 sec. and is the predominant sys. in activities of more than 2 min.