QUESTION

Which parameter is required to calculate extracellular fluid (ECF) volume using a tracer method?

A Creatinine clearance

B Inulin clearance

C **Amount of tracer distributed / concentration** CORRECT

D Total body water

RIGHT ANSWER

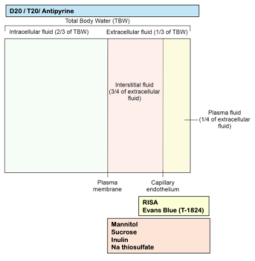
OK **C. Amount of tracer distributed / concentration**

WHY THIS IS RIGHT

To measure any fluid compartment (like ECF), we use:

This is the indicator dilution principle
Tracer dilution principle states: volume = amount of tracer injected ÷ equilibrium concentration. A marker that distributes only in ECF is used, and after equilibration its plasma concentration is measured. This ratio directly gives ECF volume. Clearance values and total body water are not used for this calculation.
Known amount of tracer injected
↓
Tracer distributes uniformly in target compartment (ECF)
↓
Sample taken -> concentration measured
↓
Apply formula:
Volume = Amount / Concentration

$$\text{Volume} = \frac{\text{Amount of tracer injected}}{\text{Concentration of tracer}}$$



QUESTION

All of the following increase the rate of diffusion across a membrane, except:

A **Increased membrane thickness** CORRECT

B Increased temperature

C Greater lipid solubility

D Higher surface area

RIGHT ANSWER

OK

A. Increased membrane thickness

WHY THIS IS RIGHT

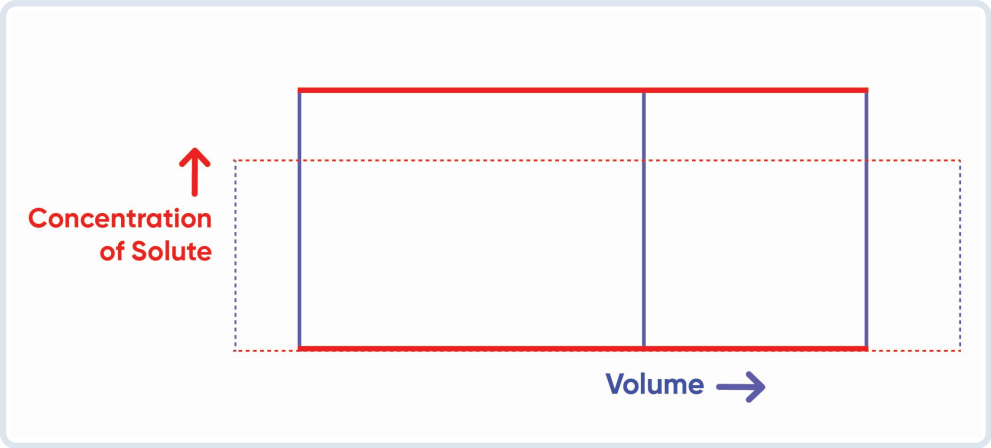
The rate of diffusion across a membrane follows Fick's law of diffusion, which states that diffusion is directly proportional to the surface area, concentration gradient, and permeability, and inversely proportional to the membrane thickness.
Factors that increase diffusion:
• Higher temperature -> increases molecular kinetic energy.
• Greater lipid solubility -> substances cross lipid membranes more easily.
• Larger surface area -> more area available for diffusion.

Increased membrane thickness decreases diffusion because molecules must travel a longer distance.

$$\text{Rate of diffusion} \propto \frac{\text{Surface area} \times \text{Concentration gradient} \times \text{Permeability}}{\text{Membrane thickness}}$$

QUESTION

Which of the following is the unlikely diagnosis for the Darrow-Yannet diagram shown below (dotted lines abnormal)?



A Right heart failure

B Cirrhosis

C Nephrotic syndrome

D **Diuretic abuse** CORRECT

OK RIGHT ANSWER

D. Diuretic abuse

WHY THIS IS RIGHT

The Darrow-Yannet diagram illustrates changes in body fluid compartments-intracellular fluid (ICF) and extracellular fluid (ECF)-with respect to volume (x-axis) and osmolarity/solute concentration (y-axis).

In the diagram, the dotted line (abnormal) shows:
• Expansion of extracellular fluid volume
• No significant change in osmolarity (isotonic expansion)

This pattern occurs in conditions causing edema due to fluid retention, such as:
• Right heart failure
• Cirrhosis
• Nephrotic syndrome

These conditions lead to isotonic expansion of ECF with secondary fluid shifts.

Diuretic abuse, however, causes loss of isotonic fluid, resulting in ECF volume contraction, not expansion.

QUESTION

A 45-year-old woman undergoes total thyroidectomy for papillary thyroid cancer. Following, surgery the patient develops perioral numbness and spasm of the muscles of her hand. The latter change is due to a change in the resting membrane potential of cells. Which of the below mentioned conditions will have a similar effect on the RMP of a cell?

A SIADH

B **Conn's syndrome** CORRECT

C A bolus injection of insulin

D Multiple myeloma

OK RIGHT ANSWER

B. Conn's syndrome

WHY THIS IS RIGHT

After thyroidectomy, the patient likely develops hypocalcemia due to accidental removal or damage to the parathyroid glands, leading to neuromuscular irritability (tetany).

Mechanism:
• Low extracellular Ca^{2+} increases neuronal membrane excitability by making voltage-gated Na^{+} channels easier to open.
• This effectively reduces the threshold for depolarization, producing muscle spasms (e.g., carpopedal spasm).

Similar effect on resting membrane potential:
• Conn's syndrome (primary hyperaldosteronism) causes hypokalemia due to increased renal potassium loss.
• Low extracellular K^{+} -> hyperpolarization of the resting membrane potential, altering excitability of muscle and nerve cells.

QUESTION

What is the normal insensible water loss?

A 100 ml/hr

B 150 ml/hr

C **50 ml/hr** CORRECT

D 200 ml/hr

OK RIGHT ANSWER

C. 50 ml/hr

WHY THIS IS RIGHT

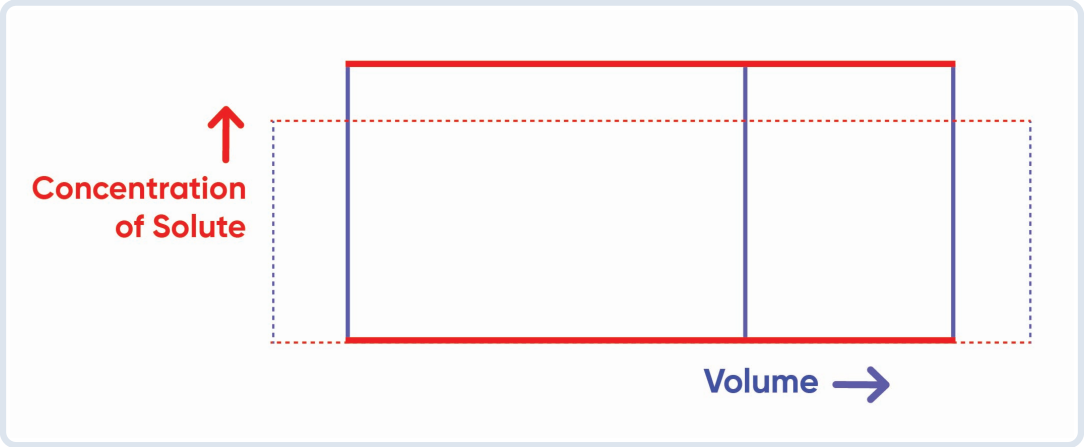
Insensible water loss refers to the continuous, unnoticeable loss of water from the body through:
• Skin (diffusion through epidermis)
• Respiratory tract (water vapor in expired air)

Normal value:
• Approximately 800-1200 mL/day in adults
• Equivalent to about 40-50 mL/hour

Characteristics:
• Occurs independently of sweating
• Increases with fever, hyperventilation, burns, and high environmental temperature

QUESTION

The solid line represents a normal individual, and the dotted line represents this patient. Which of the following conditions is most likely causing this patient's findings?



A Acute gastrointestinal hemorrhage

B Diabetes insipidus

C Hypertonic saline infusion

D **Primary polydipsia** CORRECT

RIGHT ANSWER

OK **D. Primary polydipsia**

WHY THIS IS RIGHT

The diagram represents changes in body fluid compartments (ECF and ICF) comparing a normal individual (solid line) with the patient (dotted line).
In primary polydipsia (excess water intake):
• Plasma osmolality decreases (dilution of solutes).
• Water distributes into both ECF and ICF, causing expansion of both compartments.
• Solute concentration decreases in both compartments due to dilution.

Interpretation of the graph:
• Decreased concentration of solutes (↓ osmolarity)
• Increased total body water -> expansion of both ICF and ECF volumes

QUESTION

Identify the correct order of End plate potential at the neuromuscular junction:

A Ca2+ entry in Axon Terminal -> Ach Release -> Na+ channel opens -> Action potential

B **Na+ channel opens -> Action potential -> Ca2+ entry in Axon Terminal -> Ach Release** CORRECT

C Ach Release -> Na+ channel opens -> Action potential -> Ca2+ entry in Axon Terminal

D Action potential -> Ca2+ entry in Axon Terminal -> Ach Release -> Na+ channel opens

OK RIGHT ANSWER

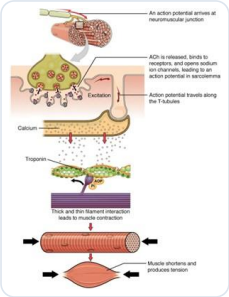
B. Na+ channel opens -> Action potential -> Ca2+ entry in Axon Terminal -> Ach Release

WHY THIS IS RIGHT

At the neuromuscular junction, opening of voltage-gated Na□ channels initiates the nerve action potential.
Arrival of the action potential at the axon terminal causes opening of voltage-gated Ca²□ channels.
Calcium influx triggers acetylcholine release into the synaptic cleft.

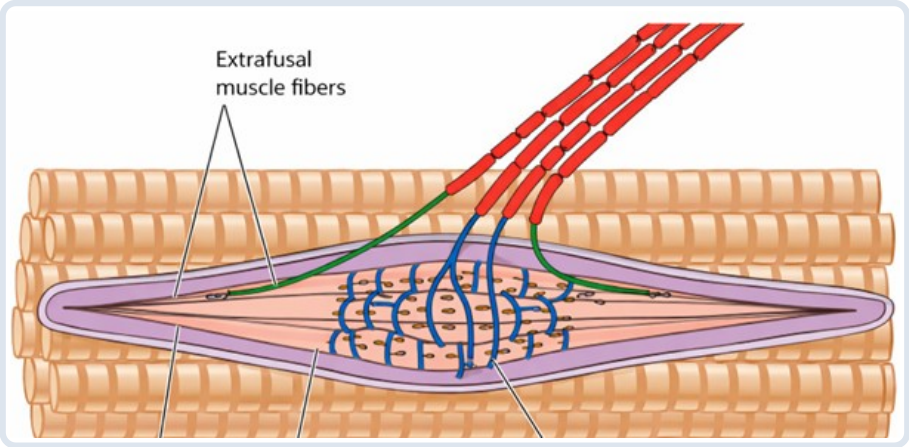
Motor neuron action potential arrives
↓
Voltage-gated Ca²□ channels open
↓
Ca²□ enters presynaptic terminal
↓
Vesicles release ACh
↓
ACh binds nicotinic receptors
↓
Na□ channels open (end plate potential)
↓
Muscle action potential generated

Thus, the correct sequence is Na□ channel opens -> Action potential -> Ca²□ entry -> ACh release.



QUESTION

The motor supply of the muscle spindle is which of the following?



A Alpha neuron

B **Gamma neuron** CORRECT

C Beta neuron

D Delta neuron

OK RIGHT ANSWER

B. Gamma neuron

WHY THIS IS RIGHT

The source quiz contains the placeholder “$19” here and does not include a written explanation for this item.

QUESTION

Which one of the following ion is released by the ryanodine receptor (RyR) leading to malignant hyperthermia?

A Na+

B K+

C Cl-

D **Ca2+** CORRECT

OK RIGHT ANSWER

D. Ca2+

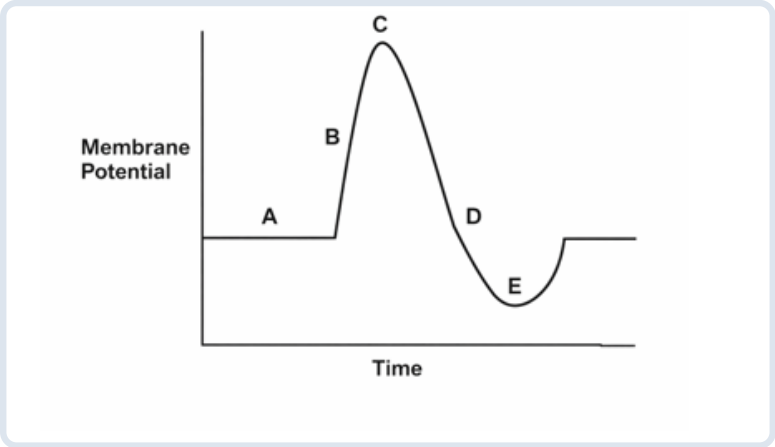
WHY THIS IS RIGHT

Ryanodine receptors are Ca^{2+} release channels on the sarcoplasmic reticulum of skeletal muscle. In malignant hyperthermia, defective RyR causes uncontrolled Ca^{2+} release into the cytosol. Excess intracellular Ca^{2+} leads to sustained muscle contraction and hypermetabolism. Thus Ca^{2+} is the ion responsible.
Normal E-C Coupling-
Action potential in muscle
↓
T-tubule depolarization
↓
DHP receptor activation
↓
Ryanodine receptor (RyR) opens
↓
Ca^{2+} released from SR
↓
Ca^{2+} binds troponin
↓
Muscle contraction

In Malignant Hyperthermia
Trigger (e.g., halothane, succinylcholine)
↓
Defective RyR (genetic mutation)
↓
Uncontrolled Ca^{2+} release
↓
Sustained muscle contraction
↓
↑ ATP consumption
↓
Heat production ↑↑
↓
Muscle rigidity + hyperthermia
Treatment: Dantrolene
Mechanism:
• Blocks RyR
• ↓ Ca^{2+} release

QUESTION

Which of the following statements about the nerve action potential curve is correct?



A Threshold point is at A

B At point E, the nerve is more excitable

C Point C to D is due to opening of Na+ and closure of K+ channels

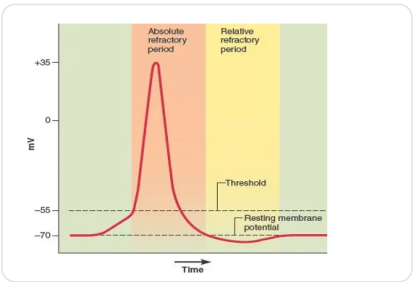
D **Point B to D is refractory period** CORRECT

OK RIGHT ANSWER

D. Point B to D is refractory period

WHY THIS IS RIGHT

Segment B to D spans depolarization and early repolarization when voltage-gated Na□ channels are inactivated. During this interval, a second action potential cannot be generated, defining the absolute refractory period.
Excitability only begins to return after further repolarization. Hence B to D represents the refractory period.



QUESTION

A patient was brought to the hospital after a road traffic accident. He had severe muscle injury and his serum K+ level was found to be 5.5 mEq/L. What change will happen to the resting membrane potential in this patient?

A No change

B Becomes more negative

C **Becomes more positive** CORRECT

D First becomes more positive, then negative

RIGHT ANSWER

OK

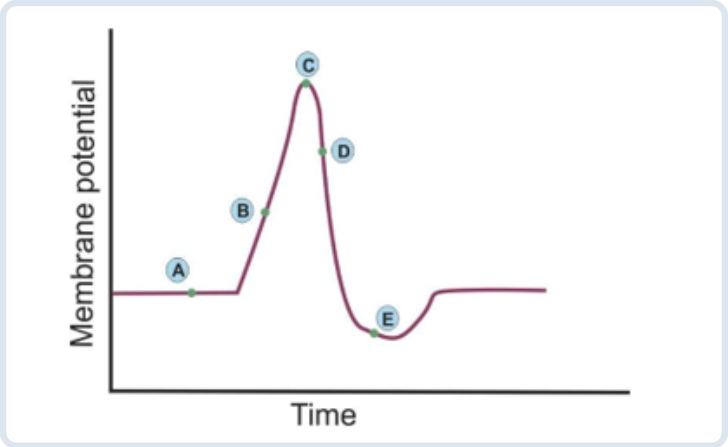
C. Becomes more positive

WHY THIS IS RIGHT

Hyperkalemia reduces the K□ gradient across the cell membrane, decreasing outward K□ diffusion. This makes the resting membrane potential less negative (partial depolarization). As extracellular K□ rises, the membrane shifts toward threshold. Hence the resting membrane potential becomes more positive.
↑ Extracellular K□
↓
↓ Concentration gradient
↓
↓ K□ efflux from cell
↓
Less positive charge leaving
↓
Inside becomes less negative
↓
RMP shifts toward zero (more positive)

QUESTION

True statement regarding the given nerve action potential curve is?



A Threshold point is at A

B At point E, the nerve is more excitable

C Point C to D is due to opening of Na+ and closure of K+ channels

D **Point B to D is refractory period** CORRECT

OK RIGHT ANSWER

D. Point B to D is refractory period

WHY THIS IS RIGHT

Points B to D span depolarization through early repolarization, corresponding to the absolute refractory period. During this phase, voltage-gated Na□ channels are inactivated and a new action potential cannot be generated. Excitability is reduced until repolarization progresses. Hence B to D represents the refractory period.

Option	Statement	Correct/Incorrect	Explanation
A	Threshold at A	□ Incorrect	A = resting potential, threshold at B
B	At E nerve is more excitable	□ Incorrect	E = hyperpolarization -> less excitable
C	C-D due to Na□ opening & K□ closure	□ Incorrect	Opposite: Na□ closes, K□ opens
D	B-D is refractory period	□ CORRECT	Covers absolute + most of refractory phase

QUESTION

Which ion is most responsible for the resting membrane potential (RMP):

A **K+** CORRECT

B Ca2+

C Na+

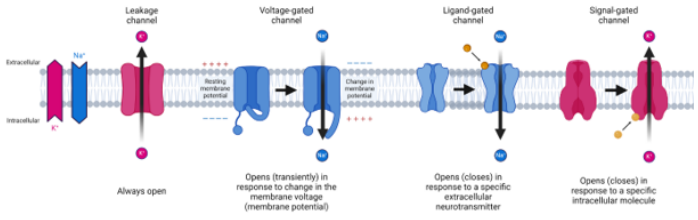
D Cl-

OK RIGHT ANSWER

A. K+

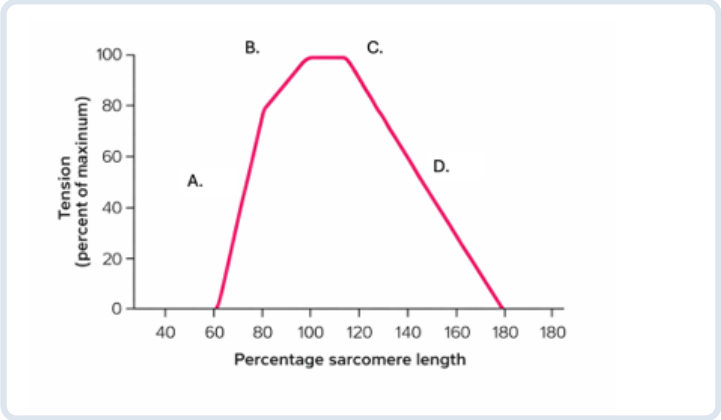
WHY THIS IS RIGHT

Resting membrane potential is primarily determined by potassium permeability across the cell membrane. High resting K□ conductance through leak channels allows outward diffusion, making the inside negative. The membrane potential closely approximates the K□ equilibrium potential. Na□ and Ca²□ have minimal resting permeability compared to K□.
High intracellular K□
↓
K□ diffuses out via leak channels
↓
Loss of positive charge from inside
↓
Cell interior becomes negative
↓
Electrical gradient opposes further K□ loss
↓
Equilibrium reached -> Resting membrane potential



QUESTION

Which of the following actin myosin cross bridges pair correctly represents the point (B-C) shown on length-tension relationship in the sarcomere curve?



A https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD3TGYBZ2ZWK42TV3K4WK.png

B **https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD3YBF9G91V2FJ26ZC2BQ.png** CORRECT

C https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD41DVCC3KKDFJVS4XDBE.png

D https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD446GG06BW8DT2VVWRBP.png

RIGHT ANSWER

OK **B. https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD3YBF9G91V2FJ26ZC2BQ.png**

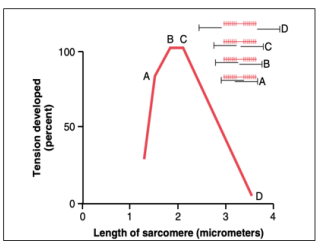
WHY THIS IS RIGHT

The length-tension relationship describes how muscle force varies with sarcomere length. Point B-C on the graph represents the plateau phase where maximum active tension (100%) is generated. At B-C (Plateau phase):
• Optimal overlap between actin and myosin
• Maximum number of cross-bridges formed
• No interference, no overstretching

Result: Maximum active tension

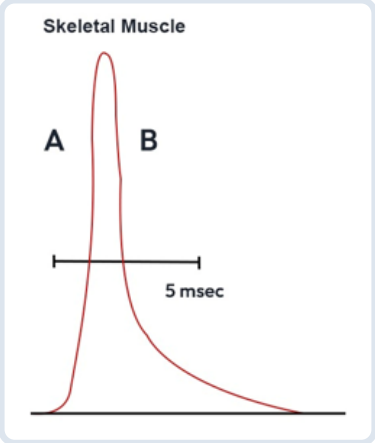
At this optimal length (2.0-2.2 μm):
• All myosin heads can interact with actin binding sites
• No interference from overlapping actin filaments
• Maximum number of cross-bridges form simultaneously
• This produces peak contractile force

Option B correctly shows this optimal arrangement - complete overlap between actin and myosin without actin-actin interference, allowing maximum cross-bridge formation and force generation.



QUESTION

In the adjoining image of the muscle fiber action potential, the phase marked B is due to which of the following?



A **Efflux of potassium** CORRECT

B Influx of potassium

C Sodium efflux

D Calcium influx

RIGHT ANSWER

OK

A. Efflux of potassium

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1a” here and does not include a written explanation for this item.

QUESTION

All the following are properties of ventricular muscle fibers:
1. All or none law
2. Length-tension relation
3. Tetanus
4. Long refractory period

A 1 only

B 1 and 2

C 1, 2, and 3

D **1, 2, and 4** CORRECT

OK RIGHT ANSWER

D. 1, 2, and 4

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1b” here and does not include a written explanation for this item.

QUESTION

Which of the following contributes to the latent period in a single muscle twitch?
a. Excitation-contraction coupling
b. Opening of sodium channels on NMJ
c. Transmission of impulse from the site of stimulus to NMJ
d. Pumping of calcium back to the sarcoplasmic reticulum

A a and b

B **a, b, c** CORRECT

C only b

D a, b, c, d

OK RIGHT ANSWER

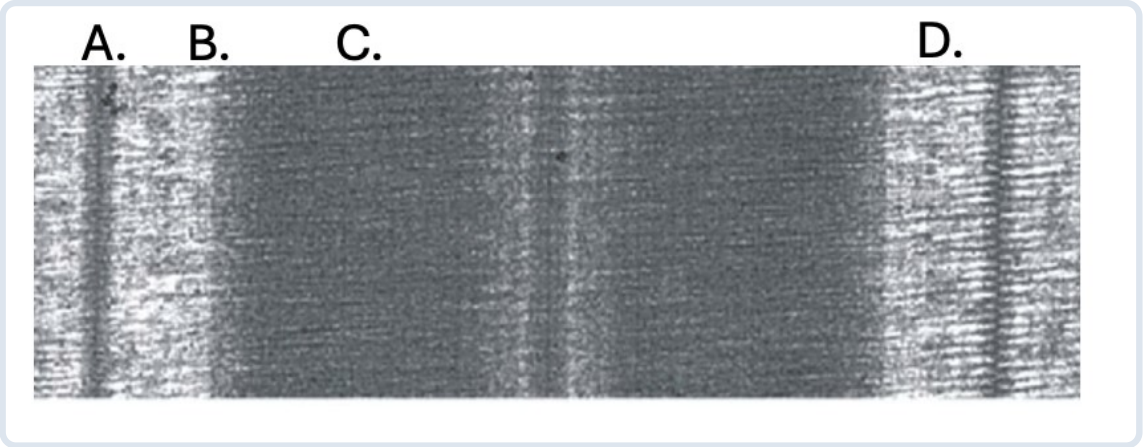
B. a, b, c

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1c” here and does not include a written explanation for this item.

QUESTION

Identify the correct labeling (A, B, C, D) in the given image?



A **Z line, A band, H zone, I Band** — CORRECT

B A band, Z line, H zone, M Band

C A band, I Band, Z line, H zone

D Z line, A band, M Band, H zone

OK

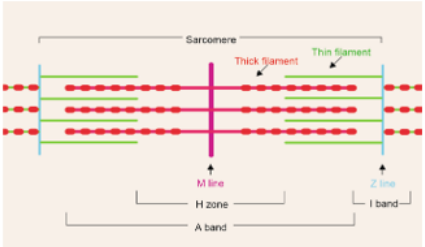
RIGHT ANSWER

A. Z line, A band, H zone, I Band

WHY THIS IS RIGHT

- A is the Z line: The light line marking the boundary between sarcomeres
- B (A band): The darker, thicker region representing myosin filaments
- C (H zone): The lighter area between the A bands
- D (I Band): The lighter area between Z lines containing actin filaments

Muscle contraction begins
↓
Actin slides over myosin
↓
Z lines move closer
↓
I band shortens
↓
H zone disappears
↓
A band remains constant



QUESTION

If a simple muscle twitch has a latent period of 10 milliseconds, a contraction period of 40 milliseconds, and a relaxation period of 50 milliseconds, what is the tetanizing frequency?

A 20HZ

B 40HZ

C **25HZ** CORRECT

D 50HZ

OK RIGHT ANSWER

C. 25HZ

WHY THIS IS RIGHT

Tetanizing frequency = frequency at which next stimulus arrives before relaxation completes -> sustained contraction (tetanus).
• Latent period = 10 ms
• Contraction period = 40 ms
• Relaxation period = 50 ms
• Total twitch duration:

Contraction period = 40 ms

So, frequency:

Phase	Duration	Event
Latent	10 ms	Excitation-contraction coupling
Contraction	40 ms	Cross-bridge cycling
Relaxation	50 ms	Ca^{2}□ reuptake

QUESTION

Which of the following is correct about the recruitment of fast fatiguable motor unit?

A Recruited first

B **Recruited last** CORRECT

C During relaxation

D For the less demanding tasks

RIGHT ANSWER

OK **B. Recruited last**

WHY THIS IS RIGHT

Motor units are recruited according to the Henneman size principle, which states that motor neurons are activated from smallest to largest depending on the force required.
Recruitment order:
1. Slow (Type I) motor units - small neurons, fatigue-resistant, used for low-force, sustained activities.
2. Fast fatigue-resistant (Type IIa) - moderate force and endurance.
3. Fast fatigable (Type IIb/IIx) - large neurons producing high force but fatigue quickly.
Therefore, fast fatigable motor units are recruited last, only during high-intensity or powerful muscle contractions.

QUESTION

Which of the following is a characteristic feature of single-unit (visceral) smooth muscle?

A Absence of gap junctions

B Each fiber functions independently

C Innervated by a single nerve ending per fiber

D **Fibers are connected via many gap junctions and contract as a syncytium** CORRECT

OK RIGHT ANSWER

D. Fibers are connected via many gap junctions and contract as a syncytium

WHY THIS IS RIGHT

Single-unit (visceral) smooth muscle functions as a functional syncytium because the individual muscle fibers are electrically coupled by numerous gap junctions.
• Many gap junctions connect adjacent cells.
• Electrical activity spreads from cell to cell, so the muscle contracts as a coordinated unit (syncytium).
• Usually innervated by a few nerve fibers, not one nerve per cell.
• Often shows spontaneous rhythmic activity.
Examples:
• Gastrointestinal tract
• Uterus
• Urinary bladder
• Small blood vessels
Contrast with multiunit smooth muscle:
• Fibers act independently
• Few or no gap junctions
• Each fiber has individual innervation (e.g., iris, ciliary muscle).

QUESTION

All are correct statements about muscle tension curves, except:

A Passive tension increases with muscle stretch

B Active tension is highest at optimal length

C Total tension equals sum of passive and active tension

D **Passive tension is highest at resting muscle length** CORRECT

RIGHT ANSWER

OK

D. Passive tension is highest at resting muscle length

WHY THIS IS RIGHT

The muscle length-tension relationship describes how muscle force varies with sarcomere length.
• Active tension: Produced by actin-myosin cross-bridge formation.
• Maximum at optimal sarcomere length (ideal overlap of actin and myosin).
• Passive tension: Produced by elastic elements of muscle (titin, connective tissue).
• Increases progressively as the muscle is stretched beyond resting length.
• Total tension:
• Total tension = active tension + passive tension

Passive tension is not highest at resting length; it is minimal at resting length and increases with stretch.

QUESTION

All are features of postganglionic lesions, except:

A **Positive histamine test** CORRECT

B Good prognosis

C Distal to dorsal root ganglion

D Surgical repair is possible

RIGHT ANSWER

OK

A. Positive histamine test

WHY THIS IS RIGHT

A postganglionic lesion refers to nerve damage distal to the dorsal root ganglion (DRG), affecting the peripheral nerve after the sensory neuron cell body.
Features of postganglionic lesions:
• Occur distal to the dorsal root ganglion.
• Better prognosis because peripheral nerves can regenerate.
• Surgical repair may be possible in cases of nerve injury.

Histamine test:
• Used to assess integrity of sensory nerve fibers.
• In postganglionic lesions, the axon reflex is lost, so the flare response is absent -> negative histamine test.

Therefore, positive histamine test is not seen in postganglionic lesions, making it the incorrect statement.

QUESTION

All of the following are true regarding Na□/K□ ATPase structure, except:

A ATP binding site is located intracellularly

B K□ binding site is on the extracellular side

C **Ouabain binds to the cytoplasmic domain** CORRECT

D Phosphorylation site is intracellular

RIGHT ANSWER

OK

C. Ouabain binds to the cytoplasmic domain

WHY THIS IS RIGHT

The Na□/K□ ATPase pump is a membrane-bound enzyme that maintains the electrochemical gradients of sodium and potassium across the cell membrane.
• ATP binding site: located on the intracellular side.
• Phosphorylation site: also on the intracellular domain of the pump.
• K□ binding site: located on the extracellular side.
• Ouabain (cardiac glycoside) binding site: located on the extracellular surface of the pump.

Function:
• Pumps 3 Na□ out of the cell and 2 K□ into the cell using ATP hydrolysis.

Therefore, the incorrect statement is that ouabain binds to the cytoplasmic domain, because it actually binds to the extracellular side of the Na□/K□ ATPase.

QUESTION

How muscle spindle able to detect the length while muscle is contracting?

A **Nuclear bag fibers** CORRECT

B Nuclear chain fibers

C Golgi tendon organ

D Other muscle receptor

RIGHT ANSWER

OK **A. Nuclear bag fibers**

WHY THIS IS RIGHT

The muscle spindle is a proprioceptive receptor that detects muscle length and the rate of change in length (stretch reflex).

Muscle spindles contain intrafusal fibers of two types:
• Nuclear bag fibers -> detect dynamic changes in muscle length, especially during active contraction or rapid stretch.
• Nuclear chain fibers -> detect static muscle length.

Mechanism during contraction:
• Gamma motor neurons stimulate intrafusal fibers to maintain spindle sensitivity while the muscle shortens.
• Nuclear bag fibers help the spindle continue sensing changes in muscle length even during contraction.

Other receptors:
• Golgi tendon organ senses muscle tension, not muscle length.

QUESTION

Sequentially arrange the steps involved in excitation-contraction coupling of smooth muscle cells.
1. Myosin phosphorylation
2. Increased influx of Ca2+ into the cell
3. Activation of calmodulin-dependent myosin light chain kinase
4. Binding of myosin to actin

A 2-1-3-4

B 2-1-4-3

C 3-2-1-4

D **2-3-1-4** CORRECT

OK RIGHT ANSWER

D. 2-3-1-4

WHY THIS IS RIGHT

In smooth muscle excitation-contraction coupling, contraction is regulated by Ca^{2+}-dependent phosphorylation of myosin rather than troponin (as in skeletal muscle).
Correct sequence:
1. Increased influx of Ca^{2+} into the cell (via voltage-gated or receptor-operated channels).
2. Ca^{2+} binds to calmodulin, activating calmodulin-dependent myosin light chain kinase (MLCK).
3. MLCK phosphorylates myosin light chains.
4. Phosphorylated myosin binds to actin, initiating cross-bridge cycling and contraction.

QUESTION

The resting membrane potential (RMP) of the nerve is -70mV. Increased permeability of which ion is responsible for the RMP?

A Calcium

B Sodium

C **Potassium** CORRECT

D Chloride

RIGHT ANSWER

OK

C. Potassium

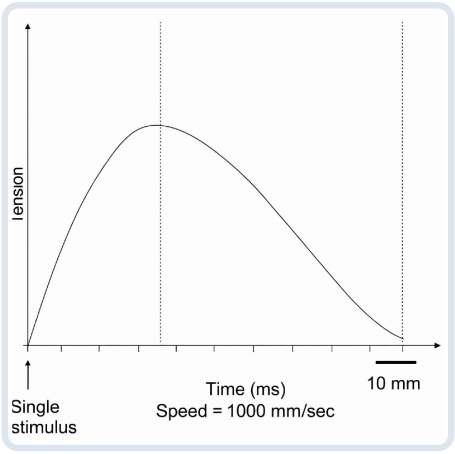
WHY THIS IS RIGHT

The resting membrane potential (RMP) of most neurons is about -70 mV, primarily due to high permeability of the membrane to potassium (K□).
• At rest, K□ leak channels allow potassium to diffuse out of the cell down its concentration gradient.
• Loss of positive charge makes the inside of the cell more negative relative to the outside.
• This movement drives the membrane potential toward the K□ equilibrium potential (\~-90 mV).

Other contributors:
• Na□/K□ ATPase pump maintains ionic gradients (3 Na□ out, 2 K□ in).
• Slight Na□ leak shifts RMP from -90 mV toward -70 mV.

QUESTION

Given below is the demonstration of tetanisation in the gastrocnemius muscle of a frog. Identify the tetanising frequency.



A **20-25 Hz** CORRECT

B 30-35 Hz

C 15-20 Hz

D 10-15 Hz

OK RIGHT ANSWER

A. 20-25 Hz

WHY THIS IS RIGHT

Tetanization occurs when muscle stimuli are delivered at a frequency high enough that individual muscle twitches fuse, producing a sustained contraction (tetanus).

For frog gastrocnemius muscle:
• A single twitch lasts about 0.04-0.05 seconds (40-50 ms).
• When stimuli are given before the muscle completely relaxes, temporal summation occurs.
• At around 20-25 Hz, stimuli are frequent enough to produce complete tetanus (fused contraction).

Key concepts:
• Low frequency: Separate twitches
• Moderate frequency: Incomplete tetanus (wave summation)
• High frequency: Complete tetanus

QUESTION

Perception of pain in an area that lacks sensation is known as:

A **Anesthesia dolorosa** CORRECT

B Hyperalgesia

C Paresthesia

D Allodynia

RIGHT ANSWER

OK **A. Anesthesia dolorosa**

WHY THIS IS RIGHT

Anesthesia dolorosa refers to pain perceived in an area that is otherwise numb or lacks normal sensation. It occurs due to damage to sensory pathways, especially after nerve injury or central nervous system lesions.
• Loss of normal sensory input (anesthesia)
• Simultaneous abnormal spontaneous pain signals from damaged nerves

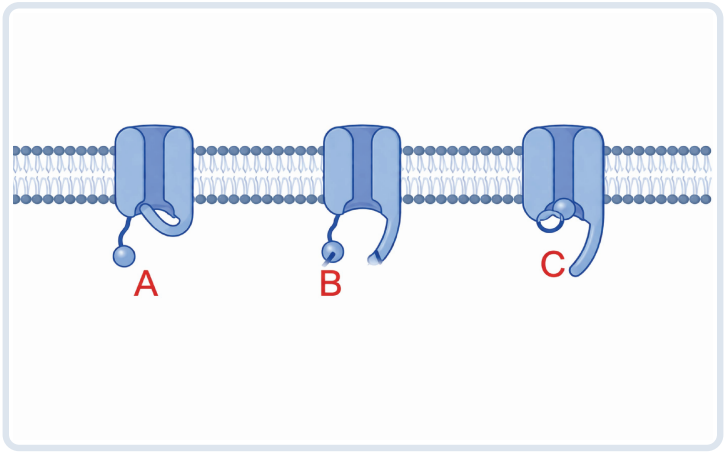
Clinical examples:
• Trigeminal nerve injury after procedures for trigeminal neuralgia
• Thalamic lesions or other central sensory pathway injuries

Other terms:

B. Hyperalgesia: Increased response to a painful stimulus
C. Paresthesia: Abnormal sensations like tingling or “pins and needles”
D. Allodynia: Pain due to a normally non-painful stimulus

QUESTION

When the membrane potential moves from +30 mv to -20 mv the sodium channel is predominantly seen in which of the following states?



A A

B B

C **C** CORRECT

D None

OK RIGHT ANSWER

C. C

WHY THIS IS RIGHT

Voltage-gated Na□ channels exist in three functional states during an action potential:

1. Closed (resting) state - activation gate closed, inactivation gate open (ready to open).
2. Open (activated) state - both gates open -> rapid Na□ influx during depolarization.
3. Inactivated state - activation gate open but inactivation gate closes, preventing Na□ entry.

When the membrane potential moves from +30 mV toward -20 mV (early repolarization), most Na□ channels are in the inactivated state.
In the figure:
• A: Closed (resting)
• B: Open
• C: Inactivated

QUESTION

A patient with spinal cord injury shows loss of recurrent inhibition of alpha motor neurons, leading to increased muscle tone. Dysfunction of which of the following interneurons is most likely responsible for this finding?

A Ia inhibitory interneuron

B Golgi tendon organ neuron

C **Renshaw cell** CORRECT

D Basket cell

RIGHT ANSWER

OK

C. Renshaw cell

WHY THIS IS RIGHT

Renshaw cells are inhibitory interneurons in the spinal cord that provide recurrent inhibition to α-motor neurons.
• An α-motor neuron activates a muscle fiber and simultaneously sends a collateral branch to Renshaw cells.
• Renshaw cells release inhibitory neurotransmitters (mainly glycine).
• This inhibits the same α-motor neuron and neighboring motor neurons, preventing excessive muscle contraction.

Clinical significance:
• Loss of Renshaw cell inhibition -> increased α-motor neuron activity -> muscle hypertonia/spasticity.
• Tetanus toxin blocks inhibitory neurotransmitter release from Renshaw cells, leading to muscle rigidity and spasms.

QUESTION

Which of the following muscle filaments has a fixed length and does not change during contraction or relaxation?

A Actin (thin filament)

B Myosin (thick filament)

C Titin

D **All of the above** CORRECT

OK RIGHT ANSWER

D. All of the above

WHY THIS IS RIGHT

According to the sliding filament theory of muscle contraction, the length of individual filaments remains constant during contraction and relaxation; instead, the degree of overlap between filaments changes.

Filaments with fixed length:

- Actin (thin filament): slides over myosin but its length remains unchanged.
- Myosin (thick filament): also maintains a constant length.
- Titin: an elastic structural protein that stabilizes the sarcomere and connects myosin to the Z-disc; its structure does not shorten during contraction.

During contraction:
- Sarcomere length decreases
- Z-lines move closer
- I-band and H-zone decrease
- A-band remains constant

QUESTION

A 26-year-old man touches a hot metal surface and immediately withdraws his hand, experiencing a burning pain sensation. The receptor responsible for detecting this stimulus is most likely mediated by which of the following ion channels?

A TRPM8

B **TRPV1** CORRECT

C TRPA1

D Piezo channels

RIGHT ANSWER

OK

B. TRPV1

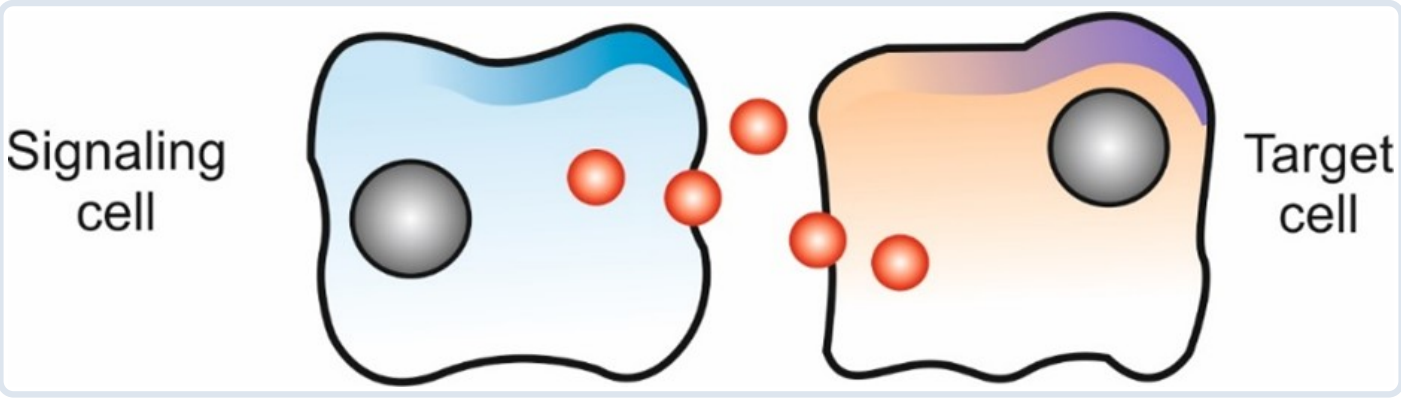
WHY THIS IS RIGHT

TRPV1 (Transient Receptor Potential Vanilloid 1) is a nociceptive ion channel present on sensory nerve endings that detects noxious heat and burning pain.
• Activated by temperatures > 43°C, capsaicin (from chili peppers), and acidic conditions.
• Opening of the channel allows Na□ and Ca²□ influx, leading to depolarization of pain fibers (C fibers) and perception of burning pain.

Other channels:
A. TRPM8: Detects cold temperatures and menthol.
C. TRPA1: Detects chemical irritants and environmental toxins.
D. Piezo channels: Mechanoreceptors involved in touch and pressure sensation.

QUESTION

The image below depicts which of the following types of cell-to-cells signaling?



A **Paracrine** — CORRECT

B Autocrine

C Endocrine

D Merocrine

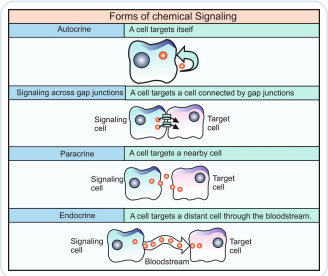
RIGHT ANSWER

OK

A. Paracrine

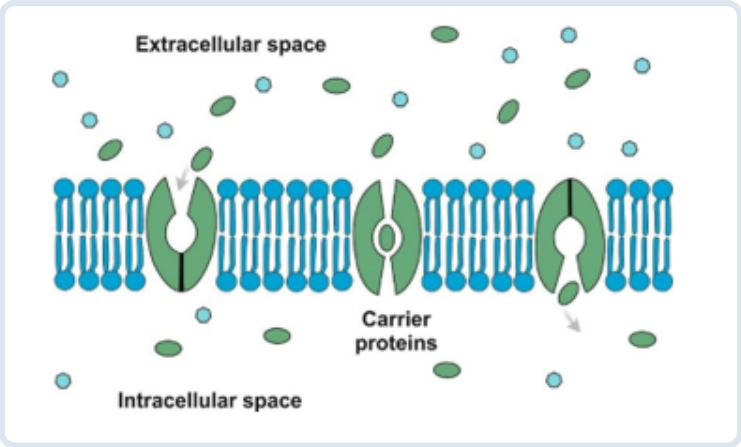
WHY THIS IS RIGHT

Cell secretes signaling molecule
↓
Diffusion through extracellular fluid
↓
Acts on nearby target cells
↓
Local physiological effect



QUESTION

Identify the type of transport across the cell membrane represented below?



A Simple diffusion

B **Facilitated diffusion** CORRECT

C Primary active transport

D Secondary active transport

OK RIGHT ANSWER

B. Facilitated diffusion

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1a” here and does not include a written explanation for this item.

QUESTION

A 25-year-old patient presents with a history of recurrent sinusitis, bronchiectasis, and chronic cough. He also mentions that he has had several ear infections and episodes of pneumonia over the past few years. On physical examination, you note digital clubbing. A chest X-ray is obtained. What is the most likely diagnosis?

A **Kartagener syndrome** CORRECT

B Cystic fibrosis

C DiGeorge syndrome

D Down syndrome

RIGHT ANSWER

OK

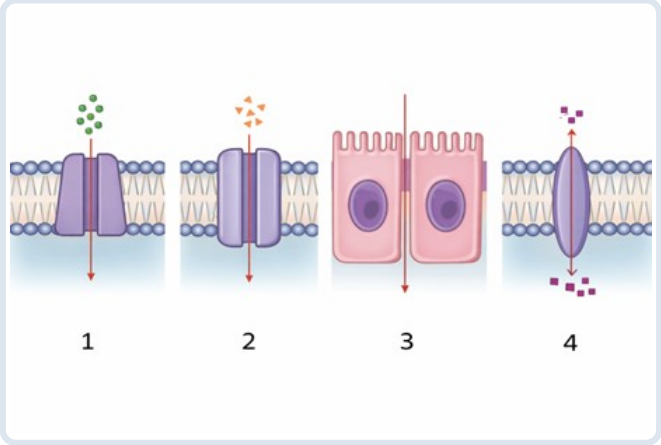
A. Kartagener syndrome

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1b” here and does not include a written explanation for this item.

QUESTION

Which of the following transport mechanism doesn't require ATP? Select the correct answer



A **1, 2, 3** — CORRECT

B 1, 2, 3, 4

C 2 only

D 3 & 4 only

OK RIGHT ANSWER

A. 1, 2, 3

WHY THIS IS RIGHT

The source quiz contains the placeholder "$1c" here and does not include a written explanation for this item.

QUESTION

Tight junction is located at which part of the cell?

A Apical

B **Apicolateral** CORRECT

C Basal

D Basolateral

OK RIGHT ANSWER

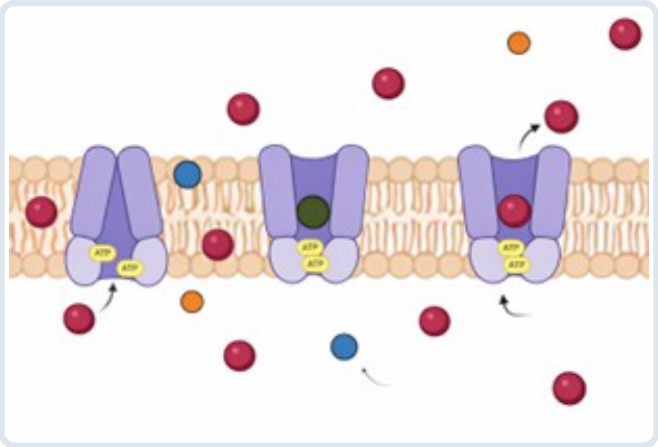
B. Apicolateral

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1d” here and does not include a written explanation for this item.

QUESTION

Identify the type of receptor given below?



A Sodium glucose co transporter-1

B Organic anion transporter-1

C GLUT-4

D **P-glycoprotein pump transporter** CORRECT

OK RIGHT ANSWER

D. P-glycoprotein pump transporter

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1e” here and does not include a written explanation for this item.

QUESTION

A 72-year-old woman is admitted to the hospital for treatment of unstable angina. Cardiac catheterization shows occlusion that has caused a 50% reduction in the diameter of the left circumflex artery. Resistance to blood flow in this vessel has increased by what factor relative to a vessel with no occlusion?

A 64

B **16** CORRECT

C 8

D 32

OK RIGHT ANSWER

B. 16

WHY THIS IS RIGHT

According to Poiseuille's law, vascular resistance (R) is inversely proportional to the fourth power of the vessel radius (r):
If the diameter is reduced by 50%, the radius also becomes half of the original.
Thus, resistance increases 16-fold.
Small decreases in vessel radius dramatically increase resistance, which significantly reduces blood flow.

$$R \propto \frac{1}{r^4}$$

$$R_{new} = \frac{1}{(1/2)^4} = \frac{1}{1/16} = 16$$

QUESTION

Upon reactivation of VZV, the virus is transported through the nerve axon to the skin. Which of the following proteins is most likely involved in the transport process leading to disease recurrence?

A Dynein

B **Kinesin** CORRECT

C Lamin

D Selectin

RIGHT ANSWER

OK

B. Kinesin

WHY THIS IS RIGHT

During reactivation of varicella-zoster virus (VZV), the virus travels from the dorsal root ganglion along the axon to the skin.

Axonal transport mechanisms:
- Anterograde transport (cell body -> axon terminal/skin): mediated by kinesin along microtubules.
- Retrograde transport (axon terminal -> cell body): mediated by dynein.

During VZV reactivation, the virus moves anterogradely toward the skin, causing herpes zoster (shingles).

Other proteins:
C. Lamin: structural protein of the nuclear lamina.
D. Selectin: adhesion molecule involved in leukocyte rolling during inflammation.

QUESTION

Regarding the speed of axonal transport, All of the following statements are correct except:

A Fast anterograde (orthograde) transport occurs at a speed of approximately 200-400 mm/day

B Retrograde axonal transport occurs at a speed of approximately 100-300 mm/day

C Slow anterograde axonal transport occurs at a speed of approximately 1-5 mm/day

D **Retrograde axonal transport is slower than slow anterograde transport** CORRECT

RIGHT ANSWER

OK **D. Retrograde axonal transport is slower than slow anterograde transport**

WHY THIS IS RIGHT

Axonal transport moves materials between the neuronal cell body and axon terminals along microtubules using motor proteins.
Types of axonal transport:
● Fast anterograde (orthograde) transport:
• Speed: \~200-400 mm/day
• Motor protein: Kinesin
• Carries synaptic vesicles, mitochondria, enzymes

● Retrograde transport:
• Speed: \~100-300 mm/day
• Motor protein: Dynein
• Carries endocytosed materials, growth factors, toxins, viruses back to the cell body

● Slow anterograde transport:
• Speed: \~1-5 mm/day
• Carries cytoskeletal proteins (actin, tubulin) Statement D is incorrect because retrograde transport is faster than slow anterograde transport.

QUESTION

Which of the following junctions is/are calcium dependent?
A. Desmosomes
B. Tight junctions
C. Adherens junctions
D. Gap junctions

A Only A

B **A & C** CORRECT

C Only C

D B & C

OK RIGHT ANSWER

B. A & C

WHY THIS IS RIGHT

Calcium-dependent cell junctions are those that use cadherins, which require Ca^{2+} for proper adhesion between cells.

Calcium-dependent junctions:
• Desmosomes -> mediated by desmogleins and desmocollins (cadherins)
• Adherens junctions -> mediated by E-cadherin

Calcium-independent junctions:
• Tight junctions -> formed by claudins and occludins
• Gap junctions -> formed by connexins (connexons) for cell-to-cell communication

QUESTION

A 48-year-old man with diabetes undergoes stress testing. He walks for 7 minutes without chest pain. Peak heart rate is 132/min, BP increases from 95 to 112 mmHg. Which of the following parameters was most likely decreased during peak stress?

A Cardiac output

B Left ventricular end-diastolic pressure

C Systemic systolic blood pressure

D **Total systemic vascular resistance** CORRECT

RIGHT ANSWER

OK

D. Total systemic vascular resistance

WHY THIS IS RIGHT

During exercise or stress testing, increased metabolic activity in skeletal muscles causes local vasodilation due to accumulation of metabolites (adenosine, CO□, H□, K□).

Physiological changes during exercise:
• ↑ Heart rate
• ↑ Cardiac output
• ↑ Systolic blood pressure
• ↑ Venous return
• ↓ Total systemic vascular resistance (SVR) due to vasodilation in active muscles

Even though sympathetic tone increases, the metabolic vasodilation in skeletal muscles predominates, causing an overall decrease in SVR.

QUESTION

During exercise, skeletal muscle blood flow increases primarily due to:

A Sympathetic vasodilation

B **Local metabolic vasodilation** CORRECT

C Increased parasympathetic tone

D Increased blood viscosity

RIGHT ANSWER

OK **B. Local metabolic vasodilation**

WHY THIS IS RIGHT

During exercise, skeletal muscle blood flow increases mainly due to local metabolic vasodilation in active muscles.
• Contracting muscles produce metabolic by-products such as:
• CO□
• H□ (lactic acid)
• K□
• Adenosine
• ↓ O□
• These metabolites cause local arteriolar dilation, greatly increasing muscle perfusion.

Although sympathetic activity increases during exercise, the local metabolic effects override sympathetic vasoconstriction in active muscles.

QUESTION

During isometric (static) exercise, which of the following hemodynamic changes is most characteristic?

A Decrease in total peripheral resistance

B Decrease in diastolic blood pressure

C **Increase in both systolic and diastolic blood pressure** CORRECT

D Increase in stroke volume with fall in heart rate

OK RIGHT ANSWER

C. Increase in both systolic and diastolic blood pressure

WHY THIS IS RIGHT

During isometric (static) exercise (e.g., handgrip, weight holding), sustained muscle contraction compresses blood vessels within the muscle, increasing total peripheral resistance (TPR). Hemodynamic effects:
• Sympathetic activation
• Increased heart rate and cardiac output
• Increased total peripheral resistance

As a result, both systolic and diastolic blood pressure rise.

Contrast with dynamic exercise:
• Dynamic exercise (running, cycling): ↓ TPR due to vasodilation -> SBP ↑ but DBP normal or ↓.
• Isometric exercise: ↑ TPR -> *both SBP and DBP increase.*

QUESTION

Which of the following mechanisms is seen in the baroreceptor reflex?

A Feedforward

B Positive feedback

C **Negative feedback** CORRECT

D Adaptive control regulation

RIGHT ANSWER

OK

C. Negative feedback

WHY THIS IS RIGHT

The source quiz contains the placeholder “$19” here and does not include a written explanation for this item.

QUESTION

Sour taste is mediated by:

A **TRPV1 Channel** CORRECT

B Metabotropic Receptor

C GPCR T1R1

D GPCR T1R3

RIGHT ANSWER

OK **A. TRPV1 Channel**

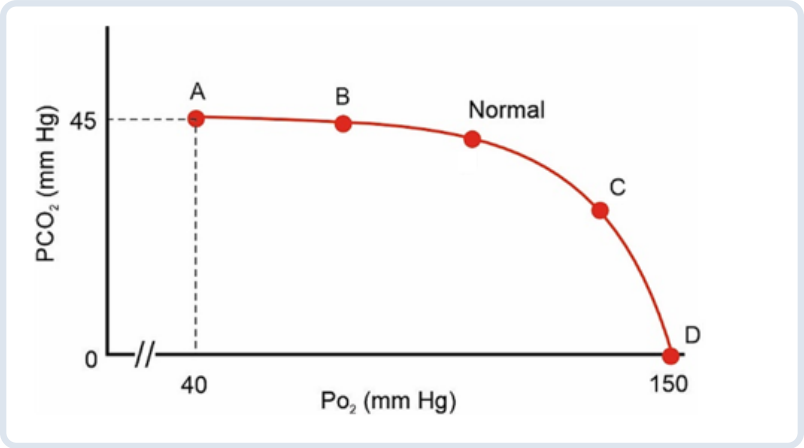
WHY THIS IS RIGHT

Sour taste = H□ ions -> activate ion channels (mainly TRP family like TRPV1) -> depolarization
Sour taste is mediated by proton-sensitive ion channels activated by H□ from acids. TRPV1-related channels respond to acidity and depolarize taste receptor cells. This mechanism is ion channel-based, not GPCR mediated. T1R receptors are involved in sweet and umami, not sour taste.
Acidic food (↑ H□)
↓
H□ interacts with taste receptor cell
↓
Activation of TRPV1 / inhibition of K□ channels
↓
Depolarization
↓
Neurotransmitter release
↓
Gustatory nerve activation

Taste	Receptor type	Key receptor examples
Sweet Umami Bitter	GPCR	TAS1R2 + TAS1R3
Sour	Ion channels-H+	PKD2L1, TRPV1
Salty	Ion channels-Na+	ENaC

QUESTION

In a patient with pulmonary embolism causing complete obstruction of blood flow. Which of the following point on V/Q curve corresponds with given condition?



A Point A

B Point B

C Point C

D **Point D** CORRECT

OK RIGHT ANSWER

D. Point D

WHY THIS IS RIGHT

In pulmonary embolism with complete obstruction of blood flow, the affected lung region receives normal ventilation but zero perfusion, creating alveolar dead space. The V/Q ratio approaches infinity (V/Q -> ∞).

The formula: V/Q = Ventilation/Perfusion = Normal/0 = ∞
At Point D:
• PO□ ≈ 150 mmHg (approaches inspired air PO□)
• PCO□ ≈ 0 mmHg (no CO□ delivered from blood)
• Alveolar gas resembles humidified inspired air
• No gas exchange occurs despite normal ventilation

Pulmonary embolism
↓
Blood flow blocked (Perfusion = 0)
↓
Alveoli still ventilated
↓
No gas exchange possible
↓
Alveolar gas ≈ Inspired air
↓
V/Q -> ∞ (Dead space)
This represents pure dead space ventilation where air enters and exits the alveoli without participating in gas exchange, essentially wasting ventilation.

QUESTION

Which of the following is an example of a feedforward mechanism?

A **Vasoconstriction after exposure to cold** CORRECT

B Increase in heart rate on standing from supine position

C Increase in cardiac output in response to anemia

D Increased vasopressin secretion during dehydration

RIGHT ANSWER

OK **A. Vasoconstriction after exposure to cold**

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1a” here and does not include a written explanation for this item.

QUESTION

The serotonergic cell bodies of the analgesia pathway projecting to the dorsal horn of the spinal cord are located in which part of the brain?

A Periaqueductal gray area

B Rostral ventromedial medulla

C Locus ceruleus

D **Nucleus raphe** CORRECT

OK RIGHT ANSWER

D. Nucleus raphe

WHY THIS IS RIGHT

The descending pain inhibitory (analgesia) pathway modulates pain transmission at the dorsal horn of the spinal cord.
Key components of this pathway:
1. Periaqueductal gray (PAG) in the midbrain receives pain signals.
2. PAG activates neurons in the nucleus raphe magnus (raphe nuclei) in the medulla.
3. Serotonergic neurons from the nucleus raphe descend to the dorsal horn of the spinal cord.
4. These neurons stimulate enkephalin-releasing interneurons, which inhibit pain transmission from primary afferent neurons.
Important neurotransmitters:
• Serotonin (5-HT) from raphe nuclei
• Enkephalins in the spinal cord

Other structures:
• Locus ceruleus: provides noradrenergic modulation of pain.
• PAG: initiates the descending analgesic pathway but is not the source of serotonergic projections.

QUESTION

Counter current mechanism is found in:
i. Eye
ii. Testis
iii. Gut
iv. Kidney
v. Lungs

A i, ii are correct

B ii, iii, iv are correct

C iii, iv, v are correct

D **ii, iii, iv, v are correct** CORRECT

OK RIGHT ANSWER

D. ii, iii, iv, v are correct

WHY THIS IS RIGHT

A countercurrent mechanism occurs when two fluids flow in opposite directions, allowing efficient exchange of heat, gases, or solutes.

Sites where countercurrent mechanisms occur:
• Testis: Countercurrent heat exchange in the pampiniform plexus helps maintain testicular temperature lower than body temperature for spermatogenesis.
• Gut: Countercurrent blood flow in intestinal villi facilitates efficient nutrient absorption and exchange.
• Kidney: Countercurrent multiplier (Loop of Henle) and countercurrent exchanger (vasa recta) concentrate urine.
• Lungs: Countercurrent heat and moisture exchange occurs in the respiratory passages.

Eye does not have a classical countercurrent exchange system.

QUESTION

A 29-year-old goes on a month-long trek across the Himalayas. Which of the following physiological adaptations would you expect to see in him at high altitudes following acclimatization?
1. Erythropoietin secretion increases
2. Tissue myoglobin decreases
3. Tissue content of cytochrome oxidase increases
4. pH of blood increases

A 1, 3 & 5

B 2, 3, & 5

C **1, 3, 4** CORRECT

D 1, 2, 3, 4

OK RIGHT ANSWER

C. 1, 3, 4

WHY THIS IS RIGHT

At high altitude, decreased atmospheric oxygen causes hypoxia, leading to several acclimatization responses to improve oxygen delivery and utilization.
Key adaptations:
• ↑ Erythropoietin (EPO) secretion -> increased RBC production -> improved oxygen-carrying capacity.
• ↑ Mitochondrial oxidative enzymes such as cytochrome oxidase, enhancing tissue oxygen utilization.
• Respiratory alkalosis occurs due to hyperventilation, causing an increase in blood pH initially.

Incorrect statement:
• Tissue myoglobin actually increases, not decreases, to improve oxygen storage in muscle.

QUESTION

Which of the following equations is used to determine the pH of a buffer solution?

A Nernst equation

B Goldman equation

C Gibbs-Donnan equation

D **Henderson-Hasselbalch equation** CORRECT

RIGHT ANSWER

OK

D. Henderson-Hasselbalch equation

WHY THIS IS RIGHT

The Henderson-Hasselbalch equation is used to calculate the pH of a buffer solution based on the ratio of a weak acid and its conjugate base.
This equation explains how blood pH is maintained by the balance between bicarbonate (kidneys) and CO□ (lungs).

Other equations:

A. Nernst equation: Calculates equilibrium potential of ions across membranes.
B. Goldman equation: Determines membrane potential considering multiple ions.
C. Gibbs-Donnan equation: Describes ion distribution across membranes with impermeant charged molecules.

Equation:

$$pH = pK_a + \log\left(\frac{[\text{Base}]}{[\text{Acid}]}\right)$$

Physiological example (bicarbonate buffer system):

$$pH = 6.1 + \log\left(\frac{[HCO_3^-]}{0.03 \times PCO_2}\right)$$

QUESTION

A deep-sea diver develops euphoria, impaired judgment, and altered consciousness at increased depth due to exposure to an inert gas under high pressure. This phenomenon is known as:

A Helium narcosis

B Oxygen toxicity

C **Nitrogen narcosis** CORRECT

D Decompression sickness

OK RIGHT ANSWER

C. Nitrogen narcosis

WHY THIS IS RIGHT

At greater diving depths, the partial pressure of nitrogen increases in the breathing gas mixture. Nitrogen dissolves in neuronal lipid membranes and depresses central nervous system activity, producing effects similar to alcohol intoxication.
Clinical features of nitrogen narcosis:
• Euphoria
• Impaired judgment
• Slowed reaction time
• Confusion and altered consciousness

These symptoms usually occur at depths >30 meters (≈100 ft) and resolve when the diver ascends and nitrogen partial pressure decreases.

Why other options are incorrect:

A. Helium narcosis: Helium is used in deep diving precisely because it does not cause narcosis like nitrogen.

B. Oxygen toxicity: Occurs at very high oxygen partial pressures, causing seizures or lung injury.

D. Decompression sickness: Caused by nitrogen bubble formation during rapid ascent, leading to joint pain (“the bends”), neurologic deficits, and embolic phenomena.

QUESTION

A 62-year-old man develops sudden massive blood loss following trauma. His mean arterial pressure falls to 35 mmHg. Within seconds, he develops marked sympathetic activation with intense peripheral vasoconstriction and a sharp rise in heart rate. This powerful pressure response is mediated by which of the following mechanisms?

A Carotid body chemoreceptor stimulation

B Baroreceptor reflex from carotid sinus

C **Direct ischemia of the vasomotor center** CORRECT

D Activation of renin-angiotensin system

OK RIGHT ANSWER

C. Direct ischemia of the vasomotor center

WHY THIS IS RIGHT

When mean arterial pressure (MAP) falls to very low levels (<40 mmHg), the brainstem experiences ischemia, leading to activation of the central nervous system ischemic response.

Mechanism:
• Reduced cerebral perfusion causes CO□ accumulation and decreased O□ in the medullary vasomotor center.
• This strongly stimulates the sympathetic nervous system, producing:
• Intense peripheral vasoconstriction
• Marked increase in heart rate
• Rapid rise in blood pressure
• This response is one of the most powerful short-term mechanisms for restoring blood pressure during severe shock.

QUESTION

Prolonged exposure to high partial pressure of oxygen causes pulmonary capillary endothelial damage, leading to alveolar inflammation and edema. This phenomenon is known as:

A Paul Bert effect

B **Lorrain-Smith effect** CORRECT

C Bohr effect

D Haldane effect

RIGHT ANSWER

OK **B. Lorrain-Smith effect**

WHY THIS IS RIGHT

Lorrain-Smith effect refers to pulmonary oxygen toxicity caused by prolonged exposure to high partial pressures of oxygen (hyperoxia).
• Excess oxygen leads to formation of reactive oxygen species (ROS).
• ROS cause damage to pulmonary capillary endothelium and alveolar epithelium.
• This results in alveolar inflammation, pulmonary edema, and decreased lung compliance.

Clinical settings:
• Prolonged oxygen therapy
• Hyperbaric oxygen exposure
• Diving or high-pressure environments

Other effects:

A. Paul Bert effect: CNS oxygen toxicity -> seizures due to high oxygen pressure.
C. Bohr effect: Effect of CO_2 and pH on hemoglobin oxygen affinity.
D. Haldane effect: Oxygenation of hemoglobin reduces CO_2 carrying capacity.

QUESTION

Infinite feedback gain is a characteristic feature of which of the following physiological control systems?

A Baroreceptor reflex

B Chemoreceptor reflex

C Thermoregulation

D **Renal-body fluid mechanism** CORRECT

OK

RIGHT ANSWER

D. Renal-body fluid mechanism

WHY THIS IS RIGHT

Infinite feedback gain refers to a control system that can completely correct a disturbance and return the regulated variable exactly to normal, even after significant changes.

The renal-body fluid mechanism controlling arterial blood pressure demonstrates near-infinite feedback gain because:
• The kidneys regulate sodium and water excretion.
• Changes in blood pressure alter renal excretion of salt and water (pressure natriuresis/diuresis).
• Over time, this mechanism can fully restore blood pressure to normal.

Other mechanisms (baroreceptor reflex, chemoreceptor reflex, thermoregulation) have finite feedback gain and provide short-term or partial correction.

QUESTION

A 23-year-old man wants to become a fighter pilot in the Indian Air Force. He is made to undergo tests for positive-G in a flight simulator. Which of the following physiological effects is not seen in this individual during exposure to positive-G?

A Blackout

B Decreased cardiac output

C Increased hydrostatic pressure in lower limb veins

D **Increased cerebral arterial pressure** CORRECT

RIGHT ANSWER

OK

D. Increased cerebral arterial pressure

WHY THIS IS RIGHT

Exposure to positive G-forces (+Gz) (e.g., during rapid upward acceleration in fighter aircraft) causes blood to shift toward the lower parts of the body due to gravity.

Physiological effects:
• Pooling of blood in lower limbs -> increased hydrostatic pressure in leg veins.
• Reduced venous return to the heart -> decreased cardiac output.
• Reduced cerebral perfusion -> visual disturbances (grey-out/blackout) and possible loss of consciousness.

Therefore, cerebral arterial pressure decreases, not increases.

QUESTION

Which parameter is required to calculate extracellular fluid (ECF) volume using a tracer method?

A Creatinine clearance

B Inulin clearance

C **Amount of tracer distributed / concentration** CORRECT

D Total body water

RIGHT ANSWER

OK

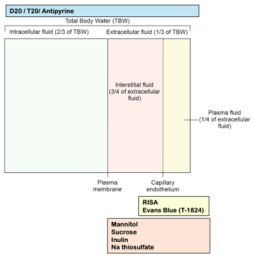
C. Amount of tracer distributed / concentration

WHY THIS IS RIGHT

To measure any fluid compartment (like ECF), we use:

This is the indicator dilution principle
Tracer dilution principle states: volume = amount of tracer injected ÷ equilibrium concentration. A marker that distributes only in ECF is used, and after equilibration its plasma concentration is measured. This ratio directly gives ECF volume. Clearance values and total body water are not used for this calculation.
Known amount of tracer injected
↓
Tracer distributes uniformly in target compartment (ECF)
↓
Sample taken -> concentration measured
↓
Apply formula:
Volume = Amount / Concentration

$$\text{Volume} = \frac{\text{Amount of tracer injected}}{\text{Concentration of tracer}}$$



QUESTION

Identify the correct order of End plate potential at the neuromuscular junction:

A Ca2+ entry in Axon Terminal -> Ach Release -> Na+ channel opens -> Action potential

B **Na+ channel opens -> Action potential -> Ca2+ entry in Axon Terminal -> Ach Release** CORRECT

C Ach Release -> Na+ channel opens -> Action potential -> Ca2+ entry in Axon Terminal

D Action potential -> Ca2+ entry in Axon Terminal -> Ach Release -> Na+ channel opens

RIGHT ANSWER

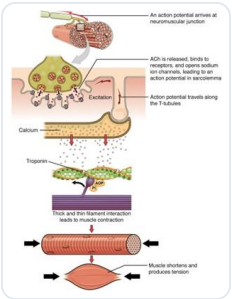
OK **B. Na+ channel opens -> Action potential -> Ca2+ entry in Axon Terminal -> Ach Release**

WHY THIS IS RIGHT

At the neuromuscular junction, opening of voltage-gated Na□ channels initiates the nerve action potential.
Arrival of the action potential at the axon terminal causes opening of voltage-gated Ca²□ channels.
Calcium influx triggers acetylcholine release into the synaptic cleft.

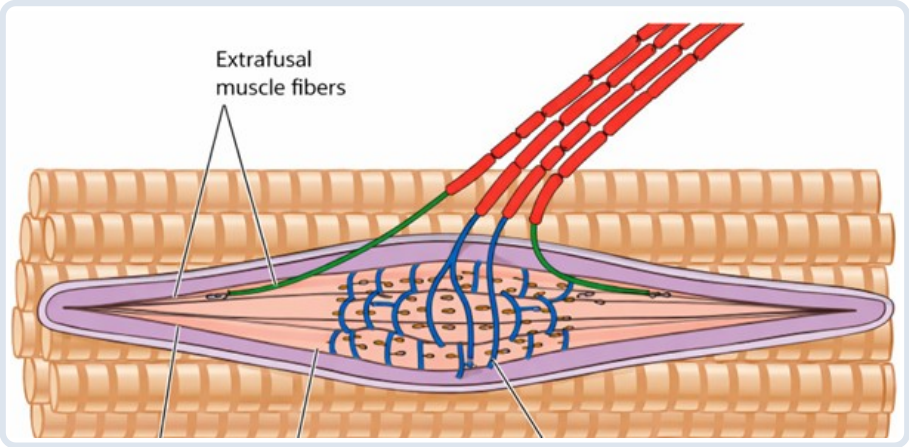
Motor neuron action potential arrives
↓
Voltage-gated Ca²□ channels open
↓
Ca²□ enters presynaptic terminal
↓
Vesicles release ACh
↓
ACh binds nicotinic receptors
↓
Na□ channels open (end plate potential)
↓
Muscle action potential generated

Thus, the correct sequence is Na□ channel opens -> Action potential -> Ca²□ entry -> ACh release.



QUESTION

The motor supply of the muscle spindle is which of the following?



A Alpha neuron

B **Gamma neuron** CORRECT

C Beta neuron

D Delta neuron

RIGHT ANSWER

OK **B. Gamma neuron**

WHY THIS IS RIGHT

The source quiz contains the placeholder “$19” here and does not include a written explanation for this item.

QUESTION

Which one of the following ion is released by the ryanodine receptor (RyR) leading to malignant hyperthermia?

A Na+

B K+

C Cl-

D **Ca2+** CORRECT

OK RIGHT ANSWER

D. Ca2+

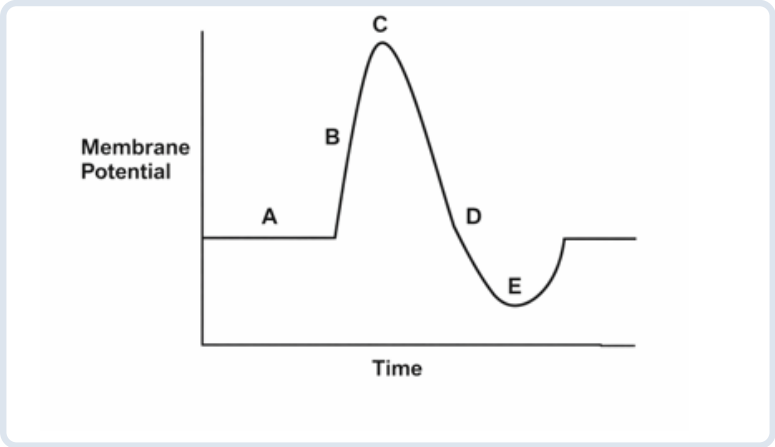
WHY THIS IS RIGHT

Ryanodine receptors are Ca^{2+} release channels on the sarcoplasmic reticulum of skeletal muscle. In malignant hyperthermia, defective RyR causes uncontrolled Ca^{2+} release into the cytosol. Excess intracellular Ca^{2+} leads to sustained muscle contraction and hypermetabolism. Thus Ca^{2+} is the ion responsible.
Normal E-C Coupling-
Action potential in muscle
↓
T-tubule depolarization
↓
DHP receptor activation
↓
Ryanodine receptor (RyR) opens
↓
Ca^{2+} released from SR
↓
Ca^{2+} binds troponin
↓
Muscle contraction

In Malignant Hyperthermia
Trigger (e.g., halothane, succinylcholine)
↓
Defective RyR (genetic mutation)
↓
Uncontrolled Ca^{2+} release
↓
Sustained muscle contraction
↓
↑ ATP consumption
↓
Heat production ↑↑
↓
Muscle rigidity + hyperthermia
Treatment: Dantrolene
Mechanism:
• Blocks RyR
• ↓ Ca^{2+} release

QUESTION

Which of the following statements about the nerve action potential curve is correct?



A Threshold point is at A

B At point E, the nerve is more excitable

C Point C to D is due to opening of Na+ and closure of K+ channels

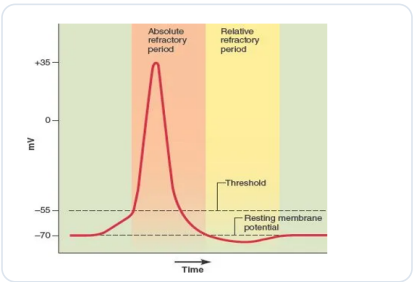
D **Point B to D is refractory period** CORRECT

OK RIGHT ANSWER

D. Point B to D is refractory period

WHY THIS IS RIGHT

Segment B to D spans depolarization and early repolarization when voltage-gated Na□ channels are inactivated. During this interval, a second action potential cannot be generated, defining the absolute refractory period.
Excitability only begins to return after further repolarization. Hence B to D represents the refractory period.



QUESTION

A patient was brought to the hospital after a road traffic accident. He had severe muscle injury and his serum K+ level was found to be 5.5 mEq/L. What change will happen to the resting membrane potential in this patient?

A No change

B Becomes more negative

C **Becomes more positive** CORRECT

D First becomes more positive, then negative

RIGHT ANSWER

OK

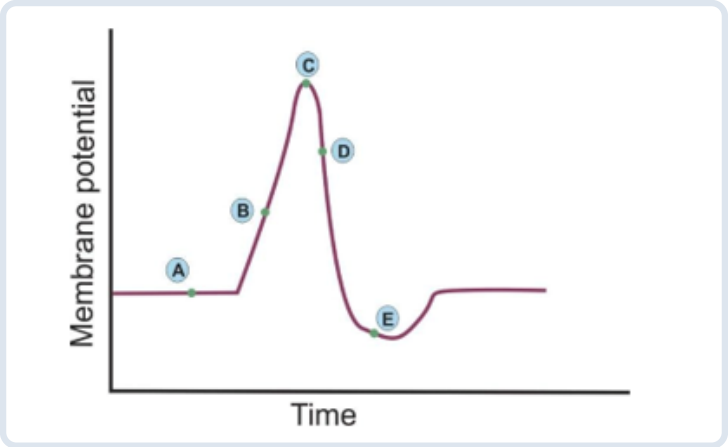
C. Becomes more positive

WHY THIS IS RIGHT

Hyperkalemia reduces the K□ gradient across the cell membrane, decreasing outward K□ diffusion. This makes the resting membrane potential less negative (partial depolarization). As extracellular K□ rises, the membrane shifts toward threshold. Hence the resting membrane potential becomes more positive.
↑ Extracellular K□
↓
↓ Concentration gradient
↓
↓ K□ efflux from cell
↓
Less positive charge leaving
↓
Inside becomes less negative
↓
RMP shifts toward zero (more positive)

QUESTION

True statement regarding the given nerve action potential curve is?



A Threshold point is at A

B At point E, the nerve is more excitable

C Point C to D is due to opening of Na+ and closure of K+ channels

D **Point B to D is refractory period** CORRECT

OK RIGHT ANSWER

D. Point B to D is refractory period

WHY THIS IS RIGHT

Points B to D span depolarization through early repolarization, corresponding to the absolute refractory period. During this phase, voltage-gated Na□ channels are inactivated and a new action potential cannot be generated. Excitability is reduced until repolarization progresses. Hence B to D represents the refractory period.

Option	Statement	Correct/Incorrect	Explanation
A	Threshold at A	□ Incorrect	A = resting potential, threshold at B
B	At E nerve is more excitable	□ Incorrect	E = hyperpolarization -> less excitable
C	C-D due to Na□ opening & K□ closure	□ Incorrect	Opposite: Na□ closes, K□ opens
D	B-D is refractory period	□ CORRECT	Covers absolute + most of refractory phase

QUESTION

Which ion is most responsible for the resting membrane potential (RMP):

A **K+** CORRECT

B Ca2+

C Na+

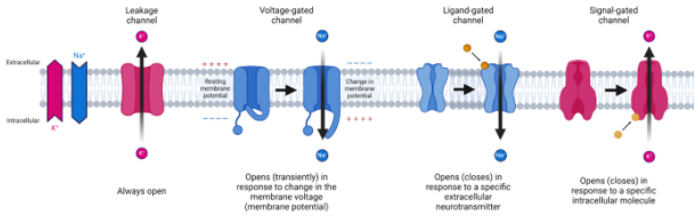
D Cl-

OK RIGHT ANSWER

A. K+

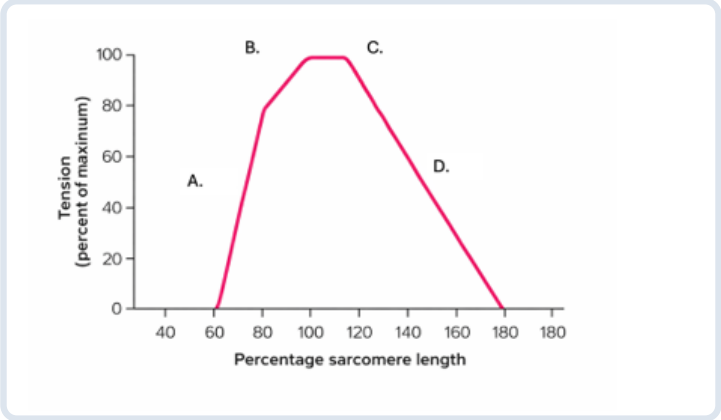
WHY THIS IS RIGHT

Resting membrane potential is primarily determined by potassium permeability across the cell membrane. High resting K□ conductance through leak channels allows outward diffusion, making the inside negative. The membrane potential closely approximates the K□ equilibrium potential. Na□ and Ca²□ have minimal resting permeability compared to K□.
High intracellular K□
↓
K□ diffuses out via leak channels
↓
Loss of positive charge from inside
↓
Cell interior becomes negative
↓
Electrical gradient opposes further K□ loss
↓
Equilibrium reached -> Resting membrane potential



QUESTION

Which of the following actin myosin cross bridges pair correctly represents the point (B-C) shown on length-tension relationship in the sarcomere curve?



A https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD3TGYBZ2ZWK42TV3K4WK.png

B **https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD3YBF9G91V2FJ26ZC2BQ.png** CORRECT

C https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD41DVCC3KKDFJVS4XDBE.png

D https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD446GG06BW8DT2VVWRBP.png

RIGHT ANSWER

OK **B. https://corebtr-assets-production.s3.ap-south-1.amazonaws.com/questions_image/option/01KMFBD3YBF9G91V2FJ26ZC2BQ.png**

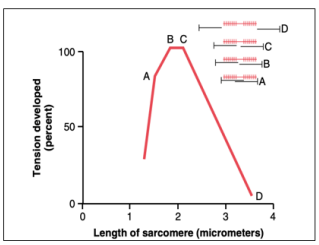
WHY THIS IS RIGHT

The length-tension relationship describes how muscle force varies with sarcomere length. Point B-C on the graph represents the plateau phase where maximum active tension (100%) is generated. At B-C (Plateau phase):
• Optimal overlap between actin and myosin
• Maximum number of cross-bridges formed
• No interference, no overstretching

Result: Maximum active tension

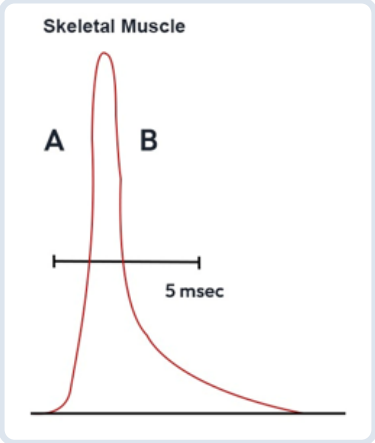
At this optimal length (2.0-2.2 μm):
• All myosin heads can interact with actin binding sites
• No interference from overlapping actin filaments
• Maximum number of cross-bridges form simultaneously
• This produces peak contractile force

Option B correctly shows this optimal arrangement - complete overlap between actin and myosin without actin-actin interference, allowing maximum cross-bridge formation and force generation.



QUESTION

In the adjoining image of the muscle fiber action potential, the phase marked B is due to which of the following?



A **Efflux of potassium** CORRECT

B Influx of potassium

C Sodium efflux

D Calcium influx

RIGHT ANSWER

OK

A. Efflux of potassium

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1a” here and does not include a written explanation for this item.

QUESTION

All the following are properties of ventricular muscle fibers:
1. All or none law
2. Length-tension relation
3. Tetanus
4. Long refractory period

A 1 only

B 1 and 2

C 1, 2, and 3

D **1, 2, and 4** CORRECT

OK RIGHT ANSWER

D. 1, 2, and 4

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1b” here and does not include a written explanation for this item.

QUESTION

Which of the following contributes to the latent period in a single muscle twitch?
a. Excitation-contraction coupling
b. Opening of sodium channels on NMJ
c. Transmission of impulse from the site of stimulus to NMJ
d. Pumping of calcium back to the sarcoplasmic reticulum

A a and b

B **a, b, c** CORRECT

C only b

D a, b, c, d

OK RIGHT ANSWER

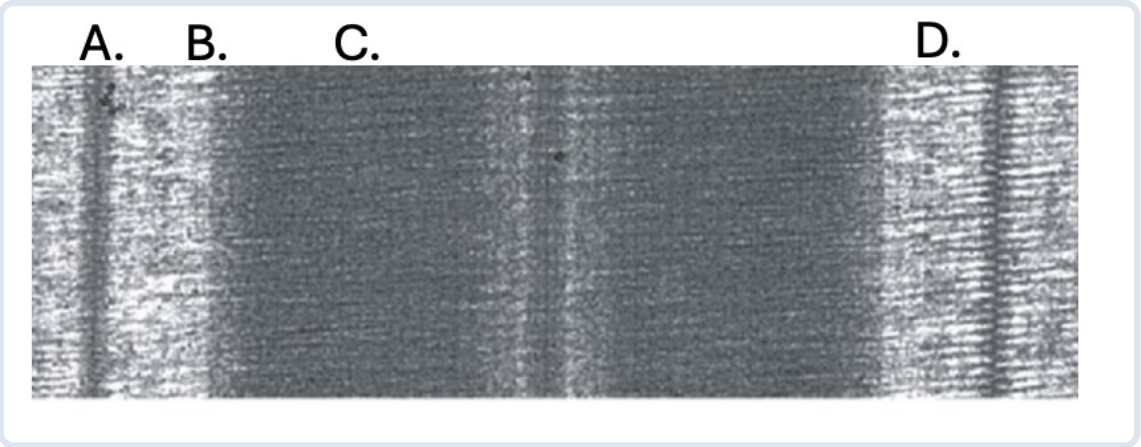
B. a, b, c

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1c” here and does not include a written explanation for this item.

QUESTION

Identify the correct labeling (A, B, C, D) in the given image?



A **Z line, A band, H zone, I Band** CORRECT

B A band, Z line, H zone, M Band

C A band, I Band, Z line, H zone

D Z line, A band, M Band, H zone

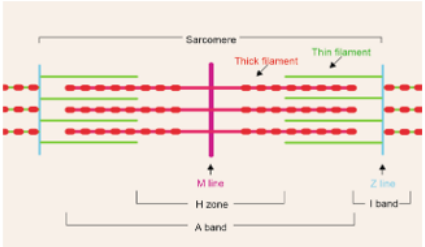
OK RIGHT ANSWER

A. Z line, A band, H zone, I Band

WHY THIS IS RIGHT

- A is the Z line: The light line marking the boundary between sarcomeres
- B (A band): The darker, thicker region representing myosin filaments
- C (H zone): The lighter area between the A bands
- D (I Band): The lighter area between Z lines containing actin filaments

Muscle contraction begins
↓
Actin slides over myosin
↓
Z lines move closer
↓
I band shortens
↓
H zone disappears
↓
A band remains constant



QUESTION

If a simple muscle twitch has a latent period of 10 milliseconds, a contraction period of 40 milliseconds, and a relaxation period of 50 milliseconds, what is the tetanizing frequency?

A 20HZ

B 40HZ

C **25HZ** CORRECT

D 50HZ

RIGHT ANSWER

OK

C. 25HZ

WHY THIS IS RIGHT

Tetanizing frequency = frequency at which next stimulus arrives before relaxation completes -> sustained contraction (tetanus).
• Latent period = 10 ms
• Contraction period = 40 ms
• Relaxation period = 50 ms
• Total twitch duration:

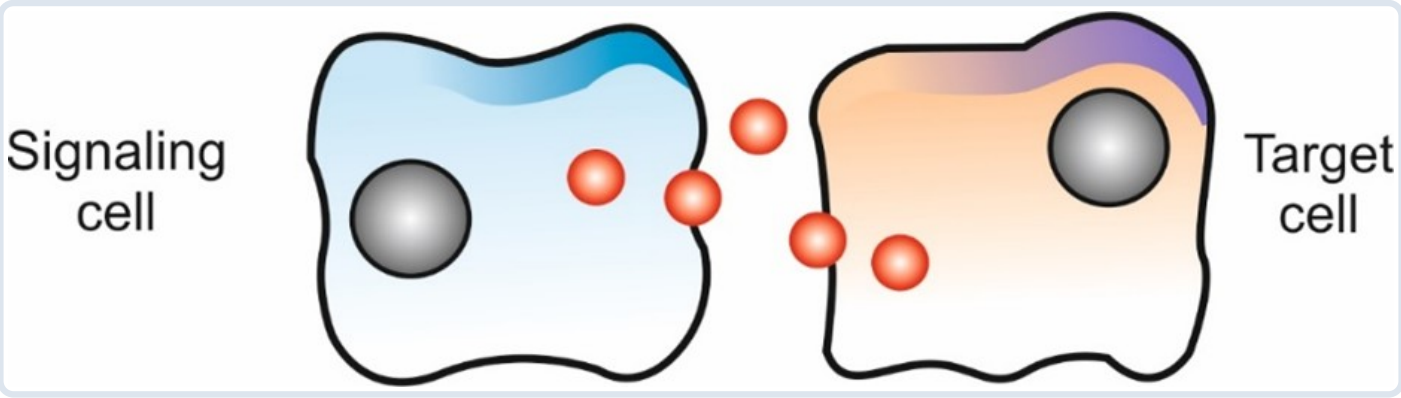
Contraction period = 40 ms

So, frequency:

Phase	Duration	Event
Latent	10 ms	Excitation-contraction coupling
Contraction	40 ms	Cross-bridge cycling
Relaxation	50 ms	Ca^{2}□ reuptake

QUESTION

The image below depicts which of the following types of cell-to-cells signaling?



A **Paracrine** — CORRECT

B Autocrine

C Endocrine

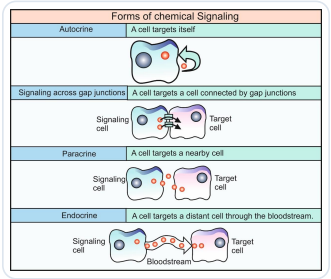
D Merocrine

RIGHT ANSWER

OK **A. Paracrine**

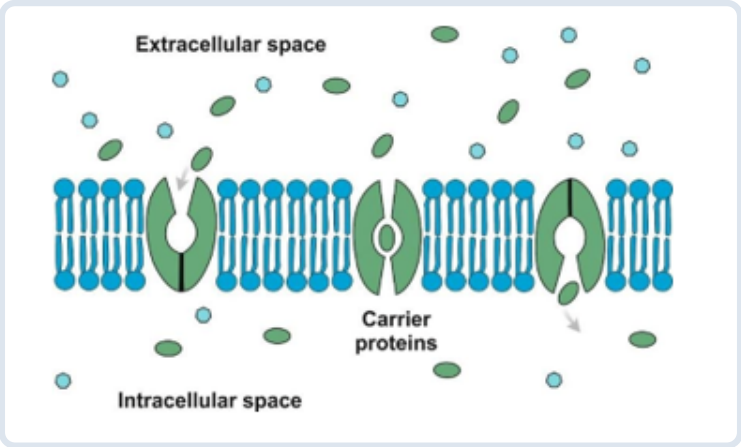
WHY THIS IS RIGHT

Cell secretes signaling molecule
↓
Diffusion through extracellular fluid
↓
Acts on nearby target cells
↓
Local physiological effect



QUESTION

Identify the type of transport across the cell membrane represented below?



A Simple diffusion

B **Facilitated diffusion** CORRECT

C Primary active transport

D Secondary active transport

OK RIGHT ANSWER

B. Facilitated diffusion

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1d” here and does not include a written explanation for this item.

QUESTION

A 25-year-old patient presents with a history of recurrent sinusitis, bronchiectasis, and chronic cough. He also mentions that he has had several ear infections and episodes of pneumonia over the past few years. On physical examination, you note digital clubbing. A chest X-ray is obtained. What is the most likely diagnosis?

A **Kartagener syndrome** — CORRECT

B Cystic fibrosis

C DiGeorge syndrome

D Down syndrome

RIGHT ANSWER

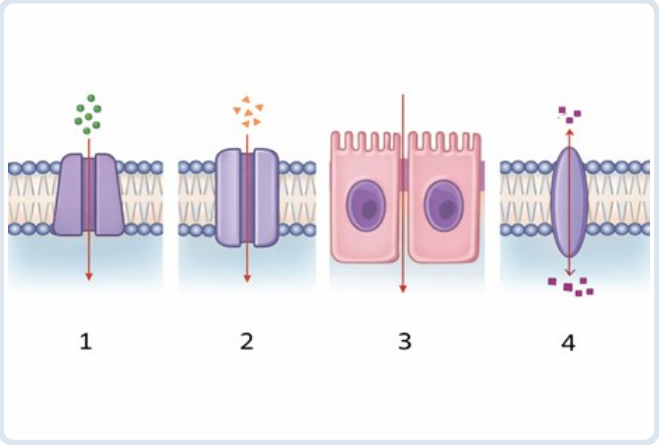
OK **A. Kartagener syndrome**

WHY THIS IS RIGHT

The source quiz contains the placeholder “$1e” here and does not include a written explanation for this item.

QUESTION

Which of the following transport mechanism doesn't require ATP? Select the correct answer



A **1, 2, 3** — CORRECT

B 1, 2, 3, 4

C 2 only

D 3 & 4 only

OK RIGHT ANSWER

A. 1, 2, 3

WHY THIS IS RIGHT

The source quiz contains the placeholder "$1f" here and does not include a written explanation for this item.

QUESTION

Tight junction is located at which part of the cell?

A Apical

B **Apicolateral** CORRECT

C Basal

D Basolateral

RIGHT ANSWER

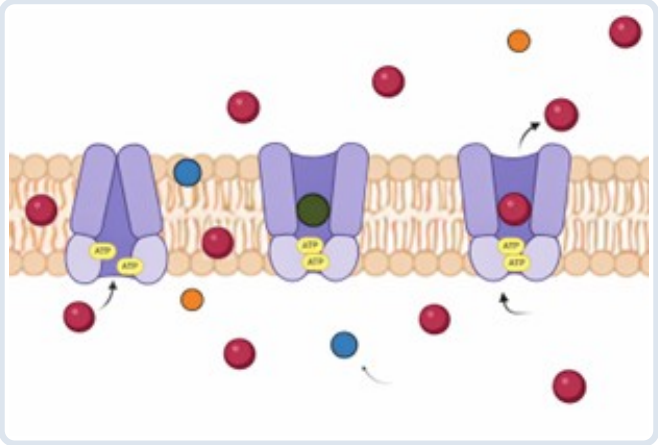
OK **B. Apicolateral**

WHY THIS IS RIGHT

The source quiz contains the placeholder “$20” here and does not include a written explanation for this item.

QUESTION

Identify the type of receptor given below?



A Sodium glucose co transporter-1

B Organic anion transporter-1

C GLUT-4

D **P-glycoprotein pump transporter** CORRECT

OK RIGHT ANSWER

D. P-glycoprotein pump transporter

WHY THIS IS RIGHT

The source quiz contains the placeholder “$21” here and does not include a written explanation for this item.

QUESTION

Which of the following mechanisms is seen in the baroreceptor reflex?

A Feedforward

B Positive feedback

C **Negative feedback** CORRECT

D Adaptive control regulation

OK RIGHT ANSWER

C. Negative feedback

WHY THIS IS RIGHT

The source quiz contains the placeholder “$22” here and does not include a written explanation for this item.

QUESTION

Sour taste is mediated by:

A **TRPV1 Channel** CORRECT

B Metabotropic Receptor

C GPCR T1R1

D GPCR T1R3

RIGHT ANSWER

OK **A. TRPV1 Channel**

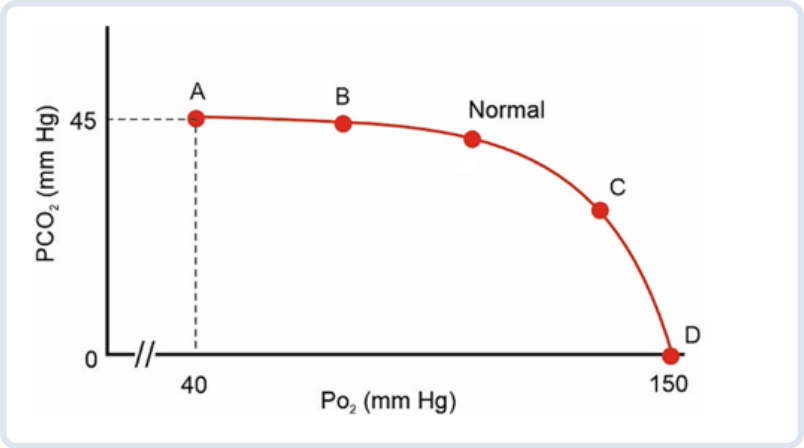
WHY THIS IS RIGHT

Sour taste = H□ ions -> activate ion channels (mainly TRP family like TRPV1) -> depolarization
Sour taste is mediated by proton-sensitive ion channels activated by H□ from acids. TRPV1-related channels respond to acidity and depolarize taste receptor cells. This mechanism is ion channel-based, not GPCR mediated. T1R receptors are involved in sweet and umami, not sour taste.
Acidic food (↑ H□)
↓
H□ interacts with taste receptor cell
↓
Activation of TRPV1 / inhibition of K□ channels
↓
Depolarization
↓
Neurotransmitter release
↓
Gustatory nerve activation

Taste	Receptor type	Key receptor examples
Sweet Umami Bitter	GPCR	TAS1R2 + TAS1R3
Sour	Ion channels-H+	PKD2L1, TRPV1
Salty	Ion channels-Na+	ENaC

QUESTION

In a patient with pulmonary embolism causing complete obstruction of blood flow. Which of the following point on V/Q curve corresponds with given condition?



A Point A

B Point B

C Point C

D **Point D** CORRECT

OK RIGHT ANSWER

D. Point D

WHY THIS IS RIGHT

In pulmonary embolism with complete obstruction of blood flow, the affected lung region receives normal ventilation but zero perfusion, creating alveolar dead space. The V/Q ratio approaches infinity (V/Q -> ∞).

The formula: V/Q = Ventilation/Perfusion = Normal/0 = ∞
At Point D:
• PO□ ≈ 150 mmHg (approaches inspired air PO□)
• PCO□ ≈ 0 mmHg (no CO□ delivered from blood)
• Alveolar gas resembles humidified inspired air
• No gas exchange occurs despite normal ventilation

Pulmonary embolism
↓
Blood flow blocked (Perfusion = 0)
↓
Alveoli still ventilated
↓
No gas exchange possible
↓
Alveolar gas ≈ Inspired air
↓
V/Q -> ∞ (Dead space)
This represents pure dead space ventilation where air enters and exits the alveoli without participating in gas exchange, essentially wasting ventilation.

QUESTION

Which of the following is an example of a feedforward mechanism?

A **Vasoconstriction after exposure to cold** CORRECT

B Increase in heart rate on standing from supine position

C Increase in cardiac output in response to anemia

D Increased vasopressin secretion during dehydration

RIGHT ANSWER

OK

A. Vasoconstriction after exposure to cold

WHY THIS IS RIGHT

The source quiz contains the placeholder “$23” here and does not include a written explanation for this item.