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## **Semen Production & Sperm Maturation**

**Study Guide — Reproductive System**

Pre-med/IB-style questions on semen composition, accessory gland contributions (seminal vesicles, prostate, bulbourethral glands), sperm production vs maturation (seminiferous tubules vs epididymis), and key physiology concepts such as pH, coagulation/liquefaction, capacitation, and ejaculation control.

**50 items — Study Guide with Answers**

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Generated February 20, 2026

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1 Which statement **BEST** distinguishes semen from spermatozoa?

- A Semen is produced only in the seminiferous tubules of the testes.
- B Spermatozoa are the fluid portion of the ejaculate; semen is the male gamete.
- C Semen is a mixture of spermatozoa plus secretions from accessory glands; spermatozoa are the male gamete cells. ✓**
- D Semen is a haploid cell that carries paternal DNA.
- E Spermatozoa are produced mainly by the prostate gland.

► **Explanation:** Semen is the ejaculatory fluid (mainly from accessory glands) that contains sperm cells. Spermatozoa are the male gametes made in the testes; the prostate and other glands add fluid but do not make sperm.



2 In a typical ejaculate, which structure contributes the **LARGEST** share of the semen fluid volume?

- A Seminal vesicles ✓**
- B Prostate gland
- C Bulbourethral (Cowper's) glands
- D Epididymis
- E Seminiferous tubules

► **Explanation:** The seminal vesicles contribute the majority of semen volume in most males. The prostate contributes a substantial but smaller portion, and bulbourethral glands contribute only a small lubricating/neutralizing secretion.



3 Fructose in semen is important because it can be used as an energy source by sperm. Which gland secretes most of this fructose?





- A Prostate gland
- B Seminal vesicles ✓**
- C Bulbourethral glands
- D Testes (Leydig cells)
- E Epididymis

► **Explanation:** Seminal vesicles secrete a fructose-rich fluid that helps fuel sperm metabolism. The prostate contributes enzymes and other components, while bulbourethral glands mainly produce mucus for lubrication and urethral neutralization.

**4** Semen contains prostaglandins that can influence the female reproductive tract. They are produced mainly by the:



- A Seminal vesicles ✓**
- B Epididymis
- C Seminiferous tubules
- D Bulbourethral glands
- E Scrotal skin (dartos muscle)

► **Explanation:** Seminal vesicles are a major source of prostaglandins in semen. Epididymis and seminiferous tubules are involved in sperm maturation/production rather than producing most semen prostaglandins.

**5** A fresh semen sample often coagulates soon after ejaculation and then becomes more liquid again. Which secretion is MOST directly responsible for the later liquefaction?



- A Fructose from seminal vesicles**





- B Proteolytic enzymes (e.g., PSA) from the prostate ✓**
- C Mucus from bulbourethral glands
- D Testosterone from Leydig cells
- E Inhibin from Sertoli cells

► **Explanation:** Liquefaction is driven by proteolytic enzymes from the prostate that break down the initial semen gel. Seminal vesicles contribute many of the gel-forming proteins, while bulbourethral mucus is mainly lubricating.

**6** Which source provides most of the proteins that cause semen to form an initial gel (coagulate) after ejaculation?



- A Seminal vesicles ✓**
- B Prostate gland
- C Bulbourethral glands
- D Epididymis
- E Aortic arch baroreceptors

► **Explanation:** Seminal vesicles provide major gel-forming proteins that make semen coagulate soon after ejaculation. The prostate then contributes enzymes that help liquefy the semen later.

**7** A small amount of clear fluid released before ejaculation can lubricate the urethra and help neutralize residual acidity. This pre-ejaculate is produced mainly by the:



- A Seminal vesicles
- B Prostate gland
- C Bulbourethral (Cowper's) glands ✓**





- D Testes
- E Epididymis

► **Explanation:** Bulbourethral glands secrete a mucus-like fluid that lubricates and helps neutralize the urethra. Seminal vesicles and the prostate contribute the bulk of semen volume during ejaculation.

8 Spermatozoa are produced (spermatogenesis occurs) primarily in the:



- A Epididymis
- B Seminal vesicles
- C Seminiferous tubules of the testes ✓
- D Prostate gland
- E Urethra

► **Explanation:** Spermatogenesis occurs in the seminiferous tubules of the testes. The epididymis mainly matures and stores sperm; accessory glands add fluid to semen but do not produce sperm cells.

9 Most sperm maturation (including gaining motility and being stored) occurs in the:



- A Seminiferous tubules
- B Epididymis ✓
- C Seminal vesicles
- D Prostate gland
- E Urinary bladder





► **Explanation:** Sperm become motile and are stored mainly in the epididymis. They are produced in the seminiferous tubules, and later they still require capacitation in the female tract to achieve full fertilizing capability.

**10** Which statement about sperm leaving the testes (entering the epididymis) is MOST accurate?



- A They are already fully motile and ready to fertilize an egg immediately.
- B They are diploid cells that will become haploid in the epididymis.
- C They are generally non-motile and not yet fully capable of fertilization. ✓**
- D They are produced by the prostate and stored in the testes.
- E They contain no mitochondria until capacitation occurs.

► **Explanation:** Sperm entering the epididymis are typically not yet motile and not fully competent to fertilize. They gain motility and functional maturity in the epididymis, and later undergo capacitation in the female tract.

**11** Which change is a key hallmark of sperm maturation in the epididymis?



- A Sperm undergo meiosis I and II to become haploid.
- B Sperm acquire progressive motility and undergo surface membrane changes that support later fertilization. ✓**
- C Sperm synthesize large amounts of semen fructose for their own energy storage.
- D Sperm develop their acrosome for the first time by budding from the plasma membrane.
- E Sperm replicate their nuclear DNA to prepare for embryonic development.

► **Explanation:** The epididymis is where sperm gain motility and important surface modifications. Meiosis and acrosome formation occur earlier during spermatogenesis/spermiogenesis in the seminiferous tubules, and sperm do not replicate DNA after becoming haploid.





**12** Capacitation is a process that increases a sperm's ability to fertilize an egg. It occurs mainly in the:



- A Seminiferous tubules
- B Epididymis
- C Female reproductive tract after ejaculation ✓
- D Seminal vesicles before ejaculation
- E Prostate gland during semen production

► **Explanation:** Capacitation occurs after ejaculation in the female reproductive tract and prepares sperm for successful interaction with the egg (including the ability to undergo the acrosome reaction). The epididymis matures sperm but does not complete capacitation.

**13** A sperm must release enzymes to penetrate the egg's outer protective layers (especially the zona pellucida). Which event provides this enzyme release?



- A Capacitation
- B Acrosome reaction ✓
- C DNA replication
- D Translation of hemoglobin
- E Synaptic transmission

► **Explanation:** The acrosome reaction releases enzymes from the acrosome that help the sperm penetrate the zona pellucida. Capacitation prepares the sperm to undergo this reaction but is not the enzyme-release event itself.





14 During spermiogenesis, the acrosome forms primarily from the:



- A Golgi apparatus ✓
- B Mitochondria
- C Ribosomes
- D Centrioles only, without any membrane contribution
- E Nuclear envelope

► **Explanation:** The acrosome is a cap-like structure derived largely from the Golgi apparatus in developing spermatids. It stores enzymes needed for the acrosome reaction during fertilization.

15 Which part of a sperm cell contains a high concentration of mitochondria that help supply ATP for movement?



- A Acrosome
- B Nucleus in the head
- C Midpiece ✓
- D Tail tip only
- E Zona pellucida

► **Explanation:** The midpiece contains many mitochondria that support ATP production needed for flagellar movement. The acrosome contains enzymes, and the nucleus contains DNA; the zona pellucida is part of the egg, not the sperm.

16 The basic structural arrangement that allows a sperm flagellum to beat is the axoneme, which typically has a:



- A 1+1 arrangement of microtubules





- B 3+3 arrangement of microtubules
- C 9+2 arrangement of microtubules ✓**
- D Random arrangement of actin filaments only
- E Double-membrane arrangement like mitochondria

► **Explanation:** Most motile cilia and flagella (including sperm tails) have a 9+2 microtubule arrangement. Motor proteins use ATP to generate bending; it is not an actin-only structure.

**17 Why is the blood–testis barrier important for normal spermatogenesis?**



- A It prevents oxygen from reaching developing sperm, forcing anaerobic metabolism.
- B It isolates developing germ cells from immune surveillance and helps maintain a controlled microenvironment. ✓**
- C It allows sperm to enter the bloodstream to reach the prostate.
- D It increases urine acidity to activate sperm enzymes.
- E It is mainly needed to pump testosterone into the brain.

► **Explanation:** Developing sperm express proteins that can appear “new” to the immune system, and the barrier helps protect them while also controlling the fluid environment around them. It does not move sperm into blood or regulate urine acidity.

**18 The blood–testis barrier is formed mainly by:**



- A Tight junctions between Sertoli cells ✓**
- B Gap junctions between Leydig cells
- C Desmosomes between sperm heads
- D Myelin sheaths around seminiferous tubules





**E** Chloroplast membranes

► **Explanation:** Tight junctions between Sertoli cells create the blood–testis barrier. Leydig cells produce testosterone in the interstitial space but do not form the main barrier structure.

**19** Spermatogenesis requires a high local concentration of testosterone within the seminiferous tubules. Which Sertoli-cell product helps achieve this?



- A** Erythropoietin
- B** Androgen-binding protein (ABP) ✓
- C** Renin
- D** Surfactant
- E** Pepsin

► **Explanation:** Sertoli cells secrete androgen-binding protein (ABP), which binds testosterone and helps keep its concentration high near developing sperm. The other options are unrelated to concentrating testosterone in the testes.

**20** Which hormone most directly stimulates Leydig cells to produce testosterone?



- A** FSH
- B** LH ✓
- C** ADH
- D** TSH
- E** Insulin

► **Explanation:** LH stimulates Leydig cells to synthesize testosterone. FSH primarily acts on Sertoli cells to support spermatogenesis, while ADH/TSH/insulin have other main roles.





21 FSH supports sperm production mainly by acting on:



- A Leydig cells to make testosterone
- B Sertoli cells to support developing germ cells ✓
- C Red blood cells to carry oxygen
- D Platelets to initiate clotting
- E Bulbourethral glands to secrete mucus

► **Explanation:** FSH primarily stimulates Sertoli cells, which nourish and support developing sperm and regulate the seminiferous tubule environment. Leydig cells are mainly stimulated by LH.

22 Inhibin released from Sertoli cells mainly provides negative feedback on which hormone?



- A FSH ✓
- B LH
- C ADH
- D Oxytocin
- E Cortisol

► **Explanation:** Inhibin helps regulate sperm production by inhibiting FSH secretion. LH is more directly regulated by testosterone feedback, and the other hormones are not central to spermatogenesis control.

23 A student says: "If blood testosterone is normal, sperm production must be normal." What is the BEST correction?





- A Correct—spermatogenesis depends only on blood testosterone and nothing else.
- B Incorrect—spermatogenesis requires a high LOCAL (intratesticular) testosterone level and Sertoli-cell support, not just normal blood levels. ✓**
- C Incorrect—testosterone prevents spermatogenesis, so normal testosterone should lower sperm production.
- D Correct—FSH and LH do not affect sperm production.
- E Incorrect—sperm are produced in the seminal vesicles, not the testes.

► **Explanation:** Spermatogenesis depends on Sertoli cell function and very high intratesticular testosterone (maintained locally), plus appropriate FSH/LH signaling. Normal blood testosterone alone does not guarantee the local conditions needed inside seminiferous tubules.

**24** Why are the testes located in the scrotum rather than inside the abdominal cavity?



- A To keep them warmer than body temperature so enzymes work faster
- B To keep them slightly cooler than core body temperature, which supports normal spermatogenesis ✓**
- C To protect sperm from oxygen exposure
- D To allow seminal vesicles to attach directly to the testes
- E Because testosterone cannot be produced at core temperature

► **Explanation:** Spermatogenesis functions best at a temperature a few degrees below core body temperature. The scrotum and its muscles help regulate this temperature; testosterone production can still occur at core temperature.

**25** Which pairing correctly matches a structure with its role in testicular temperature regulation?



- A Dartos muscle—raises and lowers the testes by pulling on the spermatic cord





- B Cremaster muscle—wrinkles scrotal skin to reduce heat loss
- C Cremaster muscle—raises the testes closer to the body in cold conditions ✓
- D Seminal vesicle—contracts to move testes away from the body in heat
- E Prostate—acts as a heat exchanger for the scrotum

► **Explanation:** The cremaster muscle can elevate the testes toward the body (helping conserve heat). The dartos muscle wrinkles the scrotal skin to reduce heat loss; seminal vesicles and the prostate are not temperature-regulating muscles.

26 Which sequence correctly traces sperm from the site of production to leaving the body (simplified)?



- A Seminiferous tubules → epididymis → vas deferens → ejaculatory duct → urethra ✓
- B Seminiferous tubules → vas deferens → epididymis → ejaculatory duct → urethra
- C Epididymis → seminiferous tubules → vas deferens → urethra → ejaculatory duct
- D Seminal vesicle → epididymis → prostate → vas deferens → urethra
- E Seminiferous tubules → urethra → epididymis → vas deferens → ejaculatory duct

► **Explanation:** Sperm are produced in seminiferous tubules, mature in the epididymis, travel via the vas deferens, pass through the ejaculatory duct, and exit via the urethra. The other sequences misorder these structures or include glands that do not produce sperm.

27 The ejaculatory duct is formed by the union of the:



- A Ureter and urethra
- B Duct of the seminal vesicle and the vas deferens ✓
- C Epididymis and seminiferous tubules





- D Prostate and bulbourethral glands
- E Aortic arch and carotid sinus

► **Explanation:** The duct of the seminal vesicle joins the vas deferens to form the ejaculatory duct, which empties into the prostatic urethra. The other pairings describe unrelated structures.

28 Which outcome is **MOST** expected after a successful vasectomy?



- A Ejaculate contains no seminal vesicle fluid, so semen volume drops dramatically.
- B Ejaculate contains little or no sperm, but most semen volume remains because accessory glands still secrete fluid. ✓**
- C Testosterone production stops because the vas deferens produces testosterone.
- D Spermatogenesis stops immediately because sperm cannot be made without an open vas deferens.
- E Urine becomes alkaline because sperm normally acidify urine.

► **Explanation:** Vasectomy blocks sperm transport through the vas deferens, so sperm are absent or greatly reduced in the ejaculate. Accessory glands still contribute most of the fluid volume, and testosterone production by Leydig cells continues.

29 After a vasectomy, sperm are still produced in the testes. What happens to most of these sperm?



- A They are excreted in urine through the ureters.
- B They accumulate forever and the testes rapidly swell to several times their size in all cases.
- C They are broken down and reabsorbed (e.g., by cells in the epididymis/testis). ✓**
- D They enter the bloodstream and travel to the lungs for oxygenation.
- E They are converted into seminal vesicle fluid.





► **Explanation:** Sperm continue to be produced but cannot leave via the vas deferens, so they are typically degraded and reabsorbed in the male reproductive tract. They do not normally enter urine via ureters or circulate in blood.

**30** A semen sample has unusually **LOW** volume and very **LOW** fructose, but testicular hormone function appears normal. Which structure is the most likely cause?



- A Seminal vesicles are not contributing normally.** ✓
- B Leydig cells are not producing testosterone.
- C The kidney glomerulus is filtering too much fructose.
- D The epididymis is not storing sperm.
- E The carotid sinus baroreceptors are damaged.

► **Explanation:** Seminal vesicles contribute a large fraction of semen volume and are a major source of fructose. Low fructose with low volume points strongly to reduced seminal vesicle contribution (or obstruction preventing its secretions from reaching the urethra).

**31** A semen sample remains abnormally gel-like and does not liquefy properly after ejaculation. Reduced secretion from which gland best explains this?



- A Seminal vesicles
- B Prostate gland** ✓
- C Bulbourethral glands
- D Adrenal glands
- E Thyroid gland

► **Explanation:** Liquefaction depends largely on proteolytic enzymes from the prostate. If these enzymes are reduced, the semen may remain coagulated/gel-like longer than normal.





32 Semen is typically slightly alkaline overall. Which structure contributes most to this alkalinity?



- A Seminal vesicles ✓
- B Prostate gland
- C Epididymis
- D Ureters
- E Testicular veins

► **Explanation:** Seminal vesicle fluid is relatively alkaline and helps raise the overall pH of semen, supporting sperm survival in the acidic environment of the vagina. Prostatic fluid contributes important enzymes but is not the main source of semen alkalinity.

33 What is the BEST reason semen being slightly alkaline can be beneficial for fertility?



- A It dissolves sperm DNA so the egg can read it more easily.
- B It helps protect sperm and support motility in the acidic environment of the vagina. ✓
- C It prevents capacitation from occurring.
- D It turns sperm into diploid cells.
- E It blocks oxygen from entering sperm cells.

► **Explanation:** The vagina is relatively acidic, which can reduce sperm survival and motility. Slightly alkaline semen helps buffer that acidity and creates a more favorable environment for sperm.





34 Which statement BEST captures the likely purpose of prostaglandins in semen (concept level)?

- A They provide the sperm's nuclear DNA.
- B They can influence contractions and secretions in the female reproductive tract, helping sperm transport. ✓**
- C They are required to make sperm haploid during meiosis.
- D They neutralize stomach acid to allow digestion of semen proteins.
- E They form the sperm tail microtubules.

► **Explanation:** Prostaglandins can affect smooth muscle and secretory activity, which may help move sperm through the female reproductive tract. They do not contain DNA and are not part of meiosis or sperm structure.



35 Which pairing of process and primary nervous control is MOST accurate?

- A Emission (moving semen into urethra) — parasympathetic; Ejaculation (expulsion) — parasympathetic
- B Emission — somatic motor; Ejaculation — endocrine only
- C Emission — sympathetic; Ejaculation (expulsion) — somatic motor reflex (with sympathetic involvement) ✓**
- D Emission — controlled by the kidneys; Ejaculation — controlled by the liver
- E Emission — controlled by the vagus nerve; Ejaculation — controlled by baroreceptors

► **Explanation:** Emission (movement of sperm and gland secretions into the urethra) is primarily sympathetic. Expulsion involves a spinal reflex with somatic motor activation of pelvic muscles, while sympathetic activity also contributes.



36 Which statement about autonomic control is MOST accurate at a basic level?





- A Erection is mainly sympathetic; ejaculation is mainly parasympathetic.
- B Both erection and ejaculation are controlled only by the kidneys.
- C Erection is mainly parasympathetic (NO-mediated vasodilation); ejaculation involves sympathetic and somatic pathways. ✓**
- D Erection requires aldosterone; ejaculation requires ADH.
- E Erection occurs only after capacitation.

► **Explanation:** Erection is largely parasympathetic via vasodilation (commonly linked to nitric oxide). Ejaculation requires sympathetic activity (especially emission) and a somatic reflex for expulsion.

**37** Retrograde ejaculation (semen flowing into the bladder) is most likely if which event fails?



- A Closure of the internal urethral sphincter (bladder neck) during emission ✓**
- B Opening of the ureters during ejaculation
- C Production of sperm in the prostate gland
- D Liquefaction of semen by the seminal vesicles
- E Filtering of semen by the kidneys before ejaculation

► **Explanation:** During emission/ejaculation, the bladder neck (internal urethral sphincter) normally closes to prevent semen entering the bladder. If it does not close, semen can move backward into the bladder (retrograde ejaculation).

**38** The ejaculatory ducts deliver semen into which part of the urinary/reproductive tract?



- A Urinary bladder
- B Ureter





**C Prostatic urethra** ✓

D Epididymis

E Scrotal sac

► **Explanation:** Ejaculatory ducts pass through the prostate and empty into the prostatic urethra, where semen then travels through the urethra to exit the body.

**39** Most mature sperm are stored primarily in the:

A Seminal vesicles

**B Tail of the epididymis** ✓

C Prostate gland

D Urinary bladder

E Bulbourethral glands

► **Explanation:** The epididymis (especially its tail) is the main storage site for mature sperm. Seminal vesicles and the prostate store/produce fluids, not sperm cells.



**40** During emission, sperm are propelled toward the urethra mainly by powerful smooth muscle contractions in the:

**A Vas deferens** ✓

B Ureter

C Seminiferous tubules

D Carotid artery

E Trachea





► **Explanation:** The vas deferens has thick smooth muscle walls and contracts strongly during emission (largely under sympathetic control) to move sperm toward the ejaculatory ducts and urethra.

**41** Which change would most likely **DECREASE** semen volume the **MOST** while leaving sperm production in the testes relatively intact?



- A** Loss or blockage of seminal vesicle secretion ✓
- B** A vasectomy (cutting the vas deferens)
- C** Damage to the sperm tail microtubules
- D** Complete failure of LH secretion
- E** Destruction of Sertoli cells

► **Explanation:** Seminal vesicles contribute the largest fraction of semen volume, so losing their secretion markedly reduces volume. Vasectomy mainly removes sperm from semen but does not remove most fluid; LH/Sertoli failure would impair sperm production rather than primarily volume.

**42** A man has normal spermatogenesis in the testes, but severe epididymal damage prevents normal maturation. Which finding is **MOST** likely?



- A** Semen contains normal volume and many sperm that are often less motile/less functionally mature, reducing fertility. ✓
- B** Semen volume becomes zero because the epididymis makes most semen fluid.
- C** Testosterone level becomes zero because the epididymis produces testosterone.
- D** Sperm become diploid again in the epididymis and cannot fertilize.
- E** Semen becomes strongly acidic because sperm produce hydrochloric acid.

► **Explanation:** The epididymis is crucial for sperm maturation (motility and functional changes). It does not make most semen fluid or testosterone, and it does not change sperm ploidy.





43 Which process occurs primarily in the seminiferous tubules (as part of spermiogenesis), NOT in the epididymis?



- A Acrosome formation on developing spermatids ✓
- B Acquisition of progressive motility
- C Long-term storage of mature sperm
- D Capacitation in preparation for fertilization
- E Major mixing with seminal vesicle fluid

► **Explanation:** Spermiogenesis (including acrosome formation and tail development) occurs in the seminiferous tubules. Motility acquisition and storage occur in the epididymis, while capacitation occurs later in the female tract.

44 Which change is MOST characteristic of sperm capacitation (concept level)?



- A Replication of the sperm's nuclear DNA
- B Removal/alteration of surface coatings (e.g., cholesterol/glycoproteins), increasing membrane responsiveness and enabling the acrosome reaction ✓
- C Conversion of the sperm head into a gel to prevent movement
- D Formation of the sperm's flagellum for the first time
- E Production of semen fructose inside the sperm nucleus

► **Explanation:** Capacitation involves biochemical membrane changes that make sperm more responsive and able to undergo the acrosome reaction (often with hyperactivated motility). DNA replication and flagellum formation occur earlier, and sperm do not synthesize semen fructose.





**45** From a functional perspective, what is a plausible advantage of semen initially coagulating after ejaculation?

- A** It permanently immobilizes sperm so they cannot leave the male body.
- B** It may help retain semen in the female tract temporarily, reducing immediate leakage; later liquefaction allows sperm to swim onward. ✓
- C** It prevents the acrosome reaction by destroying the acrosome.
- D** It makes semen acidic so sperm become activated.
- E** It is required to make sperm diploid again.

► **Explanation:** Initial coagulation can help keep semen in place, and later liquefaction allows sperm to move and progress. The other options contradict basic sperm physiology (coagulation is temporary and does not change ploidy).



**46** A semen sample is unusually watery immediately after ejaculation and fails to form the normal initial gel. Which gland's secretion is most likely reduced?

- A** Seminal vesicles ✓
- B** Prostate gland
- C** Bulbourethral glands
- D** Adrenal cortex
- E** Pituitary posterior lobe

► **Explanation:** Seminal vesicles provide major gel-forming proteins and much of semen volume. Prostate enzymes mainly promote liquefaction later, and bulbourethral glands contribute only a small mucus secretion.



**47** If the seminal vesicles contribute little or nothing to the ejaculate, which pattern is MOST expected?





**A** Greatly reduced semen volume and fructose, with semen tending to be less alkaline; sperm may still be present from the testes. ✓

**B** Normal semen volume but no sperm, because seminal vesicles produce sperm.

**C** Normal fructose but no liquefaction, because fructose is produced by the prostate.

**D** No testosterone production, because seminal vesicles make testosterone.

**E** Sperm become diploid again due to loss of seminal vesicle hormones.

► **Explanation:** Seminal vesicles provide most semen volume, much of its fructose, and contribute to its alkalinity. Sperm are produced in the testes, so sperm may still be present even if seminal vesicle fluid is missing.

**48** Two men have no sperm detected in the ejaculate. Man 1 has normal semen volume and normal fructose. Man 2 has low semen volume and very low fructose. Which interpretation is BEST?



**A** Man 1 is more consistent with ejaculatory duct obstruction; Man 2 with vasectomy.

**B** Man 1 is more consistent with vasectomy; Man 2 with ejaculatory duct obstruction affecting seminal vesicle input. ✓

**C** Both patterns must be identical because accessory glands do not affect semen volume.

**D** Both patterns indicate failure of the blood–testis barrier.

**E** Man 2 is more consistent with increased baroreceptor firing.

► **Explanation:** Vasectomy blocks sperm transport but leaves accessory gland secretions (volume and fructose) largely intact. Ejaculatory duct obstruction can prevent seminal vesicle secretions (major volume/fructose) and sperm from reaching the urethra, reducing volume and fructose.

**49** Where do sperm FIRST mix with most seminal vesicle secretions (simplified anatomy)?



**A** Seminiferous tubules





- B Epididymis
- C Ejaculatory duct (where vas deferens meets seminal vesicle duct) ✓**
- D Ureter
- E Renal pelvis

► **Explanation:** Sperm travel through the vas deferens and then join the duct of the seminal vesicle to form the ejaculatory duct, where seminal vesicle secretions enter the pathway. They do not mix with these secretions in the testes or epididymis.

**50** At puberty, the accessory sex glands enlarge and begin producing much more seminal fluid. This change is driven primarily by increased:



- A Testosterone (and other androgens) ✓**
- B Insulin
- C Thyroxine (T4)
- D Erythropoietin
- E Glucagon

► **Explanation:** Rising androgen levels at puberty stimulate growth and secretory activity of accessory glands (seminal vesicles, prostate, etc.). The other hormones have important roles but are not the primary drivers of male reproductive gland maturation.

