

# BONUS SECTION 6: WHEEL BEARINGS AND SEALS

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## 10 Targeted Practice Questions

1. A customer reports a humming noise from the left front that changes pitch when the steering wheel is turned slightly left or right at highway speed. The noise increases when turning right and decreases when turning left. This behavior is MOST consistent with:

- A. A worn left front CV joint that is sensitive to steering angle changes
- B. A failing left front wheel bearing — the lateral load shift during cornering changes the load on the damaged bearing, altering the noise intensity
- C. A left front brake caliper that is making intermittent contact with the rotor under lateral g-forces
- D. A loose left front wheel that is shifting slightly on the hub during cornering maneuvers

2. A non-serviceable (sealed) unitized hub bearing assembly differs from a traditional adjustable tapered roller bearing in that:

- A. The sealed unit uses ball bearings instead of tapered rollers and cannot be used on heavy-duty applications
- B. The sealed unit is a complete assembly that is replaced as a single unit — it cannot be cleaned, repacked, or adjusted and has no user-serviceable components
- C. The sealed unit does not require a specific torque specification for the axle nut since the bearing preload is set internally at the factory
- D. The sealed unit cannot be used on driven axles and is limited to non-driven front wheels on front-wheel-drive vehicles

3. A technician is adjusting a traditional tapered roller front wheel bearing on a rear-wheel-drive vehicle. After adjusting to zero preload with no end play, the correct final adjustment is to:

- A. Tighten the adjusting nut an additional 1/4 to 1/2 turn past zero end play to set a slight preload
- B. Back off the adjusting nut slightly until a small amount of end play is felt — typically 0.001 to 0.005 inches — then install the cotter pin
- C. Leave the bearing at exactly zero end play and torque the adjusting nut to 50 ft-lbs before installing the cotter pin
- D. Back off the adjusting nut exactly one full turn from snug and install the cotter pin in the nearest available hole

4. A leaking rear axle seal on a rear-wheel-drive vehicle with semi-floating axles allows gear oil to migrate outward along the axle shaft. This gear oil MOST commonly contaminates which brake component?

- A. The rear wheel cylinder, causing piston seal failure
- B. The rear brake shoe linings, dramatically reducing their coefficient of friction
- C. The rear brake line near the axle flange, degrading the rubber hydraulic hose
- D. The rear caliper piston boots, causing swelling and caliper seizure

5. A technician is replacing a front wheel bearing on a vehicle with a separate hub and bearing assembly pressed into the steering knuckle. After pressing the new bearing in, the technician should verify:

- A. That the bearing outer race is fully seated against the knuckle bore shoulder with no gap visible
- B. That the bearing spins freely with no drag since any resistance indicates incorrect installation
- C. That the bearing grease has not been displaced during pressing by checking for grease at the seal lips
- D. That the bearing inner race can be rotated independently from the outer race to confirm proper roller alignment

6. A vehicle with a front-wheel-drive transaxle has a failing inner CV joint on the right front axle shaft. This condition would affect braking because:

- A. A failing inner CV joint reduces power transfer, causing the right front wheel to spin freely during braking
- B. A severely worn or failed inner CV joint can allow the axle shaft to shift laterally, affecting the relationship between the rotor and caliper
- C. Inner CV joint failure does not affect braking — it only affects power delivery and may produce clunking during acceleration
- D. The inner CV joint boot retains grease that lubricates the wheel bearing, and boot failure leads to bearing failure that affects braking

**7.** A technician installs a new front wheel bearing and hub assembly and torques the center axle nut to specification. After torquing, the technician checks for wheel bearing end play and finds 0.008 inches of end play. The correct action is:

- A. Accept the end play since 0.008 inches is within the typical tolerance for sealed hub assemblies
- B. Tighten the axle nut further to eliminate the end play — sealed hub assemblies should have zero measurable end play when properly torqued
- C. Replace the hub bearing assembly since the presence of end play after torquing indicates a defective unit
- D. Install a thicker axle nut washer to take up the end play without changing the torque value

**8.** A wheel bearing that produces a growling or rumbling noise that is constant and does not change with steering input or load changes is MOST consistent with:

- A. A front wheel bearing since front bearings are more sensitive to steering angle changes
- B. A rear wheel bearing — rear bearings carry primarily radial loads without the lateral load changes that affect noise intensity in front bearings
- C. A worn CV joint that produces a consistent noise under all driving conditions
- D. A brake rotor that has developed a rough surface texture producing a continuous grinding sound

**9.** When replacing a rear axle seal on a semi-floating rear axle, the technician must remove the axle shaft to access the seal. After installing the new seal, the technician should also inspect:

- A. The parking brake cable routing since axle removal can disturb the cable bracket position
- B. The axle shaft bearing that is pressed onto the axle shaft just inboard of the axle flange for wear or damage since seal failure often accompanies bearing deterioration
- C. The differential fluid for metal contamination since a failed bearing always leaves debris in the differential
- D. The brake line routing along the axle housing since axle shaft removal requires disconnecting the brake line

**10.** A customer reports a clicking noise from the right front that occurs only during low-speed turns and disappears at highway speed or when driving straight. The MOST likely cause is:

- A. A failing right front wheel bearing that is most loaded during low-speed cornering

- B. A worn or dry right front outer CV joint that produces clicking under the high angularity of low-speed tight turns
- C. A right front brake pad anti-rattle clip that shifts during cornering and contacts the rotor
- D. A loose right front lug nut allowing the wheel to shift slightly during turning maneuvers.

# BONUS SECTION 6 — ANSWERS AND EXPLANATIONS

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**1. B** — Failing left front wheel bearing changing under lateral load — A worn wheel bearing that makes noise when turning in one direction but not the other is a classic diagnostic pattern. When turning right, the vehicle's weight shifts to the left, loading the left front bearing more heavily and increasing the noise. When turning left, weight shifts away from the left front bearing, reducing its load and decreasing the noise intensity.

**2. B** — Replaced as a complete sealed unit with no serviceable components — Unitized hub bearings are manufactured with precise internal preload set at the factory and sealed for life. They contain no grease fitting, no adjusting nut, and no serviceable rollers. When they fail, the entire assembly is unbolted from the steering knuckle or pressed out of the knuckle and replaced as a single unit. There is no provision for rebuilding, adjusting, or repacking these bearings in the field.

**3. B** — Back off to 0.001–0.005 inches end play — Tapered roller wheel bearings on non-driven axles require a small amount of end play after final adjustment. Zero end play or preload causes rapid heat buildup and early bearing failure. The specified end play of 0.001 to 0.005 inches provides the correct running clearance to accommodate thermal expansion during normal operation while preventing excessive looseness that would allow rotor wobble.

**4. B** — Rear brake shoe linings — Rear axle seal failure allows differential gear oil to flow outward along the axle shaft and onto the brake backing plate, where it contacts the brake shoe lining surfaces. Even a small amount of oil on the lining dramatically reduces the coefficient of friction, causing unpredictable, grabby, or near-zero rear braking. The shoes and drum must be cleaned or replaced and the seal repaired before the vehicle is safe to drive.

**5. A** — Outer race fully seated against knuckle bore shoulder — When pressing a bearing into a knuckle, the outer race must be driven squarely to the bottom of the bore until it contacts the knuckle's internal shoulder. Any gap between the outer race and the shoulder indicates incomplete installation. A bearing that is not fully seated will move slightly under cornering loads, causing noise, vibration, and rapid bearing damage.

**6. C** — Inner CV joint failure does not directly affect braking — The inner CV joint transmits torque between the transaxle and the axle shaft but has no direct connection to the braking system. A worn inner joint produces vibration or clunking during acceleration and deceleration but does not create a condition that directly degrades hydraulic brake function. Wheel bearing integrity and brake hardware are separate from CV joint condition.

**7. B** — Tighten axle nut further to eliminate end play — Sealed unitized hub bearing assemblies are designed to have zero measurable end play when the center axle nut is properly torqued. The axle nut torque is what sets the bearing preload internally and clamps the assembly to the knuckle.

End play after torquing means either the torque specification was not achieved or the nut was not properly seated. The nut should be tightened to the full specified torque.

**8. B** — Rear wheel bearing with constant radial load — Rear wheel bearings on most vehicles carry primarily vertical (radial) load with minimal changes in lateral load during normal straight driving. A damaged rear bearing produces a consistent, directionally-insensitive growl that does not vary significantly with minor steering inputs. This constant noise pattern helps distinguish a rear bearing from a front bearing, which almost always changes intensity with steering input due to lateral load variation.

**9. B** — Inspect the axle shaft bearing for wear — The inner axle shaft bearing on a semi-floating rear axle is pressed onto the axle shaft and supports the axle within the axle housing. Axle seal failure often occurs in conjunction with bearing wear because a worn or rough bearing seat creates an uneven surface that accelerates seal lip deterioration. Replacing only the seal without inspecting the bearing frequently results in a repeat seal failure within a short service interval.

**10. B** — Worn outer CV joint clicking under high angularity — Clicking during low-speed tight turns is the textbook symptom of a worn outer CV joint. The outer joint operates at its maximum angularity during tight low-speed turns. A worn joint with insufficient grease or damaged ball grooves cannot smoothly transfer torque at high angles, producing a rhythmic click with each revolution that disappears at highway speed where the joint operates at low angularity.

# BONUS SECTION 7: DISC BRAKE CALIPERS, PADS, AND HARDWARE

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## 10 Targeted Practice Questions

1. A technician is replacing front disc brake pads and finds the inboard pad on the left front is worn to 2mm while the outboard pad on the same caliper is worn to 8mm. The MOST likely cause of this uneven pad wear is:

- A. A warped rotor pushing the inboard pad away from the rotor on each revolution
- B. A seized or corroded caliper piston that is not retracting fully after brake release, keeping the inboard pad in continuous contact with the rotor
- C. Incorrect pad installation on the previous service — the thicker outboard pad was installed on the inboard side
- D. The caliper bracket is bent, shifting the caliper inboard and causing preferential inboard pad contact

2. When installing new disc brake pads, a technician applies brake lubricant (caliper grease) to the pad backing plates before installation. The technician should be careful to:

- A. Apply grease liberally to the entire backing plate surface to ensure full coverage and noise suppression
- B. Apply a thin coat only to the metal-to-metal contact points between the pad backing plate and the caliper piston face and caliper fingers — never allowing grease to contact the friction material
- C. Apply grease only to the outboard pad since the inboard pad contacts the piston which is self-lubricating with brake fluid
- D. Avoid all lubrication of the backing plates since any lubricant near the brake caliper creates a fire hazard

3. A technician is replacing brake pads on a vehicle with a fixed opposed-piston caliper. This caliper type has multiple pistons on both sides of the rotor. When compressing the pistons for pad removal, the technician must:

- A. Compress all pistons simultaneously using a single large compression tool that spans the full caliper width

B. Compress each piston individually on both the inboard and outboard sides, using a small piston compression tool or wooden dowel

C. Open the bleeder screw before compressing each piston to allow displaced fluid to exit rather than returning to the reservoir

D. Remove the caliper from the vehicle before attempting piston compression since fixed calipers cannot be compressed in place

4. A disc brake caliper slide pin boot that is torn or missing allows:

A. Brake fluid to leak from the caliper since the boot seals the hydraulic chamber

B. Moisture and road debris to contact the slide pin, causing corrosion that prevents the caliper from sliding freely and results in uneven pad wear

C. The slide pin to fall out of the caliper bracket during hard braking maneuvers

D. Air to enter the hydraulic circuit through the exposed slide pin bore

5. A vehicle has all four brake pads replaced. Six months later, the right rear inboard pad is worn to 1mm while the right rear outboard pad measures 9mm. The right rear caliper slides freely on the pins. The MOST likely cause is:

A. The right rear brake hose is internally collapsed, trapping pressure and keeping the caliper applied

B. The right rear caliper piston is seized and not retracting, maintaining constant inboard pad contact with the rotor

C. The right rear proportioning valve port is stuck open, delivering excessive pressure to the right rear

D. The right rear rotor has excessive lateral runout, forcing the inboard pad outward on each revolution

6. Anti-squeal shims are installed between the brake pad backing plate and the caliper piston. Their primary function is to:

A. Increase the clamping force of the caliper on the rotor by adding spring tension to the piston contact

B. Prevent direct metal-to-metal contact between the pad backing plate and caliper piston, damping the high-frequency vibrations that produce brake squeal

C. Protect the caliper piston seal from the heat generated at the pad-rotor interface during hard braking

D. Center the brake pad laterally in the caliper bracket to prevent edge contact with the rotor

7. A customer reports a rattling noise from the front brakes during driving over rough roads that disappears when the brake pedal is lightly pressed. The MOST likely cause is:

A. Worn caliper slide pin bushings allowing excessive caliper movement over road imperfections

B. Missing, broken, or improperly installed brake pad anti-rattle clips or hardware that normally hold the pads against the caliper bracket under spring tension

C. Loose caliper mounting bolts allowing the caliper body to vibrate against the bracket

D. Brake pads with worn backing plates that have lost their retention tabs

8. A technician is replacing brake pads on a vehicle and finds the caliper bracket pad contact channels have a thin layer of surface rust. The brake pads slide in the channels but with noticeable resistance. The correct preparation before installing new pads is to:

A. Apply a heavy coat of caliper slide grease to the channels to lubricate the pad movement and override the rust resistance

B. Clean the channels with a wire brush to remove all rust and corrosion, restore smooth metal surfaces, then apply a thin coat of approved brake lubricant to the contact areas

C. Lightly sand the pad edges with sandpaper to reduce their width slightly so they slide more easily in the corroded channels

D. Replace the caliper bracket since corroded channels cannot be adequately cleaned and will cause pad hang-up again immediately

9. A vehicle with high-performance fixed calipers has brake pads that must be replaced. The technician finds there is no bleeder screw accessible from the normal position. This is because:

A. Fixed calipers on performance applications are sealed units that do not require bleeding

B. High-performance fixed calipers often have the bleeder screws on the top of the caliper body rather than on the side, requiring the technician to locate them at the highest point of the caliper

C. The bleeder screws are located inside the wheel well on the caliper bridge and are only accessible with the wheel removed and a specialized angled wrench

D. Performance brake systems use a pressure-only design that eliminates bleeder screws entirely

**10.** A technician completes a front brake pad replacement and during the test drive notices a high-pitched squealing noise under light braking that was not present before the service. The caliper slides are free and the pads are correctly installed. The MOST likely cause is:

A. The new pads have a higher friction rating than the originals and the caliper cannot apply enough force to dampen their vibration

B. The anti-squeal shims from the old pads were reused without cleaning or replacement and are no longer providing adequate vibration damping

C. The new pads were not bedded in properly and the friction material surface is still too smooth to resist vibration

D. The brake rotor surface finish from the machining is too smooth, creating a resonance condition with the new pad material

# BONUS SECTION 7 — ANSWERS AND EXPLANATIONS

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**1. B** — Seized caliper piston not retracting — When only the inboard pad wears excessively while the outboard pad remains thick, the caliper piston is the culprit. The piston pushes the inboard pad against the rotor during braking but fails to fully retract when hydraulic pressure releases. The inboard pad remains in light contact continuously, wearing rapidly while the outboard pad, which is moved only by caliper body sliding, sees far less contact time.

**2. B** — Thin coat on metal contact points only — Brake lubricant prevents metal-to-metal noise and corrosion at the interface between the pad backing plate and caliper piston face and caliper body fingers. It must never contact the friction material surface since even a microscopic amount of grease on the pad face dramatically reduces braking effectiveness and causes grabbing or pulling. Precision application is critical.

**3. B** — Compress each piston individually on both sides — Fixed calipers have pistons on both sides of the rotor. To install new pads, all pistons on both sides must be pushed back into their respective bores. Each piston is compressed individually. Opening the bleeder screw during this process prevents displaced fluid from returning to the reservoir and potentially overflowing, though it is not required if the reservoir level is watched carefully.

**4. B** — Moisture and debris cause corrosion and binding — The slide pin boot is a protective rubber sleeve that seals out road contamination from the precision-machined slide pin bore. Without this protection, water and road salt accelerate corrosion on the pin surface, creating friction and binding that prevents the caliper from freely centering on the rotor. The result is one pad wearing faster than the other and potential brake drag.

**5. B** — Seized caliper piston maintaining constant contact — Free-sliding caliper pins rule out a slide pin problem. With the slides confirmed free, uneven pad wear with the inboard worn significantly more than the outboard points directly to the piston. A seized piston that cannot retract keeps the inboard pad in continuous contact, consuming it rapidly while the outboard pad, which is applied only when the caliper body slides in response to piston movement, sees proportionally less wear.

**6. B** — Dampen high-frequency vibrations causing squeal — Brake squeal is caused by resonant vibration between the pad and rotor at specific frequencies. Anti-squeal shims are layered metal and rubber or polymer composites that interrupt the vibration transmission path between the piston and the pad backing plate. By absorbing and dissipating these micro-vibrations, the shims prevent them from building into the audible resonance that produces squeal.

**7. B** — Missing or damaged anti-rattle clips or hardware — Brake pads are held snugly against their caliper bracket contact points by spring clips or integrated spring tangs on the pad backing plate. When this hardware is missing, broken, or not properly installed during the previous service,