Prepare yourself for ASE testing with these questions on BRAKES

NOTE: The following questions are written in the ASE style. They are similar to the kinds of questions that you will see on the ASE test. However, none of these questions will actually appear on the test.

1. On a car with disc/drum brakes, the front brakes grab quickly when light pedal pressure is applied. This problem could be caused by a bad:
   A. proportioning valve
   B. pressure safety switch
   C. metering valve
   D. residual check valve

2. The driver of a vehicle with power disc/drum brakes says that the brake pedal moves slowly to the floor while maintaining pedal pressure at a stoplight. What could cause this problem?
   A. leaking primary piston cup in master cylinder
   B. leaking power brake booster
   C. leaking residual check valve in master cylinder
   D. internal leak in the combination valve

3. Which of the following would MOST LIKELY happen if the measurements taken from the check shown above varied from the manufacturer’s specifications?
   A. noisy brake operation
   B. brake grab or pull
   C. pulsating brake pedal
   D. low brake pedal

4. What is the purpose of the master cylinder residual check valve(s) on vehicles equipped with drum brakes?
   A. allows the driver to pump up the brakes
   B. prevents air from entering the hydraulic system
   C. prevents wheel lockup by reducing the hydraulic pressure
   D. reduces pedal pulsation by controlling hydraulic pressure

5. A technician has just overhauled the front brakes on a vehicle with front disc and rear drum brakes. However, when he attaches a pressure bleeder (pressurized to about 25 psi) to the master cylinder, he cannot get any fluid to come out of the disc brake caliper bleeder screws. Which of the following is MOST LIKELY the cause?
   A. bad proportioning valve
   B. bad pressure differential valve
   C. proportioning valve release button not activated
   D. metering valve release button not activated

6. On a vehicle with single piston floating caliper front disc brakes, the brake pads on the left side of the vehicle are almost completely worn while the right side is almost new. Technician A says that too much rotor runout could be the cause. Technician B says that a binding caliper piston could be the cause. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

7. What is the purpose of the bar that is being removed from the brake assembly shown below?
A. to equalize the braking force between the shoes during normal braking
B. to center the shoes after each brake application
C. to force the shoes into the drum when the parking brakes are applied
D. to reduce the distance between the shoes and the drum

8. A hydraulic brake line is leaking. Which of the following is the correct repair procedure?
   A. Cut out the bad section and replace with new steel tubing using compression fittings.
   B. Replace the leaking line with double-flared, seamless copper tubing.
   C. Cut out the bad section and replace with single-flared steel tubing using flare nuts and unions.
   D. Replace the leaking line with double-flared steel tubing.

9. The set-up shown above is used to check:
   A. rotor parallelism
   B. wheel bearing adjustment
   C. rotor lateral runout
   D. rotor face wear

10. Which of the following problems would be caused by using a residual check valve in a disc brake master cylinder?
    A. reduced brake pedal travel
    B. reduced brake system pressure
    C. increased brake pad wear
    D. increased rotor runout

11. A customer complains that their vehicle pulls to the right when the brakes are applied. Technician A says a restricted brake line to the left caliper can cause this problem. Technician B says a malfunctioning proportioning valve is probably the cause. Who is right?
    A. Technician A only
    B. Technician B only
    C. Both A and B
    D. Neither A or B

12. With foot pressure applied, the brake pedal on a vehicle with vacuum assisted power brakes moves down slightly when the engine is started. Technician A says that this condition can be caused by a leaking power brake booster diaphragm. Technician B says that the cause could be a faulty power brake booster check valve. Who is right?
    A. Technician A only
    B. Technician B only
    C. Both A and B
    D. Neither A or B

13. Technician A says that the tool shown above is used to adjust the brake shoes. Technician B says that the tool shown above is used to determine the inside diameter of the drum. Who is right?
    A. Technician A only
    B. Technician B only
    C. Both A and B
    D. Neither A or B
14. The hydraulic system on a vehicle with integral ABS is to be bled. Technician A says that the front brakes can be bled in a conventional manner. Technician B says that both front and rear brakes can only be bled using the pressure from a fully charged accumulator. Who is right?
   A. Technician A only  
   B. Technician B only  
   C. Both A and B  
   D. Neither A or B

15. A driver complains that the ABS system on his car engages every time he applies the brakes on a cobblestone roadway he uses going back-and-forth to work. This condition means that:
   A. The system is operating normally.  
   B. The wheels are traveling at different speeds.  
   C. A wheel speed sensor(s) is faulty.  
   D. both A and B

16. Two technicians are discussing the duo-servo type drum brake design. Technician A says the brake lining on the secondary shoe is usually longer and thicker than the brake lining on the primary shoe. Technician B says the primary shoe is installed toward the rear of the vehicle. Who is right?
   A. Technician A only  
   B. Technician B only  
   C. Both A and B  
   D. Neither A or B

17. All of the following statements about leading-trailing type drum brakes are true EXCEPT:
   A. The leading shoe does most of the forward braking.  
   B. Both brake shoes are held against a fixed anchor on the backing plate.  
   C. They are self-energizing.  
   D. The trailing shoe does most of the reverse braking.

18. Technician A says that DOT 5 brake fluid has a lower boiling point than DOT 4. Technician B says that DOT 4 brake fluid is silicone-based and should never be used in an ABS system. Who is right?
   A. Technician A only  
   B. Technician B only  
   C. Both A and B  
   D. Neither A or B

19. Brakes that drag or fail to release can be caused by which of the following conditions in the master cylinder?
   A. leaking primary cup  
   B. leaking secondary cup  
   C. failure of the residual pressure check valve  
   D. clogged compensating port

20. All of the following could cause a hard brake pedal on a vehicle with power brakes EXCEPT:
   A. an engine with the valves adjusted too tight  
   B. brake fluid on the linings  
   C. a leak in the brake hydraulic system  
   D. a frozen caliper

21. Technician A says that a caliper seal installed in the caliper bore is called a stroking seal. Technician B says that when the brake pedal is released, the piston in the caliper moves back in its bore due to the action of the piston seal. Who is right?
   A. Technician A only  
   B. Technician B only  
   C. Both A and B  
   D. Neither A or B

22. When replacing disc brake pads, you must bottom the caliper piston in its bore to create room for the new pads. Which of the following is the proper procedure?
   A. Use a C-clamp or pliers to slowly bottom the piston in the caliper.  
   B. Remove half the fluid from the master cylinder reservoir, then use a C-clamp or pliers to slowly bottom the piston in the caliper.  
   C. Connect a hose to the caliper bleeder screw and insert the other end of the hose into a suitable container, open the bleeder screw, then use a C-clamp or pliers to slowly bottom the piston in the caliper.  
   D. Remove the caliper from the vehicle, then use a C-clamp or pliers to slowly bottom the piston in the caliper.

23. Technician A says that all 3-channel ABS systems use only 3 wheel speed sensors. Technician B says that a 4-channel ABS system means that fluid pressure is independently regulated to each of the wheels during an ABS stop. Who is right?
   A. Technician A only  
   B. Technician B only  
   C. Both A and B  
   D. Neither A or B
24. Technician A says that when a rotor is machined, an equal amount of material must always be removed from both sides. Technician B says that the minimum thickness dimension cast into the rotor is the dimension that the rotor can be machined to. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

25. The purpose of an anti-lock brake system is to maintain tire (wheel) slip at what level?
   A. a level between 50-75%
   B. 100%
   C. 0%
   D. a level between 10-20%

26. While on a road test, a technician notices that the rear wheels lock up and the car skids when attempting to stop quickly from a high speed. The MOST LIKELY cause of this problem is a defective:
   A. residual pressure check valve
   B. pressure differential valve
   C. metering valve
   D. proportioning valve

27. Excessive slack in the parking brake cables can be eliminated on most vehicles by making an adjustment at the:
   A. equalizer
   B. star wheel adjusters
   C. strut rod
   D. pushrod

28. A customer complains that the brake warning light comes on whenever the brake pedal is depressed while driving. All of the following could cause this to occur EXCEPT:
   A. a leak in the rear half of the hydraulic system
   B. a short to ground in the warning light circuit
   C. a leak in the front half of the hydraulic circuit
   D. a leaking pressure differential switch

29. The MOST common cause for premature front brake pad wear in a disc/drum system is:
   A. seized calipers
   B. faulty master cylinder
   C. improperly adjusted rear shoes
   D. malfunctioning metering valve

30. Technician A says that DTCs can be accessed from any ABS system using flash diagnostics. Technician B says that ABS system tests can be performed with a bi-directional scan tool. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

31. To determine if an intermittent ABS problem is related to an erratic wheel speed sensor signal, which of the following should be used?
   A. ohmmeter
   B. voltmeter
   C. scan tool
   D. digital storage oscilloscope

32. A few minutes after the engine was turned off on a vehicle with vacuum power assist, the brake pedal is applied and it is hard to push. Technician A says that this is a normal condition. Technician B says that the booster check valve is leaking. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

Prepare yourself for ASE testing with these questions on BRAKES.
33. The above measurement is made when replacing all of the following components EXCEPT:
   A. master cylinder
   B. vacuum power booster
   C. brake caliper
   D. master cylinder pushrod

34. During a brake inspection, an area of the vacuum brake booster below the master cylinder is found to be damp. Technician A says that this is a normal condition. Technician B says that any evidence of fluid indicates a leak and the master cylinder must be replaced. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

35. Technician A says that tapered roller bearings can be adjusted using a torque wrench. Technician B says that tapered roller bearings are adjusted using a dial indicator. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

36. All of the following could cause a pulsation to be felt in the brake pedal EXCEPT:
   A. brake drum out of round
   B. normal ABS operation
   C. lateral rotor runout
   D. seized caliper piston

37. Technician A says that, when testing a proportioning valve, the pressure at the outlet port to the rear brakes should rise at a faster rate, once transition pressure is reached. Technician B says that vehicles with diagonally-split hydraulic systems must have the proportioning valve tested twice. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

38. All of the following disc brake rotor measurements can be performed using a micrometer EXCEPT:
   A. parallelism
   B. thickness
   C. runout
   D. taper

39. Which of the following disc brake caliper designs usually allow the brake pads to be removed without removing the caliper?
   A. fixed
   B. floating
   C. sliding
   D. all of the above

40. After applying the brake pedal several times to deplete the fluid reserve in the accumulator of a Hydro-Boost system, a technician applies the brake pedal with moderate pressure and starts the engine. What should the technician feel at the pedal if the Hydro-Boost system is operating properly?
   A. The pedal should initially rise before moving downward.
   B. The pedal should initially move downward before rising up.
   C. The pedal should move downward.
   D. The pedal should rise.
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41. All of the following can cause disc brake squeal EXCEPT:
   A. loose or missing anti-rattle springs
   B. grease on the linings
   C. glazed linings
   D. dirt embedded in the linings

42. Technician A says that when rebuilding a caliper with a stroking seal, the condition of the caliper bore surface is critical. Technician B says that when rebuilding a caliper with a fixed seal, the condition of the piston surface is the most important consideration. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

43. All of the following can cause a vehicle to pull to one side when the brakes are applied EXCEPT:
   A. seized caliper piston
   B. worn strut rod bushings
   C. blocked master cylinder compensating port
   D. brake fluid soaked linings

44. Technician A says that ABS wheel speed sensor gap should be adjusted with a non-magnetic feeler gauge. Technician B says that a paper spacer can be used to adjust ABS wheel speed sensor gap but the paper must be removed before the vehicle is operated. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

45. When discussing wheel bearings, all of the following statements are true EXCEPT:
   A. Tapered wheel bearings are most commonly used on drive axles.
   B. Sealed ball bearings are not adjustable.
   C. A new grease seal should be installed when bearings are repacked.
   D. The races on tapered wheel bearings cannot be interchanged.

46. All of the following could cause the parking brake to not hold a vehicle on a grade EXCEPT:
   A. seized cables
   B. excessive rear brake shoe-to-drum clearance
   C. seized wheel cylinder
   D. broken parking brake linkage

47. To determine the serviceability of a brake drum, all of the following should be checked EXCEPT:
   A. diameter
   B. minimum thickness
   C. out-of-roundness
   D. taper wear

48. A vehicle's brake pedal is pumped rapidly 20 times and then held down. The master cylinder cover is then removed and when the pedal is released, a geyser is seen coming from the reservoir. Technician A says that this indicates that air is trapped in the system. Technician B says that this means that fluid is being forced out of the cylinder bore through the compensating ports and is normal master cylinder operation. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

49. Technician A says that RWAL ABS systems must be diagnosed using a scan tool. Technician B says that the ABS warning light will only come on when there is a fault in the system. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

50. Technician A says that any imperfection found in a phenolic caliper piston warrants replacement. Technician B says that a phenolic caliper piston should be protected with a block of wood when installing it into the caliper bore with a C-clamp. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B
51. Which of the following should be used to measure the thickness of a scored rotor?
A. vernier caliper  
B. outside micrometer with flat anvil and spindle  
C. inside micrometer  
D. outside micrometer with pointed anvil and spindle

52. During routine vehicle maintenance, the fluid level in the master cylinder reservoir is checked. When the reservoir cap is removed, purple colored fluid is found in the reservoir. Technician A says that this means the fluid should be topped off with DOT 4, which has a higher boiling point than regular brake fluid. Technician B says that this means that the fluid is contaminated; all rubber parts in the system must be replaced and the system flushed. Who is right?
A. Technician A only  
B. Technician B only  
C. Both A and B  
D. Neither A or B

53. A complete front brake service has just been performed on a vehicle with disc brakes: rotors turned, calipers rebuilt, new brake pads, bearings repacked and adjusted. However, when the vehicle is road tested, a pulsation can be felt through the pedal. Which of the following is the MOST LIKELY cause of the pulsation?
A. non-directional finish not applied to rotors  
B. wrong lining compound chosen  
C. over-torqued lug nuts  
D. incorrect bleeding sequence

54. Brake fluid leaking from a cracked brake line causes the brake light on the dashboard to come on in response to the loss of hydraulic pressure. Which of the following valves in the hydraulic system switched on the light?
A. metering valve  
B. pressure differential valve  
C. proportioning valve  
D. residual check valve

55. Technician A says that an integral ABS system is an add-on system. Technician B says that a non-integral ABS system is a high-pressure system. Who is right?
A. Technician A only  
B. Technician B only  
C. Both A and B  
D. Neither A or B

56. The diameter of drums mounted on the same axle should measure within how many thousands of an inch of one another?
A. 0.001  
B. 0.005  
C. 0.010  
D. 0.020

57. Absorption of 3% moisture can reduce the boiling point of DOT 3 brake fluid by what percentage?
A. 10%  
B. 20%  
C. 25%  
D. 50%

58. All of the following are procedures for removing air from a hydraulic system EXCEPT:
A. bench bleeding  
B. power bleeding  
C. manual bleeding  
D. vacuum bleeding

59. All of the following can be used to apply a non-directional finish to a disc brake rotor EXCEPT:
A. sanding block  
B. fine file  
C. lathe attachment  
D. sanding disc

60. All of the following can cause a problem in the Hydro-Boost system EXCEPT:
A. loose power steering pump belt  
B. leaking power steering hoses  
C. low power steering pump pressure  
D. leaking check valve

61. A customer says that he has just replaced his front disc brake pads himself and now the ABS warning light is on. Which of the following could be the cause?
A. damaged wheel speed sensor  
B. incorrect wheel speed sensor gap  
C. stuck ABS solenoid valve  
D. all of the above
62. Drum brake drag can be caused by all of the following EXCEPT:
   A. frozen parking brake cables
   B. frozen star wheel
   C. restricted brake hose
   D. swelled wheel cylinder cups

63. Technician A says the type of fitting shown above is common to all brake systems. Technician B says the flare shown was formed with an inverted flaring tool. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

64. Technician A says the rear brake shoes should be properly adjusted before adjusting the parking brake. Technician B says the parking brake lever should be disengaged before adjusting the equalizer. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

65. Which of the following should be used to clean a disc brake rotor after it is machined?
   A. compressed air
   B. solvent tank
   C. soap and water
   D. brake cleaning solvent

66. A front brake hose is being replaced. On this type of hose, the male end threads directly into the caliper. Technician A says the end of the hose that attaches to the steel brake line should be connected first. Technician B says that a new copper sealing washer should be used when the hose is connected to the caliper. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

67. Technician A says that surge bleeding is used in conjunction with manual or pressure bleeding. Technician B says that surge bleeding is used to remove air that is trapped in the brake hydraulic system. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

68. All of the following are cause for brake rotor refinishing EXCEPT:
   A. hard spots
   B. heat checks
   C. scoring
   D. thickness variation

69. In the above illustration, Technician A says that new brake shoes are being adjusted after installation. Technician B says that the procedure shown above is being done so the brake drum can be removed. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B
70. The front disc brake pads are being replaced on a vehicle with composite rotors. The left front rotor is scored below the ‘machine to’ but not the ‘discard’ thickness. The right front rotor has minor heat checks but otherwise checks out OK. If cast rotors are the only available replacements, which of the following is the proper course of action?
   A. Machine both rotors, being careful not to exceed the ‘discard’ thickness.
   B. Replace the left front rotor and machine the right front.
   C. Replace both rotors.
   D. Replace the left front rotor and leave the right front alone.

71. Which of the following brake symptoms can be caused by wheel bearing problems?
   A. pedal pulsation
   B. brake pull
   C. grabbing
   D. all of the above

72. Which component in the Hydro-Boost system provides power assist if there is a loss of hydraulic pressure to the system?
   A. boost piston
   B. check valve
   C. accumulator
   D. open-center spool valve

73. A customer complains that the parking brake will not keep his car stationary. The car has four-wheel disc brakes. Technician A says the caliper levers could be out of adjustment. Technician B says the brake shoes could need adjustment. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

74. When replacing an integral hub/bearing assembly on a front wheel drive vehicle, all of the following must be removed EXCEPT:
   A. brake rotor
   B. brake caliper
   C. steering knuckle
   D. wheel

75. A wheel cylinder has been disassembled and corrosion and light scoring have been found in the bore. Technician A says the bore can be refinished using a small hone lubricated with cutting oil. Technician B says oversize pistons and cup seals can be installed if the hone removes too much material. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

76. Two technicians are discussing traction control systems. Technician A says that some traction control strategies do not use the brakes to control wheel spin. Technician B says that a fault in the ABS does not affect traction control. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

77. When rough machining a brake drum, the depth of cut and spindle feed rate should be:
   A. 0.010-0.015-in. at high feed rate
   B. 0.010-0.015-in. at low feed rate
   C. 0.005-in. at high feed rate
   D. 0.005-in. at low feed rate

78. In the test shown above, vacuum should:
   A. exist on the engine side but not on the booster side
   B. exist on the booster side but not on the engine side
   C. exist on both sides
   D. exist on neither side
79. Technician A says the number on the brake drum shown above indicates the maximum diameter, beyond which the drum should not be used. Technician B says the number indicates the maximum diameter the drum can be machined to. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B
80. A vehicle’s brake warning system schematic is shown above. All of the following could cause the brake warning light to stay illuminated EXCEPT:
   A. a short to ground between C105 and C201
   B. a stuck closed parking brake switch
   C. an open between C237 and C305
   D. a leaking wheel cylinder

(Courtesy: Kia Motors America, Inc.)
81. A technician wants to check the condition of a vehicle’s brake fluid. Where should he get the sample to make the most accurate determination?
   A. master cylinder reservoir
   B. brake caliper
   C. combination valve
   D. wheel cylinder

82. Two technicians are discussing brake bleeding procedures. Technician A says gravity bleeding is a relatively quick way to bleed a brake system. Technician B says silicone brake fluid cannot be gravity bled. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

83. Which of the following is the MOST cost-efficient method of correcting excessive lateral runout on a disc brake rotor?
   A. indexing
   B. shimming
   C. machining
   D. replacement

84. New disc brake pads have just been installed. Technician A says the new pads must undergo a burnishing process during the road test to ‘cure’ the pads. Technician B says the new pads must be burnished to seat them on the rotor. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

85. The parking brake pedal on a vehicle with automatic parking brake release remains depressed when the vehicle is placed in drive. All of the following are possible causes EXCEPT:
   A. defective vacuum motor
   B. faulty release switch
   C. vacuum leak
   D. seized cables

86. Two technicians are discussing Electronic Stability Control (ESC) systems. Technician A says the ESC control module uses inputs from the steering wheel rotation sensor and wheel speed sensors to calculate the driver’s intended path. Technician B says the ESC control module uses inputs from the lateral acceleration and yaw rate sensors to calculate the vehicle’s actual path. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

87. A vehicle exhibits intermittent ABS activation, but when the technician connects a scan tool to the DLC, no DTCs are found. Which of the following could be the cause?
   A. damaged tone wheel teeth
   B. loose wheel bearing
   C. rust under the wheel speed sensor mount
   D. all of the above

88. Technician A says as brake fluid ages, it can corrode ABS control valves. Technician B says brake fluid corrodes the copper in the brake lines. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B

89. Which of the following is the MOST correct wheel cylinder repair procedure?
   A. disassemble, loosen the bleeder screw, clean and hone, clean and assemble
   B. disassemble, clean and hone, clean and assemble, loosen the bleeder screw
   C. loosen the bleeder screw, disassemble, clean and hone, clean and assemble
   D. disassemble, clean and hone, loosen the bleeder screw, clean and assemble
90. A vehicle’s ABS warning light is on and a DTC for the left front wheel speed sensor is found in the computer’s memory. When check with an oscilloscope, the waveform for the left wheel speed sensor is erratic and uneven. Technician A says the sensor air gap is excessive. Technician B says the tone ring is probably damaged. Who is right?
   A. Technician A only
   B. Technician B only
   C. Both A and B
   D. Neither A or B
Answers to Study-Guide Test Questions

1. The correct answer is C. The metering valve delays the flow of brake fluid to the front calipers until the pressure in the system rises to a point where the wheel cylinder can overcome the tension of the brake shoe return springs. The purpose is to have both front and rear brakes apply simultaneously. This prevents the front brakes from locking up during light brake applications.

2. The correct answer is A. If the primary piston cup in the master cylinder is leaking, pressure will not build up ahead of the primary piston to increase pressure to the rear brakes. The piston will then move forward until the spring is compressed enough to move the secondary piston. Consequently, this internal leak will cause the brake pedal to slowly drop to the floor.

3. The correct answer is C. Poor rotor parallelism (thickness variation) will cause a pulsating brake pedal. This is due to the caliper piston movement that occurs as the pad rides over the alternating high and low areas on the disc. This action forces brake fluid to flow back and forth from the caliper to the master cylinder, creating the pulsating pedal feedback.

4. The correct answer is B. Residual check valve(s) are used on drum brakes to keep residual low pressure (slight static pressure) in the brake system at all times even when the brake pedal is released. This pressure (5-20 psi) keeps the lips of the wheel cylinder piston cups tight against the cylinder walls to prevent air from entering the system when at rest (brakes released).

5. The correct answer is D. A metering valve requires a minimum pressure (typically between 75-125 psi) to open. At this point pressurized fluid flows to the front calipers. Since the bleeder tank is only pressurized to 25 psi, fluid pressure is too low to open the metering valve during this procedure. Therefore, when you use a pressure bleeder on a system with a metering valve, you must manually keep the valve open by either pushing the button in on the end of the valve, or pulling the stem outward on the end of the valve.

6. The correct answer is B. Excessive rotor runout would cause a pulsating brake pedal, but not uneven side-to-side pad wear. A frozen caliper piston on the other hand, will keep both inner and outer brake pads equally applied against the rotor even when the brake pedal is released. This constant friction will cause rapid pad wear in the affected caliper as well as a front-end pull.

7. The correct answer is C. The parking brake strut bar forces the brake shoes into the drum when the parking brake is applied.

8. The correct answer is D. Steel tubing of the same size, type, and length with double flared ends must be used when replacing a traditional SAE double inverted flare style hydraulic brake line.

9. The correct answer is C. Lateral runout is the movement of the rotor from side to side as it rotates on the steering knuckle spindle. The dial-indicator set-up shown in the illustration is used to make this measurement once the wheel bearing nut has been tightened (bearing play removed).

10. The correct answer is C. If a residual check valve was installed in a disc brake master cylinder, it would cause increased brake pad wear since the residual brake pressure would cause the caliper pistons to keep the pads applied even when the brake pedal is released.

11. The correct answer is A. A restriction in the brake line will cause a drop in fluid pressure to the affected caliper. This will cause the caliper to be unable to exert the same force against the pads as the unrestricted side. Because of this, the vehicle will pull to the side where the pressure is highest and brake force is greatest. In this case, that would be the right side.

12. The correct answer is D, neither technician is right. With the brake pedal applied while starting the engine, the pedal should move down slightly indicating that the vacuum booster is operating properly.

13. The correct answer is A. The illustration shows a technician setting a brake shoe adjustment gauge, or caliper, to the inside diameter of a brake drum. The other side of the gauge is then positioned over the brake shoes and the star wheel turned until the shoes lightly contact each end of the gauge. Technician B is wrong because a brake drum micrometer is used to measure the inside diameter of a brake drum.
14. **The correct answer is A.** The front hydraulic circuits in an integral ABS system can be bled in the conventional manner since it is the booster piston in the hydraulic modulator assembly that supplies fluid to the front brakes. However, the rear circuit is dependent upon boost pressure from the accumulator, which means the accumulator must be fully charged in order to bleed the rear brakes.

15. **The correct answer is D.** When a vehicle with ABS is braked on abnormally irregular road surfaces, like a cobblestone road, the wheels decelerate at different speeds. Because the signals coming from the wheel speed sensors under this condition are not in sync with each other, the ABS control unit interprets this as impending wheel lockup and responds by engaging the system.

16. **The correct answer is A.** In a duo-servo drum brake design under normal forward braking, the friction developed by the secondary lining is greater than the primary lining. Therefore, the secondary shoe is typically longer and thicker than the primary shoe. The primary shoe is installed facing the direction of forward motion.

17. **The correct answer is C.** The leading-trailing drum brake design is not self-energizing. This is due to the fixed anchor on the backing plate, which prevents the shoes from transferring their force to one another.

18. **The correct answer is D, neither technician is right.** It is DOT 4 brake fluid that has a lower boiling point, and DOT 5 that is silicone-based and should not be used in any ABS system.

19. **The correct answer is D.** The compensating port allows for residual hydraulic line pressure to be discharged into the reservoir as the brake pedal is released. A clogged or restricted compensating port will create a pressure build-up, which will cause the brakes to drag or fail to release. The port can be clogged by foreign matter, blocked by a swollen primary cup or covered by the primary cup if the master cylinder pushrod is improperly adjusted.

20. **The correct answer is C.** A leak in the hydraulic system wouldn’t cause a hard pedal, but rather create the exact opposite condition due to the hydraulic pressure loss. An engine with the valves adjusted too tight would develop low vacuum. This would adversely affect the operation of the power brake booster and cause a hard pedal. Brake fluid on the linings will cause the friction material to grab resulting in a hard pedal, while a frozen caliper would prevent retraction of the piston resulting in a similar condition.

21. **The correct answer is B.** The outward movement of the caliper piston during brake application causes the piston seal to distort. Once the brakes are released however, the seal returns to its original shape forcing the piston to retract in its bore. A caliper seal that is installed on the piston is known as a stroking seal.

22. **The correct answer is C.** By opening the bleeder screw on the caliper, contaminated fluid is not forced back into the master cylinder (or on ABS vehicles, into the hydraulic control unit). Answer B is wrong because, while it will work, doing so can cause problems in the hydraulic system. Answer A is wrong because, without checking the fluid level or opening the bleeder screw, fluid could be forced into and spill out of the master cylinder reservoir. Answer D is wrong because caliper removal is not necessary.

23. **The correct answer is B.** The number of wheel speed sensors used on an ABS system does not necessarily indicate the number of channels the system has. A channel is an independently controlled fluid path from the hydraulic modulator to the wheel. Therefore, a 3-channel system on a car can have a wheel speed sensor at each wheel, even though there are only 3 individually controlled hydraulic circuits: two in the front, and one in the rear.

24. **The correct answer is D, neither technician is right.** The minimum thickness dimension cast into the rotor is usually the discard dimension. The rotor should not be machined closer than 0.030-in. to this dimension in order to allow for wear. When machining a rotor, you do not have to remove an equal amount of material from both sides if the vehicle has floating or sliding calipers. However, on fixed calipers an equal amount must be machined from both sides.

25. **The correct answer is D.** Maximum braking effectiveness is achieved when tire slip is maintained at a level between 10-20%.

26. **The correct answer is D.** The proportioning valve reduces the pressure applied to the rear wheel cylinders in relation to the pressure applied to the front calipers under heavy braking. A defective proportioning valve can cause the rear wheels to lock and skid during sudden stops because the fluid pressure to the rear wheel cylinders would be unregulated.
27. The correct answer is A. On most vehicles, parking brake adjustment consists of shortening the length of one or more cables to remove excessive slack. This adjustment is generally made by tightening an adjusting nut at the equalizer.

28. The correct answer is B. Any leak in the hydraulic system that causes unequal pressure to be applied to one side of the pressure differential piston will cause the warning light to illuminate. The only choice here is a short to ground in the light. This failure would cause the light to stay on all the time regardless of hydraulic condition.

29. The correct answer is C. While all of the choices listed could cause the pads to wear prematurely, the most common cause of this condition is when the rear shoes are incorrectly adjusted. Since the majority of braking action is done by the front brakes (especially on front-wheel-drive cars), it is imperative that the rear shoes are adjusted properly. This will help balance brake action as well as lining wear.

30. The correct answer is B. Only a few ABS systems (primarily RWAL) offer flash code diagnostics for retrieving stored fault codes. A bidirectional scan tool can be used to perform tests on ABS system components. A technician can activate solenoids and valves while observing the change in that circuit.

31. The correct answer is D. Answers B and C are incorrect because the sampling rates are too low. An intermittent can be seen with the digital storage oscilloscope (DSO) because it samples the electrical signal over 250,000 times per second.

32. The correct answer is B. Technician A is incorrect because there should be at least one power assist before the pedal gets hard to push. Technician B is correct because the lack of power assist indicates that the check valve is leaking.

33. The correct answer is C. Replacing a disc brake caliper would not require measuring master cylinder pushrod length. Measuring pushrod length may be required when replacing any of the other components.

34. The correct answer is A. A small amount of fluid present here is normal due to the lubricating action of the master cylinder bore end seal. The brake fluid is kept from leaking back into the power booster by a seal on the pushrod. If a large amount of fluid is present, unbolt the master cylinder from the booster and look for signs of leakage.

35. The correct answer is C, both technicians are right. Both methods are commonly used to adjust tapered roller bearings. Consult the vehicle service manual for the specific adjustment procedure.

36. The correct answer is D. A seized caliper piston can cause a brake pull or a hard pedal, but it would not cause a pedal pulsation. All of the other choices can cause a pulsation to be felt through the brake pedal.

37. The correct answer is B. Vehicles with diagonally-split hydraulic systems have dual proportioning valves, so if a problem is suspected, both valves must be tested. Technician A is incorrect because, when testing a proportioning valve, the pressure at the outlet to the rear brakes will rise at a slower rate, once transition pressure is reached.

38. The correct answer is C. Lateral runout is measured using a dial indicator. All of the other measurements can be made using a micrometer.

39. The correct answer is A. The disc brake pads can usually be removed from fixed calipers while the caliper is mounted in place. Floating and sliding calipers require that the caliper be removed or pivoted out of the way to access the disc brake pads.

40. The correct answer is B. If the Hydro-Boost system is operating properly, the brake pedal should initially move downward before rising up against foot pressure.

41. The correct answer is B. Brake linings that are contaminated with grease, oil or brake fluid can cause the vehicle to pull when the brakes are applied, but would not cause brake squeal.

42. The correct answer is C, both technicians are right. A stroking seal is located in a groove in the caliper piston and moves with the piston. The lip of the seal rides against the surface of the caliper bore, so the caliper bore must be smooth to prevent leaks. A fixed seal is installed in a groove in the caliper bore. It seals against the outside surface of the caliper piston, so that surface must be in good condition to provide a good seal.
Answers to Study-Guide Test Questions

43. The correct answer is C. A blocked master cylinder compensating port could cause all brakes to drag but would not cause a brake pull. All of the other choices could cause brake pull.

44. The correct answer is A. New wheel speed sensors come with the paper spacer installed but it is not necessary to remove it; the spacer is designed to wear off during vehicle operation.

45. The correct answer is A. Tapered roller bearings are usually used on non-drive axles. All of the other statements are true.

46. The correct answer is C. The parking brake system engages the rear brakes mechanically; a seized wheel cylinder would not affect parking brake operation.

47. The correct answer is B. Minimum thickness is checked when inspecting a disc brake rotor. All of the other measurements mentioned should be made when inspecting a brake drum.

48. The correct answer is A. Pumping the brakes compresses the air and when the pedal is released, the compressed air pushes the hydraulic fluid back through the lines, causing it to squirt. Technician B is wrong because a small squirt of fluid should appear over the reservoir, indicating that fluid is being forced out of the cylinder bore through the compensating ports, only when the pedal is applied.

49. The correct answer is D, neither technician is right. Technician A is wrong because, while most Rear Wheel Anti-Lock (RWAL) systems offer flash-code diagnostics, most four-wheel ABS systems require the use of a scan tool to extract stored fault codes from the computer’s memory. Technician B is wrong because the ‘anti-lock’ warning light will come on whenever the key is turned ON, and if there are no faults in the system, will then go out after a few seconds.

50. The correct answer is B. A phenolic piston should be protected to keep it from being damaged when a C-clamp is used. Technician A is wrong because minor surface imperfections are OK provided they do not enter the dust boot groove area.

51. The correct answer is D. An outside micrometer with a pointed anvil and spindle is a disc brake micrometer. Unlike a standard micrometer that uses a flat surface on the anvil and spindle, a disc brake micrometer uses pointed tips so the instrument can fit into the grooves of scored rotors, to accurately measure the thickness.

52. The correct answer is D, neither technician is right. Purple is the color of silicone fluid, and only DOT 5 fluid should be used to top off the reservoir.

53. The correct answer is C. Over-tightening the lug nuts can distort the rotor and create excessive runout, resulting in a pedal pulsation. All of the other choices may cause other problems, but not a pedal pulsation.

54. The correct answer is B. The pressure differential valve and warning switch alerts the driver of a pressure loss in one of the hydraulic circuits. The residual check valve is often used in the master cylinder outlet port of drum brake systems in order to maintain a slight pressure in the brake lines and wheel cylinders, which keeps wheel cylinder pistons tight against their bores. The metering valve delays front disc brake operation until the rear brakes shoes overcome the return spring tension. The proportioning valve is used to control rear brake pressures, particularly during hard stops.

55. The correct answer is D, neither technician is right. The non-integral ABS system is added on to the vehicle’s existing hydraulic brake system, and is generally a low-pressure arrangement.

56. The correct answer is C. The diameter of brake drums mounted on the same axle must be within 0.010-in. of one another.

57. The correct answer is C. Absorption of 3% moisture can reduce the boiling point of DOT 3 brake fluid by 25%.

58. The correct answer is A. Bench bleeding is a procedure for removing air from the master cylinder only. All of the other procedures remove air from the entire system.

59. The correct answer is B. Files are not used to apply a non-directional finish on a disc brake rotor. All of the others methods can be used to give the rotor a swirl-like finish.
60. **The correct answer is D.** A vacuum check valve is used on a vacuum power booster. The Hydro-Boost system uses power steering pump fluid pressure rather than intake manifold vacuum, so all of the other choices would apply.

61. **The correct answer is D.** Some common ABS problems can be caused by carelessness when performing basic brake service. Wheel speed sensors can be disturbed or damaged accidentally. Solenoid valves can stick if the caliper bleeder screws are not opened when the caliper pistons are retracted. Since the caliper is the lowest point in the system, dirt and corrosion naturally accumulate there. If the bleeder screws are not opened, brake fluid and these contaminants are forced backward into the system. When these contaminants find their way into the hydraulic control unit, they can cause valves to stick.

62. **The correct answer is B.** A frozen star wheel would not cause brake drag. Rather, it would prevent the automatic adjuster mechanism from working, which would gradually cause the brake shoe-to-drum clearance to increase as the linings wore. All of the other answers could cause the brake shoes to not retract from the drum, resulting in brake drag.

63. **The correct answer is D, neither technician is right.** The fitting shown is an ISO flare fitting. ISO flare fittings are used on many newer vehicles, but should never be intermixed on the same vehicle with the more common inverted flare style fittings.

64. **The correct answer is A.** The brake shoes must be correctly adjusted for the parking brake to work properly. There may not be enough adjustment in the parking brake system to overcome excessive shoe-to-drum clearance, resulting in the parking brake not being able to hold the vehicle in place when it is applied. Technician B is wrong because the parking brake lever must be engaged a certain number of clicks before the equalizer is adjusted.

65. **The correct answer is C.** When rotor resurfacing is completed, wash the rotor with soap and water and wipe it off with a clean shop towel. Brake cleaning solvent may not remove all of the fine particles left over from the machining process, and these can become imbedded in the new pads and cause brake noise.

66. **The correct answer is B.** Technician A is wrong because the male end of the hose should be connected and tightened first. If the female end of the hose is connected to the brake line first, the hose will twist when it is threaded into the caliper.

67. **The correct answer is C, both technicians are right.** Surge bleeding is a method of removing air from the hydraulic system that can be used when manual or pressure bleeding has proved inadequate. Surge bleeding churns the air in the wheel cylinder in order to loosen any pockets of air. However, the system should first be manually or pressure bled and again after surge bleeding to make sure all air has been expelled.

68. **The correct answer is A.** Hard spots call for rotor replacement, since resurfacing seldom removes the entire hard spot. All of the other conditions can be corrected by machining, provided it can be done without machining past the minimum rotor refinish- ing thickness.

69. **The correct answer is B.** The screwdriver shown in the illustration is not necessary when turning the star wheel to expand the brake shoes. However, if the shoes are too tight against the drum or a lip has developed due to wear that prevents the brake drum from being removed, the shoe-to-drum clearance must be reduced. To back off the star wheel adjustment, the screwdriver is used to hold the self-adjuster lever away from the wheel, allowing it to be turned in the opposite direction.

70. **The correct answer is C.** Composite and cast rotors should not be mixed on the same axle. Answer A is wrong because, as the question indicated, the rotor is already worn past the ‘machine to’ dimension. Even if the rotor is not machined beyond the ‘discard’ thickness, this leaves no allowance for wear in the future.

71. **The correct answer is D.** Loose wheel bearings can cause excessive rotor runout, which in turn can cause pedal pulsation. A failed wheel bearing seal can allow grease to contaminate the brake linings and cause brake pull and grabbing.

72. **The correct answer is C.** The accumulator can supply enough power assist for two stops if there is a loss of hydraulic pressure in the Hydro-Boost system. The boost piston provides the force to operate the master cylinder and the open-center spool valve regulates pump pressure. The check valve is used on vacuum operated boosters.
73. The correct answer is C, both technicians are right. The brakes must be inspected before reaching a diagnosis, but without knowing what type of system the car had, either technician could be right. There are two kinds of parking brakes on vehicles with rear disc brakes. One kind has small brake shoes inside a drum that is incorporated in the disc brake rotor. The shoes are forced against the drum by the linkage and cables in the same manner as conventional drum parking brakes. These shoes must be properly adjusted for the parking brake to work correctly. The other kind uses the rear disc brake pads. The linkage and cables actuate a cam or screw mechanism inside the caliper piston to push the caliper piston and pads against the rotor. Some of these systems require a caliper lever adjustment.

74. The correct answer is C. The steering knuckle does not have to be removed when replacing an integral hub/bearing assembly. However, it must be removed when replacing the press-fit type front wheel bearing.

75. The correct answer is D, neither technician is right. Use only fresh clean brake fluid to lubricate the honing stones; never use petroleum-based cutting oil. After the cylinder has been honed, inspect it for excessive piston clearance. To check the maximum clearance, place a 0.003-inch feeler shim lengthwise in the cylinder bore. If the piston can be inserted with the shim in place, the cylinder is oversize and cannot be rebuilt.

76. The correct answer is A. Some manufacturers reduce power to the spinning wheel by retarding the ignition timing, cutting off fuel injection to certain cylinders and/or mechanically closing the throttle, and may only apply the brakes if the wheel continues to spin. Technician B is wrong because the TCS uses the same components as the ABS; if there is a fault in the ABS the TCS is turned off as well.

77. The correct answer is A. The tool depth on a rough cut, where a large amount of material is removed to initially clean the drum, is usually about 0.010 - 0.015-in. at a fast spindle feed rate.

78. The correct answer is B. The illustration shows a vacuum operated brake booster check valve being tested. Vacuum should exist at the booster side of the check valve, but not on the engine side.

79. The correct answer is A. The number on the drum shown in the illustration is the maximum diameter. This specification is the discard diameter and not what the drum can be machined to. As a general rule, the maximum refinish diameter is 0.030-in. less than the maximum diameter, but refer to the vehicle service manual to be sure.

80. The correct answer is C. For the light to illuminate, the circuit must be grounded, either intentionally or unintentionally. Answer D is an example of the former: a leak and loss of pressure in the brake hydraulic system causes the brake pressure differential switch contacts to close and complete the circuit. Answers A and B are examples of an unintentional ground: a short to ground or a switch that is stuck closed will still complete the circuit. Answer C is right because an open will not provide a ground and complete the circuit.

81. The correct answer is B. The most accurate way to determine brake fluid condition is to take a sample from the vehicle’s disc brake caliper, because the heat generated while stopping breaks down the corrosion inhibitors in the brake fluid.

82. The correct answer is D, neither technician is right. Technician A is wrong because gravity bleeding is the easiest but most time consuming method of brake bleeding. Gravity bleeding relies on atmospheric pressure, acting on the surface of the fluid in the master cylinder, to force the fluid through the hydraulic system and out through the bleeders, which may take several hours. Technician B is wrong because gravity bleeding does not agitate the fluid and generate air bubbles, which is advantageous for systems with DOT 5 silicone fluid since it is prone to aeration.

83. The correct answer is A. Indexing involves moving the rotor position on the hub and rechecking the runout with a dial indicator. The number of wheel studs determines the number of possible positions to correct runout. This method requires little extra labor, no parts expense and no machining labor or expense. Resurfacing the rotor unnecessarily removes material and makes the rotor thinner, lessening its ability to absorb and dissipate heat and shortening the rotor’s useable lifespan.

84. The correct answer is C, both technicians are right. Whenever new brake pads are installed, they must undergo a burnishing, or break-in procedure before the vehicle can be operated normally. Burnishing accomplishes two things: It ‘cures’ the resin in the friction material, which could otherwise boil to the surface and cause glazing if the vehicle

was immediately subjected to hard braking; and it ensures that the pads seat and make full contact with the rotor. The latter is particularly important if the rotors were not machined, since even a rotor that was deemed serviceable will not have a perfectly smooth surface.

85. The correct answer is D. An automatic parking brake release mechanism releases the parking brakes when the automatic transmission is shifted into drive or reverse. These systems usually consist of a vacuum motor that is attached to a release lever, and a vacuum switch that routes vacuum to the motor when the transmission is placed in drive or reverse. When the driver selects the drive or reverse position, the switch directs engine vacuum to the vacuum motor, which releases the lever and the parking brakes. Seized cables could keep the vehicle from moving or cause severe drag, but would not keep the pedal from returning to the unapplied position. All of the other possibilities listed could keep the release lever from releasing the pedal, causing it to remain in the applied position.

86. The correct answer is C, both technicians are right. The ESC control program determines the driver's intentions using throttle and transmission data from the Powertrain Control Module (PCM), wheel speed rate from the wheel speed sensors and steering wheel position and rate of movement input from the steering wheel rotation sensor. It compares this information with the input from the lateral acceleration and yaw rate sensors to determine if correction is needed. If the actual path the vehicle is traveling does not match the intended path, the control module applies brake pressure to individual wheels and/or reduces engine power to correct the motion of the vehicle.

87. The correct answer is D. False ABS activation occurs when the ABS is engaged even though none of the wheels are slipping. The ABS control module can interpret a weak or erratic wheel speed sensor signal as wheel slip and cycle the ABS at the affected wheel. Rust under the sensor mount, loose wheel bearings and damaged tone wheel teeth can all affect the sensor gap, which in turn can cause a weak or erratic signal.

88. The correct answer is B. At a slow rate, over several months or years, brake fluid slowly corrodes the copper in the inner lining of steel brake tubing. The copper leaches into the brake fluid as ions, atoms with an electrical charge. When the corrosion inhibitors in the brake fluid eventually deplete, these copper ions become the oxidizer that corrodes ferrous metal parts like ABS control valves. Technician A is wrong because it is not the brake fluid that corrodes the ABS control valves, but rather the copper ions that are released by the brake fluid.

89. The correct answer is C. Before rebuilding a wheel cylinder, first make sure that the bleeder screw can be loosened before disassembling the unit. If the bleeder screw breaks off, the wheel cylinder must be replaced.

90. The correct answer is B. A tone ring with chipped or damaged teeth will cause an erratic, uneven waveform. Technician A is wrong because excessive air gap would cause a low amplitude waveform.
Glossary of Terms

--a--

abrasion - rubbing away or wearing of a part.

ABS - see anti-lock brake system.

accumulator - in a non-integral ABS system, a chamber that temporarily stores fluid during the pressure decrease phase of ABS operation. In an integral ABS system, a sealed vessel containing a thick flexible diaphragm that separates brake fluid from high-pressure nitrogen gas. In the Hydro-Boost power brake system, a component that provides a reserve of at least two power assisted stops if there is a loss of hydraulic pressure.

actuator - a control device that delivers mechanical action in response to an electrical signal.

air gap - a specified space between two components.

air lock - a bubble of air trapped in a fluid circuit that interferes with normal circulation of the fluid.

alternating current (AC) - an electric current whose polarity is constantly changing from positive to negative and then back again.

anchor pin - a component located on the brake backing plate, on which the brake shoes rotate and to which the return springs are secured.

anti-lock brake system (ABS) - a computer controlled system that allows the vehicle to be controlled under heavy braking by releasing hydraulic pressure to wheels that are about to lock up and skid. Sensors located at the wheels, monitor rotating wheel speed in relation to other wheels and send the information to a control module that in turn controls a hydraulic modulator, which regulates hydraulic fluid pressure to each brake assembly.

anti-rattle spring - a device used with disc brake pads to keep them from moving and making noise.

--b--

backing plate - the component to which the brake shoes, wheel cylinder and related components are attached.

ball bearing - an anti-friction bearing that uses a series of steel balls that rotate between inner and outer bearing races.

bearing race - machined circular surface of a bearing against which the roller or ball bearings ride.

bleeder screw - a valve located on disc brake calipers, wheel cylinders and some master cylinders that allows air and fluid to be removed from the brake system.

boot - a protective rubber cover or seal that is used to protect the inside of a caliper or wheel cylinder from contaminants.

brake drag - a condition that occurs when brake pads or shoes are in continuous contact with the disc brake rotors or brake drums.

brake drum - a round cast iron housing attached to an axle shaft or spindle, on which the brake shoes press to stop its rotation.

brake fade - phenomenon that takes place when the temperature of the friction surfaces increases to a point where the application of heavy pedal pressure results in little braking action.

brake fluid - the hydraulic fluid used to transmit hydraulic pressure through the brake lines in a brake system.

brake flushing - a procedure to clean the brake hydraulic system with fresh, clean fluid that should be performed whenever new parts are installed, if there is any doubt as to the grade of fluid in the system, if a glycol fluid has been mixed with a silicone-based fluid, or if the fluid has been contaminated with petroleum or mineral based fluids.

brake hoses - flexible hoses that connect the brake lines on the chassis with the calipers or wheel cylinders, or the junction block on a solid axle.

brake lines - metal tubing that carries the brake fluid from the master cylinder to other brake system components.

brake pads - see disc brake pads.

brake rotor - see disc brake rotor.

brake shoes - friction material that is bonded or riveted to curved metal structures and attached to the backing plate. The brake shoes press on the brake drum to stop its rotation.

break-in - a slow wearing-in process between two mating part surfaces.

--c--

caliper - see disc brake caliper.
Glossary of Terms

**check valve** - a gate or valve that allows passage of gas or fluid in one direction only.

**circuit** - a path through which electricity flows before returning to its source.

**coefficient of friction** - a relative measurement of the friction developed between two objects in contact with each other such as brake pads and brake rotors.

**continuity** - the condition that exists in a working electrical circuit. A circuit that is unbroken, not open.

**corrosion** - the eating into or wearing away of a substance gradually by rusting or chemical action.

**current** - the movement or flow of electricity passing through a conductor.

**data link connector (DLC)** - a means through which information about the state of the ABS control system can be extracted with a scan tool.

**diagnostic trouble code (DTC)** - a code that represents and can be used to identify a malfunction in a computer control system.

**dial indicator** - a tool used to measure minor variations or slight movements; a dial indicator is used to check lateral runout on a brake rotor.

**diaphragm** - flexible, impermeable membrane on which pressure acts to produce mechanical movement, such as inside a vacuum power brake booster.

**differential case** - housing for the differential pinion gears and side gears. Mounting point for ring gear.

**disc brake** - a braking system that uses cast iron discs mounted on the wheel hubs, over which brake calipers are mounted. Hydraulic pressure from the brake system forces the caliper piston(s) against friction pads mounted in the calipers, which in turn clamp the brake discs, stopping their rotation.

**disc brake caliper** - a hydraulically actuated device in a disc brake system that is mounted straddling the brake disc. The caliper contains at least one piston and is used to provide the clamping force of the brake pads on the disc.

**disc brake pad burnishing** - a break-in procedure that should be performed after new brake pads are installed, to ensure the pads are properly 'cured' and seated on the rotor. Generally involves making multiple stops from a certain speed, with cooling off periods in between stops.

**disc brake pads** - friction material that is bonded or riveted to metal plates and mounted in the disc brake caliper. The brake pads are clamped against the disc brake rotor to stop its rotation.

**disc brake rotor** - a cast iron disc mounted on the wheel hub, which is clamped by the caliper and disc brake pads to slow and stop its rotation.

**DLC** - see data link connector.

**drum brake** - a braking system that uses cast iron drums mounted to the wheel hubs. Hydraulic pressure from the brake system forces pistons in the wheel cylinder to press friction lined brake shoes against the inside of the drum, stopping its rotation.

**duo-servo** - a drum brake design that provides increased stopping power due to the servo or self-energizing action of the brake shoes.

**electromagnet** - a magnet formed by electrical flow through a conductor.

**electromagnetic induction** - moving a wire through a magnetic field to create current flow in the wire.

**electronic stability control (ESC) system** - a system that determines the driver's intentions using throttle and transmission data from the Powertrain Control Module (PCM), wheel speed rate from the wheel speed sensors and steering wheel position and rate of movement input from the steering wheel rotation sensor, and then compares this information with the input from the lateral acceleration and yaw rate sensors to determine if correction is needed. If the actual path the vehicle is traveling does not match the intended path, the control module applies brake pressure to individual wheels and/or reduces engine power to correct the motion of the vehicle.

**end-play** - the amount of axial or end-to-end movement in a shaft due to clearance in the bearings.

**expansion** - an increase in size.
ferrous metal - a metal that contains iron or steel and is subject to rust.

fixed caliper - a brake caliper design that contains one or more pistons positioned on either side of the rotor. The caliper is rigidly attached to the spindle and the pads are applied with equal hydraulic pressure from both sides.

fixed seal - a type of brake caliper seal that is installed in a groove in the caliper bore.

flare - an expanded, shaped end on a metal tube or pipe.

floating caliper - a brake caliper design that uses an adapter, or anchor plate, which is bolted to the spindle. The caliper floats laterally across a pair of special bolts that are screwed into the adapter. As hydraulic pressure is applied to the piston, the inboard pad is forced against the rotor. This pressure causes the caliper to move inboard until an equal pressure is applied by the outside pad to the outer disc surface.

flux density - the degree of concentration of the magnetic lines of force that emanate from a magnetic sensor; when the tooth of a reluctor aligns with the sensor tip, the magnetic lines of force are squeezed together, which increases flux density.

foot pound - a unit of measurement for torque. One foot pound is the torque obtained by a force of one pound applied to a wrench handle that is 12-in. long.

force - a pushing effort measured in pounds.

free-play - looseness in a linkage between the start of application and the actual movement of the device, such as the movement in the steering wheel before the wheels start to turn.

friction - the resistance to the motion of two moving objects in contact with each other.

front-wheel drive (FWD) - the entire drivetrain is located at the front of and drives the front wheels of the vehicle.

ground - negatively charged side of a circuit; can be a wire, negative side of the battery or vehicle chassis.

hard spot - areas in the friction surface of a brake drum or rotor that have become harder than the surrounding metal; this condition results from the changes in metallurgy that occur during overheating.

hold-down springs - springs that are used to keep the brake shoes secured to the backing plate.

hone - abrasive tool for correcting small irregularities or differences in diameter in a cylinder, such as an engine cylinder or wheel cylinder; to enlarge or smooth a bore with a rotating tool containing an abrasive material.

hub - mounting point for the wheel on an axle or spindle; the part of the synchronizer assembly that is splined to the transmission shaft; the center part of a wheel, gear, etc., that rides on a shaft.

hydraulic pressure - pressure exerted through a liquid.

Hydro-Boost - a power brake system that uses hydraulic pressure from the power steering system to provide power assist.

hygroscopic - the ability of a material or substance to attract water.

indexing - a disc brake rotor lateral runout correction procedure, where the rotor is placed at a different position on the hub and the runout rechecked with a dial indicator to see if it is then within specs. The number of wheel studs determines the number of possible positions to achieve correction.
Glossary of Terms

**integral ABS** - an anti-lock braking system that substitutes the traditional master cylinder and power booster with a self-contained hydraulic modulator and high-pressure accumulator.

---k---

**kinetic energy** - energy in motion; the energy of a body that results from its motion; it's equal to half the product of its mass and the square of its velocity.

---l---

**lateral runout** - side-to-side movement or wobble in a wheel, tire or brake rotor.

**leading-trailing drum brakes** - a non-servo drum brake system where both brake shoes are held in place against a solidly attached anchor mounted to the bottom of the backing plate.

**lockup** - the point at which braking power overcomes the traction of the vehicle's tires and skidding occurs. The most efficient stopping occurs just before lockup is reached. Locked wheels cause loss of control, long stopping distances, and flat spotting of the tires. The point at which friction overcomes rotating force.

**lubrication** - reducing friction between moving parts such as applying brake fluid to the stones of a hone during wheel cylinder rebuilding.

---m---

**magnet** - any body with the property of attracting iron or steel.

**magnetic field** - the areas surrounding the poles of a magnet or current-carrying body (wire) where properties of attraction and repulsion are observable.

**master cylinder** - the primary fluid pressurizing device in some hydraulic systems. In automotive use, it is found in the brake and hydraulic clutch systems and is pedal-activated, either directly or through a vacuum assist unit.

**memory** - the part of a computer that stores or holds programs and other data.

**metering valve** - a valve used on front disc/rear drum brake systems for the purpose of providing a simultaneous application of the front and rear friction materials. Located in the front brake hydraulic circuit, the metering valve delays front disc brake operation until the rear brakes shoes overcome the return spring tension.

---o---

**oscilloscope** - an instrument that displays electrical activity in the form of line patterns on a screen.

**out-of-round** - refers to an inside or outside diameter that was originally designed to be perfectly round, but instead has varying diameters when measured at different points across its diameter, such as an out-of-round brake drum.

---p---

**parking brake** - a system that applies the brakes mechanically through a series of linkages and cables. Depending on the vehicle, the parking brake system will either be actuated using a foot pedal or a hand-operated lever.

**Pascal’s Law** - the law of physics stating that liquids are non-compressible, and that a force applied to the top of a liquid in a closed container is exerted equally in all directions.

**pitting** - surface irregularities caused by corrosion.

**play** - movement between two parts.

**power booster** - a device that uses a diaphragm, engine vacuum and atmospheric pressure to assist the driver with brake application. Also known as a vacuum booster.

**power brakes** - a system that uses vacuum or hydraulic pressure to assist the driver with brake application.

**preload** - thrust load applied to bearings that support a rotating part; eliminates axial play or movement.

**micrometer** - a precision measuring instrument. When a micrometer measures in thousandths of an inch, one turn of its thimble results in 0.025-in. movement of its spindle. There are 40 threads per inch (1/40th inch = 0.025-in.).

**modulator** - a component in the ABS system that contains the solenoid valves that regulate hydraulic fluid pressure to the calipers or wheel cylinders.

**module** - an electronic control unit.

**multimeter** - a tool that combines the functions of a volt meter, ohmmeter and ammeter into one diagnostic instrument.
pressure - the exertion of force upon a body.

primary shoe - the brake shoe in a duo-servo drum brake system that transfers part of its force to the secondary shoe. The brake shoe facing the front of the vehicle when the vehicle is moving forward.

proportioning valve - the proportioning valve is used to control hydraulic pressure to the rear brakes. When the pressure to the rear brakes reaches a predetermined level, the proportioning valve overcomes the force of its spring-loaded piston and stops the flow of fluid to the rear brakes. This action maintains rear brake system pressure at a lower level than the front brakes, keeping the rear brakes from locking during hard stops.

quick take-up master cylinder - a master cylinder design that is used to prevent excessive brake pedal travel. The quick take-up master cylinder uses a larger rear cylinder bore and quick take-up valve. This arrangement provides a large volume of fluid at low pressure (light pedal application) during the initial part of the pedal stroke. Also called a step-bore master cylinder.

quick take-up valve - the valve used in a quick take-up master cylinder that controls fluid flow into the reservoir.

race - the housing in which the balls or rollers of a bearing operate; on an integral disc or drum an inner and outer race is pressed into the hub to support the bearings.

rear-wheel drive (RWD) - system where the driveline drives the rear wheels of the vehicle. Most often the engine is located in the front of the vehicle and a transmission and driveshaft connect to a drive axle, however there are also systems where the entire driveline is located toward the rear of the vehicle.

reluctor - a toothed ring made of ferrous metal, which is used to change the magnetic flux density of the wheel speed sensor; mounted on the wheel hub or differential case, depending on application.

resistance - the opposition offered by a substance or body to the passage of electric current.

return springs - springs that secure the tops of the brake shoes to an anchor pin on the backing plate. These springs allow the shoes to move in and out laterally.

rotor - a component mounted on the shaft of the distributor that transfers voltage from the distributor cap center terminal (coil wire) to the spark plug wire terminals; a cast iron disc mounted on the wheel hub, which is clamped by the caliper and disc brake pads to stop its rotation.

runout - degree of wobble outside normal plane of rotation.

scan tool - a microprocessor designed to communicate with a vehicle's on-board computer for the purpose of extracting stored trouble codes and other system data; a bi-directional scan tool can send information as well as receive it.

score - a scratch, ridge or groove marring a finished surface.

secondary shoe - the brake shoe in a duo-servo drum brake system that receives force from the primary shoe when the brakes are applied. The secondary shoe does most of the braking when the vehicle is traveling forward, so its lining is larger than that of the primary shoe.

self-diagnostics - refers to the way in which the computer in the ABS system constantly monitors the state of each of its sensors and actuators. If one of them produces an implausible signal, or no signal at all, the system registers a fault code.

sliding caliper - a brake caliper design that operates similarly to the floating design, however, it attaches to the anchor plate using only one attachment point.

sponginess - the feel of a soft or mushy brake pedal usually caused by trapped air in the hydraulic system.

star wheel - the star shaped wheel that is attached to the screw of a drum brake shoe adjuster. If brake shoe-to-drum clearance is excessive, the wheel is turned by the self-adjuster lever when the brakes are applied with the vehicle in reverse, moving the brake shoes closer to the drum.

step-bore master cylinder - see quick take-up master cylinder.

stroking seal - a type of brake caliper seal that is installed on the caliper piston, so called because it moves, or strokes, with the piston as the brakes are applied and released.
Glossary of Terms

---t---

taper - the difference in thickness of a brake pad or brake rotor between its widest and narrowest points.

TCS - see traction control system.

tire slip - also called wheel slip, is a measurement (in percentage) of the friction between the tire and road surface; at zero slip the tire rotates freely, while at 100% slip the tire is locked up and is pushed along the road surface by the moving vehicle.

tone wheel - see reluctor.

torque - a twisting force.

traction control system (TCS) - a system used in conjunction with the ABS to control wheel spin and traction loss. Depending on the manufacturer's strategy, wheel spin is controlled by applying the brakes, reducing power to the wheel(s) or a combination of both.

---u---

union - a hydraulic coupling that is used to connect pipe or tubing.

---v---

vacuum booster - see power booster.

variable reluctance sensor - a magnetic sensor that generates its own alternating current voltage based on the interference of a moving object across its tip.

---w---

wheel slip - see tire slip.

wheel speed sensor - a permanent magnetic sensor that sends information to the computer in an ABS system regarding wheel speed.