

**2008 NATEF ACADEMIC STANDARDS CORRELATIONS
APPLIED SCIENCE SKILLS**

NATEF Applied Science Skills	Student Edition Vols. 1 & 2	Academic Applications
AS-1 <i>Safety</i> The technician follows all safety regulations and applicable procedures while performing the task.	EP-382, EP-451, ER-186, ER-221, HA-340, HA-364	Pages 169-170, 185, 196, 211, 213, 233-234, 257
AS-2 <i>Environmental Issues</i> The technician develops and maintains an understanding of all federal, state, and local rules and regulations regarding environmental issues related to the work of the automobile technician.	EP-382, EP-451, HA-364	Pages 169-170, 328
AS-3 <i>Environmental Issues</i> The technician uses such things as government impact statements, media information, and general knowledge of pollution and waste management to correctly use and dispose of products that result from the performance of a repair task.	EP-382, EP-451, HA-364	Pages 169-170, 328
AS-4 <i>Waste Management</i> The technician identifies the waste products resulting from a repair task.	EP-382, EP-451, HA-364	Pages 169-170, 176
AS-5 <i>Waste Management</i> The technician handles the disposal of materials such as automotive lubricants in accordance with applicable federal, state, and local rules and regulations.	EP-382, EP-451, HA-364	Pages 169-170, 176
AS-6 <i>Operational</i> The technician can relate scientific terms to automotive system diagnosis, service, and repair..	Throughout	Throughout
AS-7 <i>Maps/Charts/Tables/Graphs</i> The technician uses the information in service manual charts, tables, or graphs to determine the manufacturer's specifications for system(s) operation(s).	BR-174, EP-472, ER-197, AT-538, MD-565	Pages 123-124, 191-192, 212, 255-256, 257

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<p>AS-8 <i>Maps/Charts/Tables/Graphs</i> The technician uses the information in service manual charts, tables, or graphs to the appropriate repair/replacement procedure and/or part.</p>	BR-174, EP-472, ER-197, AT-538, MD-565	Pages 123-124, 191-192, 212, 255-256, 257
<p>AS-9 <i>Scientific Methods</i> The technician develops a theory relative to the cause of the problem based on the information provided, then tests the hypothesis to determine the solution.</p>	ER-221, ER-238, HA-275, HA-364, MD-565, MD-626	Pages 201-202, 213, 221-222, 257, 261, 262, 313
<p>AS-10 <i>Standard/Metric</i> The technician can convert measurements taken in the standard or metric system to specifications stated in either system.</p>	HB-78 through HB-80, EP-361, AT-538	Pages 193-194, 255-256
<p>AS-11 <i>Information Processing</i> The technician can use computer databases to input and retrieve information for billing, warranty work, and other record-keeping purposes.</p>		Pages 287, 300, 319
<p>AS-12 <i>Levers</i> The technician can explain how levers can be used to increase an applied force over distance.</p>	BR-188, BR-197, BR-203, SS-536, MD-589	Pages 112, 125-126, 127, 199-200, 258
<p>AS-13 <i>Pulleys</i> The technician can explain how pulleys can be used to increase an applied force over distance.</p>		Pages 245-246
<p>AS-14 <i>Distance/Length</i> The technician can use precision measuring devices to determine if wear and adjustments are within the manufacturer's tolerances.</p>	BR-177, HA-372, AT-550	Pages 97-98
<p>AS-15 <i>Force</i> The technician can use a tension gauge such as a torque wrench to measure the force or tension required to tighten connections to manufacturer's specifications.</p>	SS-519	Pages 197-198

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AS-16 <i>Balance</i> The technician can measure and balance rotating systems.		Pages 215-216
AS-17 <i>Pressure</i> The technician can measure pressures in hydraulic or pneumatic systems and compare them to the manufacturer's specifications.	EP-442, ER-186	Pages 81-82, 211
AS-18 <i>Time</i> The technician uses direct and indirect methods to measure time and compare the results to the manufacturer's specifications.		Page 260
AS-19 <i>Fahrenheit/Centigrade</i> The technician measures system temperatures and converts them to °F or °C as required.	BR-116, AT-409	Pages 78, 240
AS-20 <i>Liquids/Solids</i> The technician can measure the volume of a liquid in a system and compare it to the manufacturer's specifications.	EP-451, AT-409	Pages 185, 240
AS-21 <i>Fractional Distillation</i> The technician can explain the ignition characteristics of fuels resulting from varying levels of fractional distillation (fuels with differing chemical makeups).	ER-197	Pages 188, 212
AS-22 <i>Internal/External Combustion</i> The technician can demonstrate an understanding of how fuel characteristics affect combustion in an automotive engine.	EP-451, ER-197	Page 212
AS-23 <i>Phases/States</i> The technician can explain in detail the three states of matter.	HA-329, HA-340	Pages 231-232

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AS-24 <i>Chemical Reactions</i> The technician can demonstrate an understanding of the chemical reactions that occur in the automotive engine that are related to the combustion of fuels and the operation of the catalytic converter.	EP-451, EP-472, EP-494, ER-197	Pages 185, 186, 191-192, 212
AS-25 <i>Inhibitors</i> The technician can explain the purpose of having additives in automobile lubricants.		Page 121, 326
AS-26 <i>Temperature</i> The technician can define heat and determine its affect in vehicle components by taking temperature readings.	HA-275	Pages 221-222, 257
AS-27 <i>Heat</i> The technician can demonstrate an understanding of the effect of heat on automotive systems.	BR-222, ER-146, ER-221, HA-275, HA-300, HA-329, HA-340, AT-409, MD-565	Pages 128, 207-208, 213, 221-222, 229-230, 240, 257
AS-28 <i>Conduction/Convection</i> The technician is able to explain the concept of heat transfer in terms of conduction, radiation, and convection in automotive systems.	BR-222, MD-565	Pages 128, 257
AS-29 <i>Expansion/Contraction</i> The technician is able to demonstrate an understanding of the expansion and contraction of system parts as a result of heat generated during the use of the system.	EP-358, ER-116, AT-538	Page 168
AS-30 <i>Fusion/Vaporization</i> The technician can demonstrate an understanding of how heat causes a change in the state of matter.	EP-358, ER-116, HA-340	Pages 168, 233-234
AS-31 <i>Insulation</i> The technician can explain the role of insulation in maintaining temperatures.		Pages 225-226

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<p>AS-32 <i>Radiation</i> The technician can demonstrate an understanding of heat transfer that involves infrared rays.</p>		Pages 223-224
<p>AS-33 <i>Refraction</i> The technician can demonstrate an understanding of refraction as it occurs in systems that employ fiber optics.</p>		Pages 159-160
<p>AS-34 <i>Ultraviolet</i> The technician can demonstrate an understanding of why some dyes added to lubricants fluoresce in ultraviolet light.</p>		Pages 161-162
<p>AS-35 <i>Ultraviolet</i> The technician can demonstrate a process for determining the source of leakage using ultraviolet light.</p>		Pages 161-162
<p>AS-36 <i>Sound</i> The technician can demonstrate an understanding of the role sound plays in identifying various problems in the vehicle.</p>		Pages 171-172, 175
<p>AS-37 <i>Vibrations/Waves</i> The technician is able to demonstrate an understanding of the cause and types of vibrations caused by out-of-balance or excessively worn systems.</p>	SS-557	Page 175
<p>AS-38 <i>Amplification</i> The technician can explain to a customer how sound can be amplified in a vehicle due to resonant cavities and other physical characteristics of the vehicle.</p>		Pages 171-172, 173
<p>AS-39 <i>Carriers/Insulators</i> The technician can demonstrate an understanding of how sound generated in one place can be carried to other parts of the body or engine through metal and other materials.</p>	EP-382, HA-364	Pages 171-172

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AS-40 <i>Decibels/Intensity</i> The technician can demonstrate an understanding of how sound intensity can be measured.		Pages 171-172
AS-41 <i>Frequency-Hertz</i> The technician can explain how frequency of a sound can be used to identify normal and abnormal operating systems.		Page 175
AS-42 <i>Hearing</i> The technician can demonstrate an understanding of the role of listening for unusual sounds as part of the trouble-shooting process.	EP-382, HA-364	Pages 19, 20
AS-43 <i>Noise/Acoustics</i> The technician can demonstrate an understanding of why the acoustics of the vehicle affect specific noises.	EP-382, HA-364	Pages 171-172, 173
AS-44 <i>Overtones/Harmonics</i> The technician can explain that the presence of overtones may indicate changes in vibrations in systems.		Pages 171-172, 173
AS-45 <i>Pitch/Frequency</i> The technician can explain the relationship of pitch to frequency.		Pages 171-172
AS-46 <i>Resonance</i> The technician can demonstrate an understanding of what happens when an object resonates.		Pages 171-172, 175
AS-47 <i>Force, Balanced/Unbalanced</i> The technician can demonstrate an understanding of the role of balanced and unbalanced forces on linear or rotating vehicle assemblies.	BR-197, AT-430	Pages 127, 215-216, 245-246

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AS-48 <i>Centrifugal/Centripetal</i> The technician can explain the relationship of centrifugal/centripetal force to the functioning or failure of a rotating system.	BR-110, AT-477	Pages 115-116, 249
AS-49 <i>Pressure</i> The technician can demonstrate an understanding of the concept of pressure in relation to the concept of force.	BR-134, EP-442, ER-186, AT-477, MD-589	Pages 31, 32, 211
AS-50 <i>Work</i> The technician can explain the relationship between torque and horsepower.		Pages 189-190
AS-51 <i>Acceleration/Deceleration</i> The technician can demonstrate an understanding of a vehicle's acceleration and deceleration as a function of vehicle weight and power.	BR-110, BR-144, BR-174, MD-607	Pages 115-116, 121-122, 123-124, 259
AS-52 <i>Circular</i> The technician can demonstrate an understanding of circular motion as it relates to changes in toe and camber on turns.	SS-582	Pages 203-204
AS-53 <i>Electricity</i> The technician can demonstrate an understanding of and explain the properties of electricity as they relate to lighting, engine management, and other electrical systems in the vehicle.	EL-244, EP-409, HA-380, AT-521	Pages 129, 133-134, 137-138, 179, 253-254
AS-54 <i>Batteries</i> The technician can demonstrate an understanding of the electrochemical reactions that occur in wet-cell and dry-cell batteries.	EL-262	Pages 147, 151-152
AS-55 <i>Acids/Bases</i> The technician can identify the effects of the pH of a solution on various systems.		Pages 141-142, 143-144

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AS-56 <i>Density/Specific Gravity</i> The technician can explain the role of specific gravity in determining the condition of the system.	EL-262	Pages 149-150, 151-152
AS-57 <i>Conductors</i> The technician can explain the difference between an electrical conductor and an insulator.	EL-244	Pages 133-134
AS-58 <i>AC-DC</i> The technician can explain the difference between direct and alternating current.	EL-244	Page 129
AS-59 <i>Ground</i> The technician can demonstrate an understanding of the characteristics of a quality electrical ground.	EL-323, ER-157	Page 130, 158
AS-60 <i>Ground</i> The technician can demonstrate an understanding of the problems associated with having an electrical circuit inadequately grounded.	EL-323, ER-157	Page 130, 158
AS-61 <i>Parallel/Series Circuits</i> The technician can explain current flow and voltage in series and parallel circuits.	EL-231 through EL-233	Pages 137-138
AS-62 <i>Short Circuit</i> The technician can demonstrate an understanding of the processes used to locate a short circuit in the electrical/electronic system.	EL-244	Page 130
AS-63 <i>Generators</i> The technician can explain how the movement of a conductor in a magnetic field will generate electricity.	EL-290	Pages 153-154, 157
AS-64 <i>Motors</i> The technician can demonstrate an understanding of the role of the generator/alternator in maintaining battery and system voltage.	EL-290	Pages 148, 157

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AS-65 Transformers The technician can explain the ignition coil transformer's role in generating the high voltage required to fire a spark plug.	EP-431	Pages 180, 181-182
AS-66 Electricity--Measurement The technician can demonstrate an understanding of the correct procedure to measure the electrical parameters of voltage, current, and resistance.	EP-399, EP-409	Pages 131-132, 137-138, 177-178, 179, 237-238
AS-67 Ammeter/Voltmeter The technician can demonstrate an understanding of how to correctly measure electrical current and voltage in a circuit.	EP-399, EP-409, AT-521	Pages 131-132, 137-138
AS-68 Electrical The technician can use precision electrical test equipment to measure current, voltage, and resistance.	EL-346, EP-399, HA-380	Pages 137-138, 167, 177-178, 237-238
AS-69 Fuse The technician can explain the role of a fuse or fusible link as a protective device in an electrical or electronic circuit.	EL-244, EL-323	Pages 135-136, 158
AS-70 Ohm's Law The technician can demonstrate an understanding of and explain the use of Ohm's Law in verifying circuit parameters (resistance, voltage, amperage).	EL-244, HA-385	Pages 85-86, 129
AS-71 Resistance The technician can demonstrate an understanding of the relationship of resistance to heat, voltage drop, and circuit parameters.	EL-244, HA-385	Pages 85-86, 129
AS-72 Voltage The technician can demonstrate an understanding of and explain system voltage generation, uses, and characteristics.	EL-290	Pages 157, 181-182

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AS-73 <i>Electrochemical Reactions</i> The technician can demonstrate an understanding of the ion transfer process that occurs in an automotive battery.	EL-262	Pages 139-140, 145, 151-152
AS-74 <i>Activity of Metals</i> The technician can explain the conductivity problems in a circuit when connectors corrode due to electrochemical reactions.	EL-244	Page 146
AS-75 <i>Electromagnetism</i> The technician can explain the relationship between current in a conductor and strength of the magnetic field.	EL-277, EP-431	Pages 70-71, 155-156, 180
AS-76 <i>Coil</i> The technician can explain how a coil can increase the battery voltage needed to fire a spark plug.	EP-431	Pages 180, 181-182
AS-77 <i>Capacitance</i> The technician can demonstrate an understanding of the role of capacitance in timer circuits such as RC timers or a MAP sensor.	EP-482	Pages 45-46
AS-78 <i>Magnetic Fields/Force</i> The technician can explain the effect of magnetic fields on unshielded circuits in control modules.	EL-277	Pages 153-154, 155-156, 206
AS-79 <i>Semiconductor Devices</i> The technician can demonstrate an understanding of the capability of semiconductor devices to rapidly modify engine operation parameters.	EP-482	Pages 165-166, 167
AS-80 <i>Mechanical Transducers</i> The technician can demonstrate an understanding of the role transducers play in sending a control signal to modify the system's operation.		Page 164

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AS-81 <i>Photocells</i> The technician can demonstrate an understanding of the purpose of photocells.		Page 288
AS-82 <i>Photocells</i> The technician can demonstrate the measurement processes used to determine the output of photocells.		Page 288
AS-83 <i>Barometric Pressure</i> The technician can demonstrate an understanding of the relationship of barometric pressure to engine performance.	HA-340	Pages 167, 227-228
AS-84 <i>Relative Humidity</i> The technician can demonstrate an understanding of and discuss relative humidity in terms of its effect on automotive heating and air conditioning systems.	HA-275	Pages 221-222
AS-85 <i>Problem Solving</i> The technician can use computers, scan tools, and on-board data to diagnose problems.	EP-409, EP-472	Pages 45-46
AS-86 <i>Action/Reaction</i> The technician can demonstrate an understanding of the action/reaction of fluids involving valves or pistons.	BR-134, AT-409	Pages 117-118, 240
AS-87 <i>Hydraulics</i> The technician can explain how fluid pressure transmits force from one location to another.	BR-134, ER-186, AT-430, AT-449	Pages 117-118, 211, 347-348
AS-88 <i>Pneumatics</i> The technician can demonstrate an understanding of the forces and motions in pneumatic systems.		Pages 219-220
AS-89 <i>Ions</i> The technician can explain the principles by which a catalytic converter modifies emission gasses at the atomic level to provide a lower level of HC, CO, and NO _x in the final exhaust.		Pages 195-196

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AS-90 <i>Friction</i> The technician can demonstrate an understanding of friction and its effects on linear and rotational motion.	BR-110, BR-144, BR-174, SS-582, AT-491, MD-607, MD-672	Pages 115-116, 121-122, 123-124, 177-178, 203-204, 251-252, 259, 265-266
AS-91 <i>Friction</i> The technician can explain the role that friction plays in acceleration and deceleration.	BR-110, BR-174, AT-491, MD-607, MD-672	Pages 115-116, 123-124, 186, 251-252, 259, 265-266
AS-92 <i>Friction</i> The technician can explain the need for lubrication to minimize friction.	BR-110, BR-174, AT-491, MD-607, MD-672	Pages 115-116, 123-124, 186, 251-252, 259, 265-266
AS-93 <i>Metallurgy</i> The technician can explain the critical need for metals of different hardnesses in automotive parts.	ER-164, ER-265, AT-538, MD-565, MD-659	Page 201-202, 209-210, 217, 255-256, 257, 263-264
AS-94 <i>Dynamics</i> The technician can explain the forces and motions involved in a hydraulic system.	BR-123, ER-186, AT-430, AT-449	Pages 211, 247-248
AS-95 <i>Surface Process (Absorption/Adsorption)</i> The technician can explain the surface process that occurs on system seals due to absorption of the contained materials.		Pages 218, 241-242
AS-96 <i>Contamination</i> The technician can demonstrate an understanding of how a contaminated liquid can cause a chemical reaction that results in the deterioration of performance.	AT-409	Pages 113-114
AS-97 <i>Torque</i> The technician can demonstrate an understanding of how torque relates to force and angular acceleration.	SS-519, ER-164	Pages 112, 197-198, 209-210

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AS-98 <i>Simple Machines</i> The technician can demonstrate an understanding of how cams, pulleys, and levers are used to multiply force or change the direction of force in a mechanical system.	BR-188, BR-197, SS-536, MD-626	Pages 125-126, 127, 199-200, 245-246, 261-262
AS-99 <i>Rotational</i> The technician can explain how rotational motion can be converted to linear motion and why balance is important in rotating systems.	EP-358, SS-582	Pages 203-204, 215-216
AS-100 <i>Flow Rate</i> The technician can demonstrate an understanding of how variances in flow rate in airflow sensors and cooling systems can affect engine performance.	EP-399, EP-442, EP-438, ER-146	Pages 45-46, 81-82
AS-101 <i>Proportion Mixtures</i> The technician can correctly mix fluids using proportions.	EP-451, HA-300	Page 79-80, 185, 229-230
AS-102 <i>Adhesives/Sealants</i> The technician can demonstrate an understanding of how surface processes and cohesive/adhesive forces determine the effectiveness of glues, tapes, and sealants.		Pages 218, 231
AS-103 <i>Viscosity</i> The technician can demonstrate an understanding of fluid viscosity as a measurement and explain how it impacts engine performance.	ER-146	Pages 207-208