



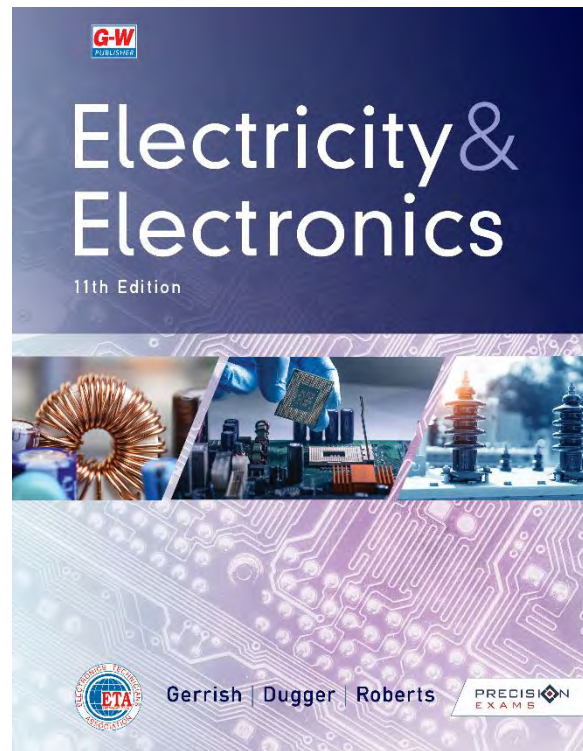
**Correlation of
Electricity & Electronics, Gerrish, Dugger, and Roberts
(Goodheart-Willcox Publisher ©2021)**

to

ETA International Student Electronics Technician (SET) Knowledge Competencies

The following chart correlates Goodheart-Willcox Publisher's *Electricity & Electronics* to the ETA International's Student Electronics Technician (SET) Knowledge Competencies. Listed are the standard's competencies, and the corresponding/applicable content from *Electricity & Electronics*.

The SET Knowledge Competencies are for use by high school and post-secondary programs that offer training in basic electronics applications. The SET may be used for program assessment and as student certification from the following topics in these competencies.



Knowledge Competencies	G-W Content
1.0 Safety	
1.1. Describe electrical shock and its causes.	Textbook: pgs. 3–4
1.2. List the effects of electric current on the human body.	Textbook: pgs. 3–4
1.3. Explain shock hazards when working around power sources.	Textbook: pgs. 4–5
1.4. Identify sources of static charges and its damage to sensitive components.	Textbook: pgs. 3–5
1.4.1. Describe static charge prevention straps, mats and grounding.	Textbook: pgs. 4–5
1.5. List tools use hazards in the workplace and in the field.	Textbook: pgs. 7–10

Knowledge Competencies	G-W Content
1.6. Describe lockout and tagging rules for unsafe electrical or mechanical hazards.	Textbook: pg. 4
1.7. Explain where eye and ear protection are needed.	Textbook: pgs. 6–7
1.8. List safety concerns related to the National Electrical Code®.	Textbook: pgs. 4, 75
1.9. Describe the types and usage of fire extinguishers.	Textbook: pgs. 14–15
2.0 Electron Theory	
2.1. Describe atomic structure and parts of the atom with its electric charges.	Textbook: pgs. 33–34
2.2. Describe the action of electrons, protons and neutrons.	Textbook: pgs. 34–35
2.3. Explain static charges and <i>coulombs</i> .	Textbook: pg. 36
2.4. Explain current flow and units of measure.	Textbook: pg. 42
2.5. Explain potential difference, voltage drop and units of measure.	Textbook: pgs. 40, 42, 75
2.6. List types of resistive materials and units.	Textbook: pgs. 42–43, 73–74
2.7. Describe voltage sources, batteries and electromagnetic force.	Textbook: pgs. 106, 179
2.8. Explain the creation of magnet poles and magnetic effects.	Textbook: pgs. 161–164
3.0 DC Basics	
3.1. State Ohm's law and Watt's power laws.	Textbook: pgs. 45, 96–98
3.2. List 12 common basic electronic formulas derived from Ohm's and Watt's laws.	Textbook: pgs. 45, 96–98
3.3. State Kirchhoff laws for current and voltage.	Textbook: pgs. 127, 136
3.4. Explain formulas used in series circuits.	Textbook: pgs. 127–129
3.5. Explain formulas used for parallel circuits.	Textbook: pgs. 136–140
3.6. Identify circuit configurations of series, parallel and combination circuits.	Textbook: pgs. 127–129, 136–140
3.7. Explain the purposes of grounding and common conventions.	Textbook: pgs. 3–4
3.8. Calculate power consumption, dissipation and energy units.	Textbook: pg. 96
3.9. Describe capacitance and its units of measure including charging and discharging curves.	Textbook: pgs. 275, 282–284

Knowledge Competencies	G-W Content
4.0 AC Basics	
4.1. List methods that produce alternating current.	Textbook: pgs. 179–184, 188–189
4.2. Describe sine wave shapes and RMS values.	Textbook: pgs. 179, 191
4.3. Describe capacitance and its units of measure.	Textbook: pgs. 275–276
4.4. Describe magnetic flux and inductance and list its units of measure.	Textbook: pgs. 164, 253
4.5. Explain how series circuits with R, C and L values are used in electronics equipment.	Textbook: pgs. 257–258, 281–283, 293–295
4.6. Explain how inductance relates to magnetism and describe coil construction, cores and usages.	Textbook: pgs. 178, 253–254, 256
4.7. Compare reactance and resistance and describe current/voltage relationships.	Textbook: pgs. 261–263
4.8. Compare impedance with reactance and resistance.	Textbook: pgs. 227, 265–266
4.8.1. Explain the causes and effects of impedance.	Textbook: pgs. 227, 265–266
5.0 Wire and Cables	
5.1. List wire types, purpose of insulation and construction.	Textbook: pgs. 69–74, 527–528
5.2. Explain the American Wire Gauge (AWG) sizes of conductors.	Textbook: pgs. 69–72
5.3. List common uses for copper cables in electrical and telecommunications applications.	Textbook: pgs. 464–466, 527–528
5.4. Explain differences between copper, coaxial and fiber optic cables.	Textbook: pgs. 474–475, 527–528
5.5. Explain the effects of proper and improper termination.	Textbook: pgs. 480–482
5.6. Describe types and testing of splices.	Textbook: pgs. 481–482
6.0 Electronic Components	
6.1. Identify common electronic symbols of components and connection points.	Textbook: pgs. 59, 62, 65, 73, 76, 82–84, 88, 90, 253, 255–258, 275
6.2. Identify types of switches and use in circuits.	Textbook: pgs. 82–83
6.3. Describe fuses and circuit breakers.	Textbook: pg. 84
6.4. Explain where passive components are used in circuits.	Textbook: pgs. 85–87, 88–90, 317–319, 327–329

Knowledge Competencies	G-W Content
6.5. Identify resistor values by color code and numerical markings.	Textbook: pgs. 88–92
6.6. Identify capacitor types, ratings and use in circuits.	Textbook: pgs. 275–279
6.7. Identify inductive components, core materials and how coil diameter and wire size affect values.	Textbook: pgs. 253–254, 256–262
6.8. Identify common types of transformers and explain step-up/step-down in relation to turns ratio.	Textbook: pgs. 220–223, 232–234
7.0 Semiconductors	
7.1. Explain P-N junction theory.	Textbook: pgs. 317–318, 337–340
7.2. Describe types of diodes.	Textbook: pgs. 318–319
7.3. Explain Zener diode ratings; describe their usage in regulator circuits.	Textbook: pg. 318
7.4. Identify PNP and NPN transistors as to type and usage.	Textbook: pgs. 337–339
7.5. Describe FET, MOSFET and CMOS types of components.	Textbook: pgs. 339–341, 391
7.6. Identify other semiconductors and symbols and explain their uses.	Textbook: pgs. 317–319
7.7. Compare thyristors with other semiconductors.	Textbook: pgs. 360–361
7.8. Identify diacs, triacs and SCRs and explain their operation.	Textbook: pgs. 360–361
7.9. Identify common types of Integrated Circuit packages and chip cases.	Textbook: pgs. 365, 370–374
8.0 Power Supplies	
8.1. Describe types of batteries and common usage including primary, secondary and rechargeable cells.	Textbook: pgs. 106–113,
8.2. Describe how to safely work on and around power supplies.	Textbook: pgs. 3–10
8.3. Describe the differences between half wave and full wave power supply types.	Textbook: pgs. 324–326
8.4. Identify components that determine output voltage and power.	Textbook: pgs. 326–328
8.5. Explain the need for power supply filtering, describe hum, and identify common filter types.	Textbook: pgs. 304–307, 326–328, 417

Knowledge Competencies	G-W Content
8.6. Explain the reasons for regulation in an electronic power supply.	Textbook: pgs. 322–324
8.7. Explain why and where fuses and circuit breakers are located in protection circuits.	Textbook: pgs. 62–65, 84, 233
9.0 Amplifiers and Analog Circuits	
9.1. List common amplifier devices.	Textbook: pgs. 341, 352, 354–359
9.2. List common amplifier configurations.	Textbook: pgs. 349–352
9.3. Describe the purpose of components in an amplifier circuit.	Textbook: pgs. 341–342, 345–347
9.4. List the usages and classes of amplifiers.	Textbook: pgs. 348–352
9.5. Describe decibel (dB) measurements, voltage and power gain.	Textbook: pgs. 345–347
9.6. Explain frequency response of an amplifier circuit and why it is important.	Textbook: pg. 348
9.7. Explain the uses of operational amplifiers and how they differ from discrete amplifiers.	Textbook: pgs. 370–372, 410
9.8. Identify causes of distortion in amplifiers and list ways to reduce or eliminate it.	Textbook: pg. 348
9.9. List types of feedback.	Textbook: pg. 403
9.10. Describe types of oscillator circuits.	Textbook: pgs. 403–410
10.0 Interfacing of Electronics Products	
10.1. List signal levels in electronics products.	Textbook: pgs. 415–417
10.2. List anticipated signal or voltage levels for output circuits in audio and video equipment.	Textbook: pgs. 416–419
10.3. Explain the importance of impedance matching and list causes of mismatches.	Textbook: pgs. 227, 359
10.4. Explain common types of connectors.	Textbook: pgs. 464–466
10.5. Explain grounding methods.	Textbook: pg. 230
10.6. Describe power transfer between circuits, components used and problems of mismatch.	Textbook: pgs. 337–341, 359
11.0 Digital Concepts and Circuitry	
11.1. Describe the use of binary numbers and math, converting between binary and decimal.	Textbook: pgs. 378–379
11.2. Identify symbol and function of digital logic gates: (AND, OR, NOT, NAND, NOR, XOR and XNOR).	Textbook: pgs. 382–387
11.3. Explain truth tables for basic gates.	Textbook: pg. 382

Knowledge Competencies	G-W Content
11.4. Explain Boolean equations from a truth table for combinational logic circuit.	Textbook: pgs. 388–390
11.4.1. Simplify Boolean equations using Boolean Algebra or K-map.	Textbook: pgs. 388–390
11.5. Simplify combinational logic circuits to the fewest number of chips using NAND or NOR gates.	Textbook: pgs. 385–386, 390
11.6. Explain the purpose of a latch and list common flip-flops.	Textbook: pgs. 394–397
11.7. Explain the purpose of clocks in sequential circuits.	Textbook: pg. 399
11.8. List types and functions of shift registers.	Textbook: pgs. 398–399
11.9. Explain how counters and timers operate.	Textbook: pgs. 374, 397–398
12.0 Computer Electronics	
12.1. Describe the major components of a computer.	Textbook: pgs. 495–505
12.2. Describe how the computer block diagram and flow charts are utilized.	Textbook: pgs. 62–65, 467
12.3. Explain Operating System functions and common types.	Textbook: pg. 507
12.4. Explain the function of a bus and how it connects the CPU, peripherals, and/or memory devices.	Textbook: pgs. 497–499, 518
12.5. Describe different types of computer memory and how storage is accomplished.	Textbook: pgs. 501–504
12.6. List various types of peripherals, USB and other connector usage.	Textbook: pgs. 503–504, 508–510
12.7. Describe how microprocessors function and identify internal sections.	Textbook: pgs. 497–498
13.0 Computer Applications	
13.1. Explain basic computer operation.	Textbook: pgs. 495–507
13.2. List ways to backup data and the importance of daily back-ups.	Textbook: pgs. 501–504
13.3. Explain the importance of impedance matching; list causes of mismatches.	Textbook: pgs. 227, 233, 359
13.4. Explain major components and use of the Internet, browsers and IP addressing.	Textbook: pgs. 511–512, 523–524
13.5. List commonly used programming languages.	Textbook: pgs. 561–564

Knowledge Competencies	G-W Content
13.6. List commonly used software application programs.	Textbook: pgs. 506–507
14.0 Audio and Video Systems	
14.1. Explain major components of common entertainment, function and security products.	Textbook: pgs. 422, 443–444, 455–457, 464–466, 495–505
14.2. Describe microphone types, construction and usage.	Textbook: pg. 422
14.3. Explain speaker construction, usage and precautions.	Textbook: pg. 443
14.4. List the types of cables and connectors used in audio and video applications.	Textbook: pgs. 464–466
14.5. Describe distorted sound and electronic/acoustical causes of distortion.	Textbook: pgs. 416, 424, 433, 443
14.6. Explain how signals may conflict and the indications the conflict may produce, including interference and static.	Textbook: pgs. 416–418, 442
14.7. Explain how to isolate problems between discrete equipment.	Textbook: pgs. 448–449, 469–470, 568–572
15.0 Optical Electronics	
15.1. Describe symbols for photo resistors, photodiodes and phototransistors.	Textbook: pg. 483
15.2. List materials that make up optical devices.	Textbook: pgs. 474–475, 478–479, 481–484
15.3. List common display devices and describe how numbers and letters are activated.	Textbook: pgs. 455–457
15.4. Explain where and how LCD displays are used.	Textbook: pgs. 455–457
15.5. Describe how LED devices function.	Textbook: pgs. 318–319, 456–457
15.6. List applications of opto-isolators.	Textbook: pgs. 565–566
15.7. Describe uses for light-activated controls and photosensitive devices.	Textbook: pgs. 118, 555–556
15.8. Explain where charge-coupled devices (CCD) are found.	Textbook: pgs. 455, 477, 509–510
15.9. List products where lasers are used.	Textbook: pgs. 486–488
16.0 Telecommunications Basics	
16.1. Describe major types of communications: landline, wireless and two-way.	Textbook: pgs. 445, 474, 504–505, 511–512
16.2. Explain half duplex and full duplex communications.	Textbook: pgs. 511–512

Knowledge Competencies	G-W Content
16.3. Describe copper and fiber telephone local loop circuits.	Textbook: pg. 511
16.4. Explain the common connectors, plugs and jacks used in communications.	Textbook: pgs. 464–466, 511–512
16.5. List fiber optics types.	Textbook: pgs. 478–479, 481–484
16.6. List common RF (Radio Frequency) bands.	Textbook: pgs. 423–428
16.7. Explain types and frequencies used in cellular communications.	Textbook: pgs. 445–449, 549–550
16.8. Describe common wireless schema, such as WiFi, Bluetooth, and Zigbee.	Textbook: pgs. 512, 537, 541
17.0 Industrial and Manufacturing Automation	
17.1. Identify types of DC motors.	Textbook: pgs. 210–212
17.2. Describe the common uses of AC motors.	Textbook: pgs. 237–238
17.3. Identify types of alternator and generator power sources.	Textbook: pgs. 178–184, 192
17.4. Describe use and types of sensors.	Textbook: pgs. 558, 564, 567
17.5. Explain the use of ladder logic and control devices.	Textbook: pgs. 567–568
17.6. Explain how microcontrollers and PLCs function.	Textbook: pgs. 555–556, 567–568
17.7. Describe the use and programming of major types of control panels.	Textbook: pgs. 555–556, 558–560
18.0 Test Equipment and Measurements	
18.1. Describe how a Digital Multimeter (DMM) and related meters operate.	Textbook: pgs. 59–60
18.2. Identify meter protection, safety and usage.	Textbook: pgs. 60–61
18.3. Explain care of equipment and test leads.	Textbook: pgs. 57, 60–61
18.4. List the purposes and types of signal generators.	Textbook: pgs. 370–371, 409, 448–449
18.5. Describe meter loading and precautions observed.	Textbook: pg. 56
18.6. List the uses and precautions for logic tracer test probes.	Textbook: pg. 393
18.7. Explain how logic pulsers are used.	Textbook: pg. 393
18.8. Describe oscilloscope usage and explain the purposes of front panel controls.	Textbook: pgs. 197–200

Knowledge Competencies	G-W Content
19.0 Soldering—Desoldering Tools	
19.1. Describe soldering safety.	Textbook: pgs. 78–81
19.2. Explain hazards of solder fumes and solder spatter.	Textbook: pgs. 79–81
19.3. Explain solder flux usage and describe types.	Textbook: pg. 79
19.4. List types of solder and reasons for choosing each.	Textbook: pgs. 78–79
19.5. Identify cold solder joints and explain causes.	Textbook: pg. 81
19.6. Describe the differences between good and bad mechanical and electrical solder connections.	Textbook: pgs. 80–81
19.7. Describe various types of desoldering equipment and how it is used.	Textbook: pgs. 80–81
19.8. Describe how to use of braid-wick solder removers.	Textbook: pgs. 80–81
20.0 Troubleshooting and Repair Procedures	
20.1. Explain the order of the troubleshooting process and techniques to find problems.	Textbook: pgs. 141–142, 153–155, 195–196, 232, 248, 484–485, 568–572
20.2. Describe how to locate/cross reference parts and products in catalogs and online.	Textbook: pgs. 469–470, 568–572
20.2.1. Explain how to safely download service and technical information.	Textbook: pg. 569
20.3. Explain the purposes and requirements for proper documentation.	Textbook: pg. 572
20.4. Explain how block diagrams are used for troubleshooting and maintenance of electronics products.	Textbook: pgs. 467–469, 569–570
20.5. Explain the differences between wiring prints, circuit board views, schematics and block diagrams.	Textbook: pgs. 62–65, 558, 569–570
20.6. Describe the purpose and use of test points including their likely placement on schematics.	Textbook: pg. 570
20.7. Explain how schematics are used to locate component and wiring failures in electronics products.	Textbook: pg. 62
20.8. Explain the methods of using flow diagrams/charts.	Textbook: pgs. 64–65