

# Extra Class

## Pre-Study Question Packet

### (2020 – 2024)

Welcome to your Extra Class Element 4 pre-study homework. This *Pre-Study Question Packet* is fill-in-the-blank. Your actual Element 4 written examination will be multiple choice – all the easier.

This *Pre-Study Question Packet* is straight out of my Gordon West's *Extra Class* book. The fill in the blank questions follow the exact order of my book. We have rearranged the questions to make the concepts easier to learn, and we've even given you page numbers.

My *On the Air Audio Experiences* contain the exciting sounds of the exclusive Extra class portions of the ham bands and a brief introduction to the book. The files are housed exclusively in ARRL's Learning Center. I also have a comprehensive teaching PowerPoint called "Gordon West Instructor Extra Class License Presentation" here. These are only accessible to ARRL Registered Instructors.

Begin reading over my *Extra Class* book and start filling in the answers to this *Pre-Study Packet*.

I come with the book as your personal instructor via phone or E mail! If you have any questions, or don't understand a concept, or simply want my personal words of encouragement, call me and let's talk ham radio! (see my contact information below)

*A foreword written by Gordon West.*

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**Contact Gordon West, WB6NOA**

Email: [wb6noa@arrl.net](mailto:wb6noa@arrl.net)

Phone: 714 549-5000 from M-R,  
10AM - 4PM California time.

\*A reminder that any available Gordon West material can only be accessed via the digital ARRL Learning Center site <https://learn.arrl.org/> or for purchase on the ARRL main website at <https://www.arrl.org/gordon-west>

## EXTRA CLASS PRIVILEGES (pages 1 – 8)

1. X refers to the Gordon West *Extra Class* book. Do you have it? \_\_\_\_\_
2. On which bands do you gain 25 kHz window of exclusive CW privileges at the bottom of each band?  
\_\_\_\_\_
3. When you get to Extra, you gain \_\_\_\_\_ kHz of additional voice and data privileges?
4. On 75 meters, your Extra class voice privileges, not shared with other operators, are from \_\_\_\_\_ MHz to \_\_\_\_\_ MHz?
5. On the popular 20-meter band, Extras have non-shared voice privileges from \_\_\_\_\_ MHz to \_\_\_\_\_ MHz.
6. As an Extra class operator, you may test for all levels as a V \_\_\_\_\_ E \_\_\_\_\_.

## HAM RADIO HISTORY (pages 9 -16)

1. How many hams are in the USA? \_\_\_\_\_
2. How old is the amateur radio service? \_\_\_\_\_
3. In 1979, what test was eliminated for operation above 30 MHz? \_\_\_\_\_
4. In 2007, what test requirement was eliminated for high frequency licensing?  
\_\_\_\_\_
5. When did Volunteer testing begin? \_\_\_\_\_
6. Which test element is Element 2? \_\_\_\_\_
7. Which element is Element 3? \_\_\_\_\_
8. Which element is Element 4? \_\_\_\_\_
9. May an applicant go from Technician to Extra without taking the General element? \_\_\_\_\_

## GETTING READY FOR THE EXAM (pages 17 – 21)

1. How many test questions are on upcoming Extra Class Element 4 exam? \_\_\_\_\_
2. Answer \_\_\_\_\_ or more correctly, and you pass!
3. Confirm: Is your General class license current? \_\_\_\_\_
4. Important: When you pass your Extra class exam, the license term still remains the same – you don't automatically get 10 more years before renewal. Check your General license renewal date. This is when your new Extra class renewal is due. Luckily, no retest is required!
5. What does Extra sub element E9 cover? \_\_\_\_\_
6. After my rearrangement of topics, how many topic areas are there? \_\_\_\_\_
7. OK, I scrambled the question numbers – where will you find the cross reference? p \_\_\_\_\_ to p \_\_\_\_\_?  
Hint: back of the book!
8. Make sure you download and play the audio course in the front of the book from the ARRL Learning Center. Did you play it? \_\_\_\_\_

## RULES AND REGULATIONS (pages 23 – 41)

1. When operating USB, how close to the top of the band may you operate? \_\_\_\_\_
2. How much power output on 60 meters? \_\_\_\_\_
3. How much power output on 30 meters code and data band? \_\_\_\_\_
4. With an Extra ticket, you gain authority in most \_\_\_\_\_ countries.
5. Where is the line A restriction for portions of 70 cm? \_\_\_\_\_
6. What type of control is a common repeater up on a mountainside under? \_\_\_\_\_
7. Where may repeater operation take place on 10 meters? \_\_\_\_\_
8. What is the minimum age limit to become a Volunteer Examiner? \_\_\_\_\_
9. What is issued to an examinee after passing a test element? \_\_\_\_\_
10. Fraudulent exam results might cost a VE team their own \_\_\_\_\_ .

## PROPAGATION (pages 42 – 60)

1. What are the two fields in an electromagnetic wave? \_\_\_\_\_
2. What is the polarization of an antenna whose electric field is perpendicular to the surface of the earth?  
\_\_\_\_\_
3. Which ham band provides great DX for nearly 24 hours a day? \_\_\_\_\_
4. Twilight conditions between two distant stations may lead to fantastic DX, called \_\_\_\_\_  
\_\_\_\_\_ propagation?
5. Best band for a meteor scatter contact? \_\_\_\_\_
6. What's that "horn" you see in the sun photo on p.47? \_\_\_\_\_
7. A VHF/UHF contact, sometimes lasting for days between stations separated 2,000 miles over the ocean is called \_\_\_\_\_?
8. You tune in on a DX station on 14.120, that indicates they are listening "up 35". Where should you transmit?  
\_\_\_\_\_

## SATELLITE AND SPACE COMMUNICATIONS (pages 61 – 73)

1. Which class of amateur license allows satellite communication? \_\_\_\_\_
2. What band do you receive on for satellite mode V/U? \_\_\_\_\_
3. Why does a satellite signal tune in higher as it is coming up toward you from the horizon?  
\_\_\_\_\_
4. What type of satellite appears in one steady position in the sky? \_\_\_\_\_
5. Where might you find CW and data moon bounce communications on 2 meters?  
\_\_\_\_\_
6. The best time to complete a moon bounce contact is when the moon is at \_\_\_\_\_.

## VISUAL AND VIDEO (pages 75 – 80)

1. Amateurs still use analog ham radio TV transmissions. What is the name of the video signal that carries color information? \_\_\_\_\_
2. Ham analog video fast scan TV is wide! – \_\_\_\_\_ MHz. Where on HF is a reserved spot for slow scan television? \_\_\_\_\_ MHz
3. On older oscilloscopes, if we exceed \_\_\_\_\_ we could cause the cathode ray tube to generate X-rays.
4. What is the big benefit of a liquid crystal display? \_\_\_\_\_

## DIGITAL (pages 81 – 94)

1. What digital mode is common below 30 MHz? \_\_\_\_\_
2. Which digital mode to transfer binary files? \_\_\_\_\_
3. What is the formula to determine digital band width? \_\_\_\_\_
4. Watch this level when adjusting PSK31? \_\_\_\_\_
5. How might we send our position over the air? \_\_\_\_\_
6. What is the common 2-meter frequency for sending digital position bursts?  
\_\_\_\_\_
7. Spread spectrum transmissions are allowed above \_\_\_\_\_ MHz.
8. What is the maximum transmitter power for spread spectrum? \_\_\_\_\_ watts
9. What is the formula for calculating CW bandwidth? \_\_\_\_\_

## MODULATION (pages 95 - 109)

1. What is the formula for modulation index?  
\_\_\_\_\_
2. What is the formula for deviation ratio?  
\_\_\_\_\_
3. What type of wave consists of a sine wave plus all odd harmonics? \_\_\_\_\_ wave
4. What influences power output measured on your SSB peak reading watt meter?  
\_\_\_\_\_
5. What is RMS voltage on your wall socket? \_\_\_\_\_
6. What would be the peak voltage on your wall socket? \_\_\_\_\_
7. What stage can generate an FM phone emission? \_\_\_\_\_
8. How might we generate an SSB phone signal? \_\_\_\_\_
9. What does DSP stand for? \_\_\_\_\_
10. Which components in the upper arm of a filter will create lowpass? \_\_\_\_\_
11. Which components in the upper arm of a filter will create highpass? \_\_\_\_\_
12. What is it called when the signals mix from two close-proximity repeaters, creating unwanted interference?  
\_\_\_\_\_
13. What are those large cans seen at repeater sites? \_\_\_\_\_

## AMPLIFIERS & POWER SUPPLIES (pages 111 – 121)

1. Which amplifier class offers best linearity with least distortion? \_\_\_\_\_
2. Which amplifier type eliminates even-order harmonics?
3. Which amplifier type offers best efficiency, but poor linearity? \_\_\_\_\_
4. What is the process for preventing unwanted oscillations in a power amplifier?  
\_\_\_\_\_
5. What devices do we find at UHF for power amplifier applications? \_\_\_\_\_
6. What device is used as a stable reference voltage in a linear voltage regulator? \_\_\_\_\_
7. What circuit is shown in figure E7-3? \_\_\_\_\_
8. What is the purpose of a bleeder resistor? \_\_\_\_\_
9. Watch out for this component – it can store a **lethal** voltage, even after the circuit is turned off?  
\_\_\_\_\_

## RECEIVERS & FILTERS (pages 123 – 140)

1. Which component in your radio develops the piezoelectric effect? \_\_\_\_\_
2. Which filter has no ripple and good attenuation beyond the passband? \_\_\_\_\_
3. The rearranged formula for determining intermodulation interference, frequency 2?  
\_\_\_\_\_
4. Is  $-174$  dBm great or fair for receiver sensitivity? \_\_\_\_\_
5. Your SSB voice filter network has this selectivity or greater? \_\_\_\_\_ kHz
6. Where is most of the noise coming from over your high frequency station antenna system?  
\_\_\_\_\_
7. What device provides rectification and filtering of RF signals? \_\_\_\_\_
8. What occurs within the mixer circuit if you introduce excessive preamplification?  
\_\_\_\_\_
9. Noise blankers are good for eliminating this type of interference? \_\_\_\_\_

## OSCILLATORS & SYNTHESIZERS (pages 141–150)

1. The oscillator that uses a quartz crystal? \_\_\_\_\_
2. Common oscillator for VFOs? \_\_\_\_\_
3. What does PLL stand for? \_\_\_\_\_
4. What does DDS stand for? \_\_\_\_\_
5. What are the unwanted components of DDS? \_\_\_\_\_

## RESONANCE – Don't Panic! (pages 151-174)

E = voltage L = inductance in a coil I = current C = capacitive reactance in a capacitor

1. In an ELI circuit, is it voltage or current *leading*? \_\_\_\_\_
2. In an ICE circuit, does current *lead* or *lag*?
3. When working phase angle questions on the test, most correct answers start off with \_\_\_\_\_ degrees?
4. A (+j) reactance is inductive or capacitive? \_\_\_\_\_
5. A circuit (-j) is capacitive or reactive? \_\_\_\_\_
6. What coordinate system may display the phase angle of circuits containing resistance, inductance, and/or capacitive reactance? \_\_\_\_\_
7. In polar coordinates, when inductive reactance cancels capacitive reactance, leading only to resistance in series, what is the phase angle? \_\_\_\_\_ degrees
8. Formula to determine half-power bandwidth? \_\_\_\_\_
9. In a time constant circuit, how many time constants for a capacitor to be charged 63.2 per cent of the supply voltage? \_\_\_\_\_ time constants
10. What page in the Gordo book allows you to visualize time constants? \_\_\_\_\_
11. As frequencies increase, RF current flows in a thinner layer of the conductor, close to the surface.  
What is this called? \_\_\_\_\_
12. What is the term for out-of-phase nonproductive power within a coil or capacitor? \_\_\_\_\_
13. Formula for computing true power? \_\_\_\_\_
14. Advantage of a toroidal core inductor? \_\_\_\_\_

## COMPONENTS (pages 175 - 186)

1. Draw a PNP transistor. \_\_\_\_\_
2. Draw an N-channel dual gate MOSFET. \_\_\_\_\_
3. What diode amplifies and oscillates? \_\_\_\_\_
4. Draw a varactor diode. \_\_\_\_\_
5. Input voltage to a logic "low" in an old TTL device? \_\_\_\_\_
6. What is a MMIC? \_\_\_\_\_
7. MMIC devices require \_\_\_\_\_ volts?

## DIGITAL LOGIC & OPTOS (pages 187 – 204)

1. Draw the symbol for an AND gate. \_\_\_\_\_
2. You can spot an OR gate symbol by a \_\_\_\_\_ on its nose.
3. A list of inputs and corresponding outputs for a digital device is called a \_\_\_\_\_.
4. This provides receiver calibration \_\_\_\_\_?
5. What does OP-AMP stand for? \_\_\_\_\_
6. Formula for the gain of an inverting IC OP-AMP? \_\_\_\_\_
7. Typical output impedance of an integrated circuit OP-AMP? \_\_\_\_\_
8. The tuning shaft and LED shine through this device? \_\_\_\_\_
9. What absorbs energy when light shines on a photovoltaic cell? \_\_\_\_\_

## TEST EQUIPMENT (pages 205 -211)

1. This instrument shows frequencies on the horizontal axis. \_\_\_\_\_
2. This instrument indicates pulses in a digital logic circuit. \_\_\_\_\_
3. This instrument measures frequencies. \_\_\_\_\_
4. An increase in current on an RF ammeter in series with the antenna feedline indicates less or more current to the antenna? \_\_\_\_\_
5. What type of meter shows a traditional needle movement? \_\_\_\_\_

## ANTENNAS (pages 213 – 232)

1. Do you want maximum or minimum radiation resistance of an antenna? \_\_\_\_\_
2. What's missing on an HF quarter wave antenna? \_\_\_\_\_
3. What provides the best RF ground to Earth? \_\_\_\_\_
4. What provides the best RF ground aboard a sailboat? \_\_\_\_\_
5. What is the approximate feedpoint impedance of a half-wave dipole? \_\_\_\_\_
6. What is the approximate feedpoint impedance of a folded dipole? \_\_\_\_\_
7. What antenna has no gain in any direction? \_\_\_\_\_
8. To improve radiation efficiency of a mobile antenna, add a \_\_\_\_\_ to increase top loading?
9. What antenna might produce patterns seen on page 239? \_\_\_\_\_
10. Increasing the boom length does what for a Yagi antenna? \_\_\_\_\_



## FEEDLINES & SAFETY (pages 253 – 273)

1. What is one type of matching network to a Yagi antenna? \_\_\_\_\_
2. What instrument allows you to test antenna resonance? \_\_\_\_\_
3. What is the typical velocity factor of coax cable with a solid polyethylene dielectric?
4. That little bird is sitting on which element of my stacked two meter Yagi (p. 232)? \_\_\_\_\_
5. Which chart allows you to calculate impedance along transmission lines? \_\_\_\_\_
6. Why don't we see more rhombics in downtown neighborhoods? \_\_\_\_\_
7. The bigger the dish, beamwidth \_\_\_\_\_ .
8. What does SAR measure? \_\_\_\_\_
9. What type of direction finding requires multiple bearings at multiple locations? \_\_\_\_\_