THE EXAM CORNER #3

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For #3, let's begin a series of 3 lessons on propagation. The General Class license is so desirable because it gives us access to worldwide communications on HF bands, but over-the-horizon signals have to be reflected (technically refracted in most cases) back down to Earth by the atmosphere. The layer of the atmosphere most commonly involved is the ionosphere, which is "charged up" by the Sun, so solar activity has a major effect on long-distance radio communications.

Again, I will briefly discuss what you need to know about an aspect of that subject, then show you the only exam questions that could appear on that aspect, and follow with hints as to how you can remember the right answer. The correct answer is in **bold.**

● Sunspots and solar flares are important indicators of the level of solar activity. Although sunspots appear dark from Earth, they indicate a disturbance in the Sun's magnetic field and an <u>increase</u> in the intensity of particles and radiation emitted toward us. Higher solar activity improves propagation on the higher-frequency bands like 6, 10, 12 and 15 meters. Those bands are not reliable for long-distance communications during low solar activity, but lower-frequency HF bands like 20 meters usually work throughout the solar cycle.

G3A01 What is the significance of the sunspot number with regard to HF propagation?

A. Higher sunspot numbers generally indicate a greater probability of good propagation at higher frequencies
B. Lower sunspot numbers generally indicate greater probability of sporadic E propagation
C. A zero sunspot number indicate radio propagation is not possible on any band
D. All of these choices are correct.

G3A09 What effect does a high sunspot number have on radio communications?

A. High-frequency radio signals become weak and distorted
B. Frequencies above 300 MHz become usable for long-distance communication
C. Long-distance communication in the upper HF and lower VHF range is enhanced
D. Microwave communications become unstable

G3A04 Which of the following are least reliable for long distance communications during periods of low solar activity?

A. 80 meters and 160 meters
B. 60 meters and 40 meters
C. 30 meters and 20 meters
D. 15 meters, 12 meters and 10 meters

G3A07 At what point in the solar cycle does the 20-meter band usually support worldwide propagation during daylight hours?

A. At the summer solstice
B. Only at the maximum point of the solar cycle
C. Only at the minimum point of the solar cycle
D. At any point in the solar cycle

Hint: the preceding four questions ask essentially the same thing – and all you have to know to answer them is that more solar activity means that the higher frequency bands work better.

● Higher solar activity improves HF communications, but only up to a point. When the Sun throws a fit and blasts the Earth too hard, it can disrupt communications. A "geomagnetic storm" is a disturbance in the Earth's magnetic field caused by <u>particles</u> from the Sun, and it degrades radio communications -- especially in the high latitudes (near the North Pole and South Pole) because the Earth's magnetic field concentrates the

incoming particles in those regions (which is why auroras occur there). A "sudden ionospheric disturbance" is caused by radiation from the Sun and it disrupts communications but affects lower frequencies more than higher ones.

G3A06 What is a geomagnetic storm?
A. A sudden drop in the solar flux index
B. A thunderstorm which affects radio propagation
C. Ripples in the ionosphere
D. A temporary disturbance in the Earth's magnetosphere

G3A08 Which of the following effects can a geomagnetic storm have on radio propagation?
A. Improved high-latitude HF propagation
B. Degraded high-latitude HF propagation
C. Improved ground-wave propagation
D. Improved chances of UHF ducting

G3A14 How are radio communications usually affected by the charged particles that reach the Earth from solar coronal holes?
A. HF communications are improved
B. HF communications are disturbed
C. VHF/UHF ducting is improved
D. VHF/UHF ducting is disturbed
Hint: note that this is another geomagnetic storm question although not using that term since it relates to particles.

G3A02 What effect does a Sudden Ionospheric Disturbance have on the daytime ionospheric propagation of HF radio waves?
A. It enhances propagation on all HF frequencies
B. It disrupts signals on lower frequencies more than those on higher frequencies
C. It disrupts communications via satellite more than direct communications
D. None, because only areas on the night side of the Earth are affected

G3A16 What is a possible benefit to radio communications resulting from periods of high geomagnetic activity?
A. Auroras that can reflect VHF signals
B. Higher signal strength for HF signals passing through the polar regions
C. Improved HF long path propagation
D. Reduced long delayed echoes
Hint: this last question is one of the few areas where the test designers may be getting a little tricky. Note that this question relates to VHF, while all the others in this lesson involve HF propagation.

- Sunspots increase and decrease in a cycle that typically takes 11 years. In addition, the questions in this unit cover three other time periods. Solar radiation (like visible light and x-rays) travels at the speed of light and reaches Earth in 8 minutes. Particles emitted from the Sun (the solar wind) take 20 to 40 hours to reach us. And it takes the Sun 28 days to rotate on its axis (like an Earth day is 24 hours).

G3A11 Approximately how long is the typical sunspot cycle?
A. 8 minutes
B. 40 hours
C. 28 days
D. 11 years

G3A03 Approximately how long does it take the increased ultraviolet and X-ray radiation from solar flares to affect radio propagation on the Earth?
A. 28 days
B. 1 to 2 hours
C. 8 minutes
D. 20 to 40 hours
Hint: key word is radiation.

G3A15 How long does it take charged particles from coronal mass ejections to affect radio propagation on the Earth?

A. 28 days
B. 14 days
C. 4 to 8 minutes
D. 20 to 40 hours
Hint: key word is particles.

G3A10 What causes HF propagation conditions to vary periodically in a 28 day cycle?

A. Long term oscillations in the upper atmosphere
B. Cyclic variation in the Earth's radiation belts
C. The Sun's rotation on its axis
D. The position of the Moon in its orbit
Hint: don't get confused by the fact that the Moon also has a monthly cycle – the Moon has virtually no effect on propagation so the answer has to relate to the Sun.

- Some numbers are commonly used to signify the strength of solar activity at any given time. The solar flux index is just a measure of solar radiation at a particular wavelength in the UHF band (10.7 cm). The A-index describes the long-term stability of the Earth's magnetic field and the K-index covers short-term stability of that field.

G3A05 What is the solar flux index?

A. A measure of the highest frequency that is useful for ionospheric propagation between two points on the Earth
B. A count of sunspots which is adjusted for solar emissions
C. Another name for the American sunspot number
D. A measure of solar radiation at 10.7 centimeters wavelength

G3A12 What does the K-index indicate?

A. The relative position of sunspots on the surface of the Sun
B. The short term stability of the Earth's magnetic field
C. The stability of the Sun's magnetic field
D. The solar radio flux at Boulder, Colorado

G3A13 What does the A-index indicate?

A. The relative position of sunspots on the surface of the Sun
B. The amount of polarization of the Sun's electric field
C. The long term stability of the Earth's geomagnetic field
D. The solar radio flux at Boulder, Colorado

That's the end of installment #3. One question on the exam is guaranteed to come from the list above.

Comments are welcome -- contact me at aa8sw@att.net, or Robert at ak3q@ak3q.com.