# SUBELEMENT 9A
# RADIO SYSTEM THEORY
## (13 Examination Questions taken from 71 total questions)

**9A01 (B)**
In a radio receiver, the AGC voltage must always be:
A. Present before adjustments can be made.
B. DC but may be either polarity.
C. Positive DC
D. Negative DC

**9A02 (A)**
What would be indicated by a measurement of little or no voltage across an emitter resistor in the IF stage of a receiver?
A. The transistor is probably open.
B. The resistor is probably open.
C. There is no input signal.
D. The bypass capacitor is open.

**9A03 (D)**
Which of the following would be indicated by a high voltage reading across an emitter resistor of a receiver's transistor IF stage?
A. The resistor is shorted.
B. The bypass capacitor is shorted.
C. The transistor is open.
D. The transistor is shorted.

**9A04 (C)**
Which of the following is least likely to be the cause of intermittent trouble in a solid-state receiver?
A. A cold solder joint.
B. A break in printed circuit wiring.
C. Incorrect value replacement parts installed.
D. An electrolytic capacitor.

**9A05 (D)**
Of the following, which is not true of Gunn effect diodes?
A. They can generate microwaves when applied to cavities.
B. They require a resonant circuit to oscillate.
C. They produce current pulses at the Anode.
D. They employ a metal to semiconductor junction.

**9A06 (A)**
An audio amplifier stage which exhibits frequency response roll-off at low frequencies:
A. May have a bypass capacitor in the emitter circuit.
B. Is probably direct coupled.
C. Should be checked to see if it is oscillating.
D. Should be grounded at the input.

**9A07 (C)**
In testing a receiver you find that a SAW filter output is 6dB down from the input.
A. The filter is improperly terminated.
B. The device is faulty.

C. This is normal.
D. The filter is not resonating.

**9A08 (B)**
While coastal sailing, your VHF DSC receiver seems to loose sensitivity in a certain geographic area. The most probable cause is:
A. Intermittent connection.
B. Signal Fade.
C. Overheating finals.
D. VWSR mismatch.

**9A09 (C)**
An FM receiver active IF limiter:
A. Is used to limit the deviation to the FM detector stage.
B. Is used to cause the IF amplifier carrier to be a constant, fairly low value, regardless of input strength of the signal.
C. Is operated as an amplifier on very weak signals.
D. Is used to tolter front end noice.

**9A10 (B)**
A FM receive signal will:
A. Vary in amplitude with modulation.
B. Vary in frequency with modulation.
C. Vary in frequency and amplitude with wideband modulation.
D. Have a frequency deviation that is proportional to the amplitude.

**9A11 (C)**
A superheterodyne receiver:
A. Is FM only.
B. Is AM only.
C. Uses a local oscillator feeding the mixer stage.
D. None of these.

**9A12 (B)**
On maritime superheterodyne receivers that utilize triple conversion, a wave trap:
A. Is used in the antenna input circuit to reduce high impulse interference such as lightning static.
B. Is used in the antenna circuit to eliminate an unwanted received signal.
C. Is used to reduce the corrosive effect of sea waves.
D. Is peaked to resonance of the desired received signal.

**9A13 (B)**
In a triple conversion superheterodyne receiver, diode mixer stages are:
A. Operated in the linear region.
B. Operated in the non-linear region.
C. Operated as Class A amplifiers.
D. Operated as Class B amplifiers.

**9A14 (D)**
The advantage of using a superheterodyne receiver over a TRF receiver is:
A.  Greater selectivity at higher frequencies.
B.  Reduces or eliminates ghosts.
C.  Greater sensitivity at higher frequencies.
D.  Greater selectivity and sensitivity at higher frequencies.

**9A15 (A)**
When two FM  signals of different strengths are received on the same frequency:
A.  Only the stronger will appear in the AF output.
B.  Both will appear in the AF output.
C.  One steady heterodyne will appear in the AF output.
D.  Neither signal will be intelligible unless the weaker signal is at least 10 times weaker.

**9A16 (D)**
In an FM receiver the discriminator should be:
A.  Adjusted for zero voltage across the two series resistors at center frequency.
B.  Adjusted for maximum voltage across the two series resistors at center frequency.
C.  Adjusted with a very weak signal.
D.  Adjusted for zero voltage and maximum voltage across the two series resistors at center frequency.

**9A17 (D)**
Which of the following types of modulation produces sidebands?
A.  AM.
B.  SSB.
C.  FM.
D.  All of these.

**9A18 (B)**
For a given carrier, the minimum baseband frequency is:
A.  Equal to the carrier frequency.
B.  0 Hertz.
C.  One tenth the carrier frequency.
D.  Half the carrier frequency.

**9A19 (B)**
When a transmitter is operated with a modulation index of 2.4, the carrier level will:
A.  Be maximum for any modulation frequency.
B.  Be a Bessel null.
C.  Not change because it is FM.
D.  Increase by a factor of 2.4.

**9A20 (D)**
Of the following parameters, which should be checked when servicing an FM transmitter:
A.  Pre-emphasis, clipping, and noise figure.
B.  Noise figure.
C.  Clipping.
D.  Linearity, frequency, and deviation.

**9A21 (C)**
A power amplifier in an FM transmitter which is not linear:
A.  May not be operated legally on maritime frequencies.
B.  Causes severe distortion in the audio signal.
C.  May be desirable because of its efficiency.
D.  Is usually caused by improper bias.

**9A22 (C)**
The peak amplitude of the audio signal applied to a phase modulator:
A.  Is unlimited.
B.  Is limited to a value less than the deviation.
C.  Should be limited.
D.  Is of no concern with phase modulation.

**9A23 (D)**
Of the following, which is not characteristic of both AM and FM receivers?
A.  RF amplifier.
B.  Oscillator/mixer.
C.  IF amplifier.
D.  Discriminator.

**9A24 (D)**
Which of the following is not normally included in a phase-locked loop?
A.  Voltage controlled oscillator.
B.  Low pass filter.
C.  Phase detector.
D.  High pass filter.

**9A25 (A)**
A ground mounted vertical antenna should be:
A.  No longer than 5/8 wavelength at the operating frequency.
B.  As long as possible, regardless of operating frequency.
C.  Fed with balanced feedline.
D.  No longer than 1/2 wavelength of the highest frequency used.

**9A26 (A)**
A trap antenna is operated on a frequency below the resonant frequency of the trap. The trap operates as:
A.  An inductor.
B.  A capacitor.
C.  An antenna gain multiplier.
D.  A high pass filter.

**9A27 (C)**
Regarding the driven element of a ground plane antenna used for VHF:
A.  The longer the better.
B.  The shorter the more selective.
C.  Length determines operating frequency.
D.  Must be top loaded.

**9A28 (B)**
The plane elements of a ground plane antenna are
sometimes referred to as a:
A.  Parasitic elements.
B.  Counterpoise.
C.  Dummy elements.
D.  Lightning protector.

**9A29 (A)**
In a one-half wave Hertz antenna, the:
A.  Voltage and current are 90 degrees out of phase.
B.  Voltage and current are in phase.
C.  Voltage and current are 180 degrees out of phase.
D.  Feed points are unbalanced and maximum
    impedance.

**9A30 (B)**
An antenna parasitic element:
A.  Is unnecessary to improve directivity.
B.  Increases directivity.
C.  Is required for all vertical antennas.
D.  Has to be the same physical length as the active
    element.

**9A31 (D)**
Matching the impedance of an antenna to the
transmission line:
A.  Produces lowest SWR.
B.  Produces maximum power transfer.
C.  Causes reduced harmonic radiation.
D.  Produces lowest SWR and maximum power
    transfer.

**9A32 (A)**
On a transmitter, transmission line and antenna system,
high SWR will:
A.  Reflect a portion of the RF power from the antenna
    back to the transmitter.
B.  Provide maximum power transfer from transmitter to
    antenna.
C.  Distort modulation.
D.  Cause a power gain.

**9A33 (D)**
ERP takes into account:
A.  Transmitter output.
B.  Antenna Gain.
C.  Transmission line loss.
D.  All of these.

**9A34 (A)**
SWR stands for:
A.  Standing wave ratio.
B.  Single wave radius
C.  Short wave reception.
D.  Safety with radio.

**9A35 (A)**
Increasing the physical length of a long wire antenna:
A.  Increases its resonant wavelength.
B.  Decreases its resonant wavelength.

C.  Increases its Q.
D.  Increases its power handling capability.
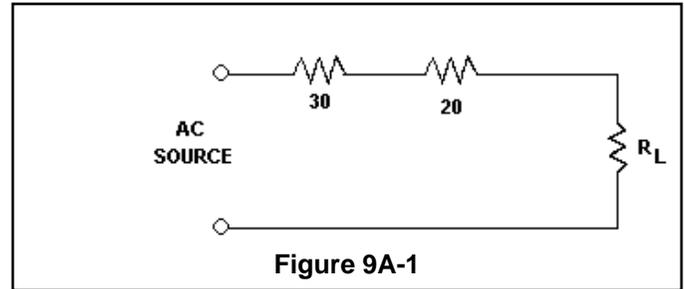

**Figure 9A-1**

**9A36 (D)**
On Figure 9A-1, assuming the impedance of the AC
source to be 600Ω, the best SWR is achieved when RL
is:
A.  10 ohms.
B.  20 ohms.
C.  30 ohms.
D.  50 ohms.

**9A37 (C)**
An antenna with a gain of 3db with 100 watts entering
the antenna feed point will have an ERP of:
A.  50 watts.
B.  100 watts.
C.  200 watts.
D.  300 watts.

**9A38 (A)**
A 200 foot transmission line that has a loss of 6db per
100 ft has 100 watts inserted from a transmitter at 4
MHz. How much power will actually be at the antenna
feed point?
A.  6.250 watts.
B.  33.3 watts.
C.  166 watts.
D.  12 watts.

**9A39 (D)**
SWR is important or significant at:
A.  microwave frequencies.
B.  VHF/UHF frequencies.
C.  HF/MF frequencies.
D.  All of these.

**9A40 (D)**
SWR can be expressed and calculated in terms of:
A.  Power.
B.  Voltage.
C.  Current.
D.  All of these.

**9A41 (A)**
Theoretically, a perfect impedance match between the
transmitter and the antenna would produce a SWR of:
A.  1:1.                         B.  1:1.5.
C.  1:2.                         D.... 1:4.

**9A42 (D)**
An operator reports that calls can be made with the HF/MF communications equipment on 2182 kHz, but that greatly reduced power is indicated on all higher frequencies. After verifying that the transmitter functions properly into a dummy load, the antenna tuner of the system could be investigated by:
A.  Observing changes in variable component positions or relay selections as other channels are tried.
B.  Observing the coupler output with an oscilloscope of suitable bandwidth.
C.  Observing the reflected power between the transmitter and the coupler.
D.  Observing changes in variable component positions or relay selections as other channels are tried and observing the reflected power between the transmitter and the coupler.

**9A43 (B)**
The criteria for oscillation is:
A.  180 degrees phase shift; unity gain.
B.  360 degrees phase shift; unity gain.
C.  360 degrees phase shift; gain greater than 1.
D.  180 degrees phase shift; gain greater than 1.

**9A44 (A)**
A PLL is locked onto an incoming signal with a frequency of 1 MHz at a phase angle of 50 degrees. The VCO signal feeds the phase detector at a phase angle of 20 degrees. The peak amplitude of the incoming signal is 0.5V and that of the VCO output signal is 0.7V.  What is the VCO frequency?
A.  1 MHz.              B.  700 kHz.
C.  1.2 MHz.            D.  200 kHz.

**9A45 (C)**
The output frequency of a certain VCO changes from 50 kHz to 65 kHz when the control voltage increases from 0.5V to 1V.  What is the conversion gain?
A.  65 kHz.             B.  15 kHz.
C.  30 kHz/V.           D.  15 kHz/V
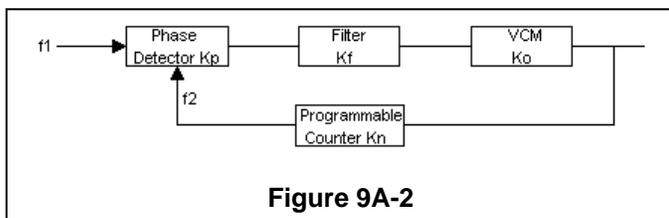


**Figure 9A-2**

**9A46 (A)**
On Figure 9A-2, in troubleshooting a PLL, you find that the signals f1 and f2 are the same frequency but are 45 degrees out of phase.
A.  This is normal.
B.  Check the Low pass filter for correct cutoff frequency.
C.  The VCO is low in gain.
D.  The input signal is slewing faster than the VCO can follow.
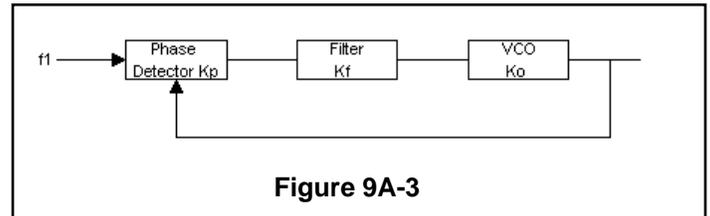


**Figure 9A-3**

**9A47 (B)**
On Figure 9A-3, when measuring the frequencies, you find that the VCO is running at 34.5 MHz.  f1 is at 34.4 MHz.
A.  This is within system and measurement accuracies
B.  You need to look further to find the problem within the PLL..
C.  Replace the Low pass filter.
D.  Replace the gain block Av.
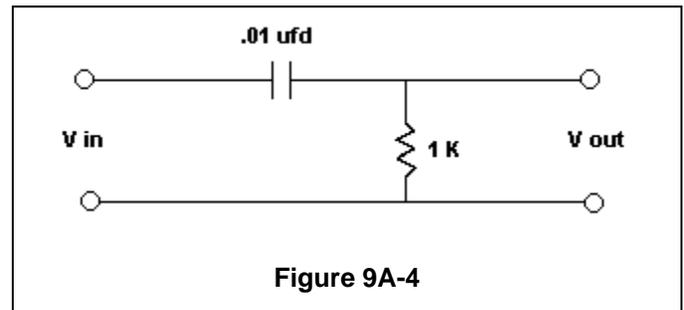


**Figure 9A-4**

**9A48 (C)**
An RC circuit is configured as in Figure 9A-4.  With a 5 Volt, 10 kHz signal in, the output is:
A.  2.343 V.
B.  1.929 V.
C.  2.66 V.
D.  1.632 V.

**9A49 (D)**
In longitude 160W, you wish to place a call to a city which is located at 78W.  Daylight savings time is not in force.  What is the time difference between yourself and that city?
A.  It is 6 hrs earlier in that city
B.  It is 5 hrs later in that city.
C.  It is 7 hrs earlier in that city.
D.  It is 6 hrs later in that city..

**9A50 (B)**
The advantage of a stepping motor over a conventional DC motor is:
A.  It has higher position accuracy due to D/A conversion.
B.  It can be directly driven by digital inputs.
C.  It has higher speed capability.
D.  It has higher positioning accuracy.

**9A51 (A)**
The gyros in the steerable antenna system are of the following type:
A. Rate or Step gyro.
B. Universally mounted.
C. Mercury erected.
D. Not precession limited.

**9A52 (A)**
In a gyro, precession is in what direction?
A. Right angles to the applied force.
B. In a direction which will line itself up in the opposite direction that the applied force is trying to turn it.
C. At a 90 degree angle formed by the center of the earth and the vector of the applied force.
D. In a direction where the gyro wheel is spinning toward the applied force.

**9A53 (C)**
Choose the most correct statement:
A. Frequency modulation is the same as phase modulation.
B. In Frequency modulation, the deviation is proportional to both the voltage and the frequency of the modulating signal.
C. In Frequency modulation, the deviation is proportional to the voltage of the modulating signal.
D. Frequency modulation requires less bandwidth than amplitude modulation.

**9A54 (B)**
Choose the most correct answer:
A. Deviation ratio = maximum modulating frequency/maximum deviation frequency.
B. Deviation ratio = maximum frequency deviation/maximum modulating frequency.
C. Deviation ratio = peak frequency deviation x maximum frequency.
D. Deviation ratio = minimum phase deviation/minimum modulating frequency.

**9A55 (D)**
The sensitivity of an FM modulator is measured in:
A. V/Radian
B. Rad/Sec.
C. Modulation index.
D. kHz/V..

**9A56 (A)**
Phase Modulation is often used instead of Direct FM Modulation because Direct FM Modulation:
A. Has inherent frequency instability.
B. Occupies too much bandwidth.
C. Has inherent non-linearity when directly modulated.
D. Utilizes expensive schottky diodes.

**9A57 (C)**
Which of the following cannot be used as an FM detector?
A. Ratio detector.
B. Phase discriminator.

C. All answers are correct.
D. Quadrature detector.

**9A58 (D)**
Line losses in a transmission line may be attributed to:
A. Ohmic resistance.
B. Radiation from the line.
C. Improper line insulation.
D. All of these.

**9A59 (B)**
Which of the following is not a source of RF noise?
A. Resistor.
B. All of these.
C. Radio receiver.
D. Neon lights.

**9A60 (D)**
In an Inmarsat C system, the main source of noise is:
A. Atmospheric noise.
B. Sky noise.
C. Rain.
D. The receiver.

**9A61 (C)**
Antenna impedance mismatch will have the following effect on the noise figure.
A. Decrease in noise figure.
B. Increase in noise figure.
C. No effect.
D. Increase in noise factor.

**9A62 (A)**
What is meant by compander system?
A. Compressing speech at the transmitter and expanding it at the receiver.
B. Using an audio frequency signal to produce pulse length modulation.
C. Combining amplitude and frequency modulation to produce a single sideband signal.
D. Detecting and demodulating a single sideband signal by converting it to a pulse modulated signal.

**9A63 (B)**
The SITOR operator cannot make contact with a shore station.  Your forecast shows that he is operating at a frequency 1.2 times m.u.f.  Your solution is:
A. Go to a higher band.
B. Decrease frequency to 0.8 m.u.f.
C. Change baud rate to correspond to frequency
D. Change frequency to the predicted m.u.f.

**9A64 (C)**
Low receive amplitude in an Inmarsat C station may be caused by:
A. Latitude of the vessel.
B. Longitude of the vessel.
C. All of these.
D. Obstruction by superstructure.

**9A65 (C)**
Choose the most correct answer regarding the ionosphere.
A.  The F1 layer exists only during daylight.
B.  The E Layer is important for hf daytime propagation and mf night propagation.
C.  All are true.
D.  The F2 layer is the principal reflector for long distance HF communications.

**9A66 (B)**
In an FM system, pre-emphasis/de-emphasis is used to:
A.  Decrease system bandwidth.
B.  Improve output signal-to-noise ratio.
C.  Pre-compress high frequencies.
D.  Increase fidelity.

**9A67 (A)**
A red LED on the control panel has failed.  You find a spare which has the same electrical characteristics, but is marked 1.06micrometers.
A.  This cannot be used as it is not visible.
B.  This can be used but is the wrong color.
C.  This is not an LED.
D.  It can be used with a filter.

**9A68 (B)**
The solar cell in Figure 9A-5 is being illuminated and is producing a current of 250 uA.  What is the voltage out of the circuit.
A.  +2.5 V.
B.  -2.5 V.
C.  -5 V.
D.  +5 V.
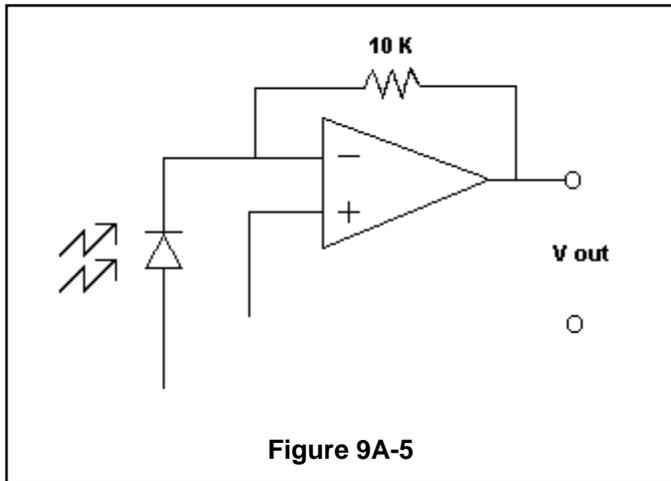


**Figure 9A-5**

**9A69 (A)**
What is the characteristic difference that is responsible for the emission of light from light emitting diodes, but not from ordinary rectifying diodes?
A.  LEDs are constructed of semitransparent materials.
B.  LEDs are constructed of opaque materials.
C.  Gallium and arsenide are necessary to produce photons.

D.  Rectifying diodes are usually black.

**9A70 (C)**
Which statement is not true of liquid crystal displays?
A.  LCDs operate at microampere current levels.
B.  LCDs must be externally illuminated.
C.  LCD performance is enhanced at lower temperatures.
D.  The nematic liquid is used to shift light polarity.

**9A71 (A)**
With regard to methods of joining optical fibers, which statement is incorrect?
A.  Splices are inferior to any detachable connector.
B.  Refractive indices should match at coupling interfaces.
C.  Couplers should be clean and of high quality.
D.  Precision tools should be used when making splices.

[END OF SECTION 9A]
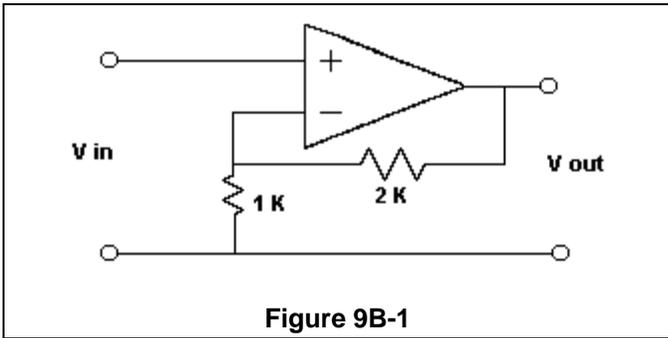
**Figure 9B-1**

**9B01 (C)**
With a 1VDC input the output of the operational amplifier
shown on Figure 9B-1 is:
A.   -3VDC.
B.   2VDC.
C.   3VDC.
D.   -2VDC.
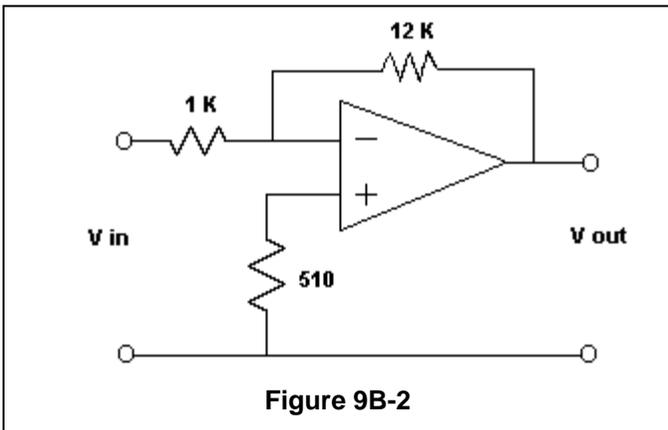


**Figure 9B-2**

**9B02 (B)**
On Figure 9B-2, with an input voltage of +5 volts, the
voltage measured at the inverting (-) input of the op-amp
will be:
A.   +5 volts
B.   0V.
C.   1.3 volts
D.   0.7 volts

**9B03 (C)**
In the op amp circuit shown on Figure 9B-3, the output
voltage will be:
A.   V2 - V1
B.   2 x (V1 - V2)
C.   -2 x (V1 + V2).
D.   V1 + V2
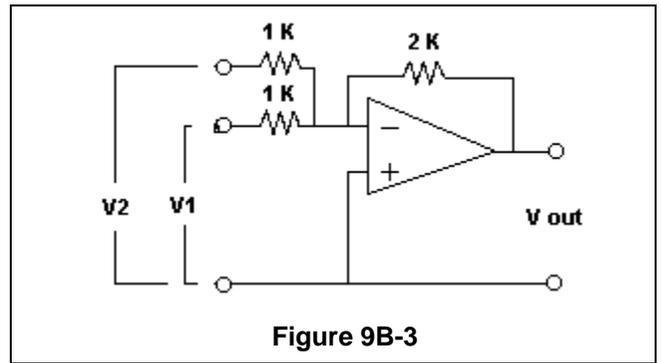


**Figure 9B-3**
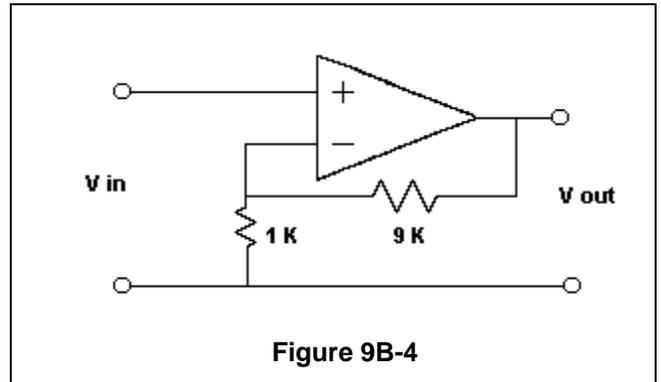


**Figure 9B-4**

**9B04 (A)**
In the comparator circuit shown on Figure 9B-4, the
nominal output voltage when the output is high is 4.5
volts.  The upper trip point will be:
A.   450 mV.
B.   0 V
C.   4.5 V
D.   0.7 V
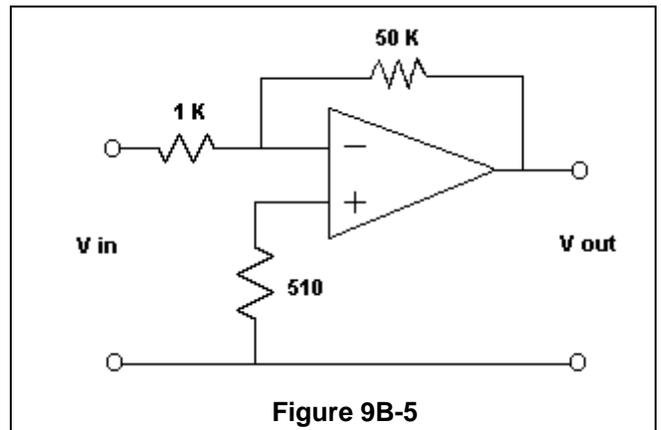


**Figure 9B-5**

**9B05 (B)**
In the op amp circuit on Figure 9B-5, the input voltage is
-100mV DC. The output voltage you would expect to
measure is:
A.   -5 volts DC.
B.   5 volts DC.
C.   7.5 DC.
D.   100 mV DC.
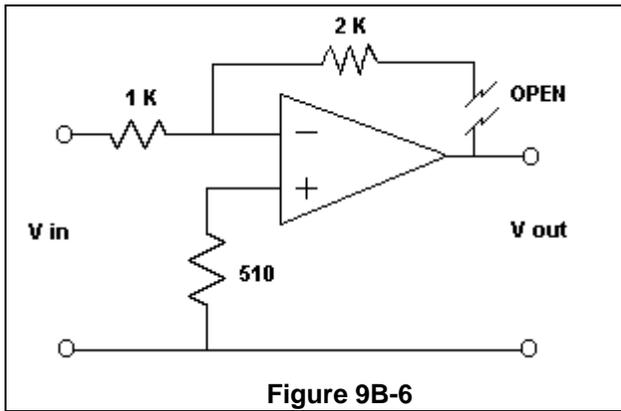
**Figure 9B-6**

**9B06 (B)**
In the circuit shown on Figure 9B-6, resistor R3 has opened due to vibration of the vessel.  The input is a 1Vp-p sine wave centered about zero.  The ouput waveform will:
A.   Be zero.
B.   Increase in peak-peak amplitude.
C.   Change in frequency.
D.   Be an oscillation.
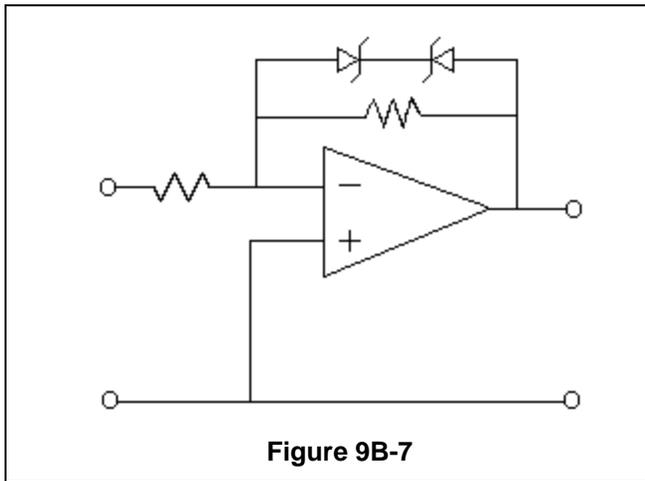


**Figure 9B-7**

**9B07 (A)**
In the circuit shown on Figure 9B-7, both zener diodes have the same zener breakdown voltage. The output will be limited by:
A.   The zener voltage plus one diode drop.
B.   The power supplies.
C.   The zener voltage.
D.   Twice the zener voltage.

**9B08 (D)**
With a 2 VDC input, the output of the operational amplifier shown on Figure 9B-1 is:
A.   4 VDC.
B.   -6 VDC.
C.   +4 VDC.
D.   -+6 VDC.
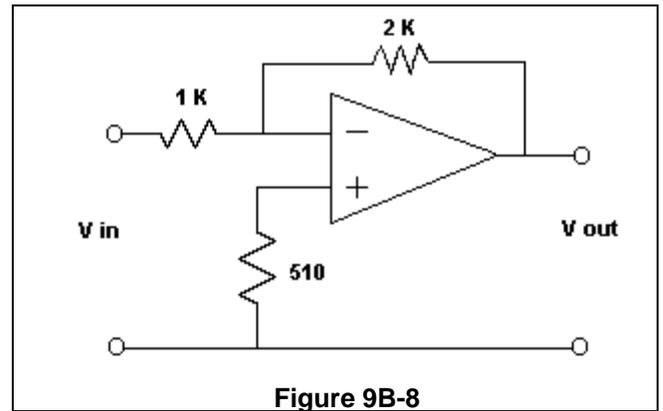


**Figure 9B-8**

**9B09 (B)**
On Figure 9B-8, the input to the op amp is a 1V sine wave centered about +2V.  The output will be:
A.   A 1V sine wave centered about +2V.
B.   A 2V sine wave centered about -4V.
C.   A 3V sine wave centered about 1.5V.
D.   A 3V sine wave centered about -1.5V.
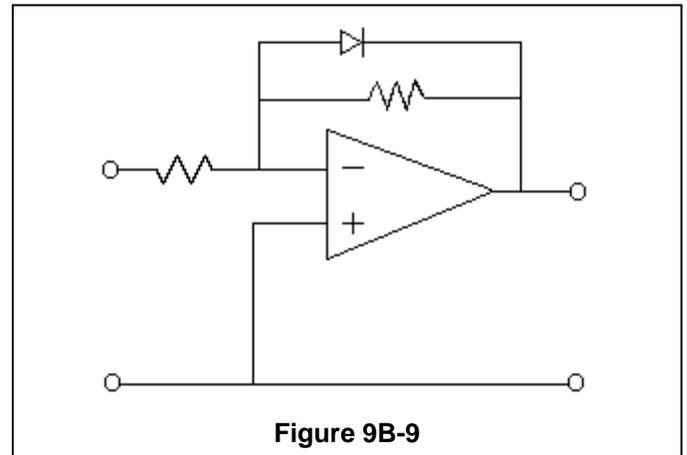


**Figure 9B-9**

**9B10 (C)**
In the circuit on Figure 9b-9, the purpose of the diode is to:
A.   Bound the circuit in the positive swing.
B.   Speed up the rise time of the output waveform.
C.   Limit the negative swing to one diode drop below ground.
D.   Slow the rise time during the negative portion of the input signal swing.

**9B11 (A)**
An advantage of high frequency operation of a DC-DC converter is:
A.   A small filter capacitor may be used.
B.   The output does not need to be filtered.
C.   Less RFI is generated.
D.   Fewer components are required.

**9B12 (B)**
What happens if the gate voltage on an SCR falls below the trigger point with anode and cathode voltage applied?
A. The SCR turns on.
B. The SCR stays on.
C. The SCR turns off.
D. A pulse is generated.

**9B13 (C)**
A power supply crowbar circuit may consist of a:
A. Transformer, rectifier, and filter.
B. Transformer, capacitor, and diode.
C. Zener diode and SCR.
D. Rheostat, switch, and indicator lamp.

**9B14 (A)**
What would be the effect of an open filter capacitor in a DC power supply under load?
A. The DC output voltage would drop.
B. The transformer would overheat if the fuse didn't blow.
C. No power would be transferred to the load.
D. The rectifier could be damaged due to excessive PIV.

**9B15 (B)**
Most switching power supplies do not use a line isolation transformer. This implies the following:
A. No line isolation will improve the No load/Full load response.
B. There is no line isolation. Using a grounded scope in this system will destroy the supply.
C. Low voltages cannot be achieved due to the high power required for voltage conversion.
D. This is a transformerless system, which reduces parts cost, which makes it a desired unit.

**9B16 (A)**
In a switching power supply, the output voltage is controlled in the following manner:
A. Feeding the output back to either a DC/DC chopper or a Pulse Width Modulated inverter.
B. Using a ferro resonant reactor to control output.
C. Feeding the output back to a magnetic amplifier, which in turn controls the output voltage.
D. The error voltage is used to control SCR gates, which accomplish the regulation.

**9B17 (D)**
In a voltage regulator incorporating foldback current limiting, output current decreases with:
A. Device temperature.
B. Excessive output voltage.
C. Decreasing input voltage.
D. Excessive input/output voltage differential.

**9B18 (D)**
When it has been determined that a zener reference diode in a regulated power supply has avalanche breakdown, the best thing to do is:
A. Replace the diode with one with higher ratings.
B. Replace the diode with one having the same specifications.
C. Remove the diode from the circuit and retest it.
D. None of these.

**9B19 (D)**
If a zener breakdown occurs at 24 volts, in which mode does it operate?
A. Rectifer.
B. Diode.
C. Catastrophic failure.
D. Avalanche.
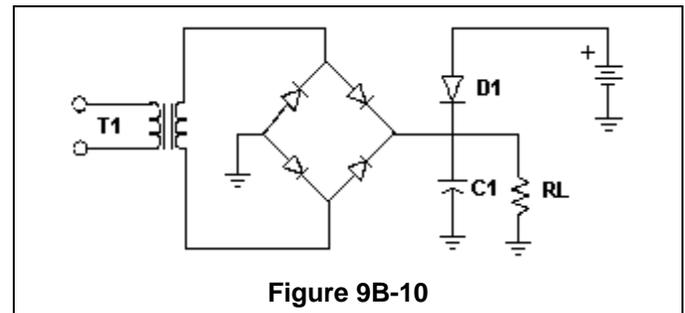

**Figure 9B-10**

**9B20 (B)**
Which of the following is true regarding the circuit in Figure 9B-10?
A. Normally, D1 is forward biased by the battery.
B. Normally, D1 is reverse biased by the voltage on C1.
C. The battery will charge to the peak voltage across C1.
D. Charging stops when AC power to T1 is removed.

**9B21 (A)**
After the emergency generator was tested on-line, the GMDSS VHF transceiver failed. The defective power supply fuse was replaced but failed again. Which of the following corrective actions could safely get the power supply working again?
A. Replace the shorted SCR in the crowbar.
B. Install a fuse rated for 10x the current draw in transmit.
C. Connect a 12 V lamp in series with the power supply output.
D. Connect the receiver power leads in parallel with those of another transceiver that is still working.

**9B22 (C)**
Edison type storage cell battery charge condition can be determined by:
A. Measuring the specific gravity of the electrolyte.
B. Observing the color of the electrolyte.
C. Measuring voltage with cell under load.
D. Measuring maximum voltage with cell not loaded.

**9B23 (A)**
Lead-acid type storage cell battery charge condition can best be determined by:
A. Measuring the specific gravity of the electrolyte.
B. Observing the color of the electrolyte.
C. Measuring voltage with cell under load.
D. Measuring maximum voltage with cell not loaded.

**9B24 (D)**
Internal resistance of a battery is:
A. A fixed resistor placed physically inside battery to limit current flow.
B. A fixed resistor placed physically inside battery to provide a trickle flow of electrons during unused periods.
C. Resistance measured when plates short circuit internally.
D. None of these.

**9B25 (B)**
The most common acid used in lead-acid batteries is:
A. Muric Acid.
B. Sulphuric Acid.
C. Nitric Acid.
D. Phosphoric Acid.

**9B26 (C)**
The approximate voltage of a fully charged lead-acid battery cell is:
A. 12.6.
B. 6.3.
C. 2.1.
D. 1.27.

**9B27 (C)**
The common type dry cell battery contains:
A. Lead and lead sponge.
B. Lead and zinc.
C. Carbon and zinc.
D. Zinc and lead.

**9B28 (B)**
Energy stored in a lead-acid battery is:
A. Kinetic.
B. Chemical.
C. Dynamic.
D. Piezoelectric.

**9B29 (D)**
A fully charged lead-acid battery rated at 500 amp-hours could power a:
A. 10 amp receiver for 50 hours.
B. 50 amp load for 10 hours.
C. 5 amp load for 100 hours.
D. All these.
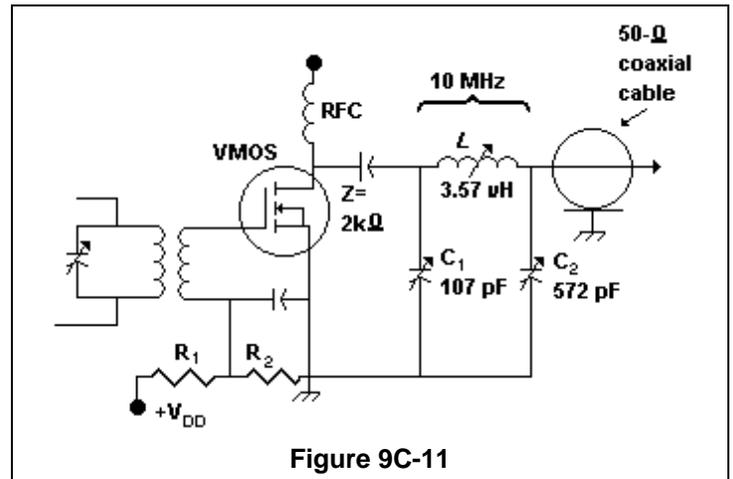

**Figure 9C-11**

**9B30 (A)**
Figure 9C-11 shows:
A. A pi network output circuit.
B. A low noise preamplifier.
C. A digital line driver.
D. A power factor correction circuit.

**9B31 (B)**
Crossover distortion in a push-pull amplifier occurs when
A. High and low frequency signals are not separating in crossover network.
B. DC base voltage is zero and input signal voltage has not exceeded Vbe.
C. Base current is not equal in both transistors.
D. The high frequency tweeters are shorted.

**9B32 (D)**
A single stage transistor RF amplifier operated class B:
A. Operates in the linear range for 180 degrees of the input signal cycle and is cutoff for the remaining 180 degrees.
B. Is more efficient than a class A amplifier.
C. Requires an output tank circuit to produce an undistorted output.
D. All of these.

**9B33 (C)**
The maximum efficiency for a class B solid state power amplifier is:
A. 40%.          B. 80%.
C. 60%.          D. 25%.

**9B34 (C)**
The maximum efficiency for a class A solid state power amplifier is:
A. 80%.          B. 60%.
C. 40%.          D. 25%.

**9B35 (B)**
A class C RF power amplifier has 2000 volts on the plate at 300 mA under operating conditions. The output power of the amplifier is between:
A. 600 to 700 watts.     B. 420 to 510 watts.
C. 50 to 60 watts.       D. Lower than 40 watts.

**9B36 (D)**
Parasitic oscillations are undesired in RF amplifier stages and:
A. Can be clamped.
B. Must be tolerated because they are close to the operating frequency.
C. Can be shifted far from the desired frequency to cause no interference.
D. Can be reduced or eliminated with a parasitic choke.

**9B37 (C)**
A class B RF amplifier with an output tuned resonant tank, requires:
A. A 2 transistor configuration known as push-pull.
B. Bias to be twice the cutoff value.
C. Only one amplifier transistor.
D. Neutralization.
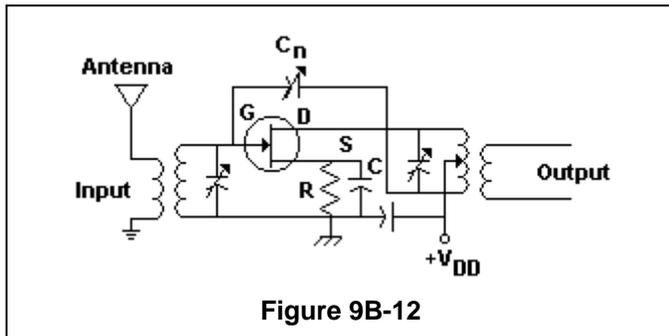


**Figure 9B-12**

**9B38 (A)**
Figure 9B-12 is an example of:
A. A JFET RF amplifier.
B. A MOSFET RF amplifier.
C. A varactor tuning stage.
D. An IGFET RF amplifier.
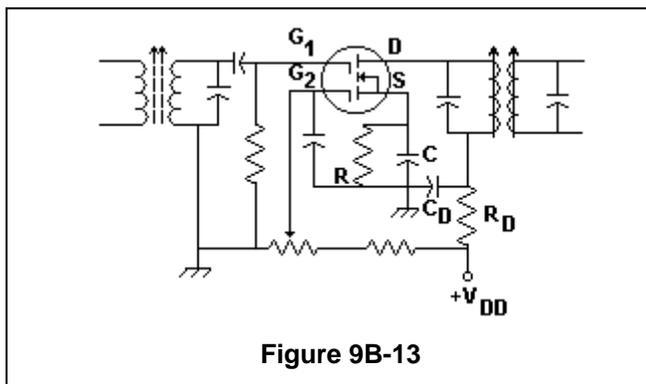


**Figure 9B-13**

**9B39 (C)**
Figure 9B-13 is best described as:
A. A JFET audio amplifier.
B. A BJT RF or IF amplifier.
C. A dual gate MOSFET RF or IF amplifier.
D. A JFET RF or IF amplifier.

**9B40 (C)**
When operating a VMOS (power FET) in a high frequency Class C amplifier, the following is true:
A. The VMOS FET is interchangeable with a BJT.
B. The FET must be forward biased in a quiescent state.
C. The stage may require neutralization if operated in a common source configuration.
D. If not loaded heavily enough the stage may break into oscillation.
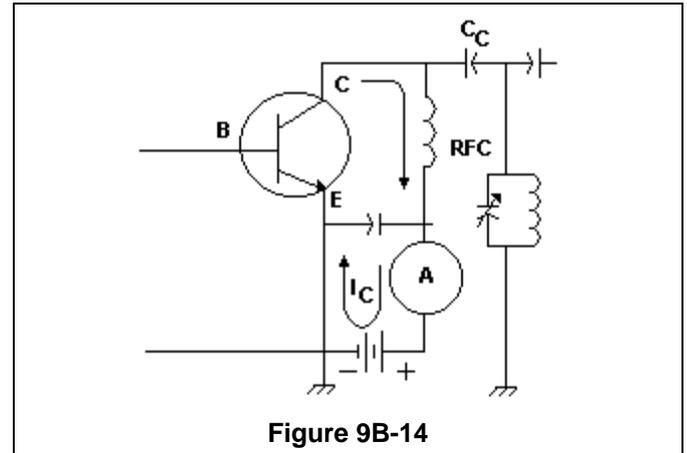


**Figure 9B-14**

**9B41 (A)**
Figure 9B-14 illustrates:
A. A shunt fed RF amplifier output circuit.
B. A series fed RF amplifier output circuit.
C. A high impedance input circuit.
D. A common base RF amplifier.

**9B42 (D)**
Audio filters are commonly used for:
A. Bandpass filters.
B. High pass filters.
C. Low pass filters.
D. All of these.

**9B43 (B)**
A simple pi network with inductors on each leg and a capacitor in the center is a:
A. Bandpass filter.
B. High pass filter.
C. Low pass filter.
D. Notch filter.

**9B44 (D)**
A simple pi network with inductors on each leg and a capacitor in the center has:
A. A balanced input and unbalanced output.
B. A balanced input and balanced output.
C. An unbalanced input and balanced output.
D. An unbalanced input and unbalanced output.

**9B45 (D)**
Communication transmitters with microphones that have a frequency response to 10 kHz:
A. Provide better clarity under weak signal conditions.
B. Usually contain a high pass filter to limit the frequencies that modulate the transmitter.
C. Are more desireable than microphones with a lower frequency response.
D. None of these.

**9B46 (D)**
To obtain maximum power level of an SSB transmitter, the audio circuit should have a:
A. Low pass filter.
B. A speech clipper after modulation.
C. Compression of the audio wave.
D. All of these.

**9B47 (A)**
Linear amplification can be achieved at audio frequencies by operating class B. With regard to this, which of the following is true?
A. A push-pull configuration is necessary.
B. A single stage class B amplifier must be proceeded by a Class A amplifier.
C. This can be achieved using a single transistor stage.
D. It is not possible to obtain linear amplification with a class B configuration.
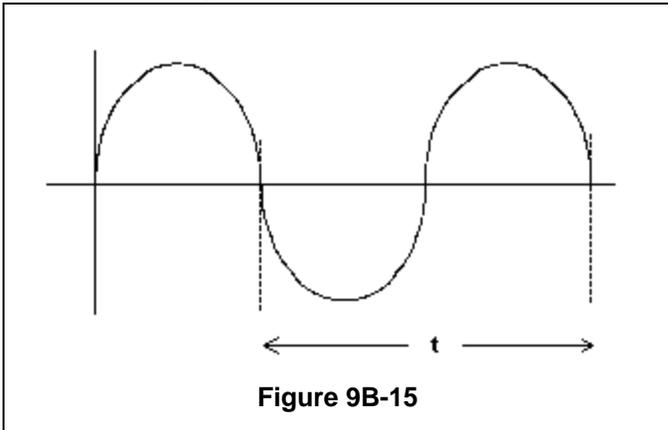


**Figure 9B-15**

**9B48 (B)**
On Figure 9B-15, you determine on the oscilloscope that time t is 500 microseconds. The frequency is:
A. 500 microsec.
B. 2 kHz.
C. 500 kHz.
D. 20 kHz.

**9B49 (C)**
Low frequency phase measurements should be made in the following mode:
A. High Frequency Reject.
B. Alternate.
C. Chopped.
D. Dual trace.

**9B50 (B)**
Rise time measurements are most commmonly made from the following amplitudes:
A. 0-100%.
B. 10-90%.
C. 20-80%.
D. 30-70%.

**9B51 (A)**
Pulse width measurements on the oscilloscope are normally made at:
A. 50% amplitude.
B. 90% amplitude.
C. 80% amplitude.
D. 70% amplitude.

**9B52 (D)**
An oscilloscope has a rise time of 7 ns. The probe has a rise time of 7 ns. The system BW is:
A. 40.36 MHz.
B. 50.36 MHz.
C. 30.36 MHz.
D. 35.36 MHz.

**9B53 (C)**
Using the 10 second gate of a frequency counter rather than 1 sec will improve:
A. Long term stability.
B. Accuracy.
C. Resolution.
D. Consistency.

**9B54 (B)**
When measuring the power output of a VHF transmitter, the power output does not change when modulated.
A. There is a probable modulator problem.
B. This is normal.
C. There is a strong parasitic oscillation.
D. This test is invalid on dummy load.

**9B55 (A)**
During troubleshooting, you are in doubt on the calibration of your RF signal generator. You decide that the best way to check it is:
A. Against the carrier frequency of WWV.
B. By comparing it to a crystal oscillator.
C. To measure it with a 100MHz oscilloscope.
D. By comparing it to your receiver synthesizer.

**9B56 (B)**
A discontinuity in a transmission line (ie. short, open, etc) can be precisely located by using:
A. An impedance bridge.
B. A TDR.
C. A Weinbridge.
D. A precision ohmmeter.

**9B57 (D)**
The printers found in GMDSS may interface in the following way or ways:
A. Serial "RS-232C".
B. Serial "RS-232C, TTL-Level, 20 or 60 ma current loop".
C. Parallel "Centronics".
D. All of these are correct.

**9B58 (D)**
Which of the following is not a recommended maintenance action for printers?
A. Vacuum regularly to remove dust and paper debris.
B. Wash with water and mild soap when needed.
C. Wipe with fabric softener to prevent static buildup.
D. Spray inside with a thin film of oil to prevent rust.

**9B59 (C)**
In troubleshooting a dot-matrix printer, the print head moves but it does not print. The ink ribbon is new and correctly positioned. A logical next item to check would be:
A. The paper supply.
B. Enable, strobe or busy signals if used.
C. The print-head driver signals.
D. Print-head coil resistances.

**9B60 (D)**
In Troubleshooting a dot-matrix printer, the printer prints, but the print head does not move. A logical first area to check would be:
A. The select, busy, or enable signals if used.
B. The print head drive motor.
C. The ribbon.
D. The drive head position sensor and belt.

**9B61 (C)**
Which of the following detrimental factors is the most serious for a typical modern printer in the GMDSS application?
A. Room temperatures in excess of 70 degrees F.
B. Cables not neat or connector mating screws not secured.
C. Located in a RFI environment.
D. Fans or vents blocked.

**9B62 (A)**
A color CRT that is part of the required GMDSS SITOR terminal will not turn on. The low voltage power supply in the unit is working. Where is the problem most likely to be found?
A. The horizontal sweep circuit.
B. The degaussing coil.
C. The AC line fuse.
D. The luminance circuits.

**9B63 (B)**
The GMDSS operator has been unable to use the satellite communication system because it has a video display monitor that does not work. A substitute monitor is not available. What action(s) might be appropriate to localize the problem?
A. Spray non-lubricating contact cleaner on each switch and connector while observing the monitor.
B. Use an oscilloscope to verify that there is a video signal.
C. Resolder each connector of the video cable while observing the monitor.
D. Perform a complete alignment of the video monitor inaccordance with the manufacturer's specifications.

**9B64 (D)**
The suppressor grid in a vacuum tube RF amplifier circuit:
A. Accelerates electron flow to the plate.
B. Helps to suppress interference.
C. Normally increases and decreases the signal gain by control bias.
D. Catches/attracts loose electrons that happen to bounce off the plate.

**9B65 (A)**
The presence of a blue glow in a vacuum tube operated as an audio amplifier:
A. Could indicate air or gas in the tube.
B. Could indicate RF energy is being generated to cause the blue glow.
C. Has no effect on the efficiency of the tube.
D. Can be eliminated by reducing the frequency of the input signal.

**9B66 (C)**
A beam power tetrode has beam forming plates between the:
A. Control grid and screen grid.
B. Cathode and control grid.
C. Screen grid and the plate.
D. Suppressor grid and the plate.

**9B67 (A)**
The main purpose of a screen grid in a vacuum amplifier tube is to:
A. Permit higher amplification.
B. Decrease secondary emission.
C. Absorb some heat from the plate.
D. Provide isolation from signal input to control grid signal input.

[END OF SECTION 9B]

# SUBELEMENT 9C – DIGITAL THEORY
## (11 Examination Questions taken from 64 total questions)

**9C01 (C)**
The gray code minimizes the possibility of ambiguity when changing state by:
A. Changing state on leading or trailing pulse edges.
B. Using a common clock to synchronize inputs.
C. Changing only one bit at a time.
D. Requiring coincidence between two or more samples.

**9C02 (B)**
Convert the decimal number 164 to hex.
A. 104.
B. A4.
C. 10110100.
D. 5B.

**9C03 (D)**
A computer memory location is designated F09Fh. The decimal equivalent is:
A. 4367.
B. 1010101.
C. 10110100.
D. 61599.

**9C04 (C)**
Which of the following items is not an ASCII item?
A. 8.
B. BS.
C. END.
D. A.

**9C05 (D)**
If the input lead to an operating TTL inverter became grounded, what would the output lead measure?
A. +0 to +0.7 VDC.
B. Ground.
C. More than +5 VDC.
D. Between +2.5 VDC and + 5VDC depending on load.

**9C06 (D)**
What is the range of supply voltage (VDD) to a CMOS logic IC?
A. +4.5 to +5.5 VDC.
B. -3 VDC to +10 VDC.
C. +5 to +25 VDC.
D. + 3 VDC to +15 VDC.

**9C07 (D)**
Using positive logic, a TTL IC will recognize the following voltages levels as valid "1" and "0" levels in an operational logic circuit:
A. Binary 0 = +0.4 VDC, Binary 1 = +3.6 VDC.
B. Binary 0 = 0.0 VDC, Binary 1 = +5.0 VDC.
C. Binary 0 = +0.3 VDC, Binary 1 = +4.7 VDC.
D. All of these.

**9C08 (A)**
If the output of a TTL gate measures 2.0VDC:
A. There is a problem either in the gate or the loading.
B. This is a normal high.
C. This is a normal low.
D. None of these.

**9C09 (A)**
A digital logic chip has a supply voltage of -5.2V. This chip belongs to which family?
A. ECL
B. TTL
C. CMOS
D. RTL

**9C10 (D)**
Which of the following integrated circuit or semiconductors devices normally require special handling to avoid damage by static electricity?
A. TTL
B. ECL
C. MOV
D. CMOS
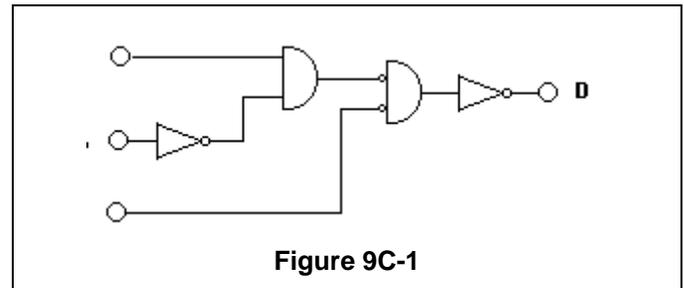


**Figure 9C-1**

**9C11 (B)**
On Figure 9C-1, the function D is described as:
A. AB(~C).
B. C + (~A)B.
C. C + AB.
D. A + BC.

**9C12 (C)**
ECL achieves high speed due to:
A. The use of gallium arsenide conductors.
B. Construction in small geometries.
C. The operating transistors being unsaturated.
D. Operation in low noise negative supply region.

**9C13 (D)**
By DeMorgan's Theorem, (X + Y) =
A. ~X + ~Y
B. (X + Y)
C. ~(X + Y)
D. X Y

**9C14 (A)**
The logic family which typically has the largest fanout is:
A. CMOS.
B. ECL.
C. TTL.
D. RTL.

**9C15 (D)**
In order of highest to lowest speed, the logic families are
ranked:
A. ECL, CMOS, Schottky TTL, Standard TTL.
B. Schottky, Standard TTL, ECL, CMOS.
C. CMOS, Standard TTL, Schottky TTL, ECL.
D. ECL, Schottky TTL, Standard TTL, CMOS.

**9C16 (A)**
In a three bit binary ripple counter, the state following
111 will be:
A. 110.              B. 000.
C. 001.              D. 111.

**9C17 (C)**
In a 4 bit BCD ripple counter the state following 1001 will
be:
A. 1111.             B. 1011.
C. 0000.             D. 1000.

**9C18 (C)**
Synchronous counters are distinguished from ripple in
that:
Logic inputs are applied in parallel.
Counter feedback is synchronous.
The clock is applied to all flip flops simultaneously.
There is no ripple on synchronous counters.
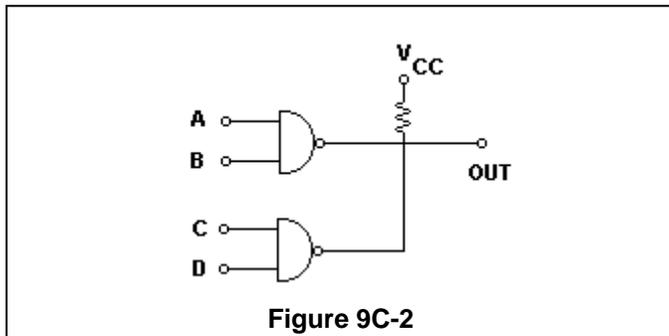

**Figure 9C-2**

**9C19 (D)**
The circuit shown on Figure 9C-2:
Is a wired exclusive or.
Is a wired or.
Is used for high speed operation.
Uses open collector gates.

**9C20 (A)**
What is the result of adding binary 110111 and 1001:
A. 1000000.          B. 11111.
C. 100000.           D. 111111.

**9C21 (B)**
What is the binary result of multiplying hexadecimal 1C
by 7?
A. 11101100.         B. 11000100.
C. 11001100.         D. 11100100.

**9C22(C)**
The value 123456 is based upon a number system
which has a minimum radix of:
A. 10.               B. 6.
C. 7.                D. 2.

**9C23 (A)**
A twos complement number is formed by the following
method:
A. Complement individual bits; then add 1.
B. Add the number to all ones; then add 1.
C. Subtract the number from all ones; then add 1.
D. Add individual bits; then add 1.

**9C24 (A)**
Choose the correct solution to the following:   0101 +
0010 =
A. 10111.            B. 1000.
C. 0111.             D. 01000.
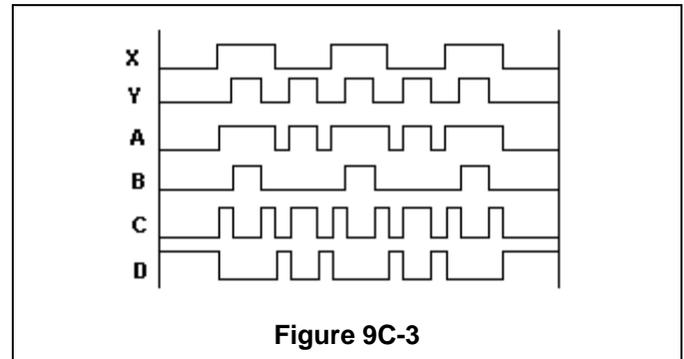

**Figure 9C-3**

**9C25 (B)**
Refer to the waveforms shown on Figure 9C-3:
   With x and y as inputs to an "AND" gate, what is the
output waveform?
A. Waveform A        B. Waveform B
C. Waveform C        D. Waveform D

**9C26 (D)**
Refer to the waveforms shown on Figure 9C-3:
   With x and y as inputs to an "OR" gate, what is the
output waveform?
A. Waveform D        B. Waveform C
C. Waveform B        D. Waveform A

**9C27 (C)**
Refer to the waveforms shown on Diagram EL9C3C:
   With x and y as inputs to a "Exclusive OR" gate, what
is the output waveform?
A. Waveform A        B. Waveform B
C. Waveform C        D. Waveform D

**9C28 (B)**
The standard serial output of a PC conforms to the
following specification.
A. 20 mA loop.
B. RS232.@@
C. NMEA0180.
D. Centronics.

**9C29 (C)**
Which of the following logic levels are in a normal range for TxD and Rxd signals on an RS232 interface line?
-2.5 V and +2.5 V.
+0.20 V and + 4.5 V.
-10 V and +10 V.
-10 V and 0 V.

**9C30 (C)**
What happens in a microprocessor system if electrical power input is interrupted?
Data stored in ROM is lost forever.
Data stored in ROM is lost, but can be restored by rebooting.
Data stored in RAM is lost.
Data stored in RAM is retained.

**9C31 (B)**
Complete the following sentence.  A bit string manipulated by a computer in one operation is usually called:
A.   A bit.
B.   A word.
C.   A byte.
D.   A nibble.

**9C32 (A)**
In a microcomputer, the program counter contains:
The address of the next instruction to be executed.
Data.
A sequential instruction set.
An instruction set.

**9C33 (B)**
Choose the most correct statement.
A RISC processor requires two or more clock cycles to execute a command.
A RISC processor has fewer instructions available than an equivalent non-RISC processor.
A RISC processor is inherently limited to a 32 bit architecture.
RISC processors cannot implement a stack.

**9C34 (D)**
A one dimensional data structure in which values are entered and removed one item at a time at one end is called what?
A ring counter.
A FIFO.
A stack pointer.
A pushdown stack.

**9C35 (C)**
The output of an assembler is:
Used only for solving floating point problems.
A higher level language.
Equivalent machine language instructions called object code.
Not in executable machine language form.

**9C36 (B)**
What is the DOS command used to copy files from one drive to another?
A.   RD.                          B.   COPY.
C.   DEL.                         D.   FC.

**9C37 (B)**
What is the command used to determine the version of DOS that the computer is currently using?
A.   MEM.                         B.   VER.
C.   VERIFY.                      D.   CHKDSK.

**9C38 (B)**
All DOS file names may contain a maximum of how many characters?
A.   6.                           B.   11.@@
C.   10.                          D.   7.

**9C39 (D)**
Compilers are used with which type of code?
High level languages.
Assembly languages.
Machine languages.
High level languages and assembly languages.

**9C40 (D)**
Choose the correct answer:
A bit is one binary digit.
A nibble is 4 bits.
A byte is 8 bits.
All answers are correct.

**9C41 (C)**
An interpreter is used with which type of code?
A.   Object codes.
B.   Assembly languages.
C.   High level languages.
D.   Machine codes.

**9C42 (A)**
An internal short between the base and collector of a bipolar transistor might be indicated by which of the following?
A.   A weak signal at the collector, in phase with the input.
B.   No signal at the output.
C.   DC supply voltage on the collector.
D.   Little or no signal at the collector and a reversal of phase.

**9C43 (C)**
When attempting to test a bipolar silicon or germanium transistor, which of the following is likely to be correct if the test is conducted after the device has been removed from its circuit?
A. If an ohmmeter is used without an external limiting resistor, excessive base current will destroy the device.
B. If A PNP transistor is being tested, forward junction resistance will be greater than reverse resistance.
C. Forward junction resistance should be less than reverse junction resistance.
D. Circuit effects which cannot be accounted for, preclude the use of resistance measurements.

**9C44 (B)**
When replacing a diac which is used with a silicon controlled rectifier, which way must the diac be installed?
A. The anode must be connected to the gate.
B. Either way will work.
C. The cathode must be connected to the gate.
D. Either way, depending on the polarity of the SCR.

**9C45 (D)**
Which of the following statements about diac bidirectional trigger diodes is incorrect?
A. A diac is a three layer device with two terminals.
B. A diac switch functions in either direction.
C. The breakover voltage is usually between 28 and 36 volts.
D. Lamps and battery chargers are typical loads for a diac.

**9C46 (B)**
Which of the following statements correctly describes photo diode operation?
A. Photodiodes generate light in response to incident photons.
B. Reverse biased photodiodes are photoresistive.
C. Efficiency is a measure of photons per electron.
D. Dark current flows in response to black light.

**9C47 (D)**
Which of the following statements distinguish phototransistors from photodiodes.
A. Phototransistors are faster than photodiodes.
B. Photodiodes are more sensitive than phototransistors.
C. Photodarlingtons are the fastest photoconductors
D. None of these.

**9C48 (A)**
Photodiode reverse current is called:
A. Dark current in the absence of light.
B. Zener current if the diode is reverse biased.
C. Photocurrent if the diode is forward biased.
D. Dark current in very low illumination.

**9C49 (C)**
What is the life expectancy of a light emitting diode operated continuously under normal operating conditions?
Up to 100 years.
Light emitting diodes may last up to 20 years.
Unlimited life expectancy.
Approximately 87660 hours.

**9C50 (A)**
How may the polarity of the leads of an LED be identified prior to installation in a circuit?
The cathode lead is usually longer than the anode lead.
There may be a flat edge on the body near the anode.
If the cathode can be seen, it is usually smaller.
The ground lead is usually lighter in color.

**9C51 (C)**
In testing a GaAs light emitting diode within the manufacturer's operating parameters of voltage and current, it appears that no light is emitted. What explanation could be given:
The LED is connected backwards.
The LED may have run out of GaAs.
The LED may be emitting invisible light.
The LED is connected backwards and may be emitting invisible light.

**9C52 (D)**
What is the typical minimum bias voltage required for normal operation of a GaAsP light emitting diode?
A. The LED will operate at 1.2 volts reverse bias.
B. The LED will operate at 0.6 volts forward bias.
C. The LED will operate at 2 volts reverse bias.
D. The LED will operate at 1.2 volts forward bias.

**9C53 (C)**
Which of the following statements is not true of light emitting diodes?
A. They can be manufactured to emit various wavelengths.
B. They can operate at very high speed.
C. They can be made to emit nearly pure white light.
D. They are vulnerable to failure due to overcurrent.

**9C54 (A)**
What is the usual method of protecting a light emitting diode from damage that would result if the operating voltage became too high?
A. A series current limiting resistor is used.
B. A zener voltage regulator is used.
C. A fast-blow fuse is used in series with the LED.
D. The LED is attached to a heat sink.

**9C55 (A)**

Assuming that a light emitting diode has an internal resistance of 5 ohms, what value of series current limiting resistor should be used if the power supply voltage is 6 volts and the diode current is to be 0.05 Amperes at 1.6 Volts DC?
A.  83 Ohms.
B.  b} 120 Ohms.
C.  88 Ohms.
D.  32 Ohms.

**9C56 (B)**
With regard to a 7-segment LED display, which statement is correct?
A.  Only one segment at a time can be illuminated.
B.  An external decoder/driver is usually used.
C.  They are often used as simple on-off indicators.
D.  Segments must be illuminated in sets of two.

**9C57 (D)**
Identify the statement below which is incorrect with respect to infrared light emitting diodes:
A.  Light from an IR LED is invisible.
B.  Photodiodes can be used with IR LEDs.
C.  Phototransistors can be used with IR LEDs.
D.  IR LEDs are often used in optical couplers but not in opto-isolators.

**9C58 (A)**
When a power MOSFET has 0V from gate to source the following is true:
A.  It is in pinch off.
B.  It is saturated.
C.  It is in a conducting region.
D.  It is drawing gate current.
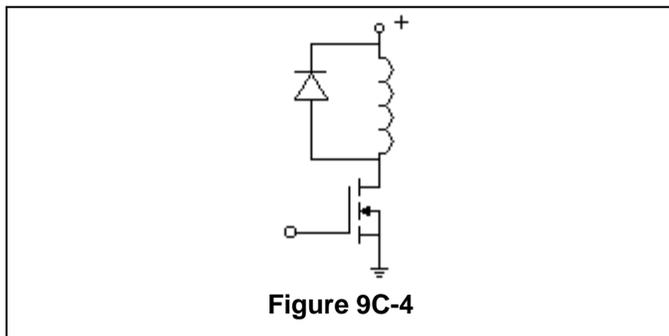


**Figure 9C-4**

**9C59 (B)**
The purpose of the diode in the circuit shown on Figure 9C-4 is to:
A.  Speed switching time.
B.  Protect the transistor.
C.  Increase current capacity.
D.  Compensate for thermal variations.

**9C60 (A)**

In the silicon transistor circuit below, you test the input and find that it is a 0.5V p-p sine wave centered about 4V. The output is a 1.5Vp-p sine wave centered about 7V.  The most likely fact is that:
A.  The circuit is operating normally and is driving a high impedance.
B.  The circuit is operating normally and is heavily loaded.
C.  The transistor is bad.
D.  One of the circuit components is bad.

**9C61 (A)**
Relay K1 contacts do not close.  Q1 base measures 0.7V.  Q1 collector measures 12V.  Proper course of action is:
A.  Change Q1.
B.  Clean K1 contacts.
C.  Change K1.
D.  Change base resistor.

**9C62 (A)**
Vin measures 3.0V.  Q1 emitter measures 2.3V.  Q1 collector = 2.3V.  Proper course of action is to:
A.  Check 10K for open.
B.  Change Q1.
C.  Change the 5K.
D.  Check the next stage.

**9C63 (A)**
It has been reported that a VHF transceiver is unusable because the LCD display characters are "all black." Which of the following might get it working again?
A.  Warm the display up to 20 degrees C.
B.  Drain and replace the LCD liquid.
C.  Replace the display's current limiting resistor.
D.  Replace the crystal.

**9C64 (B)**
Which of the following procedures would be appropriate with metal oxide semiconductor integrated circuits while making equipment repairs:
A.  Use a non-conductive mat on the work surface.
B.  Wear a conductive wrist strap with a 1 million ohm resistor to ground.
C.  Touch each lead to equalize electrostatic potentials.
D.  Keep spare IC's neatly organized in styrofoam.

[END OF SECTION 9C]

**9D01 (C)**
One licensed GMDSS operator aboard ship must be:
A. Dedicated to receive and transmit distress traffic.
B. Responsible for maintaining the watches on VHF channel 70, 2187.5 kHz and VHF channel 16.
C. All of these.
D. Responsible for receiving maritime safety broadcasts.

**9D02 (B)**
Under GMDSS regulations, a ship may leave a port only if:
A. Excluding VHF channel 16, only two other GMDSS capabilities are out of order.
B. All safety and distress equipment is operational.
C. All GMDSS distress and safety capabilities are operational except for VHF channel 70.
D. Only the Navtex receiver has failed.

**9D03 (D)**
While docked, Federal Communications Commission regulations require that the capacity of the emergency batteries be checked at intervals of:
A. 24 hours.
B. 7 days.
C. 30 days.
D. 12 months.

**9D04 (A)**
Ship requirements for reception of VHF channel 70 are:
A. To maintain a continuous watch while underway with a dedicated radio on channel 70.
B. To maintain a continuous VHF channel 70 watch with a receiver that scans other required VHF frequencies.
C. That a distress transmission must be initiated from the radio room.
D. To maintain a watch during nighttime hours.

**9D05 (D)**
GMDSS requirements for radar transponders are:
A. One for cargo ships between 300 and 500 tons.
B. At least one unit on any kind of ship.
C. One for each side of passenger ships and cargo ships of 500 tons upwards.
D. One for cargo ships between 300 and 500 gross tons and one on each side of passenger and cargo ships of more than 500 tons.

**9D06 (B)**
GMDSS requirements for radar transponders are:
A. They must be permanently installed in survival craft required by the SOLAS Convention.
B. They must be stowed in locations so they can be rapidly placed in any survival craft.
C. They must have a keyboard for loading ship or survival craft navigation position.
D. They must be tested every six months.

**9D07 (B)**
GMDSS requirements for portable VHF radio apparatus are:
A. One for cargo ships exceeding 300 tons, but less than 500 tons.
B. Two for cargo ships between 300 and 500 tons, and three on passenger and cargo ships exceeding 500 tons.
C. Three on each passenger ship and cargo ships of 500 tons upwards.
D. Two for cargo ships exceeding 300 tons, but less than 500 tons.

**9D08 (C)**
Navtex broadcasts are sent:
A. On request of maritime mobile stations.
B. Immediately following traffic lists.
C. In categories of messages.
D. Regularly after the radiotelephone silent periods.

**9D09 (A)**
Navtex uses _____ for broadcasts:
A. 518 kHz.
B. NBDP on selected HF frequencies.
C. 2182 KHz.
D. VHF Channel 16.

**9D10 (D)**
Poor copy of Navtex broadcasts can be caused by:
A. Weak signals.
B. Phase distortion.
C. Interference.
D. All of these.

**9D11 (C)**
Controls on a dedicated GMDSS Navtex must be able to select for printout:
A. One category of message.
B. No less than two categories of messages.
C. No less than three categories of messages.
D. No less than four categories of messages.

**9D12 (D)**
NAVTEX broadcasts depend on transmission by:
A. Interrupted continuous waves.
B. Line of sight waves.
C. INMARSAT.
D. Ground waves.

**9D13 (B)**
The following is not true of geo-stationary satellites:
A. They orbit at the same altitude.
B. They orbit the earth at 15 degrees North Lattitude.
C. They are not usable in polar regions.
D. Their orbit is circular.

**9D14 (C)**
The ship INMARSAT antenna is aligned for maximum signal from the Atlantic West Satellite. It is desired to down link to the Italy CES, which has been properly selected:
A. The ship radio alignment system will realign to the Italian Satellite and process the call sucessfully.
B. The Inmarsat telex system will accept the command, process the call and give a "GA+" back to the operator.
C. The Inmarsat telex system will accept the command, process the call and disconnect.
D. The Ship INMARSAT system will not accept the command and fail before accessing the Inmarsat telex system.

**9D15 (C)**
To keep the INMARSAT antenna pointing at the desired satellite regardless of the ships nautical position or changes in ship's course, it has an input from the vessel's:
A. Operational radar.
B. Radar with Automated Radar Plotting Aid (ARPA).
C. Gyro.
D. Steering control.

**9D16 (C)**
Over the Inmarsat system, telephone and telex communication channel usage is:
A. Many ships on same telex analog channel frequency and many ships per same TDM telephone channel.
B. One ship per analog telephone channel and one ship per telex analog channel frequency.
C. One ship per telephone channel and many ships per telex analog channel frequency.
D. One ship per analog channel frequency whether telephone or telex.

**9D17 (B)**
When a telex call is initiated over the INMARSAT system, the channel used is:
A. An idle channel chosen by the scanning device of the ship Inmarsat radio.
B. A common channel shared by many ship stations.
C. One of three channels a ship is assigned by Comsat and dedicated only for calling.
D. Time division multiplexed on any busy channel with an idle time division channel selected by ship's equipment.

**9D18 (B)**
The INMARSAT system uses the following method for voice transmission and reception:
A. T SSB.DM.          B. FM.
C.                    D. AM.

**9D19 (A)**
Over the INMARSAT telex system communication, the automatic answerback (AAB) request is first used by the CES to:

A. Identify the SES making the request.
B. Let the CES operator know the printer is functioning correctly.
C. Get the identity of the ship station and start the channel assignment process.
D. Confirm distress communications.

**9D20 (A)**
Over the Inmarsat system, the SF signaling tones used by the SES and CES are:
A. 2600 Hz.           B. 1688 Hz.
C. 1100 Hz.           D. 400 Hz.

**9D21 (D)**
In a properly functioning GMDSS VHF DSC system, the receiver bandwidth requirement is specified as:
A. Sufficiently wide to pass video pulses.
B. 5 kHz.
C. As narrow as possible, but not less than 170 Hz.
D. GMDSS imposes no requirement.

**9D22 (B)**
A properly operating VHF DSC transmitter used in the GMDSS system can be expected to have a carrier frequency accuracy of:
A. +/- 10 Hertz Coastal, +/- 25 Hertz Marine.
B. +/- 10 Hertz Coastal and Marine.
C. +/- 25 Hertz Coastal and Marine.
D. +/- 100 Hertz Coastal and Marine.

**9D23 (A)**
The properly operating VHF DSC transmitter in the GMDSS system differs from older non-GMDSS VHF voice transmitters in what way?
A. Required carrier stability.
B. Frequency response is flat rather than 6dB/Octave pre-emphasis.
C. Direct FM is used rather than PM.
D. 800 Hz deviation is used rather than 5 kHz.

**9D24 (D)**
In checking the demodulator for a VHF DSC receiving system:
A. The RF generator must be tuned 1.7 kHz below carrier.
B. It must recognize the ships assigned tones.
C. It must recognize 1300 and 2100 Hz within 10 Hz.
D. It must recognize 1300 and 2100 Hz within 10%.

**9D25 (C)**
The modulation index associated with 1200 baud, 1700 hz carrier, 800 Hz shift as would be used in VHF DSC mode is:
A. 1.0 +/-10%.
B. 1.0 +/-20%.
C. 2.0 +/-10%.
D. 2.0 +/-20%

**9D26 (B)**
Simplex teleprinting does not have which of the following properties:
A. There are seven bits in each character.
B. It is asynchronous.
C. Each character contains four ones.
D. Each character contains three zeros.

**9D27 (C)**
The receiving station in a SITOR link uses which of the following methods to check for invalid characters while operating in the ARQ mode?
A. Correct number of start and stop bits.
B. Odd or even polarity.
C. A 4/3 mark to space ratio.
D. Three marks to four spaces.

**9D28 (B)**
Of the following, which is true of SITOR ARQ mode direct printing radioteletype transmission?
A. The acceptance code consists of three characters.
B. Each data block consists of three characters.
C. A continuous data stream is transmitted.
D. Forward error correction reduces the number of errors.

**9D29 (A)**
Incorrect functioning of an ARQ SITOR transmitting station would be indicated by:
A. Transmitter on time equals off time.
B. Transmitter off time is greater than on time.
C. Transmitter on time is less than off time.
D. Transmitter on time is greater than off time.

**9D30 (A)**
The minimum time for two-way ARQ SITOR communication of data is:
A. About 455 milliseconds.
B. About 5 seconds.
C. About 0.21 seconds.
D. Equal to 240 milliseconds.

**9D31 (C)**
Which of the following is true of SITOR ARQ mode?
A. Each character is transmitted twice.
B. Each character is repeated three times.
C. This is an interactive mode.
D. This is an interactive mode where each character is repeated three times.

**9D32 (A)**
With regard to SITOR, what should happen when an RQ code is received correctly by the transmitting station?
A. The last block will be resent.
B. The next block will be sent.
C. The data link will be reversed.
D. The acknowledge light should illuminate.

**9D33 (B)**
If a SITOR transmitting station operating in ARQ mode has no data waiting to be sent:
A. A BREAK character will be sent and the link will drop
B. Idle characters will be sent..
C. The link will reverse.
D. Synchronization will be lost.

**9D34 (A)**
In SITOR Mode A, the time required to transmit a single group of data characters as measured using a calibrated oscilloscope with the horizontal timebase set to 50 ms/div would be indicated by a length of:
A. 4.2 divisions.
B. 4.8 divisions.
C. 3.0 divisions.
D. 3.0 centimeters.

**9D35 (D)**
In a properly functioning MF/HF DSC system, the receiver bandwidth should be:
A. Sufficiently wide to pass video pulses.
B. 1.7 khz.
C. As narrow as possible, but not less than 170 hz.
D. 300 Hz maximum.

**9D36 (B)**
A properly operating MF/HF DSC transmitter used in the GMDSS system can be expected to have a carrier frequency accuracy of:
A. +/- 10 Hertz Coastal, +/- 25 Hertz Marine.
B. +/- 10 Hertz Coastal and Marine.
C. +/- 25 Hertz Coastal and Marine.
D. +/- 100 Hertz Coastal and Marine.

**9D37 (D)**
The properly operating HF DSC transmitter in the GMDSS system differs from older non-GMDSS SSB voice transmitters in what way?
A. 170 Hz shift is used rather than 1700 kHz.
B. Frequency response is flat rather than 6dB/Octave pre-emphasis.
C. Direct FSK is used rather than AFSK.
D. Required carrier stability.

**9D38 (D)**
If you were to observe the output power of a properly operating MF/HF transmitter in the DSC mode using a typical in-line RMS wattmeter as calls were made, what would you expect to see?
A. Nothing is observed because of the quickness of the communication.
B. Normal carrier power would be indicated.
C. The meter would flicker at half second intervals.
D. The meter would flicker for approximately 0.5 second but readings could be inaccurate.

**9D39 (C)**
In checking the demodulator for a MF/HF DSC receiving system:
A. The RF generator must be tuned 1.7 kHz below carrier.
B. It must recognize the ships assigned tones.
C. It must recognize audio of 1615 and 1785 Hz.
D. It must recognize audio of 800 Hz and 1700 Hz within 10 Hz.

**9D40 (D)**
Federal Communication Commission requirements for GMDSS specify an EPIRB capable of:
A. Transmitting distress alerts on 406.025 MHz.
B. Transmitting a beacon on 121.5 MHz.
C. Receiving distress alerts on 156.8 MHz.
D. Transmitting distress alerts on 406.025 MHz and a beacon on 121.5 MHz.

**9D41 (A)**
Federal Communication Commission regulations for GMDSS specify that certain ships have a 406 MHz EPIRB capable of:
A. Floating free of a ship, in the event that it sinks, and automatically transmitting a 121.5 MHz homing beacon and a 406.025 MHz signal which contains a unique identification code for each EPIRB station.
B. Commencing transmissions after a 60 second delay only after floating free from a sinking ship.
C. Automatically activating when floating away from a sinking ship and transmitting on the 406 MHz band and 158.6 MHz.
D. Acknowledging reception by search and rescue by its flashing light.

**9D42 (B)**
When activated the GMDSS EPIRB will transmit:
A. Only a 406 MHz signal to a Marisat satellite.
B. Only a 406 MHz beacon to polar satellites and 121.5 MHz beacon to search and rescue craft.
C. A 406 MHz beacon to polar satellites and 158.6 MHz homing signal for search and rescue craft.
D. 156.8 MHz and 121.5 MHz beacons for search and rescue craft.

**9D43 (C)**
The radiotelephone alarm tone frequencies are:
A. 1100 Hz and 1900 Hz.
B. 700 Hz and 1900 Hz.
C. 1300 Hz and 2200 Hz.
D. 700 Hz and 2200 Hz.

**9D44 (A)**
The radiotelephone silence period(s) are required:
A. Twice each hour for 3 minutes duration commencing at X.00 and X.30 UTC.
B. Once each hour for 3 minutes duration commencing at X.00 UTC.

C. Four times each hour for 3 minutes duration commencing at X.00, X.15, X.30, and X.45 UTC.
D. Set by the captain of the vessel at the beginning of the voyage.

**9D45 (D)**
The radiotelephone silence period is:
A. A time period that the radiotelephone watch receiver can be powered off as no traffic is sent during this period.
B. A period dedicated for testing so as not to interfere with normal message traffic.
C. Used to pass message traffic on a non-interference basis.
D. A 3 minute period that is reserved for distress, urgency, or safety messages.

**9D46 (D)**
Which of the following is true regarding a SART:
A. Each passenger vessel must carry four SARTs on the bridge.
B. A SART is automatically activated when dropped on the ground from a height of 1 meter.
C. SARTs operate on a single radar frequency in the 9 GHz band.
D. A SART is automatically activated by water.

**9D47 (C)**
NAVTEX warnings are:
A. Exactly the same as NAVAREA warnings.
B. Transmitted on 518 MHz.
C. Relevant to all sizes and types of vessels within a service region.
D. To be relayed immediately to a nearby LUT.

**9D48 (A)**
Which of the following is most true regarding L-band satellite EPIRBs:
A. All of these.
B. They operate through the INMARSAT system.
C. They operate on a dedicated channel in the 1.6 GHz band.
D. They transmit a message which includes a ship's station identity.

[END OF SECTION 9D]