"AMECO"

RADIO AMATEUR

QUESTION and ANSWER

LICENSE GUIDE

- FCC-TYPE MULTIPLE CHOICE QUESTIONS
- TYPICAL FCC-TYPE PRACTICE EXAMS
- QUESTIONS GROUPED BY SUBJECTS
- NOVICE, TECHNICIAN & GENERAL CLASSES

50¢

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"AMECO"

RADIO AMATEUR QUESTION & ANSWER LICENSE GUIDE

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FOREWORD

The purpose of this book is to give the prospective Radio Amateur a good idea of the technical information that he must have in order to pass the FCC license examination. It will also acquaint him with the type of question that is asked on the examination.

The questions and answers in this book are not the exact ones that are asked by the FCC. However, the form (multiple-choice type) and contents of the questions are similar to those given on the FCC tests.

The first section is for those preparing for the Novice examination. The second section is for the prospective General Class and Technician Class operators. In each section, the questions are first grouped together according to their subject matter. For instance, all questions dealing with basic electricity come under the heading of "Basic Electricity", all power supply questions come under the heading of "Power Supplies", etc. In both sections, the questions are followed by a typical FCC-type examination. These examinations are similar to the ones given by the FCC in that they have the same number and type of questions. If the prospective amateur can answer 75% of these questions correctly, he has an excellent chance of passing the official examination. It is suggested, however, that one should familiarize himself with the technical knowledge contained in all the questions and thus be assured of passing the test.

The answers to all questions are on pages 30 to 32.

The numbers to the right of most of the questions are the page numbers in the AMECO "Radio Amateur Theory Course" on which complete technical information concerning the question can be found. The Radio Amateur Theory Course is published by the American Electronics Co. See back cover.

TABLE OF CONTENTS

SECTION I

SECTION II

SECTION I

NOVICE PRACTICE QUESTIONS

BASIC ELECTRICITY

1. A voltmeter measures: 9*
   a. current b. amperes c. electrical pressure
   d. power

2. One kilocycle is equal to: 35, 36
   a. 1000 cycles b. 10,000 cycles c. 1000 Mc.
   d. 100,000 cycles

3. The second harmonic of 400 kc. is: 143
   a. 400 c. b. 800 c. c. 800 kc. d. 1200 kc.

4. Resistance is measured by: 6
   a. an ammeter b. a voltmeter c. an ohmmeter
   d. a wavemeter

5. Power is measured by: 19
   a. a wattmeter b. a voltmeter c. an ohmmeter
   d. a joulemeter

6. Mc. stands for: 36
   a. microsecond b. milliampere c. megacycle d. megaphone

7. A device used to oppose the flow of audio frequency currents while permitting direct current to flow is called: 88
   a. an audio trap
   b. an audio transformer
   c. an audio frequency choke
   d. a direct current choke

8. Which of the following is not correct? 12
   a. I=E/R b. R=EI c. E=IR d. R=E/I

POWER SUPPLIES

9. The filter in a power supply: 87
   a. changes a.c. to d.c. b. filters out d.c.
   c. steps up d.c. voltage d. removes the a.c. ripple

*See last paragraph of Foreword

10. A rectifier: 83
a. steps up a.c. b. changes a.c. to d.c.
c. removes a.c. hum d. needs a well filtered power supply

11. The plate and screen voltages which the power supply provides for the transmitter tubes should be: 83, 193
a. pure d.c. b. pulsating d.c. c. a.c. d. pulsating a.c.

TRANSMITTERS AND RECEIVERS

12. F.M. stands for: App. 1
a. Frequency Monitoring b. Fundamental
c. Frequency Modulation d. Fading Motorboating

13. A detector is found in a: 157, 240
a. transmitter b. public address system c. receiver
d. power supply

14. In order to prevent r.f. from going to a certain point, one should use:
a. an i.f. choke b. a resistor c. an oscillator 179
d. an r.f. choke

15. A key-click filter consists of: 191
a. a resistor in series with the key and a resistor across the key
b. a resistor across the key and a condenser in series with the key
c. a resistor and condenser in series across the key and a choke in series with the key
d. a choke and resistor in series across the key and a condenser in series with the key

16. Attenuation means: App. 7
a. boosting b. reducing c. distorting d. amplifying

17. Overmodulation results in: 205
a. cancellation of even harmonics
b. attenuation of the high audio notes
c. generation of spurious harmonic frequencies
d. an increase in hum

18. "Continuous-wave" is abbreviated by: 178
a. c.w. b. cn.w. c. cs.w. d. C.S.W.

19. What is the d.c. power input to a tube having a plate voltage of 750 volts and a plate current 90 ma.: 112
a. 63.3 watts b. 67.5 watts c. 67,500 watts d. 63,300 watts

20. What is the d.c. power input to a tube having a plate voltage of 650 volts and a plate current of 75 ma.: 112

21. In a frequency doubler: 188

a. the signal frequency is cut in half
b. the plate tank circuit is tuned to twice the frequency of the grid tank circuit
c. the plate current is twice as high as the grid current
d. the plate voltage is one half of the grid voltage

22. Of the following percentages of modulation which one would you consider to be one of overmodulation? 204, 205

a. 50% b. 75% c. 100% d. 110%

23. Interference due to sparking at the telegraph key contacts can be eliminated by: 191

a. a spark suppressor
b. a resistor type spark plug
c. a key-click filter
d. a spark gap device

24. An amplifier stage is one which: 102

a. increases the d.c. component of the signal
b. extracts audio from an r.f. carrier
c. boosts the low frequency components of an audio signal
d. increases the signal voltage on the control grid

RULES AND REGULATIONS

25. The equipment used to measure the frequency of an amateur station shall be: 258, 259

a. completely independent of the transmitter
b. crystal controlled
c. battery operated
d. frequency modulated

26. Interference to nearby receivers is not permitted: 258

a. if the receivers are of good engineering design and not tuned to the transmitter
b. if the receivers are not tuned to the transmitter
c. if the receivers are made by a licensed receiver manufacturer
d. if the receiver contains a stable local oscillator

27. Eastern Standard Time is abbreviated by: App. 1

a. E.T. b. EST c. ESTM d. E.P.M.

28. A person without an operator license may operate an amateur transmitter: 248

a. if he sends at a code speed of less than 13 words per minute
b. if the transmitter's output doesn't travel more than one mile
c. if the transmitter is crystal controlled
d. a person without an operating license may not operate an amateur transmitter

29. A Novice Class operator may operate a c.w. transmitter in the following band: 246

a. 3700-3750 kc.
b. 27.23-29.63 Mc.
c. 28.00-28.50 Mc.
d. 50-54 Mc.

30. Notice of portable or mobile operation must be given to the FCC inspector: 253

a. at all times
b. when the portable or mobile operation is to be for a period in excess of 48 hours
c. when the portable or mobile operation is to be for a period in excess of 24 hours
d. notice need not be given for portable or mobile operation

31. A person without an amateur license may speak into the microphone of an amateur phone transmitter: 248

a. if he gives the station call letters at the proper intervals
b. if he holds an FCC operator's license
c. if a licensed amateur operator is present to control the emissions
d. a person without a license is not permitted to speak into the microphone

32. An amateur radio station licensed to the holder of a Novice Class license may be operated: 248

a. only by holders of Advanced class and Extra class licenses
b. by all amateurs except holders of Conditional class licenses
c. by all other amateurs
d. by all amateurs except holders of Technician class licenses

33. Simultaneous f.m. and a.m. transmission on frequencies below 144 Mc.: 258

a. is permitted to holders of an Advanced class license
b. is permitted on the frequencies—29.96 Mc. to 27.23 Mc. and 29.00 Mc. to 29.70 Mc.
c. is not permitted
d. is permitted if the transmitter's output is under 75 watts

34. A transmission may be made without identification of the station:
a. only if the station keeps an accurate log of each transmission
b. if the transmission is made for testing purposes only 253
c. on frequencies above 144 Mc.
d. a transmission may not be made without identification of the station

35. A Novice Class license is renewable under the following conditions:
a. upon application by the Novice operator 247
b. that the Novice operator can show proof of still being able to pass the original examination
c. proof must be given of 3 actual radio contacts with other amateurs
d. the Novice Class license is not renewable under any conditions.

36. The maximum penalty for a violation of the rules and regulations of the FCC is: 262
a. revocation of the station license and a jail term not to exceed 5 years
b. revocation of operator license
c. a fine up to $500 per day of offense plus revocation of license
d. a jail term not to exceed 3 years

37. GMT stands for: App. 1
a. General Motors Transformer
b. General Marine Tuner
c. General Motors Timer
d. Greenwich Mean Time

38. The transmission of improper language or false signals: 261
a. is forbidden at all times
b. is permitted if the transmitter's output does not travel more than one mile in any direction
c. is permitted between the hours of 1 A.M. and 7 A.M.
d. there is no FCC rule regarding the transmission of improper language

39. The log of an amateur station is: 259
a. a special type of radio calendar
b. the rules and regulations of the FCC pertaining to the amateur operator
c. a written record of transmissions made by an operator
d. a copy of the frequencies which an operator can use under his license

40. The log of an amateur station must be preserved for: 260
a. 6 months b. 1 year c. 2 years d. 3 years

TYPICAL NOVICE EXAMINATION

1. The maximum permissible percentage of modulation of an amateur radiotelephone station is: 258
   a. 75% b. 90% c. 105% d. 100%

2. A frequency multiplier in a transmitter will: 188
   a. increase the power of the fundamental frequency
   b. increase the voltage of the fundamental frequency
   c. increase the frequency in odd multiples
   d. increase the frequency in multiples of 2, 3, 4, etc.

3. The method of frequency control required in a station licensed to the holder of a Novice Class license is: 246
   a. automatic frequency control b. crystal control
   c. electron coupled oscillator must be used d. monitor control

4. Alternating current is changed to direct current by means of a:
   a. rectifier b. transistor c. filter d. transformer 83

5. a.m. stands for: 202
   a. amplitude modulation b. amplitude
   c. American measurement d. amplitude megacycle

6. Modulation is the process whereby: 202
   a. the high audio tones are attenuated
   b. audio is superimposed on an r.f. carrier
   c. r.f. is superimposed on an audio frequency carrier
   d. image interference is eliminated

7. The means by which an amateur measures his emitted frequency shall be: 258
   a. sufficiently accurate to assure operation within the amateur band being used
   b. accurate to within 2% of the dial calibrations
   c. accurate to within 5% of the dial calibrations
   d. crystal controlled

8. A detector stage: 157,236
   a. removes noise from the signal
   b. extracts audio from a modulated carrier
   c. resembles an r.f. amplifier stage
   d. is located between the mixer stage and the i.f. stage

9. Electrical energy is measured by: 19
   a. a watt-hour meter b. a wavemeter
   c. an ammeter d. a voltmeter

10. Of the following, which is not likely to be an effect of over-modulation: 205
    a. distortion of the audio component of the carrier
    b. radiation of spurious sidebands
    c. drifting of the oscillator
    d. interference with stations on nearby frequencies

11. What is the d.c. power input to a tube having a plate voltage of 250 volts and a plate current of 40 ma. 112
a. 10 watts b. 100 watts c. 1 watt d. 6.25 watts

12. The third harmonic of 2 Mc. is: 143
a. 6 Mc. b. 8 Mc. c. 12 kc. d. 12 Mc.

13. Willful interference to other radio communications: 262
a. is prohibited
b. is permitted on frequencies above 144 Mc.
c. is permitted on frequencies above 420 Mc.
d. is permitted if the output power is under 10 watts

14. A filter choke: 87, 88
a. is used to oppose audio signals
b. filters out d.c.
c. is used in amplifiers to filter out harmonics
d. is used in a power supply to filter out a.c. hum

15. The term of a Novice Class license is: 248
a. 6 months b. 12 months c. 3 years d. 5 years

16. A Novice Class operator may not operate an amateur radio station in the following band: 246
a. 3700-3750 kc. c. 21.10-21.25 Mc.
b. 50-54 Mc. d. 145-147 Mc.

17. The maximum input power permitted to the final stage of a transmitter operated by a Novice Class operator is: 246
a. 50 watts b. 75 watts c. 100 watts d. 1000 watts

18. Spurious radiations from an amateur transmitter: 258
a. are permitted on all frequencies above 30 Mc.
b. are forbidden on all amateur frequencies
c. must be reduced in accordance with good engineering practice on all frequencies below 144 Mc.
d. are forbidden by Novice Class operators

19. One megacycle is equal to: 36
a. 1,000,000 kc. b. 1,000,000 cycles
c. 1,000 cycles d. 100 kilocycles

20. Parasitic oscillations are: 187
a. oscillations at frequencies other than the desired output frequency
b. oscillations occuring at exactly twice the desired frequency
c. oscillations occuring in the receiver only
d. oscillations which take place in the audio section of the transmitter

SECTION II

GENERAL AND TECHNICIAN PRACTICE QUESTIONS

BASIC ELECTRICITY

1. The instrument used to measure resistance is: 6
   a. wattmeter b. ammeter c. voltmeter d. ohmmeter

2. The unit of power is: 18
   a. the ampere b. the coulomb c. the watt d. the joule

3. The third harmonic of 350 c.p.s. is: 143
   a. 117 c.p.s. b. 250 c.p.s. c. 700 c.p.s. d. 1050 c.p.s.

4. The instrument used to measure current is: 9
   a. wattmeter b. ammeter c. voltmeter d. ohmmeter

5. The frequency of a sine wave is: 34
   a. the time in seconds for one cycle
   b. the amplitude of the wave
   c. the number of cycles per second
   d. the angle of rotation

6. The unit of electromotive force or potential difference is: 8,9
   a. ampere b. volt c. watt d. coulomb

7. The instrument used to measure potential difference is: 9
   a. wattmeter b. ammeter c. voltmeter d. ohmmeter

8. Short-circuiting a turn of a coil in a tuned circuit will: 54
   a. increase the resonant frequency
   b. have no effect on the resonant frequency
   c. decrease the resonant frequency
   d. increase the "Q"

9. The unit of capacitance is: 44
   a. henry b. coulomb c. farad d. gilbert

10. The unit of energy is: 18
    a. watt b. joule c. coulomb d. electron

11. The unit of inductance is: 39
    a. henry b. coulomb c. farad d. gilbert

12. The unit of electrical resistance is: 6

a. ampere b. volt c. ohm d. joule

13. A frequency meter is used to measure: 229

a. r.f. currents
b. milliamperes
c. frequency
d. eddy currents

14. The time constant of an R-C circuit is equal to: App. 7

a. ohms multiplied by farads
b. farads divided by ohms
c. 63% of the product of ohms and farads
d. ohms divided by farads

15. The reciprocal of conductance is: 8

a. inductance b. resistance c. capacitance d. voltage

16. The opposition that the center of a conductor offers to high frequency currents results in: App. 7

a. Miller effect b. low distributed capacity c. skin effect
d. a low Q circuit

17. The "Q" of a resonant circuit is the: App. 7

a. inductive reactance divided by the resistance
b. inductance divided by the resistance
c. circulating current divided by the capacitance
d. circulating current divided by the inductance

18. If a 6 henry choke is connected in series with a 12 henry choke, (with no mutual inductance between them), the total inductance is: App. 7

a. 4 henries b. 3 henries c. 36 henries d. 18 henries

19. The total inductance of 2 inductors in parallel (with no mutual inductance between them), is equal to: App. 7

a. the sum of the inductances
b. the product of the inductances
c. the product of the inductances divided by the sum
d. none of the above

20. The formula for the reactance of an inductor is: 40

a. $2\pi fL$ b. $\frac{1}{2\pi fL}$ c. $\frac{1}{2fL}$ d. $\frac{2\pi fL}{2}$

21. The formula for the reactance of a condenser is: 49

a. $2\pi fC$ b. $\frac{1}{2\pi fC}$ c. $\frac{1}{2\pi C}$ d. $\frac{2\pi fC}{2}$

22. What is the total resistance of one 10 ohm resistor and two 20 ohm resistors all connected in series? 14

a. 50 ohms b. 5 ohms c. 30 ohms d. 45 ohms

23. What is the total resistance of one 20 ohm resistor and two 40 ohm resistors all connected in parallel? 15-16

a. 10 ohms b. 100 ohms c. 90 ohms d. 150 ohms

24. The total capacity of two 20 mfd. condensers in parallel is: 47

a. 5 mfd. b. 10 mfd. c. 40 mfd. **d.** 0 mfd.

25. The total capacity of two 20 mfd. condensers in series is: 46

a. 5 mfd. b. 10 mfd. c. 40 mfd. d. 0 mfd.

26. The resonant frequency of a tuned circuit is found by the following formula: 54

a. $2\pi fLC$ b. $\frac{L}{2\pi fC}$ c. $2\pi LC$ d. $\frac{1}{2\pi\sqrt{LC}}$

27. In order to double the resonant frequency of a tuned circuit, the inductance or capacitance should be: 54

a. reduced to one half of its original value
b. reduced to one quarter of its original value
c. doubled d. quadrupled

VACUUM TUBES AND AUDIO AMPLIFIERS

28. The maximum safe heat radiation capability of the plate of a tube is indicated by the following rating: 112

a. transconductance expressed in mhos.
b. maximum plate dissipation expressed in watts
c. plate resistance expressed in ohms
d. grid bias expressed in volts

29. A tetrode has: 113,114

a. one grid b. two grids
c. three grids d. four grids

30. Draw a schematic diagram of a pentode audio power amplifier stage with an output coupling transformer and load resistor, showing suitable instruments connected in the secondary for measurement of the audio-frequency voltage and current; and name each component part. 128,129

31. What is the plate power input to a tube having a plate voltage of 800 volts and a plate current of 120 ma? 112

32. Push-pull operation: 144

a. introduces harmonics into the grid circuit
b. reduces the signal strength
c. cancels the third harmonic
d. eliminates the second harmonic in the plate circuit

33. The tube that cannot amplify is the: 102

a. pentode b. tetrode c. triode d. diode

34. The value of the bias voltage of figure 1 is: 121,149-150

a. 6.25 volts b. 5 volts
c. 1.25 volts d. 50 volts

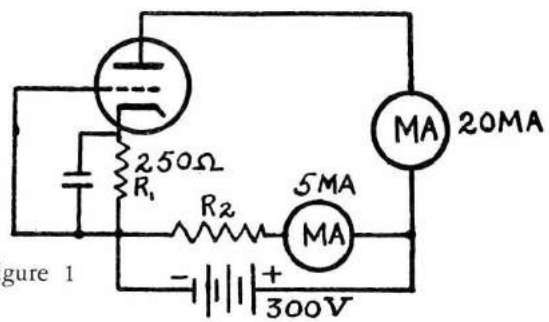


Figure 1

35. The d.c. plate power input to a tube having a plate voltage of 800 volts and a plate current of 85 ma. is: 112

a. 6,800 watts b. 68,000 watts c. 680 watts d. 68 watts

36. What is the efficiency of a tube whose d.c. input power is 100 watts and whose r.f. output power is 60 watts? 111,112

a. 60% b. 40% c. 166 and 2/3 % d. 66 and 2/3 %

37. Which of the following is not a characteristic of a class A amplifier stage? 123,124

a. high efficiency
c. no grid current drawn
b. average plate current remains constant
d. tube operates over linear portion of Eg-Ip curve

38. A low negative grid bias in a class A amplifier results in: 131, 132
    a. reduction in plate current flow
    b. better fidelity
    c. a flow of grid current
    d. class AB operation

39. Draw a diagram of a resistance coupling system between two audio-frequency amplifier stages. 128

POWER SUPPLIES

40. A bleeder resistor: 89
    a. improves the voltage regulation
    b. should be replaced
    c. is very critical
    d. improves the ripple frequency

41. A power supply filter eliminates: 87
    a. d.c. b. a.c. and d.c. c. the a.c. ripple d. r.f.

42. If the high voltage secondary of a transformer was changed from a full-wave, center-tapped connection to a bridge rectifier connection, the output voltage rating would: 90, 91
    a. remain the same
    b. be doubled
    c. be halved
    d. be tripled

43. An advantage of a mercury vapor rectifier over a high vacuum rectifier is NOT: 97
    a. better voltage regulation
    b. low internal voltage drop
    c. a critical inverse peak voltage rating
    d. a relatively high current rating

44. A swinging choke: 93, 94
    a. is used in a power supply which supplies a fixed load
    b. is used mostly in receiver power supplies
    c. tends to keep the output voltage constant with varying load
    d. has a high capacity

45. A mercury vapor rectifier: 97, 98
    a. is always connected to a condenser input filter
    b. does not require a filter
    c. should be connected to a choke input filter
    d. none of the above

46. The approximate values of the filter condensers in a transmitter power supply are between: 92
    a. 20 to 40 mfd
    b. 100 to 200 mfd
    c. 2 to 4 mfd
    d. 200 to 400 mfd

47. The visible operating characteristic of mercury vapor rectifiers is: 96

a. a bluish-green glow
b. red plates
c. green cathode
d. hot anode

48. A filter circuit in a power supply does not: 87

a. use electrolytic condensers
b. filter out the d.c.
c. filter out the a.c.
d. provide a d.c. voltage

49. If the primary of a 60 cycle power transformer were connected to d.c. mains: App. 7

a. the output would be pure d.c.
b. the primary winding would most probably burn out
c. the d.c. output would decrease
d. the ripple frequency would increase

50. The purpose of a fuse in a power supply is to: 195

a. prevent damage to the power supply
b. prevent overmodulation on high audio peaks
c. prevent radio frequency currents from going back into the power lines
d. improve the regulation of the power supply

51. In a mercury vapor rectifier system: 95-98

a. the filament and plate voltages may be applied simultaneously
b. the plate voltage must always be turned on first
c. the filament voltage must always be turned on first
d. the filament voltage is turned on 10 seconds after the plate voltage

52. Draw a simple schematic diagram of a half-wave rectifier with a filter which will furnish pure d.c. at the highest voltage output, showing filter condensers of unequal capacitance connected in series, with provision for equalizing the d.c. drop across the different condensers. 92

53. The ripple frequency of a half-wave rectifier system is: 87

a. the same as that of a full-wave rectifier
b. twice that of a full-wave rectifier
c. one-half that of a full-wave rectifier
d. 120 cycles per second

54. An important function of the bleeder resistor in a power supply is to: 89

a. reduce voltage
b. reduce shock hazzard
c. increase output voltage
d. protect the transformer

55. Power supply circuit leads should not be exposed because of:

a. possible electric shock App. 7
b. reduced output due to "Corona effect"
c. feedback from r.f. circuits
d. possible audio frequency oscillations

TRANSMITTERS AND RECEIVERS

56. An important step in neutralizing an r.f. amplifier is: 186

a. remove the plate voltage of the stage to be neutralized
b. remove the filament voltage of the oscillator
c. remove the plate coil
d. lower the plate voltage

57. The plate current of a radio-frequency power amplifier at resonance:

a. is a minimum 198
b. is a maximum
c. does not change
d. increases slightly over non-resonance

58. A triode radio-frequency power amplifier must be neutralized:

a. to increase power output 183,184
b. to prevent self-oscillations
c. to eliminate second harmonic radiation
d. when used as a frequency doubler

59. Using a frequency meter with a possible error of 0.75%, on what whole number kilocycle frequency nearest the low frequency end of the 14,000-14,400 kc. band could a transmitter safely be set? 231

a. 14,000 kc. b. 13,895 kc.
c. 14,200 kc. d. 14,106 kc.

60. If 2 Mc. is fed into the grid of a "doubler" stage, the plate tank circuit is tuned to: 187,188

a. 2 Mc. b. 1 Mc. c. 4 Mc. d. 6 Mc.

61. The ratio of modulator speech power output to class C amplifier unmodulated plate power input in a plate-modulation system is:

a. 125% b. 100% c. 25% d. 50% 212

62. A downward deflection of the antenna r.f. current meter during modulation might indicate: 219

a. excess r.f. excitation to the modulated stage
b. proper filament emission of the modulated stage
c. poor voltage regulation of the power supply common to the modulator and r.f. amplifier stages
d. improper bias on grid of modulated stage

63. Draw a simple schematic diagram of two r.f. amplifier stages using triode tubes, showing the neutralizing circuit, link coupling between stages, and between output and antenna system, and a keying connection in the negative high voltage lead including a key-click filter. 265

64. An electron-coupled oscillator: **167-169**
a. has very good frequency stability
b. has very good efficiency
c. has low output power
d. is more stable than a crystal-controlled oscillator

65. If a 1 Mc. signal is modulated by a 2 kc. audio note, the sideband frequencies are: **205-207**
a. 999 kc. and 1 Mc.
b. 2000 kc. and 1000 kc.
c. 1002 kc. and 2 kc.
d. 998 kc. and 1002 kc.

66. The usual means for protecting amateur station equipment from damage by charges of atmospheric electricity (static) on the antenna system is to: **App. 7**
a. connect a large size condenser from the top of the antenna to ground
b. use an antenna grounding switch
c. shunt the antenna with a low value resistance
d. disconnect the coupling system from the antenna when not in use

67. A certain 28 Mc. Y cut crystal has a positive temperature coefficient of 100 cycles per degree centigrade, and is started in operation at 40 degrees centigrade. What will the oscillation frequency be at a temperature of 70 degrees centigrade? **173-174**

68. The principle advantage of a screen-grid type r.f. amplifier tube over a triode of equal output rating is: **184**
a. it does not require neutralization
b. it has more gain
c. it has higher interelectrode capacity
d. the need for lower operating voltages

69. A low drift crystal for the 28.5-29.7 Mc. amateur band is calibrated to within 0.05% of its specified frequency. Desiring to operate as close to the lower band limit of 28.5 Mc. as possible, for what whole number kilocycle frequency should you order your crystal, allowing 1 kc. additional for temperature and circuit constant variations?
a. 28,516 kc. b. 28,484 kc. c. 28,984 kc. d. 28,600 kc.
174-176

70. In order to obtain optimum power output from an r.f. power amplifier: **265**
a. the antenna system should be matched to the rated tube load impedance
b. directional array antenna should be used
c. link coupling is required
d. class B push-pull operation should be employed

71. Draw a simple diagram showing the series fed plate circuit of a radio frequency amplifier. 194

72. Frequency modulation of an amplitude modulated wave: 193
   a. causes no output signal
   b. doubles the output power
   c. causes spurious side bands and interference
   d. causes undesired harmonics

73. Link coupling may not be used: 189
   a. between the oscillator and buffer
   b. between the final r.f. amplifier and the antenna coupling network
   c. between the modulator and the final r.f. amplifier
   d. between the frequency multiplier and the final r.f. amplifier

74. The purpose of using a center-tap on the secondary of a transmitting tube's filament transformer is: 197
   a. to prevent overheating of the transformer
   b. to prevent modulation of the carrier wave by the a.c. filament supply
   c. to obtain half the secondary voltage
   d. to prevent interference by radiation of harmonics

75. A separate power supply is used for the oscillator stage of a transmitter: 193
   a. because the filaments require a separate heating source
   b. because a lower B voltage is required
   c. to increase the frequency band-width radiated due to a common power supply
   d. to prevent frequency instability due to load variations being fed back through a common power supply

76. A 2050 kc. low-drift crystal has a positive temperature coefficient of 3 cycles per megacycle per degree centigrade. If the temperature at the start of operations is 60 degrees centigrade, what will be the oscillating frequency at 30 degrees centigrade? 173-174
   a. 2050.1845 kc.
   b. 2049.8155 kc.
   c. 2050 kc.
   d. 2031.55 kc.

77. A tetrode r.f. amplifier will not oscillate because: 184
   a. there are no space charges in a tetrode
   b. the plate of a tetrode is much larger than the plates of other tubes
   c. it is impossible for any r.f. amplifier to oscillate
   d. the screen grid reduces the plate-grid inter-electrode capacity

78 The result of operating an unneutralized r.f. triode amplifier is: 184

a. decreased output
b. spurious radiation
c. a decrease in harmonic content
d. varying load condition

79. The purpose of a faraday shield between the output circuit of an r.f. power amplifier and antenna coupling system is: 196-197

a. to eliminate need for neutralization
b. to reduce undesirable harmonic radiation
c. to eliminate need for antenna tuning
d. to prevent 60 cycle modulation of the carrier

80. Using a frequency meter with a possible error of 0.75% on what whole number kilocycle frequency nearest the low frequency and of the 7000-7300 kc. amateur band could a transmitter safely be set? 231

81. Draw a simple schematic diagram of a neutralized push-pull power amplifier stage using triodes. 194

82. Increasing the Q of a tuned circuit will: App. 7

a. increase the harmonic output
b. decrease the harmonic output
c. decrease the selectivity
d. increase the distributed capacity

83. The approximate bandwidth of an A1 emission signal is: App. 7

a. 75 kc. b. 7.5 kc. c. 750 cycles d. 75 cycles

84. The ratio of single sideband emission to ordinary type A3 emission is: App. 7

a. 1 to 1 b. 1 to 2 c. 1 to 3 d. 1 to 4

85. The generation of spurious harmonic frequencies from a transmitter can be reduced by: App. 7

a. a key-click filter b. a Low-pass filter c. a High-pass filter
d. a band-pass filter

86. Overloading of the front end of a television receiver by the fundamental of a transmitter can be reduced with a: App. 7

a. key-click filter b. Low-pass filter c. High-pass filter
d. mechanical filter

87. The formula for determining the characteristic impedance of an air insulated parallel conductor transmission line is: App. 7

a. $271\log.ab$ b. $\frac{276}{\log.ab}$ c. $276\log.\frac{b}{a}$ d. $\frac{276\log.a}{\log.b}$

where b is the distance between conductors
and a is the radius of each of the conductors

88. In a transmission line, the maximum current divided by the minimum current is known as the: App. 7

a. average current
b. effective current
c. standing wave ratio
d. band-pass impedance

89. The frequency of 3,000 kc. corresponds to a wave-length of: 222

a. 1 Meter b. 10 Meters c. 100 Meters d. 300 Meters

90. Draw a schematic diagram of a high-pass filter using a single, balanced type, constant-k pi section. App. 7

91. Draw a schematic diagram of a low-pass filter using a single, unbalanced type, constant-k pi section. App. 7

92. Draw a schematic diagram of an r.f. power amplifier stage using parallel feed. App. 7

93. Draw a schematic diagram of a wavemeter with an indicating device. App. 7

94. Draw a schematic diagram of a Colpitts oscillator circuit. 166

RULES AND REGULATIONS

95. The penalty for willful interference with other radio communications is: 262

a. restricting operating to the 20 meter band
b. restricting operator to c.w. operation
c. fine and suspension of license
d. restriction to local calls

96. The principle purpose of using door interlock switches is that they: 195
a. eliminate the need of turning off transmitter
b. act as an on-off switch
c. protect equipment against mishandling by incompetent personnel
d. prevent personnel from being accidentally shocked by dangerous voltages when cage to transmitter is open

97. The meaning of QRT is: App. 4
a. I am being interfered with
b. shift frequency
c. transmit each word or group twice
d. stop transmission

98. When removing an unconscious person from contact with a high voltage circuit, the first thing to do is to: 267
a. attempt to move person
b. call a doctor
c. open main switch of high voltage power supply
d. try to revive person

99. What is the highest percentage modulation of an amateur radiotelephone transmitter permitted by the FCC? 258
a. 75% b. 50% c. 25% d. 100%

100. Third party messages may be handled between amateurs of different countries: 254
a. if there is a special agreement between the countries involved
b. only during wartime
c. only between countries in North and South America
d. third party messages are prohibited

101. What amateur bands are reserved for emergency calling when an official state of emergency has been proclaimed by the FCC? 260
a. those designated by the FCC
b. the 10 and 80 Meter bands
c. 27.16-27.43
d. 29.0-29.7 Mc.

102. The transmission of improper language or false signals: 261
a. is forbidden at all times
b. is permitted if the transmitter's output does not travel more than one mile in any direction
c. is permitted between the hours of 1 A.M. and 7 A.M.
d. there is no FCC rule regarding the transmission of improper language

103. What is the maximum permissible plate power input to the final stage of an amateur transmitter on all bands except 420-450 Mc. and 1800-2000 kc.? 257

a. 850 watts b. 1000 watts c. 10 kilowatts d. 75 watts

104. A state of emergency affecting amateurs becomes effective: 260

a. when so ordered by the FCC
b. when an emergency occurs
c. at the discretion of the amateur
d. 3 hours after the emergency has started

105. What is the meaning of "QRM"? App. 4

a. I am being interfered with
b. stop sending
c. the strength of your signal is——
d. change to transmission on another frequency

106. Notice of portable or mobile operation must be given to the FCC inspector: 253

a. at all times
b. when the portable or mobile operation is to be for a period in excess of 24 hours
c. when the portable or mobile operation is to be for a period in excess of 48 hours
d. notice need not be given for portable or mobile operation

TYPICAL GENERAL AND TECHNICIAN EXAMINATION

1. The second harmonic of 400 kc. is: **143**

   a. 400 cycles b. 800 cycles c. 800 kc. d. 1200 kc.

2. A pentode has: **116**

   a. no grids
   b. one grid
   c. two grids
   d. three grids

3. The unit of electrical quantity is: **9**

   a. ampere b. volt c. coulomb d. watt

4. A mercury vapor rectifier: **95**

   a. has a constant internal voltage drop
   b. has a very high internal voltage drop
   c. has a higher internal voltage drop than a high vacuum rectifier
   d. has no internal voltage drop

5. The d.c. plate power input to a tube having a plate voltage of 650 volts and a plate current of 110 ma. is: **112**

   a. 40 watts b. 71,500watts c. 3,000 watts d. 71.5 watts

6. A state of emergency affecting amateur communications becomes effective: **260**

   a. when an emergency occurs
   b. when so ordered by FCC
   c. at discretion of the operator
   d. 3 hours after emergency has started

7. A full-wave, bridge rectifier system using the same power transformer as a full-wave center-tapped rectifier system would have: **90**

   a. one-half the output voltage
   b. double the output voltage
   c. triple the output voltage
   d. the same output voltage

8. The purpose of using a center-tap return connection on the secondary of a transmitting tube's filament transformer is to: **197**

   a. allow the filaments to heat up
   b. permit power output
   c. prevent modulation of the r.f. by the a.c. filament supply
   d. prevent radiation of spurious harmonics

9. A tetrode is superior to a triode as a radio-frequency amplifier because of its: **114,184**

   a. suppressor grid
   b. increased cathode emission
   c. high plate resistance
   d. reduced possibility of oscillations

10. Radio messages having top priority are: **260**

    a. relief or emergency messages
    b. ordinary calls
    c. ship to shore messages
    d. messages sent to foreign amateurs

11. What is the FCC regulation regarding the transmission of music by an amateur station? **255**

    a. it is permitted only on frequencies above 28 Mc.
    b. it is permitted only during the hours of 6 A.M.-11 A.M.
    c. it is permitted only on frequencies above 116 Mc.
    d. it is not permitted

12. If a transformer were connected to a source of d.c.: **App. 7**

    a. the primary current would be zero
    b. the secondary current would exceed the normal rating
    c. rectification would be easier
    d. excessive current would flow in the primary

13. A 28 Mc. crystal has a positive temperature coefficient of 200 cycles per degree centigrade and is started in operation at 45 degrees centigrade. What will the oscillating frequency be at 75 degrees centigrade? **173-174**

    a. 28.600 Mc. b. 34 Mc.
    c. 28.006 Mc. d. 27.004 Mc.

14. The diode tube has: a. one element b. two elements c. three elements d. four elements **77**

15. Draw the trapezoidal type patterns showing 50% modulation, 100% modulation and over-modulation. **219**

16. Maximum plate dissipation means: **112**

    a. maximum current to the filament
    b. maximum current the plate can absorb
    c. maximum heat in watts the plate can safely radiate
    d. maximum power output of the tube

17. What are the requirements for portable operation in excess of 48 hours from the fixed location? **253**

a. maximum power output is limited to 500 watts
b. operation permitted only in the 10 meter band
c. prior notification to FCC engineer in charge of district
d. single side band transmission

18. Using a frequency meter with a possible error of 0.5%, on what whole number kilocycle frequency nearest the high frequency end of the 7000-7300 kc. amateur band could a transmitter safely be set? **231**

19. Optimum power output from an r.f. amplifier can be obtained:

a. when the stage is a frequency doubler **265**
b. when the output circuit impedance matches the tube load impedance
c. when the plate impedance is equal to the grid load impedance
d. when the plate circuit is slightly off resonance

20. One of the characteristics of an r.f. frequency doubler amplifier is NOT: **187-189**

a. high negative grid bias
b. large excitation signal
c. high impedance plate circuit tuned to twice the excitation frequency
d. low impedance plate circuit tuned to the same frequency as the excitation voltage

21. The ratio of modulator sine wave power output to class C amplifier unmodulated plate power input is: **212**

a. 100% b. 25% c. 125% d. 50%

22. A 14 Mc. crystal has a negative temperature coefficient of 100 cycles per degree centigrade and is started in operation at 50 degrees centigrade. What is the oscillating frequency at 60 degrees centigrade. **173-174**

23. Adequately filtered d.c. plate power is required for operation of an amateur transmitter: **258**

a. on all frequencies
b. on all frequencies below 30 Mc.
c. on all frequencies below 60 Mc.
d. on all frequencies below 144 Mc.

24. The maximum power input to the final stage of a transmitter is:

a. 100 watts b. 500 watts **257**
c. 1000 watts d. 10 kilowatts

25. Full wave rectification is better than half wave rectification because: **89-90**
    a. its output is easier to filter
    b. its output contains a lower ripple frequency
    c. a choke input filter may be used
    d. a swinging choke may be used

26. The instrument used to measure power is the: **19**
    a. wattmeter b. ammeter c. voltmeter d. ohmmeter

27. The electron-coupled oscillator does not have: **167-169**
    a. excellent frequency stability
    b. large frequency variations with variations in supply voltage
    c. coupling of energy from oscillator section to plate circuit by means of the electron stream
    d. frequency independent of load variations

28. What is the meaning of "QRM"? **App. 4**
    a. I am being interferred with b. stop sending
    c. the strength of your signal is——
    d. change to transmission on another frequency

29. The purpose of a filter in a plate power supply system is: **87**
    a. to provide a.c. voltage
    b. smooth out the a.c. ripple component in the output
    c. limit the peak inverse voltage
    d. filter out the d.c. component

30. The d.c. plate power input to a tube having a plate voltage of 750 volts and a plate current of 150 ma. is: **750 112**
    a. 112.5 watts b. 10 watts c. 100 watts d. 112,500 watts

31. A crystal for the 28-29.7 Mc. band is guaranteed to be accurate to within 0.05% of its specified frequency. If you desire to operate as close as possible to the lower end of the band, for what whole number frequency in kilocycles should you order your crystal? Allow an additional 1 kc. for temperature and circuit constant variations.
    a. 28,150 kc. b. 28,140 kc. c. 28,500 kc. d. 28,015 kc. **174-175**

32. The filament is always allowed to warm up before applying plate voltage with a: **96**
    a. mercury vapor tube
    b. high vacuum rectifier
    c. cold-cathode, gas-filled rectifier
    d. beam power pentode

33. The owner of a General Class license can NOT operate a radiotelephone station in the following band: **256**
    a. 1800-2000 kc.
    b. 4000-4300 kc.
    c. 28.5-29-7 Mc.
    d. 50.0-54.0 Mc.

34. Draw a diagram of a full wave power supply. Show a filter circuit for best regulation and a bleeder resistor providing two different output voltages. Give approximate values of the filter components. Also, show a method for suppressing "hash" interference from the mercury-vapor rectifier tubes. **98**

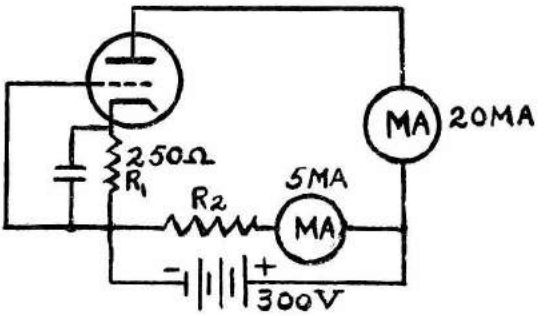
35. Using a frequency meter with a possible error of 0.75%, on what whole number kilocycle frequency nearest the high frequency end of the 3500-4000 kc. amateur band could a transmitter safely be set?
a. 3975 kc. b. 3960 kc. c. 3970 kc. d. 4030 kc. **231**

36. The purpose of a Faraday shield is: **196-197**
a. to reduce power supply interference
b. to reduce self oscillation
c. to take the place of a lightning arrestor
d. to reduce undesirable radiation of harmonics

37. Draw a schematic diagram of a filter for reducing amateur interference to broadcast reception consisting of a series tuned circuit connected in shunt with the d.c. receiver input to by-pass the interfering signal and a parallel tuned (trap) circuit in series with the receiver input to reject the interfering signal. **242**

38. The output ripple frequency of a full wave rectifier connected to a source of 60 cycle a.c. is: **87**
a. 30 cycles b. 60 cycles
c. 120 cycles d. 240 cycles

39. The value of R2 is: **121,149-150**
a. 60,000 ohms b. 60 ohms
c. 6000 ohms d. 300 ohms



40. The unit of magnetomotive force is: **28**
a. joule b. gilbert c. ohm d. rel

41. Draw a simple schematic diagram of a plate-neutralized final triode r.f. stage coupled to a Hertzian antenna, showing the antenna system and a faraday screen to reduce harmonic radiation. **185,194**

42. An amateur operating at 1 kilowatt, 100 percent modulated power input : 257-258

a. must get permission from FCC b. is operating illegally
c. must have means of adequately checking percent modulation and power output
d. can operate on all bands

43. What is the d.c. plate power input of a tube having a plate voltage of 450 volts and a plate current of 80 ma. 112

44. Draw a diagram of a crystal-controlled oscillator using a pentode. Indicate the polarity of the supply voltages. 194

45. What is the meaning of "QSY"? App. 4

a. I am being interfered with
b. stop sending
c. shift to transmission on another frequency
d. I shall call you again immediately

46. A shorted filter condenser in an unfused power supply would: 93

a. increase the d.c. voltage
b. half the ripple frequency
c. increase the output current
d. probably burn out the rectifier tube

47. In making a particular communication, an amateur should use: 269

a. any amount of power up to 1 kilowatt
b. any amount of power up to 900 watts
c. the same amount of power as the other amateur
d. the minimum amount of power necessary to maintain the desired communications

48. Emission of an unmodulated carrier below 26.96 Mc.: 258

a. is not authorized
b. is permitted for brief tests and experimental purposes
c. is permitted if the transmitter is for c.w. operation
d. is permitted if the transmitter is for phone operation

49. The circuit condition which **will not** minimize harmonic components in the output circuit of an r.f. amplifier is: 181-182

a. low L/C ratio
b. improper neutralization
c. push-pull operation
d. proper bias voltage

50. A power output r.f. amplifier **should not:** 181-182

a. be coupled to the antenna system
b. have minimum plate current at resonance
c. couple high harmonics to antenna
d. be matched to the output circuit impedance

Novice Practice Questions

1. c	5. a	9. d	13. c	17. c	21. b	25. a	29. a	33. c	37. d
2. a	6. c	10. b	14. d	18. a	22. d	26. a	30. b	34. d	38. a
3. c	7. c	11. a	15. c	19. b	23. c	27. b	31. c	35. d	39. c
4. c	8. b	12. c	16. b	20. 48.75W	24. d	28 d	32. d	36. c	40. b

Typical Novice Examination

1. d	3. b	5. a	7. a	9. a	11. a	13. a	15. b	17. b	19. b
2. d	4. a	6. b	8. b	10. c	12. a	14. d	16. b	18. c	20. a

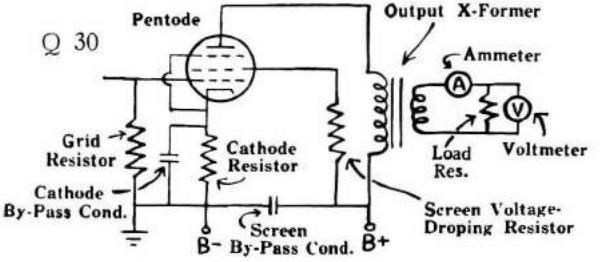
General And Technician Practice Questions

1.d	10.b	19.c	28.b	38. c	48.b	58. b	68.a	78.b	88. c	102.a
2.c	11.a	20.a	29.b	40. a	49.b	59 d	69.a	79.b	89. c	103.b
3.d	12.c	21.b	31.96 W.	41. c	50.a	60. c	70.a	80.7053 kc.	95. c	104.a
4.b	13.c	22.a	32. d	42. b	51.c	61. c	72.c	82.b	96. d	105.a
5.c	14.a	23.a	33. d	43. c	53.c	62. d	73.c	83.d	97. d	106. c
6.b	15.b	24.c	34. b	44. c	54.b	64. a	74.b	84.b	98. c	
7.c	16.c	25.b	35. d	45. c	55.a	65. d	75. d	85 b	99.d	
8.a	17.a	26.d	36. a	46. c	56.a	66. b	76.b	86.c	100. a	
9.c	18.d	27.b	37. a	47. a	57.a	67.28.003 Mc	77. d	87.c	101. a	

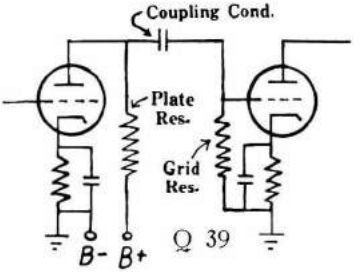
Typical General And Technician Examination

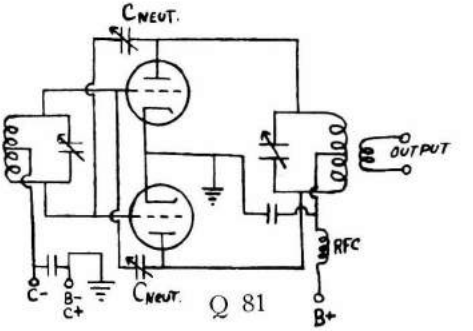
1. c	6. b	11. d	17. c	22. 13.999 Mc	27. b	32. a	39. a	46. d
2. d	7. b	12. d	18. 7263 kc.	23. d	28. a	33. b	40. b	47. d
3. c	8. c	13. c	19. b	24. c	29. b	35. c	42. c	48. b
4. a	9. d	14. b	20. d	25. a	30. a	36. d	43. 36 W.	49. b
5. d	10. a	16. c	21. d	26. a	31. d	38. c	45. c	50. c

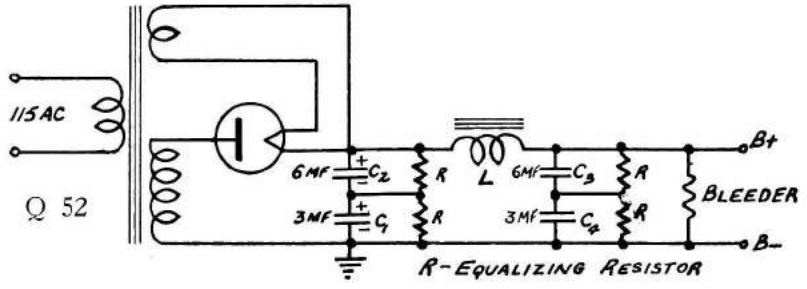
Diagrams for General Practice Questions



Q 71 - See Plate Circuit in Q44, Page 32






115AC
Q 52
6MF
C2
R
L
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BLEEDER
3MF
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C4
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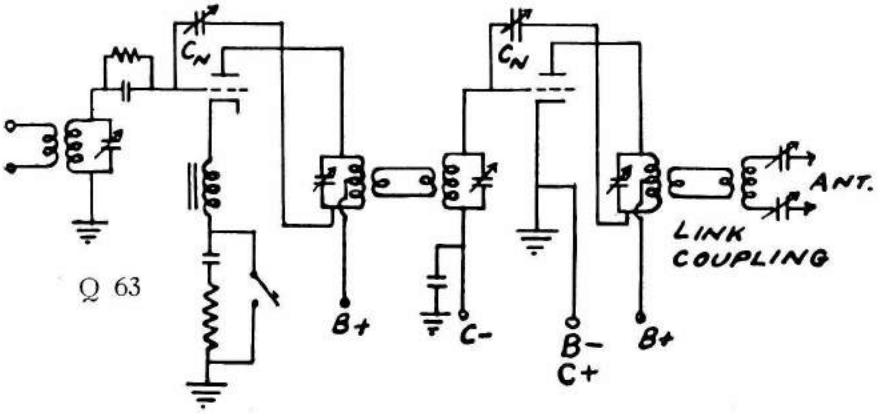
B-
R-EQUALIZING RESISTOR


CN
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LINK
COUPLING
Q 63
B+
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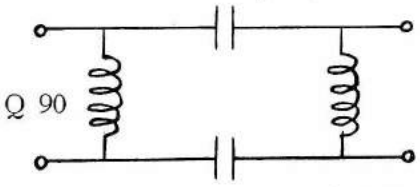
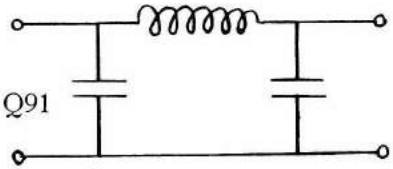
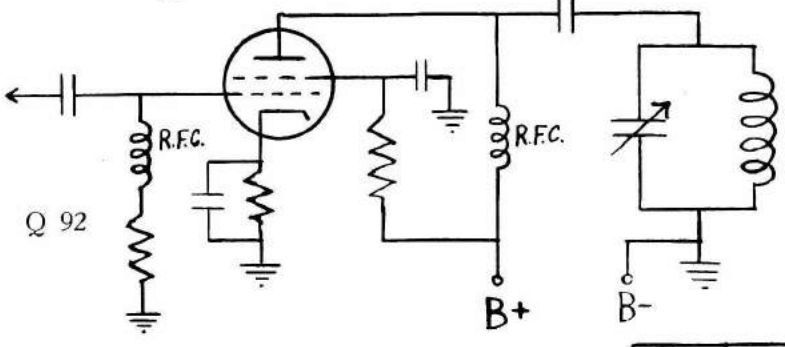
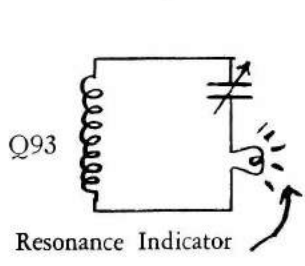
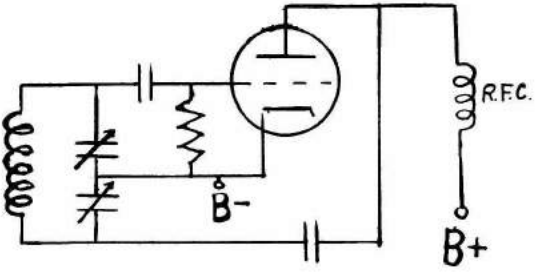

Q 90


Q91


R.F.C.
R.F.C.
Q 92
B+
B-


Q93
Resonance Indicator


R.F.C.
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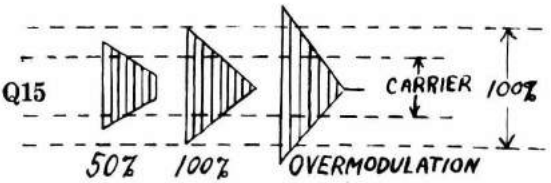
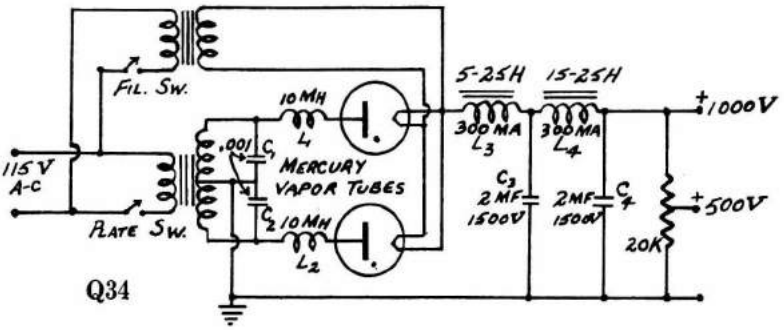
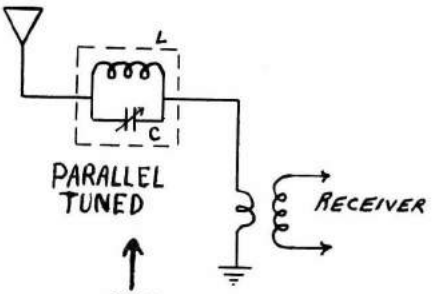
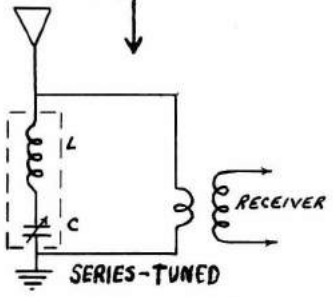
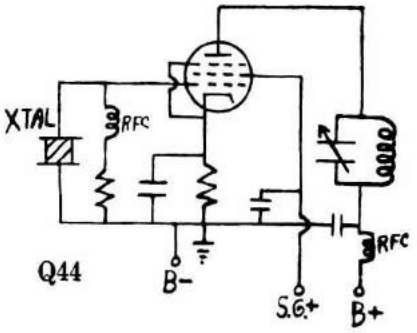
Diagrams for Typical General Exam.

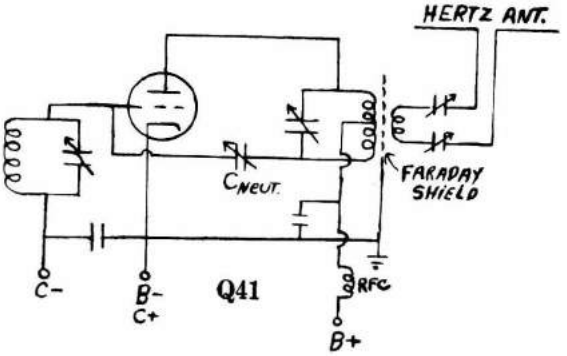












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with 78 R.P.M. Phonograph Records

PASS COMMERCIAL AND AMATEUR CODE EXAMS, AMATEUR THEORY EXAMS, FOR YOUR FCC LICENSE!

4 AMECO Courses Available:

No. 1 — NOVICE CODE COURSE. You get and keep 10 recordings (alphabet through 8 W.P.M.). Includes typical FCC type code exams. Free instruction book on learning how to send and receive code the simplest, fastest way; plus charts to check your receiving accuracy; plus an album; all for the low price of only..... **$7.95**

No. 2 — SENIOR CODE COURSE. You get and keep everything given in the Novice Course except that you get 22 recordings (alphabet through 18 W.P.M.), plus typical FCC type code exams for General class and 2nd class commercial telegraph licenses. All this for only..... **$12.95**

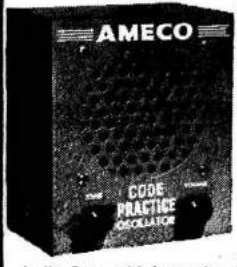
No. 3 — COMPLETE RADIO THEORY COURSE. A complete, simplified home study theory course in radio covering the Novice, Technician, conditional and general classes — all under one cover — with nearly four hundred typical FCC type questions to prepare you for license exam. No technical background required. You also get, FREE, a guide to setting up your own Ham station. All for the amazing low, low price of.... **$3.95**

No. 4 — NEW ADVANCED COURSE. Prepares Novice operators for the amateur general class and second class commercial license tests. Contains 12 recordings (8 through 18 W.P.M.) PLUS the complete code book — PLUS typical F.C.C. code examinations for general and commercial tests. ALL for only **$6.95**

No. 5 — RADIO AMATEUR QUESTIONS & ANSWER LICENSE GUIDE. A "must" if preparing for Novice, Technician or general class exams. Approx. 200 questions & answers (most multiple choice type) similar to ones given on F.C.C. exams. Has 2 typical F.C.C. type exams. Other questions by subjects, easier to study. Low, low price of **50¢**

DELUXE CODE PRACTICE OSCILLATOR

In Kit Form or Wired



The AMECO Code Practice Oscillator, for 110 volts AC or DC, with a built-in 4 inch speaker, produces a pure, steady tone with no clicks or chirps. It can take a large number of headphones or keys. After the code has been learned, the AMECO code practice oscillator is easily converted to an excellent c.w. monitor.

Other features include:

- **Variable tone control**
- **Volume control**
- **Sturdy grey hammertone cabinet**
- **Lowest prices**

In Kit Form, with Instruction, less tubes (Model CPS-KL)..... **$11.75**

Completely Wired & Tested, less tubes (Model CPS-WL)..... **$12.95**

Set of two tubes (35W4 and 50C5)..... **$ 1.80**

BEAT TVI

STAY ON THE AIR!

The AMECO low cost way!

Model LN-1

AMECO LOW PASS FILTER

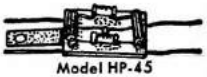
. . . suppresses radiation of all frequencies above 40 Mc, thereby removing a major cause of TVI. The Ameco low pass filter uses a constant K circuit, and is designed for coaxial cable (52 to 72 ohms).

OTHER FEATURES INCLUDE:

- **Negligible insertion loss**
- **35 db and more attenuation of harmonic and spurious frequencies above 50 Mc.**
- **Will handle up to 200 watts of RF power**
- **Each unit complete with bracket, connectors and instructions**

At the Amazing Low, Low Price of $1.95 Amateur Net

HIGH PASS FILTER



Model HP-45

The AMECO high pass filter is placed in series with the TV receiver's antenna to prevent the transmitter's signal from entering the receiver. All frequencies above 45 Mc are passed through without loss. The AMECO high pass filter is designed for use with the common 300 ohm twin line.

OTHER FEATURES INCLUDE:

- **40 db and more attenuation at 14 Mc. and below; 20 db attenuation at 10 meters.**
- **Negligible insertion loss**
- **Filter uses balanced constant K circuit**

At the amazing low, low price of 89¢ Amateur Net

FOLDED DIPOLE ANTENNA KITS

for 10 to 80 meters . . . using LOW LOSS twin lead

SENSATIONALLY LOW PRICED from $3.50

AMECO folded Dipole Antennas are easy-to-build Kits. The fine quality low loss twin lead has proven reliable in all weather conditions. Each kit complete with flat-top twin lead cut to desired frequency band, 75 ft. of lead-in wire, folded dipole connector block.

OTHER FEATURES INCLUDE:

- **Can safely handle up to 300 watts**
- **High strength, high dielectric connector block insures perfect impedance match and lowest loss**
- **No soldering necessary; solderless terminals and hardware provided**
- **Twin line uses heavy copper conductors and pure polyethylene insulation**
- **Antennas can be used for receiving as well as transmitting**

Available at these LOW PRICES

Model No.	Meters	Price Net
FD-10	10	**$3.50**
FD-20	15-20	**3.95**
FD-40	40	**4.95**
FD-80	80	**6.75**

AMERICAN ELECTRONICS CO.

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