

Amateur Radio Examination Full Level [E48160A]

Candidate: FULL, Mock (Mr) [N144840]

Date of Birth: 01 Jan 1950

Exam Centre: RSGB (RSGB TEST)

Date: Mon, 01 Nov 2021 09:00 GMT

This paper consists of 58 questions. **Time allowed:** 120 minutes

Candidate Declaration	
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<i>I confirm that this is all my own work and that I have followed the rules of the examination.</i>	
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	Candidate's Signature
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INSTRUCTIONS TO CANDIDATES

You should have 3 items.

1. This Examination Paper
2. An Optical Mark Sheet
3. Reference Data for use in the Advanced Level Examination

You will need a pen to sign this form and complete the Optical Mark Sheet, an HB Pencil and an eraser. You may use a silent, non-programmable calculator.

All questions have equal marks and all questions should be attempted.

Your answers should initially be marked in pencil on the Optical Mark Sheet or the examination paper itself. Errors should be corrected using your eraser. When you are satisfied that your answers are final, you should **INK IN** the answer box on the Optical Mark Sheet using a black pen.

Each question has 4 possible answers, identified 'A', 'B', 'C' and 'D'. Only one answer is correct, the others are wrong. You should decide which of the 4 answers is correct and mark the answer box for each question accordingly.

If you decide answer 'C' is correct, show this by shading in the box marked 'C' using an HB pencil.	A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D <input type="checkbox"/>
If you change your mind before inking-in, rub out the shading and shade in the box for your new choice.	A <input checked="" type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/>

When you are satisfied with your answer, shade in the whole box with **black ink**. Do **NOT** make any mark outside the box. **Once you have inked-in the Optical Mark Sheet, no changes can be made.**

The Reference Data booklet contains the Licence Terms Conditions and Limitations, the Schedule to the Licence the Band Plans and the Formula Sheet which may be used to help answer any question.

The Optical Mark Sheet is designed to be machine marked and will provide your result for this Examination.

It must be completed during the time allowed for the Examination.

This paper, the Optical Mark Sheet and Reference Data Booklet must be handed in at the end of the Examination.

NOTICE TO CANDIDATES

You must not talk to or distract any other candidate in the exam room.

You are not allowed any assistance with the exam questions and the Invigilator is not permitted to discuss examination questions.

If you need other assistance, please raise your hand and talk quietly to an Invigilator when approached.

You may not leave the exam room without permission and may not re-enter the room unless you have been escorted by an Invigilator at all times.

You must only use black ink for your final answers on the Optical Mark Sheet, and any calculations may be done on the reverse of the Examination Paper.

Exam Papers and Optical Mark Sheets are
candidate specific.

Please ensure this question paper and your OMR sheet has **your** name printed at the top, as incorrectly issued documents could deem the Examination **VOID**.

- 1.** When you identify your station by giving your callsign, it **MUST**
- 1A5.6444.1
N144840
- A.** always be sent phonetically if using SSB
 - B.** if sent by Morse code at a speed not exceeding 12 words per minute
 - C.** always be transmitted by Morse Code or by SSB
 - D.** be transmitted by the same type of transmission as being used for communication.
- 2.** You are supervising a Girl Guide at a Jamboree and want to pass supervisory duties to a colleague. You must
- 1B1.7875.2
N144840
- A.** tell the Guide speaking on the radio to take over the operation
 - B.** make a suitable entry in your Log
 - C.** take your personal log away with you
 - D.** ensure your colleague understands that they must actually operate the radio.
- 3.** Which one of the circumstances listed would allow you to pass an encrypted message on behalf of another person?
- 1C1.7651.4
N144840
- A.** The message has been given to you by the casualty in person
 - B.** The message contains particularly unpleasant details of injuries
 - C.** The message contains the name and address of a casualty
 - D.** The message has been given to you by a member of a User Service.
- 4.** Who must a Full licensee allow to inspect the Radio Equipment?
- 1D1.6493.1
N144840
- A.** Any person authorised by Ofcom
 - B.** The Secretary of State
 - C.** A BT officer
 - D.** The Local Authority representative.

- 5.** An amateur family GW4XYZ, 2W0ABC and MW3KLM have installed a transceiver on a high point of a friend's farm about a kilometre from their house. The transceiver is controlled by a suitably secure internet link. The transceiver may be operated from the house by
- 1E2.6505.1
N144840
- A.** MW3KLM, if supervised by GW4XYZ or 2W0ABC
 - B.** 2W0ABC operating alone unsupervised
 - C.** 2W0ABC, but only if supervised by GW4XYZ
 - D.** any licensed member of the family, giving their own callsign.
- 6.** An amateur holding the callsign MW0XYZ has permanently moved to Portugal, which has implemented CEPT Recommendation T/R 61-01. MW0XYZ can
- 1F1.6514.1
N144840
- A.** not operate as M0XYZ under the CEPT agreement
 - B.** operate under the CEPT agreement using the call M0XYZ
 - C.** operate under the CEPT agreement using the call CT/MW0XYZ/P
 - D.** operate under the CEPT agreement using the call CT/M0XYZ.
- 7.** A beacon operating on 144.8MHz in Dartmoor (England) may be left unattended for
- 1G2.7661.2
N144840
- A.** 24 hours
 - B.** 7 days
 - C.** 4 hours
 - D.** 30 minutes.
- 8.** A transmitter delivers an RF current of 0.5A into a 50Ω dummy load. The power dissipated in the dummy load is
- 2B1.6552.1
N144840
- A.** 50W
 - B.** 12.5W
 - C.** 25W
 - D.** 0.5W.

- 9.** The relative permittivity of a dielectric is a measure of the
- 2D1.6566.1
N144840
- A.** dynamic resistance of a series tuned circuit, when it is fed with a signal at the resonant frequency
 - B.** amount by which the core of a coil affects the inductance, when compared with the inductance in a vacuum
 - C.** change in capacitance compared to a capacitor of the same dimensions in a vacuum
 - D.** amount of voltage permitted on the plates of a capacitor, when fed by a rectifier diode in a power supply.
- 10.** In the case of self-inductance, the magnetic field created by a changing
- 2D4.7706.2
N144840
- A.** voltage induces a current in the same circuit
 - B.** voltage induces a resistance in the same circuit
 - C.** current induces a voltage in the same circuit
 - D.** resistance induces a voltage in the same circuit.
- 11.** On applying a constant voltage, V , to a resistor-capacitor series combination the current, I
- 2D7.7707.2
N144840
- A.** falls from an initial value equal to V/R towards zero
 - B.** is always equal to zero
 - C.** is initially zero and rises to a value equal to V/R
 - D.** may be calculated by Ohms Law and is constant.
- 12.** A resistor of 4000Ω and a capacitor of 27pF are connected in series. What is the impedance of the combination at 1.965MHz ?
- 2E6.6615.1
N144840
- A.** 7000Ω
 - B.** 5000Ω
 - C.** 3000Ω
 - D.** 5300Ω .

- 13.** The process termed a Fast Fourier Transform
- 2F2.7401.3
N144840
- A.** samples the signals picked up by the antenna and separates them out into signals in frequency order
 - B.** produces two digital representations of RF or IF signals separated in phase by 90 degrees
 - C.** demodulates data signals into their original binary format for subsequent processing
 - D.** relies on the mutual inductance between two coils normally set 90 degrees apart.
- 14.** A transformer can NOT be used to
- 2G1.6628.1
N144840
- A.** produce a greater power output in the secondary winding than the power fed into the primary winding
 - B.** provide electrical isolation between the primary winding and the secondary winding or windings
 - C.** produce a different voltage across any of its secondary windings from that fed across the primary winding
 - D.** match the impedance of a load to the output impedance of a device that is used to power the load.
- 15.** A quartz crystal
- 2H2.6644.1
N144840
- A.** has an equivalent circuit which includes a diode, two inductors and a single capacitor
 - B.** will resonate at several design frequencies, selected by an adjustment on the side of the crystal holder
 - C.** has a single resonant frequency - whether series or parallel depends on the manufacturing process
 - D.** has series and parallel resonant frequencies with the associated circuit design selecting the one required.
- 16.** In the field-effect transistor, the 'pinch-off' voltage is the bias required on the
- 2I3.6673.1
N144840
- A.** gate to reduce the drain-source current to zero
 - B.** drain to reduce the gate-drain current to zero
 - C.** source to reduce the gate-source current to zero
 - D.** source to reduce the source-drain current to zero.

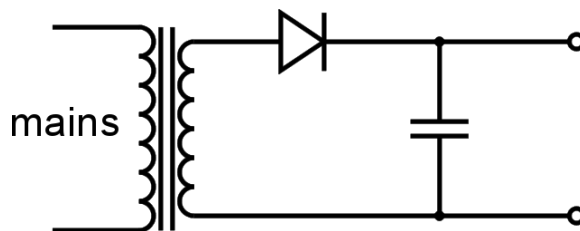
17. The loop gain of an oscillator circuit is defined as the voltage gain in the transistor amplifier (in linear units) divided by the loss in the feedback circuit. For the circuit to oscillate the loop gain must be

2I5.7739.2
N144840

- A. slightly greater than one
- B. greater than $1/(\beta)$ of the transistor
- C. slightly less than one
- D. not less than the value of β of the transistor.

18. If the secondary voltage from the transformer is 10V rms the peak inverse voltage rating (PIV) of the diode should be at least

2J3.6713.1
N144840



- A. 10V
- B. 20V
- C. 15V
- D. 30V.

19. The Modulation Index of an RF signal is the ratio of

3A2.7683.2
N144840

- A. the maximum frequency deviation to the nominal unmodulated carrier frequency
- B. the amplitude of the unmodulated carrier to the variation in amplitude of the envelope
- C. the frequency deviation from the nominal carrier frequency to the frequency of the audio signal
- D. the instantaneous frequency deviation from the nominal carrier frequency to the maximum deviation.

20. If the frequency of the master oscillator in a transmitter drifts then

3C1.6740.1
N144840

- A. the depth of modulation will vary
- B. Morse signals will change frequency during each 'dit' and 'dah'
- C. the sidebands on AM and SSB may be inverted
- D. the transmitted frequency will change.

- 21.** The look-up table in a direct digital synthesiser
- 3C3.7639.2
N144840
- A.** records the frequency, step size and maximum/minimum frequencies
 - B.** contains the amplitude of a sine wave at different points in the cycle
 - C.** keeps track of the division ratio of the VFO output signal
 - D.** contains frequency corrections for the temperature of the crystal reference.
- 22.** It is proposed to generate a microwave signal by feeding the output of a UHF transmitter to a frequency multiplier circuit. This arrangement is suitable for use with
- 3D1.6754.1
N144840
- A.** amplitude modulation
 - B.** single sideband modulation with suppressed carrier
 - C.** frequency modulation
 - D.** single sideband modulation with a pilot (reduced) carrier.
- 23.** A class AB transmitter has been in use for some time and the speech processor is then switched on and set to maximum compression. The peak transmit power is seen to be unaffected. It is **LIKELY** that the transmitter will run
- 3F4.6788.1
N144840
- A.** considerably hotter than before
 - B.** slightly hotter than before
 - C.** a bit cooler than before
 - D.** at much the same temperature as before.
- 24.** Which of the following is most likely to cause harmonics?
- 3G3.6813.1
N144840
- A.** a tuned half-wave antenna
 - B.** connecting the transmitter to a dummy load
 - C.** an overdriven PA stage
 - D.** an unscreened power supply unit.

25. A receiver can just audibly detect signals of $0.4\mu\text{V}$ (-145dBW) at its input. The receiver overloads at an input of 10mV (-57dBW) causing intermodulation products that can be heard as false signals. The dynamic range of the receiver is

3H3.6838.1
N144840

- A. 202dB
- B. 88dB
- C. 145dB
- D. 57dB.

26. The selectivity of a superheterodyne receiver is determined mainly by the

3I4.6893.1
N144840

- A. IF amplifier
- B. detector
- C. audio amplifier
- D. frequency changer.

27. It is often found that adding a preamplifier to an HF receiver has little effect on the signal to noise ratio of weak signals. Why might this be so?

3J1.7698.2
N144840

- A. The extra gain will reduce the overload margin so intermodulation effects will mask any improvement
- B. Natural HF noise is relatively high making it easy to produce receiver front ends with much lower internal noise
- C. Preamps are wideband devices so will pick up a wider range of noise which will reduce the overall noise performance
- D. HF amplifiers are inherently noisy so a preamp is unlikely to be any better than the receiver it is to be used with.

28. Which mode of signals is demodulated with a ratio detector?

3K1.6914.1
N144840

- A. FM
- B. SSB
- C. AM
- D. CW.

29. If the amplitude and phase of an incoming RF signal can be captured with reasonable accuracy then

3M1.7902.2
N144840

- A.** it is not possible to demodulate digital data signals
- B.** it is possible to demodulate only frequency modulated signals
- C.** it is possible to demodulate any known form of modulation
- D.** it is possible to demodulate only digital data signals.

30. A transceiver will often share circuits between transmitter and receiver. Typically this would include the

3N1.6935.1
N144840

- A.** frequency modulator
- B.** discriminator
- C.** AGC circuits
- D.** IF filters.

31. Which of the following is NOT a type of balun?

4B1.6952.1
N144840

- A.** Transformer
- B.** Sleeve
- C.** Differential
- D.** Choke.

32. How long is a typical half wave dipole tuned for the centre of the 1.8MHz band?

4D1.7914.2
N144840

- A.** 52.75m
- B.** 75.00m
- C.** 157.48m
- D.** 78.74m.

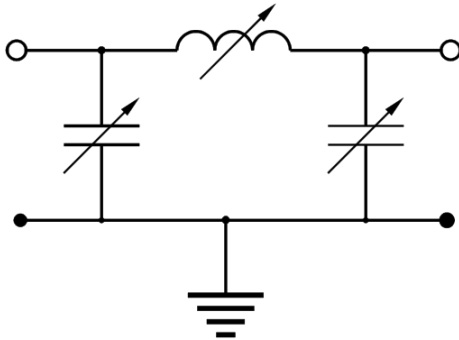
33. The return loss of a feeder and antenna is measured as 30dB. If the feeder has a loss of 3dB, the return loss of the antenna is

4E3.6989.1
N144840

- A.** 33dB
- B.** 27dB
- C.** 36dB
- D.** 24dB.

34. The diagram shows

4F1.6992.1
 N144840



- A. a 1:4 Balun
- B. a pi match AMU
- C. a 1:1 Balun
- D. an L match AMU.

35. When travelling away from a transmitter on clear ground, it is noted that the field strength has halved. The power flux density can be expected to

5A1.7016.1
 N144840

- A. remain more or less constant
- B. have reduced by a factor of about $\sqrt{2}$ (square root 2)
- C. have halved
- D. have reduced to a quarter of its initial value.

36. The Critical Frequency (CF) and Maximum Usable Frequency (MUF) for local and long distance (DX) contacts depend on ionospheric conditions. Which of the lists correctly shows the various frequencies in ascending numerical order?

5B2.7063.1
 N144840

	Increasing frequency ➔		
1	CF	MUF local	MUF DX
2	MUF DX	MUF local	CF
3	MUF DX	CF	MUF local
4	MUF local	MUF DX	CF

- A. Set 4
- B. Set 1
- C. Set 3
- D. Set 2.

- 37.** Galactic noise is most likely to influence reception when
- 5D1.7927.2
N144840
- A.** making auroral contacts
 - B.** receiving from satellites
 - C.** operating EME
 - D.** making HF ionospheric contacts.
- 38.** A neighbour has a new television of very good quality installed in his lounge. Nonetheless there are instances of interference from nearby amateur and CB transmissions. It would be sensible to check if the
- 6A2.7820.2
N144840
- A.** aerial and its downlead may have deteriorated since they were installed
 - B.** mains voltage to the premises is below the required level
 - C.** television has the latest firmware programming installed
 - D.** affected premises does not have a suitable RF earth system.
- 39.** What standards are home designed and constructed transmitters expected to comply with?
- 6A4.7821.3
N144840
- A.** The standards needed to avoid any interference to other radio equipment
 - B.** The standards set out in the amateur licence document
 - C.** The standards needed to avoid any interference to other electronic equipment
 - D.** The same standards as commercial radio equipment.
- 40.** Cross modulation is an effect that occurs when
- 6B2.7087.1
N144840
- A.** both the wanted signal and the local oscillator signal are modulated
 - B.** the receiver has inadequate rejection on its image frequency
 - C.** strong RF signals enter the RF stage of a receiver causing non-linearity
 - D.** different signals are present on the two sidebands of an AM transmission.
- 41.** One probable cause of mains borne interference is
- 6C1.7100.1
N144840
- A.** the choice of power amplifier transistors
 - B.** an antenna which is positioned too close to an overhead power supply cable
 - C.** a highly inductive mains supply
 - D.** harmonics generated in the power amplifier stage.

- 42.** A domestic VHF FM radio receiver is noticeably more sensitive to interference from a neighbour's HF transmitter when on the 3.5MHz band than on other HF bands. This is likely to be due to
- 6C3.7125.1
N144840
- A.** a harmonic of the transmission getting into receiver IF stages
 - B.** the polar diagram of the amateur antenna having a lobe in the direction of the VHF radio
 - C.** the house mains wiring being resonant at that frequency
 - D.** the dimensions of the receiver being such that direct pick-up is more efficient.
- 43.** What safety consideration must be followed when making a mains supply filter?
- 6D2.7167.1
N144840
- A.** That the laminated core of the choke is connected to earth
 - B.** That all of the components are specifically rated for mains use
 - C.** That Voltage Dependent Resistors (VDR) are fitted between the live and the neutral
 - D.** That the capacitors are rated for a working voltage of more than 250Volts DC.
- 44.** You are operating your station on 14.25MHz with an ERP of 225W and measure the RF field strength 25m from your antenna as 4.2V/m. You repeat the measurement, still with an ERP of 225W, at 28.5MHz what should the second measurement be?
- 6E1.7173.1
N144840
- A.** 8.4V/m
 - B.** 2.9V/m
 - C.** 4.2V/m
 - D.** 2.1V/m.
- 45.** Why is it difficult to achieve a good RF ground when the transmitter is in an upstairs room of a house or building?
- 6E2.7940.2
N144840
- A.** The inductance of a few metres of wire or braid results in a high reactance, typically over 1k Ω which limits the effectiveness
 - B.** The earth rods should be sited several metres from the building and any mains safety earths which is difficult to achieve
 - C.** The vertical RF earth is likely to radiate which will adversely affect the wanted radiation pattern as well as risk EMC problems
 - D.** The distance to the actual ground is a substantial portion of a wavelength so impedance transformation effects need to be considered.

- 46.** Advice for radio amateurs on mobile installations is in the
- 6F1.7712.2
N144840
- A.** Ofcom's UK Code of Practice for the installation of mobile radio and related ancillary equipment in land-based vehicles
 - B.** Post Office Communication Services UK Code of Practice for the installation of mobile radio and related ancillary equipment in land-based vehicles
 - C.** Federation of Communication Services UK Code of Practice for the installation of mobile radio and related ancillary equipment in aircraft
 - D.** Federation of Communication Services UK Code of Practice for the installation of mobile radio and related ancillary equipment in land-based vehicles.
- 47.** The first action in dealing with an EMC complaint should be to
- 6G1.240.4
N144840
- A.** cease all amateur radio activity until the problem is resolved
 - B.** carry out test transmissions on all bands at maximum power
 - C.** seek details of times and days that the problem occurs
 - D.** complete a report form and send it to the local office of Ofcom.
- 48.** You are operating from a rare and sought-after location but are swamped by requests for a contact such that you cannot identify any incoming call signs and your replies are similarly swamped. The accepted practice to resolve this situation is to
- 7A1.7946.2
N144840
- A.** cease operation until the calls die down to a manageable level
 - B.** reply saying you are listening a few kHz away
 - C.** reply saying you will listen only at five minute intervals
 - D.** reduce power so fewer people hear your calls.
- 49.** The recommended maximum bandwidth on 473.5kHz is
- 7B1.7947.2
N144840
- A.** 500Hz
 - B.** 3kHz
 - C.** 1.5kHz
 - D.** 200Hz.

50. If working on live equipment, you should

8A6.7242.1
N144840

- A.** be isolated from earth by a rubber mat or other insulation
- B.** hold an earth lead firmly in your hand
- C.** ensure that no interference is being caused to other stations by maintaining a headphone watch
- D.** ensure there is a good earth connection to your body.

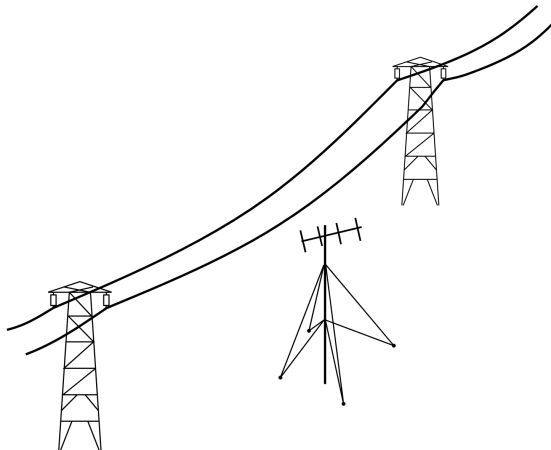
51. You have finished operating at the end of the day and you are aware that there is a strong possibility of thunderstorms. You should:

8E1.7261.1
N144840

- A.** disconnect the antenna from the antenna socket but leave it resting against the chassis of the radio
- B.** remember that a neighbour's house was recently struck by lightning and that lightning does not strike twice
- C.** leave the antenna and radio connected as it is a mains operated set and has an earth lead
- D.** disconnect the equipment from the mains and the antenna.

52. What important action or check has not been performed in planning this outdoor operating trip?

8F4.7953.3
N144840



- A.** Provision of RCBOs
- B.** Correct fusing
- C.** Site survey
- D.** Adequacy of local mains supply.

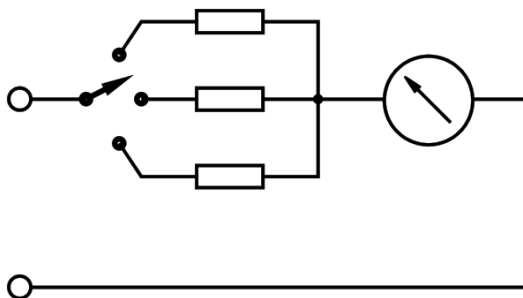
53. When operating outdoors with power from an electrical generator the fire extinguisher should be stored

8F7.7958.2
N144840

- A. with the fuel store to minimise carrying in an emergency
- B. inside the operating tent to protect from rain and excessive cold
- C. alongside the generator for speed of access in the event of a fire
- D. clearly visible and not alongside the generator or fuel store.

54. The purpose of the resistors, which have different resistances, is to provide a number of

9A1.7285.1
N144840



- A. AC voltage ranges
- B. AC current ranges
- C. DC voltage ranges
- D. DC current ranges.

55. To measure the RF output power of a transmitter, the power meter should be

9A5.7305.1
N144840

- A. connected in parallel with the antenna
- B. connected in between the transmitter and its power supply
- C. connected as close as possible to the antenna
- D. set to the highest power range to begin with.

56. An oscilloscope is displaying an AC signal showing 1 cycle across 5 divisions on the x-axis of the screen. The time base is set to $5\mu\text{s}$ per division. What is the frequency of the AC signal?

9A8.7340.1
N144840

- A. 40kHz
- B. 2kHz
- C. 400kHz
- D. 200kHz.

57. The dBm is often used to express power with respect to 1mW; that is 0dBm=1mW. What power is 20dBm?

9B1.7361.3

N144840

- A.** 10mW
- B.** 100mW
- C.** 1mW
- D.** 1000mW.

58. A home-made transmitter uses a crystal at 3.5MHz multiplied up to 28MHz. The crystal is specified as 0.5ppm per degree C. At switch on the room is at 18C but inside the transmitter case is 36C when warmed up. By how much will the transmitted frequency vary in that time?

9C1.7644.3

N144840

- A.** 252Hz
- B.** 32Hz
- C.** 504Hz
- D.** 63Hz.