

# Amateur Radio Examination Advanced Level

Candidate:  
Candidate DoB:  
Centre:  
Exam Date:

This paper consists of 62 questions

**Time Allowed:** 2 hours.

<p>Candidate Declaration.</p> <p>I confirm that this is all my own work and that I have followed the rules of the examination.</p> <p><i>I understand that breaches of the Examination rules may result in disqualification or other penalty and that breaches by the Examination Centre may invalidate the examination.</i></p>	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, an HB pencil and an eraser. You may use a silent, non-programmable calculator.

Check that your personal details on this Examination Paper and your Optical Mark Sheet are correct and sign both using your pen before the examination begins.

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

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.

Your answers should initially be marked lightly in HB pencil on the Optical Mark Sheet. Errors should be corrected using your eraser.

If you decide answer 'C' is correct, show this by marking box 'C' using an HB pencil.	A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/>
If you change your mind before inking-in, rub out the mark and ink-in the box of your new choice	A <input checked="" type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/>
To confirm your original answer ink-in the whole box.	A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" 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 Schedules 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 the result for this Examination. It must be completed during the time allowed for the Examination.**

**This paper, the Optical Mark Sheet and the 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 in answering exam questions and the Invigilator is not permitted to discuss examination questions. If you have a reader, the reader may read the questions to you but they cannot explain them.

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

If you wish to challenge an exam question please advise an Invigilator. They will not be able to help you answer the question, but will pass your challenge to the examination office.

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 use black ink for your final answers.

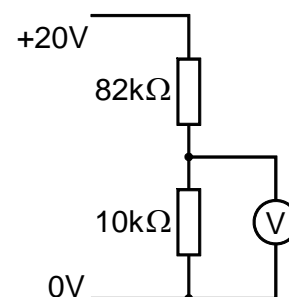
Any calculations should be done on the Examination Paper  
NOT the Optical Mark Sheet.

- 1** The Station 2M0ZZZ is heard on the 40m band. The Station is
- A a Foundation Licence holder located in the Isle of Man
  - B an Intermediate Licence holder located in the Isle of Man
  - C a Foundation Licence holder located in Scotland
  - D an Intermediate Licence holder located in Scotland.
- 2** Which of the following is NOT a User Service?
- A Women's Royal Voluntary Service.
  - B International Amateur Radio Union.
  - C St Andrew's Ambulance Association.
  - D A Category 2 responder, as defined in the Civil Contingencies Act 2004.
- 3** Which one of the following actions is permitted?
- A A non-licensed person identifying the club station under the supervision of a full licensee who is not a club member.
  - B A Club member holding a UK Foundation Licence identifying the club station under the supervision of a Club member holding a UK Intermediate Licence.
  - C A non-licensed person on a recognised training course identifying the club station under the supervision of an Club member holding a Full UK Licence.
  - D Any Club members holding a UK Foundation Licence supervising the operation of the club radio equipment by a full licensee who is not a club member.
- 4** A Maritime Mobile station is permitted to use those frequencies
- A allocated in the ITU region being visited
  - B listed in the Lloyd's Shipping Register
  - C listed in their Full Licence Schedule
  - D allocated to Maritime Users.
- 5** If you are operating in another CEPT country, which of the following Licence conditions apply?
- A Those of the host country.
  - B Those of the relevant IARU Region.
  - C Those in the UK Full Licence Schedule.
  - D Those in the CEPT Licence Schedule.
- 6** Which of the following specifically make it offence to send Messages that are grossly offensive or of an indecent, obscene or menacing nature?
- A Civil Contingencies Act 2004.
  - B The Wireless telegraphy Act 2006.
  - C CEPT Recommendation T/R 61-01.
  - D The Wireless Telegraphy (Content of Transmission) Regulations 1988.

- 7 In order to carry out the Unattended Operation of a beacon, a Full Licence holder must
- A co-ordinate the transmitted frequency with the RSGB
  - B simply remain within the terms and conditions of his Licence
  - C inform the Operations Manager at the local office of Ofcom
  - D obtain a Notice of Variation (NoV) from the Ofcom Licensing Centre.
- 8 In which one of the scenarios below is it a condition of your licence that you can be required to keep a log of your transmissions?
- A You are taking part in a Raynet exercise and have found it necessary to set your vehicle mounted 2m radio to relay your 70cms handheld transmissions whilst you are away from your vehicle for periods of less than 30 minutes.
  - B You are operating during daylight hours on the 40 and 80 meter bands whilst on board a cruise ship in international waters. You have taken the precaution of obtaining written permission from the master of the vessel.
  - C A neighbour is complaining to you that you are causing interference to his television. You doubt this because some of the times of alleged interference you are sure you were away and not operating either directly or remotely.
  - D You are assisting in passing messages from amateur stations on a pacific island which has been devastated by a tsunami and relaying the messages to the disaster relief authorities until such time as conventional communications can be established.
- 9 The Amateur Radio Licence requires the holder to ensure that his Radio Equipment does not cause undue interference to any
- A other electronic device
  - B domestic appliance
  - C wireless telegraphy
  - D audio or music equipment.
- 10 On which frequency would 400W exceed the maximum permitted power level?
- A 1.825MHz
  - B 10.125MHz
  - C 51.125MHz
  - D 433.125MHz

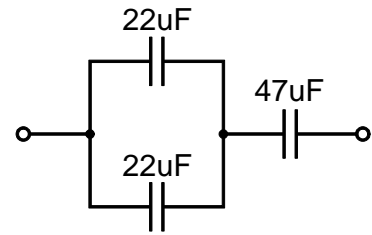
11 In the potential divider shown, the potential difference across the 10kΩ resistor is about

- A 2V
- B 10V
- C 20V
- D 82V



12 What is the approximate capacitance of the circuit shown?

- A 22 $\mu$ F
- B 27 $\mu$ F
- C 58 $\mu$ F
- D 95 $\mu$ F



13 If a 9 turn inductor has a measured value of 20 $\mu$ H and the turns are squeezed closer together the inductance might change to approximately

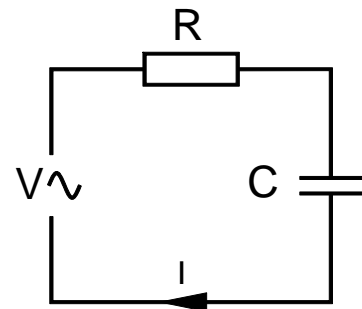
- A 20mH
- B 22 $\mu$ H
- C 18 $\mu$ H
- D 10 $\mu$ H

14 The time period of a signal at 3.8MHz is:

- A 0.16s
- B 0.61ms
- C 3.8 $\mu$ s
- D 0.26 $\mu$ s

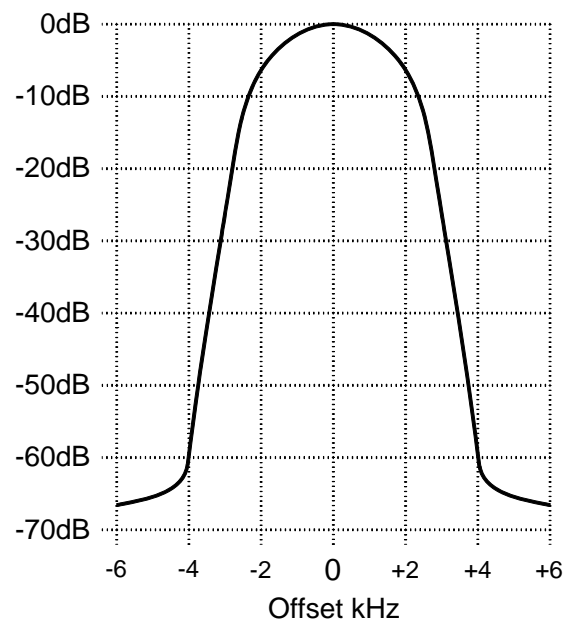
15 In the circuit shown above, if  $R = 150\Omega$  and  $C = 80\text{pF}$ , what impedance would be seen by a 10MHz voltage source?

- A 230 $\Omega$
- B 250 $\Omega$
- C 180 $\Omega$
- D 350 $\Omega$



16 The graph shows the frequency response of a filter. If the centre frequency is 10.7MHz, what is the approximate Q-factor of the filter?

- A 3.5
- B 1300
- C 3200
- D 6000

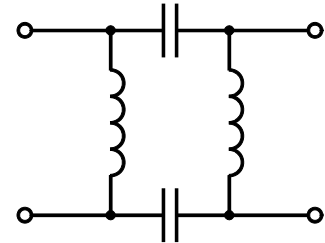


17 The primary winding of a transformer has 80 turns and the secondary has 40 turns. If the input impedance is  $250\Omega$ , what is the impedance across the secondary terminals?

- A  $62.5\Omega$
- B  $125\Omega$
- C  $176\Omega$
- D  $500\Omega$

18 The circuit shown will

- A pass frequencies below the cut off frequency
- B pass frequencies above the cut off frequency
- C pass frequencies above and below the cut off frequency
- D stop frequencies above and below the cut off frequency



19 A good way of preventing thermal drift in a VFO is to

- A allow the radio to warm up before use
- B keep the shack heated at all times
- C ensure all oscillator components have a positive temperature coefficient
- D design circuits with a balance of components with positive and negative temperature coefficients.

20 When a bi-polar transistor is conducting, the emitter-base junction is

- A reverse biased
- B open circuit
- C short circuit
- D forward biased.

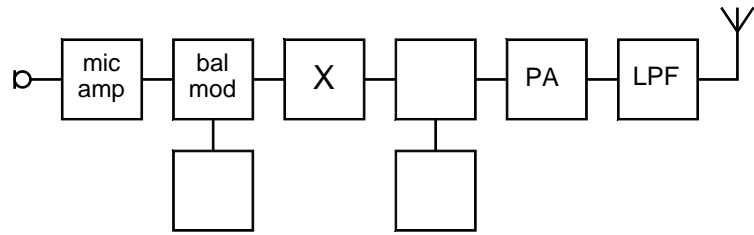
21 The input resistance of a common-emitter amplifier stage is about

- A  $5\Omega$
- B  $50\Omega$
- C  $1k\Omega$
- D  $200k\Omega$

22 Which one of the following would be most likely be used to maintain a steady output voltage in a mains to 12V DC power supply suitable for an amateur transceiver?

- A a pass transistor and a Zener diode
- B a step down transformer and a bridge rectifier
- C a large value reservoir capacitor and a rectifier diode
- D a bridge rectifier and a large value reservoir capacitor.

23 In the block diagram of an HF transmitter, what is the box marked X?



- A the main mixer
- B a sideband filter
- C a crystal oscillator
- D the variable frequency oscillator.

24 If you are designing a transmitter that will mix a crystal controlled carrier oscillator with a VFO you should

- A ensure that the frequencies are locked 'in phase'
- B avoid using one oscillator that is a harmonic of the other
- C use an accurate frequency meter to ensure that the oscillators are 'netted' on the same frequency
- D not use oscillators that will produce unwanted outputs close to the wanted frequency.

25 Applying an audio signal to a variable capacitance diode that forms part of an oscillator's tuned circuit will produce

- A Amplitude Modulation (A3E)
- B Frequency Modulation (F3E)
- C Frequency Shift Keying (F1B)
- D Single Sideband Modulation (J3E).

26 Over-driving a power amplifier will

- A give a high SWR reading
- B give minimum distortion on receive
- C generate excessive harmonics
- D maximise the power output.

27 Chirp can be cured by

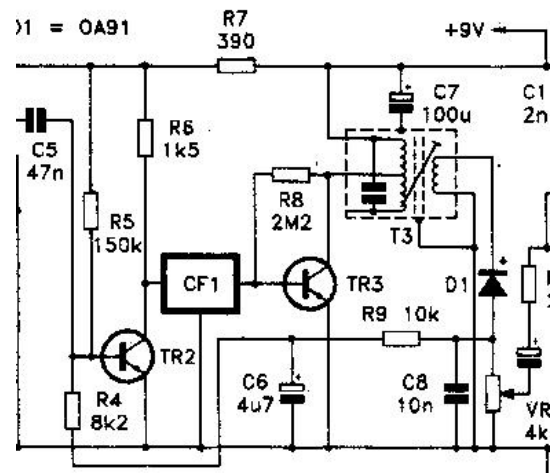
- A filtering the keying circuit
- B using a balanced modulator
- C reducing the receiver selectivity
- D stabilising the voltage to the oscillator circuits.

28 The chance of producing harmonics from an HF transmitter would NOT be reduced by

- A using a push-pull final amplifier stage
- B fitting a high-pass filter in the transmitter output
- C using the minimum drive levels necessary
- D coupling the amplifier stage via suitable inductive transformers.

- 29 Which of the following modes of transmission will cause the greatest heat dissipation in the power amplifier if the PEP outputs are the same?
- A AM (A3E)
  - B FM (F3E)
  - C CW (A1A)
  - D SSB (J3E)
- 30 Which of the following terms describes the ratio of the minimum discernible signal a receiver can detect and the maximum signal that will not be distorted?
- A sensitivity
  - B selectivity
  - C dynamic range
  - D signal to noise performance.
- 31 In a superheterodyne receiver there is some circuitry between the first mixer and the IF filter. This circuitry is likely to be an
- A IF amplifier
  - B RF amplifier
  - C AF amplifier
  - D AGC amplifier.

- 32 The circuit shows part of a radio receiver. TR3 is an
- A IF amplifier
  - B RF amplifier
  - C AF amplifier
  - D AGC amplifier.



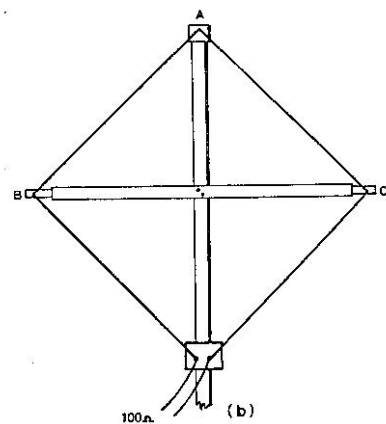
- 33 In a double conversion superheterodyne receiver the frequency difference between the wanted radio frequency signal and the so-called 'image frequency' is
- A twice the wanted radio frequency
  - B twice the first intermediate frequency
  - C twice the second intermediate frequency
  - D the sum of the first and second intermediate frequencies .



- 34 Which of the following modes of transmission requires a carrier insertion oscillator for demodulation?
- A AM
  - B FM
  - C CW
  - D SSB
- 35 In order to receive amateur signals on 433MHz using a 28MHz receiver a down-converter must be used. The frequency of the oscillator in the converter will need to be set to
- A 28MHz
  - B 433MHz
  - C 461MHz
  - D 489MHz
- 36 A half-wavelength of  $50\Omega$  feeder is terminated by a load of  $68\Omega$ . The input to the feeder will be approximately
- A  $37\Omega$
  - B  $50\Omega$
  - C  $68\Omega$
  - D  $132\Omega$
- 37 Which of the following represents the correction factor normally used in calculating the length of a wire dipole?
- A 66%
  - B 75%
  - C 80%
  - D 95%

38 The antenna shown in the diagram is a

- A quad
- B delta loop
- C trap dipole
- D folded dipole.



- 39 If an antenna/feeder system has a return loss of 25dB and the feeder has a loss of 2.5dB, what is the return loss of the antenna itself?
- A 20dB
  - B 22.5dB
  - C 27.5dB
  - D 30dB

- 40** A device used to tune out reactance at the feedpoint of the antenna systems is known as
- A an antenna reactance analyser
  - B an antenna matching unit
  - C a return loss bridge
  - D an SWR meter.
- 41** Which of the following reduces by the inverse square of the distance from the antenna?
- A SWR
  - B Field Strength
  - C Power Flux Density
  - D Angle of radiation.
- 42** The F1 and F2 layers in the ionosphere
- A combine at night
  - B combine during the day
  - C disappear at night
  - D disappear during the day.
- 43** Which of the following bands would give best chance of propagation between UK and USA during a winter's day?
- A 3.5MHz
  - B 7MHz
  - C 21MHz
  - D 50MHz
- 44** A neighbour reports interference on his terrestrial TV set at certain times of the day. You check your log and find that your 2 metre transmissions are the source. Which harmonic might be the cause?
- A 1<sup>st</sup>
  - B 3<sup>rd</sup>
  - C 5<sup>th</sup>
  - D 7<sup>th</sup>
- 45** The main cause of intermodulation products in a receiver is
- A the receiver being tuned off channel
  - B a crystal filter being used
  - C non-linearity in the RF stages
  - D a passive pre-selector being used.

- 46** Breakthrough is occurring to a neighbour's home entertainment system in his lounge which includes both TV and sound radio. The system has a single common aerial input with two suitable aerials and a combiner in the attic. The system also has a second set of speakers in the dining room. It is easy to disconnect the system's antenna lead at the socket on the lounge wall but doing so has little effect. A reasonable next step in diagnosing the cause of the problem is to
- A power the system from a mains socket in the dining room using an extension cable.
  - B remove the system from its cabinet in order to access and disconnect the leads to dining room speakers
  - C try transmitting on a known problem frequency but using a dummy load instead of your antenna
  - D disconnect the dining room speakers at the speaker end of the lead where they are easily accessible.
- 47** The main purpose of a mains filter on an amateur transmitter is to minimise
- A mains borne interference entering the receiver
  - B mains borne interference entering the transmitter
  - C the level of RF signals conducted into the mains
  - D the level of harmonics radiating from the transmitter.
- 48** Which one of the following filters should be fitted into a TV downlead in order to attenuate 145MHz signals?
- A low-pass filter
  - B high-pass filter
  - C band-stop filter at the TV frequency
  - D band-pass filter at 145MHz.
- 49** What is the field strength 20m away from an antenna radiating 400W ERP?
- A 2.6V/m
  - B 7V/m
  - C 12V/m
  - D 140V/m
- 50** Which of the following dipole antenna feed arrangements is likely to produce least EMC problems when the transmitter is located under one end of the antenna?
- A The shortest length of coaxial feed possible.
  - B The shortest length of balanced feeder possible.
  - C Balanced feeder falling away at right angles from the antenna and buried in the ground leading back to the shack.
  - D Balun with coaxial feeder falling away at right angles from the antenna and buried in the ground leading back to the shack.

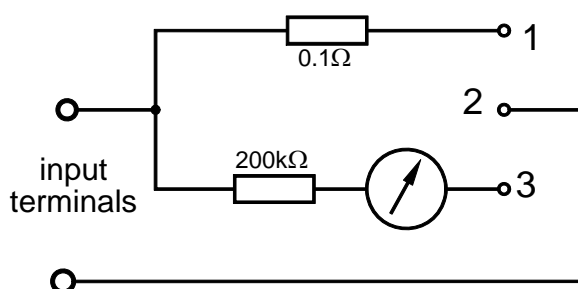
- 51** If you receive a complaint of causing interference, your first action should be to
- A close your station down
  - B send a report to the local Ofcom office
  - C seek confirmation of the problem in writing
  - D seek confirmation of dates and times of the problem.
- 52** Packet radio is unique because it is the only data mode that
- A has built in error correction
  - B is restricted to Full Licence holders
  - C is not permitted to be sent via space communication channels
  - D uses a network of amateur stations to pass messages from the sender to the intended recipient.
- 53** When operating through a VHF or UHF analogue voice repeater you should not transmit until the repeater has transmitted its
- A callsign
  - B reset tone
  - C CTCSS code
  - D time out signal.
- 54** You are operating in a VHF contest and are suffering co-channel interference from another station on an adjacent frequency. This may be due to poor quality transmissions or poor receiver performance. To check which you should
- A ask the other station to close down for a while
  - B add a pre-amp to your receiver antenna socket
  - C ask the other station to turn their beam 90° away from you and check for interference again
  - D turn your beam away from the other station and move further up the band.
- 55** Which of the following organisations is responsible for the bandplans?
- A Radio Licensing Centre (RLC).
  - B International Amateur Radio Union (IARU).
  - C Office of Communication (Ofcom).
  - D International Telecommunication Union (ITU).
- 56** If adjustments to mains powered equipment must be made with the power switched on, it is advisable to
- A use a directly earthed wrist strap
  - B wear a residual current device (RCD)
  - C ensure the equipment is insulated from earth
  - D only use one hand to make the adjustments.

- 57 You intend to set up a temporary HF station at your local Scout campsite. Before doing so it is important to check
- A there is no risk of thunderstorms during the event
  - B there is a clear take off from the roof to ensure good line of sight contacts
  - C the mains supply will deliver sufficient current for the equipment involved
  - D the RSGB propagation forecast to ensure good international contacts.

- 58 In order to protect your station from damage by near-by electrical storms you should
- A earth your antenna system
  - B bond all metal surfaces to earth
  - C unplug the transceiver from the mains supply unit
  - D fit an earthed static discharge device in the antenna feeder.

- 59 In the circuit shown, which connections should be made to allow the meter to act as a voltmeter?

- A 1 to 2
- B 1 to 3
- C 2 to 3
- D 1 to 2 to 3



- 60 A digital frequency meter can be used to measure transmission

- 1 harmonic content
- 2 sideband content
- 3 frequency deviation
- 4 frequency accuracy

- A 1, 3 and 4
- B 1 and 2
- C 3 and 4
- D 4 only.

- 61 To expand a small AC waveform on an oscilloscope display you would need to

- A increase the setting of the X axis (i.e. more time per division)
- B decrease the setting of the X axis (i.e. less time per division)
- C increase the setting of the Y axis (i.e. more volts per division)
- D decrease the setting of the Y axis (i.e. less volts per division).

- 62 A amateur holding a full licence is checking the PEP of a transmitter for use by a Foundation licensee. A good RF rms voltmeter is being used to measure a steady CW signal into a matched dummy load and the signal viewed on an uncalibrated oscilloscope. The Foundation transmitter is then set to transmit SSB into the dummy load and adjusted to so the peaks are the same level as previously displayed by the CW signal. For 10W pep, what reading should be set on the RF voltmeter during the CW phase?

- A 11V
- B 16V
- C 22V
- D 32V

**NOW GO BACK AND CHECK YOUR WORK**

**ENSURE YOUR ANSWERS ARE TRANSFERRED TO THE OPTICAL MARK SHEET**

Answer keys

1	2	3	4	5	6	7	8	9
D	B	C	A	A	D	B	B	C
10	11	12	13	14	15	16	17	18
C	A	A	B	D	B	C	A	B
19	20	21	22	23	24	25	26	27
D	D	C	A	B	D	B	C	D
28	29	30	31	32	33	34	35	36
B	B	C	A	A	B	D	C	C
37	38	39	40	41	42	43	44	45
D	A	A	B	C	A	C	C	C
46	47	48	49	50	51	52	53	54
C	C	B	B	D	D	D	B	C
55	56	57	58	59	60	61	62	
B	D	C	D	C	D	D	C	