Amateur Radio Examination Advanced Level

Candidate:
Candidate DoB:
Centre:
Exam Date:

This paper consists of 62 questions **Time Allowed:** 2 hours.

Candidate Declaration. I confirm that this is all my own work and that I have followed the rules of the examination. *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*.	Candidate's signature.

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** ☐ **B** ☐ **C** -- **D** ☐
If you change your mind before inking-in, rub out the mark and ink-in the box of your new choice	**A** ■ **B** ☐ **C** ☐ **D** ☐
To confirm your original answer ink-in the whole box.	**A** ☐ **B** ☐ **C** ■ **D** ☐

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 A Regional Secondary Identifier is

A An Ofcom officer who keeps a list identifying local amateur stations.

B That part of a packet message that contains the identity and location of the sender.

C One letter in a call sign that indicates the location of the station in the UK.

D The abbreviation that identifies each CEPT country on the license Validation Document.

2 Which statement relating to the use of Radio Equipment during an international disaster is MOST complete?

A Full licensees may pass messages to other amateurs during an international disaster.

B All UK licensees may pass messages to other amateurs during an international disaster.

C All UK licensees and all non-licensees may pass messages to other amateurs during an international disaster.

D Full licensees may use non-amateur frequencies if called by a station involved in an international disaster.

3 If you hold a Full Licence, you may, on your own authority

A use the callsign of the owner of the radio equipment you are using

B supervise a trainee using the club callsign

C supervise a foreign amateur using your equipment and callsign

D operate a club station using the club callsign.

4 When operating in international waters in the southern hemisphere, the frequencies you should use are given in the

A schedule to the amateur licence for the closest country

B schedule to your UK amateur licence

C Radio Regulations of the International Telecommunications Union (ITU)

D Admiralty Handbook of Radio Signals.

5 A Full UK licensed amateur is on holiday in France. His callsign would be

A his own call sign prefixed by F/

B his own call sign prefixed by F/ and suffixed by /P

C his own call sign prefixed by F/ and suffixed by /M

D issued by the French licensing authority.

6 Sending a message which is grossly offensive in character is a breach of

A the amateur licence

B United Kingdom civil law

C the Wireless Telegraphy Act 2006

D the Content of Transmission Regulations.

7 A radio remote control link operating in an amateur band MUST be

A limited to a transmitter output power not exceeding 500mW erp pep at both ends of the link.

B suitably encrypted to prevent other users operating the main transmitter

C failsafe to prevent unintended transmissions from the main station

D restricted to frequencies identified in the data portion of the Band Plans.

8 You have replied to a CQ call on 70cms and moved to a working frequency where you hold a conversation of six 'overs' lasting 23 minutes in total. During the time on the working frequency, to comply with your licence, you should give your callsign

A at the beginning of every 'over'

B as frequently as is practicable

C at least six times

D from time to time.

9 Licensees are required to confirm their details

A annually on the anniversary of the issue of the licence

B at least every three years

C only when changing their postal or main station address

D at least every five years.

10 Which of the following frequencies are available to a Full licensee on the basis of non-interference to other services outside the UK?

A All frequencies in the schedule.

B 431.5MHz

C 70.435MHz

D 1.26GHz

11 A 12V transmitter is being tested on the bench and powered from a 12V battery. When on transmit into the station antenna on the roof of the property it is noticed that the supply voltage at the battery has fallen to about 10V. This is most likely to be due to the

A antenna being too close to the battery and causing RF interference

B power cable between the battery and transmitter dropping too much voltage

C internal resistance of the battery

D increased losses in the transmitter.

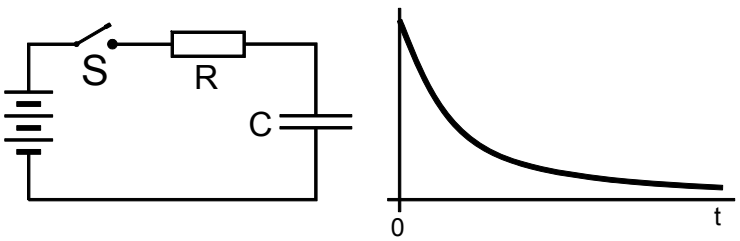
12 The diagram shows an RC circuit and a graph showing time from switch-on on the X-axis. The Y axis of the graph should be marked

A voltage across C

B charge on C

C time constant

D voltage across R

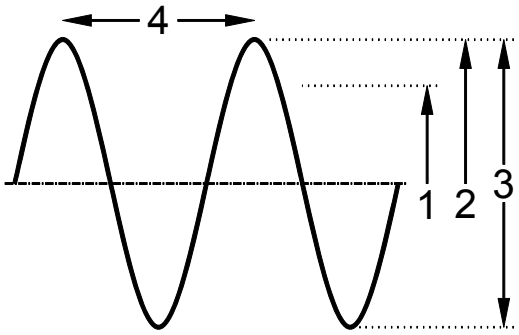


13 Which factor below will have the greatest effect on the inductance of a coil?

A Inserting a glass rod inside the coil.
B Increasing the current through the coil.
C Increasing the diameter of the coil.
D Reducing the diameter of the wire.

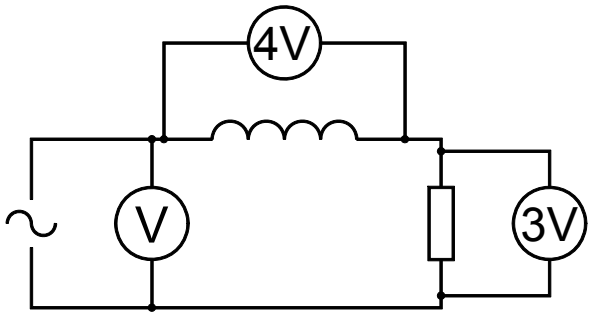
14 Which quantity labelled A, B, C or D in the diagram illustrates the RMS value of the sine wave shown?

A arrow 1
B arrow 2
C arrow 3
D arrow 4



15 The circuit shown is fed from an AC source and two of the three voltmeters show the readings obtained. What should the third meter read?

A 4V
B 5V
C 6V
D 7V



16 A simple radio receiver has a single LC tuned circuit in the collector of the RF amplifier transistor. The radio is set to receive a medium wave AM broadcast on a frequency of 600kHz and a bandwidth of 6kHz. A suitable Q-factor for the tuned circuit would be approximately

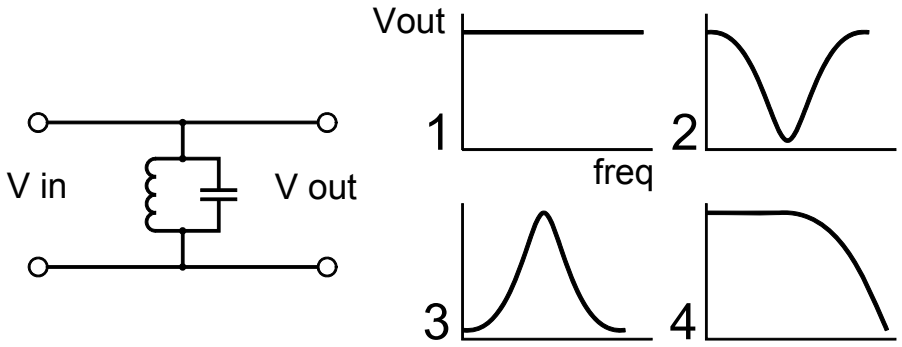
A 6
B 50
C 100
D 200

17 A balun transformer has two separate coils to provide a balanced output from an unbalanced input. The RF energy is transferred to the output due to the

A mutual inductance
B transformation ratio
C impedance matching
D symmetrical output.

18 The diagram shows a filter circuit and four frequency response curves. Which curve shows the response of the filter?

A curve 1
B curve 2
C curve 3
D curve 4

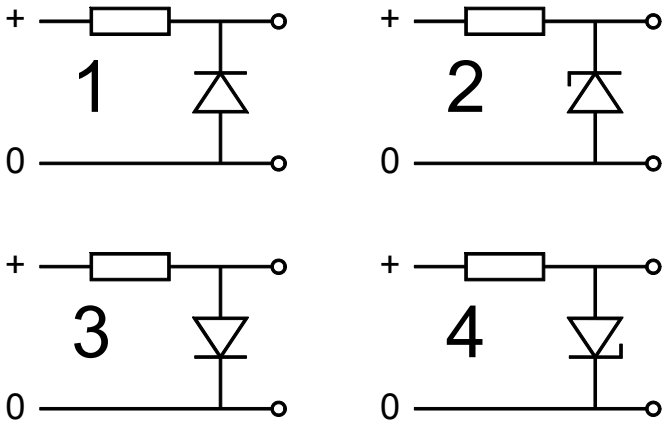


19 An RF power amplifier is rated at 100W output and a gain of 16dB. For full output power without distortion, the input should be

A 2.5W
B 5W
C 10W
D 16W

20 If the input voltage is 10V, then, given suitable component values, which circuit can give a stable 6Voutput if the load varies?

A circuit 1
B circuit 2
C circuit 3
D circuit 4.



21 Which configuration of transistor amplifier provides a voltage gain but no current gain?

A common emitter
B common base
C common collector
D emitter follower.

22 A mains transformer has a secondary winding rated 18V rms and feeds a half wave rectifier circuit with a single diode and a smoothing capacitor across the output. The maximum voltage across the diode on the non-conducting half-cycles will be about

A 18V
B 26V
C 36V
D 52V

23 Which type of frequency source utilises an error voltage to correct the frequency of an oscillator.

A A crystal oscillator

B A frequency synthesiser

C Direct digital synthesiser

D Beat frequency oscillator.

24 A transmitter utilises a balanced mixer to produce an SSB signal at 12MHz. To obtain an output at 144MHz the transmitter would

A mix the signal with an oscillator output at 144MHz

B use a frequency tripler followed by two frequency doublers.

C mix the signal with another signal at 156MHz

D feed the signal to a non-linear amplifier with a tuned collector load at 144MHz.

25 A UHF FM transmitter is set up to operate at 433MHz with a peak deviation of 5kHz. The maximum audio frequency is 3·5kHz. The bandwidth of the transmission will be approximately

A 7kHz

B 10kHz

C 17kHz

D 25kHz

26 An external power amplifier operates in class C for maximum efficiency. It would be suitable for

A FM

B AM and FM

C AM and SSB

D AM

27 The power supply voltage of a home-made transmitter is seen to drop when on transmit. Unless suitable precautions are taken there is a risk of

A key clicks

B over-modulation

C chirp

D harmonic distortion.

28 An SSB transmitter is correctly operating at 7.050MHz but is a little over-modulated by an audio voice signal. There is a consequent risk of unwanted transmissions around

A 7.045MHz

B 7.065MHz

C 14.050MHz

D 14.100MHz

29 If a stage in a transceiver produces an 'out of lock' signal, that signal should

A inhibit the transmitter stages

B indicate the receiver is off-frequency

C activate the AGC circuits

D activate the AFC circuits.

30 A receiver is specified as having a minimum discernible signal of 0.1μV at the input (-157dBW) and a dynamic range of 86dB. It can be expected to produce just detectable spurious signals at an input level of about

A 11.2μV (-116dBW)

B 2mV (-71dBW)

C 7.07V (0dBW)

D 141V (26dBW)

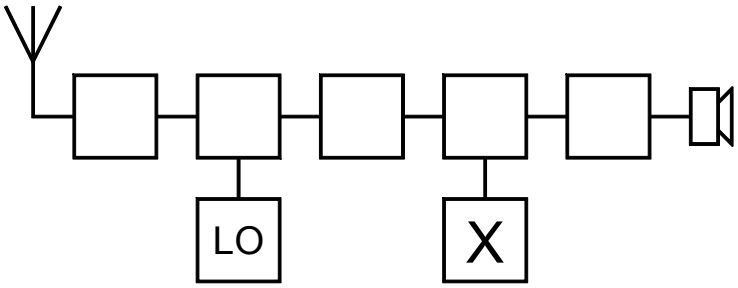
31 In the block diagram of a single superhet, what is the function of the block marked 'X'?

A Frequency synthesiser

B Beat Frequency Oscillator

C Detector

D Intermediate Amplifier.



32 The gain of an IF amplifier is reduced by reducing the bias voltage close to the 'knee' of the transistor characteristic curve, which also causes distortion of the signal. This distortion is removed

A in the audio amplifier

B by an audio frequency filter

C by the intermediate frequency tuned circuits

D by some other method.

33 A receiver initially picks up the wanted signal on 7.1MHz and again, weakly, when tuned to 8.7MHz. It is likely the local oscillator is now on a frequency of

A 7.1MHz

B 7.9MHz

C 8.6MHz

D 15.8MHz

34 The AGC control signal is normally derived from the

A RF amplifier

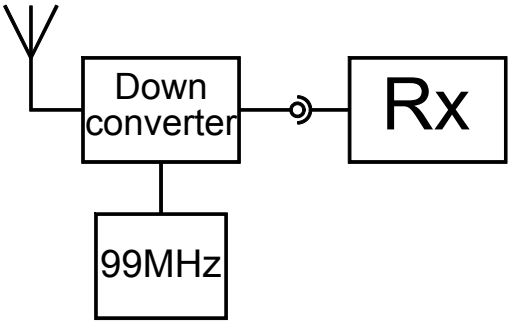
B Detector

C IF Amplifier

D Mixer

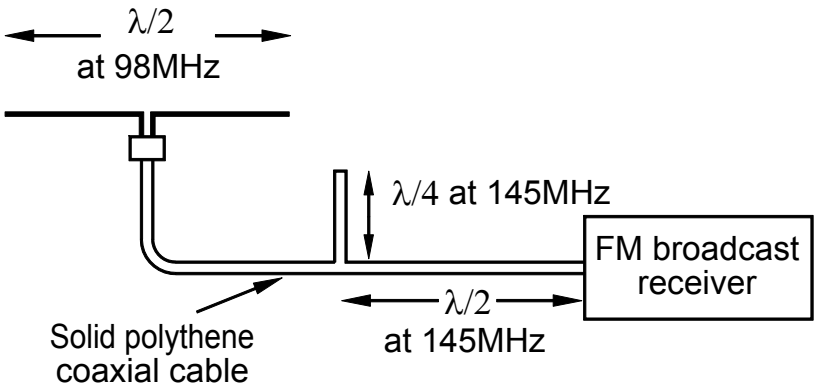
35 In order to receive a different band, a down-converter is placed in front of an amateur receiver covering 28-30MHz. Which band may be received?

A 10m
B 6m
C 4m
D 2m



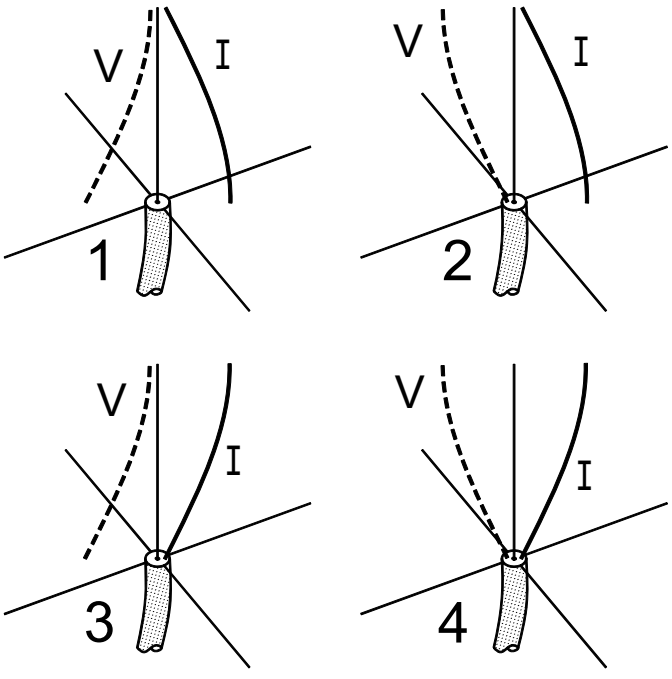
36 To minimise interference from a 2m transmitter into an FM broadcast receiver, a λ/4 (at 145MHz) coaxial stub is inserted across the coaxial down-lead from the receiver aerial, as shown in the drawing. The physical length of the coaxial stub will be about

A 34cm
B 52cm
C 77cm
D 102cm



37 Which drawing correctly shows the current and voltage distribution on a correctly fed quarter wave ground-plane antenna? (Further from the antenna denotes a greater value.)

A Drawing 1
B Drawing 2
C Drawing 3
D Drawing 4



38 An HF dipole is fitted with a trap in each leg to permit matching at two different frequencies. The traps should be resonant at the

A higher of the two frequencies to cut off the outer section

B higher of the two frequencies to include the outer section

C lower of the two frequencies to cut off the outer section

D lower of the two frequencies to include the outer section.

39 An antenna is quoted as having a Return Loss of 12dB at its centre frequency. The feeder to the shack has an attenuation of 2dB. The Return Loss measured in the shack will be

A 4dB

B 8dB

C 14dB

D 16dB

40 Which statement below best describes the function of an antenna matching unit (AMU).

A An AMU removes the reactive portion of the feed impedance.

B An AMU adjusts the length of the antenna to bring it to resonance.

C An AMU adjusts the input impedance so that Z=50Ω

D An AMU brings the input impedance to 50Ω resistive and non-reactive.

41 The field strength from a UHF antenna is measured at a distance of 20m over clear ground. At twice that distance the measurement will be

A much the same value

B about half the first value

C approximately quartered

D impossible to predict.

42 Sporadic-E is a phenomenon that affects radio propagation

A only below about 5MHz

B up to no more than about 30MHz

C well up into the VHF bands

D only in UHF bands and above.

43 The maximum usable frequency is

A usually within about 10% of the critical frequency

B lower than the critical frequency but dependent on the actual path length

C higher than the critical frequency and increases as the path length increases

D higher than the critical frequency and decreases as the path length increases.

44 A transmission on top-band (160m) is found to cause interference to a domestic medium wave radio. A likely reason for this is

A image channel interference

B breakthrough into the RF stages of the radio

C breakthrough into the IF stages of the radio

D an unwanted harmonic of the transmission.

45 A broadcast transmission is suffering interference such that the unwanted interferer can also be heard in addition to the wanted signal. This effect may be due to

A blocking in the receiver IF stages

B cross-modulation in the RF stages

C capture effect in the FM discriminator

D non-linearities in the loudspeaker.

46 A neighbour's son has a CD player and audio amplifier in his room and is complaining that an amateur is causing interference. This

A cannot be the fault of the amateur because no radio receiving device is present

B is just hard luck, the rules only protect licensed radio users so the amateur should do nothing

C is possibly caused by pickup in the loudspeaker leads.

D is likely to be direct pickup in the CD head.

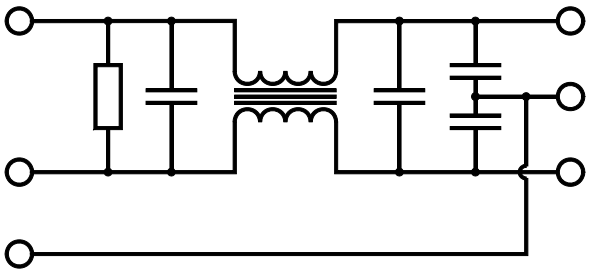
47 The device shown in the diagram

A is a combined balun and harmonic filter

B will provide impedance matching on HF

C is connected in the mains supply to radio equipment

D will cut the power in the event of a fault.



48 Additional protection from strong HF transmissions affecting television reception can be achieved by fitting a

A low pass filter in the TV aerial lead

B high pass filter in the TV aerial lead

C low pass filter in the transmitter feeder

D high pass filter in the transmitter feeder.

49 The chance of causing interference to nearby radio and electronic equipment can be reduced by

A keeping all antennas below the line of the surrounding roofs

B using minimum transmit power for the contact

C using vertical polarisation wherever possible

D using SSB in preference to FM.

50 Running a transmitter in a motor vehicle could

A increase the risk of interference to other stations

B cause a malfunction of the engine management system

C increase the rate of corrosion of the vehicle bodywork

D adversely affect radar operated speed cameras.

51 A neighbour advises that his new digital television is suffering interference. You should

A advise that amateur transmissions can affect analogue equipment but not digital and he should contact the supplier

B give the neighbour a copy of the TV interference leaflet from the RSGB EMC committee web site

C suggest he contacts Ofcom to get his installation arrangements properly checked

D ask if you can try out some test transmissions to see if it is likely to be your equipment.

52 The main difference between a packet mailbox and a digipeater used to pass a message to a more distant station is that

A a mailbox will check each packet of the message and store it until complete whereas a digipeater forwards each packet immediately and unchecked

B a mailbox will check each packet of the message and store it until complete whereas a digipeater checks only the whole message

C it is necessary to specify the end to end route of a message sent to a mailbox but a digipeater is able to route messages automatically

D digipeaters need to be separately licensed but any amateur can set up a mailbox as part of his or her own station.

53 You are on 433.100MHz, in contact with a mobile amateur who asks if you can hear him directly. To check that you should listen on

A 431.500MHz

B 432.500MHz

C 433.700MHz

D 434.700MHz

54 A special event station can be recognised by its callsign, which will be of the form (*note 'x' denotes a number and 'a' a letter*)

A GxSaa

B GBxaaa

C SPxaaa

D 2Sxaaa

55 Provided you are using the correct mode, it is considered amateur etiquette to transmit on 20m from

A 14.000 to 14.350MHz

B 14.000 to 14.089 and 14.112 to 14.350MHz

C 14.000 to 14.099 and 14.101 to 14.350MHz

D 14.000 to 14.112 and 14.125 to 14.350MHz

56 An amateur shack should have a

A notice saying ‘no entry to unauthorised persons’

B general coverage receiver for all amateur bands

C residual current circuit breaker on each item of mains powered equipment

D single master ‘off’ switch for the entire installation except a ceiling mounted light.

57 The ICNIRP provides recommendations on

A the safe levels of RF exposure

B immunity to RF interference

C lightning protection of antenna

D amateur operating procedures.

58 A significant feature of a PME mains supply to the house is that

A the multiple earthing provides a better RF earth than a conventional (non-PME) mains supply

B the house earth is bonded to the metal sheath of the company supply cable

C the house earth wiring can, under some circumstances, rise well above true earth voltage

D any RF earth in the shack must not be connected to the PME earth.

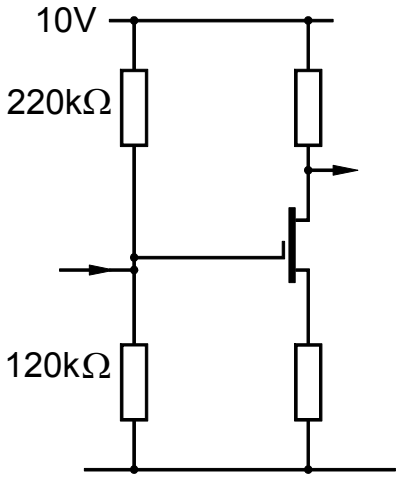
59 The diagram shows part of the circuit of an insulated gate field effect transistor amplifier. The voltage at the gate is measured with a moving coil meter having a full-scale deflection of 100μA and a 100kΩ multiplier resistor, to give a meter of 0-10V. The meter reading will be approximately

A 1.2V

B 2V

C 3.5V

D 5V



60 A heterodyne wavemeter is being used to calibrate the band edges of the 7MHz amateur band on a general coverage receiver. The wavemeter has 4 plug-in crystals for frequency reference. Which is the best crystal to select?

A 50kHz

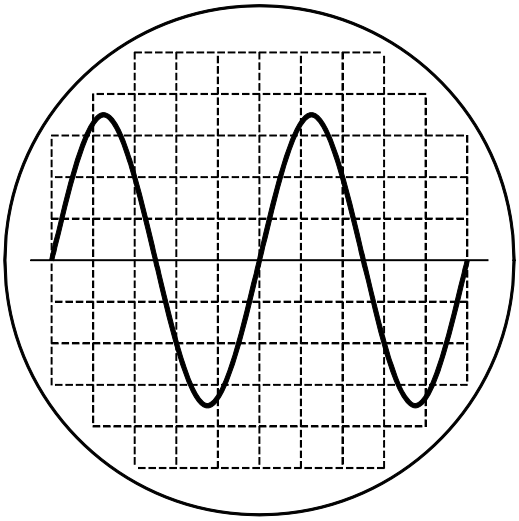
B 100kHz

C 500kHz

D 1MHz

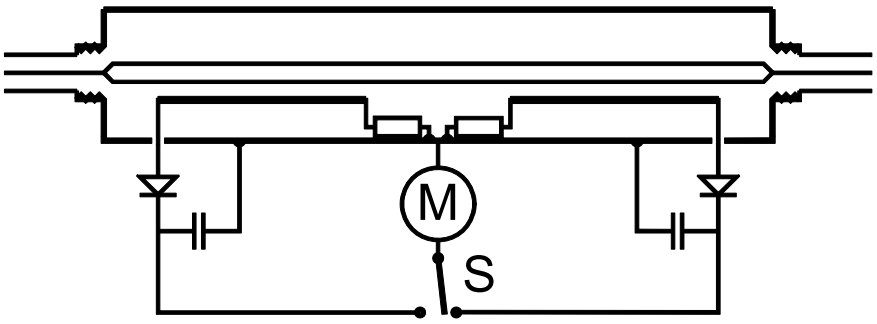
61 As a demonstration, the tutor wishes to show two cycles of a 10kHz signal on an oscilloscope. The graticule has 10 1cm divisions. The timebase should be set to

A 5μS/cm
B 10μS/cm
C 20μS/cm
D 50μs/cm



62 The switch marked ‘S’ in the diagram is likely to have the front panel legend

A On-Off
B Hi-Lo
C In-Out
D Fwd-Rev.



Answer keys

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