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1) 1) In UV-Vis spectroscopy, which transition typically occurs in conjugated aromatic compounds?
   1) - A. σ → σ*
   2) + B. π → π*
   3) - C. n → σ*
   4) - D. σ → π*
2) 2) What is the main purpose of UV spectroscopy?
   1) - A. To identify the functional group
   2) + B. To identify the conjugated system
   3) - C. To identify the arrangement of hydrogen atoms
   4) - D. All of the above
3) 3) What does carbazole consist of?
   1) - A. Pyridine linked with a benzene ring
   2) - B. Pyrimidine linked with a benzene ring
   3) - C. Benzene ring linked with furan
   4) + D. Indole fused with a benzene ring
4) 4)Which of the following is a characteristic feature of Thieno[2,3-d]pyrimidine?
   1) - A. It contains two sulfur atoms.
   2) + B. It has a pyrimidine ring fused with a thiophene.
   3) - C. It is a six-membered aromatic ring.
   4) - D. It is saturated with no double bonds.
5) 5) Which of the following is the name of a heterocyclic compound?
   1) - a. Ethane
   2) - b. Benzene
   3) + c. Pyridine
   4) - d. Propane
6) 6) Which compound is an example of a five-membered heterocyclic ring?
   1) - a. Cyclohexane
   2) + b. Furan
   3) - c. Pyrazine
   4) - d. Benzene
7) 7) Which of the following compounds is known as imidazole?
   1) - a. C2H2
   2) - b. C3H4
   3) + c. C3H6N2
   4) - d. C4H6O
8) 8) When a compound containing chlorine is analyzed in a mass spectrometer, what ion is typically observed as a prominent peak?
   1) - a) M-1
   2) - b) M+1
   3) + c) M+2
   4) - d) M+35
9) 9) Which of the following is the correct name for a six-membered heterocyclic compound with one nitrogen atom?
   1) + a. Pyridine
   2) - b. Pyrrole

3) - c. Furan
4) - d. Thiophene

10) 10) If a compound contains both chlorine and bromine, how may this be identified in its mass spectrum?
1) - a) By the M+4 peak
2) + b) By the relative intensities of M, M+2, and M+4 peaks
3) - c) By the presence of only one peak
4) - d) It cannot be identified

11) 11) Which compound is commonly referred to as pyrimidine?
1) + a. C4H4N2
2) - b. C3H3N
3) - c. C5H5N
4) - d. C6H6

12) 12) Which of the following compounds is known as thiazole?
1) + a. C3H3NS
2) - b. C5H5N
3) - c. C3H3N
4) - d. C6H6

13) 13) Which compound is commonly called pyridazine?
1) + a. C4H4N2
2) - b. C6H6
3) - c. C5H5N
4) - d. C4H4O2

14) 14) Which of the following is the correct name for a six-membered heterocyclic compound with two nitrogen atoms?
1) - a. Pyridine
2) - b. Pyrrole
3) + c. Pyrazine
4) - d. Thiophene\

15) 15) 2- Aza naphthalene is the name of ……
1) - a) Pyridine
2) - b) quinoline
3) + c) isoquinoline
4) - d) indole

16) 16) is not a heterocyclic aromatic compound.
1) - a) Furan
2) - b) Pyrrole
3) - c) Thiophene
4) + d) Naphthol

17) 17) The presence of a broad peak around 3300-3600 cm^-1 in an IR spectrum indicates the presence of:
1) - a. Alkene
2) - b. Alcohol
3) - c. Aldehyde
4) + d. Amine

18) 18) A strong and sharp peak around 1700 cm^-1 in an IR spectrum suggests the presence of:
1) + a. Carboxylic acid
2) - b. Alkene
3) - c. Alcohol
4) - d. Amine

19) 19) A peak between 1660-1700 cm^-1 in an IR spectrum indicates the presence of:

1) - a. Alkene
2) - b. Alcohol
3) - c. Amine
4) + d. Aldehyde

20) 20) A strong peak around 2200-2400 cm^-1 in an IR spectrum suggests the presence of:
1) - a. Alcohol
2) + b. Alkyne
3) - c. Aldehyde
4) - d. Carboxylic acid

21) 21) A strong peak around 1720-1780 cm^-1 in an IR spectrum suggests the presence of:
1) - a. Alcohol
2) - b. Alkene
3) - c. Aldehyde
4) + d. Ester

22) 22) A peak between 2800-3000 cm^-1 in an IR spectrum indicates the presence of:
1) - a. Alcohol
2) - b. Alkene
3) - c. Aromatic
4) + d. Alkane

23) 23) A peak between 1500-500 cm^-1 in an IR spectrum indicates the presence of:
1) - a. Alcohol
2) + b. Finger print
3) - c. Aldehyde
4) - d. Ether

24) 24) A strong peak between 3300-2500 cm^-1 in an IR spectrum suggests the presence of:
1) + a. Alcohol
2) - b. Alkene
3) - c. Amide
4) - d. Aldehyde

25) 25) What is the HDI of a compound with the molecular formula C6H12O6?
1) - a. 0
2) + b. 1
3) - c. 2
4) - d. 3

26) 26) What is the HDI of a compound with the molecular formula C7H15Br?
1) + a. 0
2) - b. 1
3) - c. 2
4) - d. 3

27) 27) Which compound has an HDI of 2?
1) - a. C2H6
2) - b. C3H7NO2
3) - c. C4H10
4) + d. C6H11NO2

28) 28) Which compound has an HDI of 3?
1) - a. C7H6O2
2) - b. C4H6O
3) - c. C5H10O
4) + d. None of the above

29) 29) What is the name of a saturated six-membered ring that has two nitrogen atom?
1) - A. Pyridine
2) - B. Pyrrole
3) + C. Piperazine
4) - D. Imidazole

30) 30) In the HNMR spectrum of aspirin, which proton(s) would be expected to appear as a singlet?
1) - a. The proton(s) attached to the carbonyl group
2) - b. The proton(s) attached to the aromatic ring
3) + c. The proton(s) attached to methyl attached to ester group
4) - d. None of the above

31) 31) In the HNMR spectrum of aspirin, which proton(s) would be expected to appear as a triplet?
1) - a. The proton(s) attached to the carboxylic acid group
2) + b. Some of proton(s) attached to the aromatic ring
3) - c. The proton(s) attached to the methyl of ester group
4) - d. All of the above

32) 32) What is the chemical shift range (in ppm) for the protons attached to aromatic group in the HNMR spectrum of aspirin?
1) - a. 0.5-2.5 ppm
2) - b. 2.5-4.5 ppm
3) - c. 4.5-7.5 ppm
4) + d. 6.5-9 ppm

33) 33)Which of the following correctly describes 4-amino-Furo[2,3-b]pyridine?
1) - A. It is a pyridine derivative with an amino group at the 4-position.
2) - B. It is a furan fused to a pyridine ring with an amino substituent.
3) - C. It has a dual aromatic system consisting of a furan and a pyridine.
4) + D. All of the above are correct.

34) 34) Which of the following statements is true about 1,2,4-triazine-3,5-diamine?
1) - A. It is a heterocyclic compound containing a triazine ring.
2) - B. It has two amino groups located at the 3 and 5 positions of the triazine ring.
3) - C. It does not contain any double bonds.
4) + D. Both A and B are correct

35) 35) Which of the following statements is true about 5-hydroxyindole?
1) - A. It is a derivative of indole with a hydroxyl group at the 5-position.
2) - B. It plays a role in the biosynthesis of serotonin.
3) - C. It is an aromatic compound.
4) + D. All of the above are correct

36) 36)Which of the following statements is true about phenothiazine?
1) - A. It is a tricyclic compound.
2) - B. It contains sulfur within its structure.
3) - C. It is commonly used as CNS an antipsychotic medication.
4) + D. All of the above are correct.

37) 37) The presence of a peak around 2.1-2.4 ppm in the HNMR spectrum of aspirin indicates the presence of:
1) - a. Protons attached to a carboxylic acid group
2) - b. Protons attached to an aromatic ring
3) - c. Protons attached to an ester group
4) + d. Protons attached to a methyl group

38) 38) In the HNMR spectrum of aspirin, the chemical shift for the protons attached to the aromatic ring would be expected to be:
1) - a. Downfield (higher ppm values)

2) - b. Upfield (lower ppm values)
3) + c. In the middle of the spectrum (around 7-9 ppm)
4) - d. It depends on the specific instrument used.

39) 39) In the HNMR spectrum of an aliphatic compound with an aldehyde group (-CHO), which proton(s) would be expected to show a chemical shift around 9-10 ppm?
1) + a. The proton(s) attached to the aldehyde group
2) - b. The proton(s) attached to a carbon-carbon double bond
3) - c. The proton(s) attached to a carbon-carbon triple bond
4) - d. The proton(s) attached to an aromatic ring

40) 40) Given the following spectral data for an organic compound, identify the compound:
IR Spectrum:
Strong absorption at ~3300 cm^{-1} (indicative of an O-H stretch).
Sharp absorption at ~1710 cm^{-1}
HNMR Spectrum:
One broad singlet at δ 10.5 ppm (indicative of a carboxylic acid proton).
One peak at δ 2.1 ppm (indicating a methyl ($-CH_3$) group adjacent to the carbonyl).What is the most likely structure of the compound?
1) + a) Acetic acid
2) - b) Propanoic acid
3) - c) Butanoic acid
4) - d) 2-Butenoic acid

41) 41) In the C13NMR spectrum of an organic compound, which region(s) would be expected to show chemical shifts between 120-170 ppm?
1) - a. Alkyl carbon atoms
2) + b. Aromatic carbon atoms
3) - c. Carbonyl carbon atoms
4) - d. All of the above

42) 42) In the C13NMR spectrum of an organic compound, which region(s) would be expected to show chemical shifts above 160 ppm?
1) - a. Alkyl carbon atoms
2) - b. Aromatic carbon atoms
3) + c. Carbonyl carbon atoms
4) - d. None of the above

43) 43) Which functional group(s) is typically associated with a carbon atom signal around 160-220 ppm in the C13NMR spectrum?
1) - a. Alkyl groups
2) - b. Aromatic groups
3) - c. Alkene groups
4) + d. Aldehyde groups

44) 44) In the mass spectrum of ion would be expected appear at m/z 43 which group containing in a compound?
1) + a. CH3CO
2) - b. CH3
3) - c. CH2CO
4) - d. CH2

45) 45) In the mass spectrum of ion would be expected appear at 45 m/z which group containing in a compound?
1) + a. COOH
2) - b. CO

3) - c. OH
4) - d. H2O

46) 46) In the mass spectrum of ion would be expected appear at 29 m/z which group containing in a compound?
1) - a. CH2CH2
2) - b. CH3
3) + c. CH3CH2
4) - d. CH2

47) 47) In the mass spectrum of ion would be expected appear at 77m/z which group containing in a compound?
1) - a. C6H6
2) + b. C6H5
3) - c. C5H6
4) - d. C5H5

48) 48) IR Spectrum:
Strong absorption at ~1715 cm^{-1} (carbonyl stretch).
Broad absorption around ~3300 cm^{-1} (hydroxyl stretch).
Mass Spectrometry:
Molecular ion peak (M) at m/z = 120.
M+2 peak at m/z = 122 (suggesting the presence of chlorine).
HNMR Spectrum:
One singlet at δ 2.1 ppm (indicating a methyl group adjacent to a carbonyl).
One broad peak at δ 11.5 ppm (indicative of an acidic proton, likely from –COOH).
C13 NMR Spectrum:
A signal at δ 20 ppm (for the methyl carbon).
A signal at δ 30 ppm (for a carbon adjacent to the carbonyl).
A signal at δ 170 ppm (for the carbonyl carbon).
1) - a) 3-Chloropropanoic acid
2) - b) 2-Chloropropanoic acid
3) + c) 2-Chloro-2-methylpropanoic acid
4) - d) 4-Chloro-2-butanone

49) 49) In the IR spectrum of aspirin, which peak would indicate the presence of the carbonyl (C=O) stretching vibration?
1) - a. Around 3300-3500 cm-1
2) + b. Around 1670-1690 cm-1
3) - c. Around 1640-1660 cm-1
4) - d. None of the above

50) 50) How many signals present in CH3CH2 COCH3, in its HNMR and C13NMR spectra:
1) - a. three H signals and three 13C signals
2) - b. Two H signals and three 13C signals
3) + c. Three H signals and four 13C signals
4) - d. Two H signals and two 13C signals

51) 51) Analyze the molecule CH3CH2COCH2CH3 (pentane-2,4-dione) to determine the number of signals in its HNMR and C13NMR spectra:
1) - a. Three H signals and three 13C signals
2) + b. Two H signals and three 13C signals
3) - c. Three H signals and four 13C signals
4) - d. Two H signals and two 13C signals

52) 52)What region of the electromagnetic spectrum does UV-Vis spectroscopy operate in?

1) - a) Infrared region
2) - b) Microwave region
3) + c) Ultraviolet to visible region
4) - d) X-ray region

53) 53)In an NMR spectrum, a singlet indicates:
1) + a) No neighboring protons
2) - b) Multiple neighboring protons
3) - c) A high degree of symmetry
4) - d) Solvent effects

54) 54)The presence of which proton would likely resonate at (downfield) in an NMR spectrum?
1) - a) Methyl protons ($-CH_3$)
2) - b) Methine protons ($-CH$)
3) + c) Proton attached to a carbonyl ($C=O$)
4) - d) Aromatic protons

55) 55) Nuclear Magnetic Resonance (NMR) spectroscopy can provide information about the molecular weight of a compound.
1) - T
2) + F

56) 56(A singlet in NMR indicates that the proton has no neighboring protons influencing its signal.
1) + T
2) - F

57) 57(Hydrogen bonding can cause a peak in an IR spectrum to appear broader than expected.
1) + T
2) - F

58) 58) IR spectroscopy can identify the presence of functional groups in a molecule.
1) + T
2) - F

59) 59) In NMR, protons on carbon atoms adjacent to electronegative atoms typically resonate at higher frequencies (downfield).
1) + T
2) - F

60) 60) IR spectrometry can be used to determine the molecular weight of a molecule.
1) - T
2) + F

61) 61) A strong and broad peak in the IR spectrum around 3300 cm-1 indicates the presence of an alkane
1) - T
2) + F

62) 62) A high m/z value in a MASS spectrum corresponds to a larger fragment.
1) + T
2) - F

63) 63) HNMR spectroscopy can be used to determine the relative position of protons in a molecule.
1) + T
2) - F

64) 64) C13NMR spectroscopy can be used to distinguish between primary, secondary, and tertiary carbons.
1) + T
2) - F

65) 65(Chromophores and auxochromes are concepts used in visible light absorption, not ultraviolet (UV) absorption.
1) - T

2) + F