IR Problems

DISCUSSION

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which compound would be expected to show intense IR absorption at 3300 cm^{-1}? 1) _____

A) butane

B) $CH_3CH_2C{\equiv}CH$

C) $CH_3C{\equiv}CCH_3$

D) but-1-ene

2) Which compound would be expected to show intense IR absorption at 2820, 2710 and 1705 cm^{-1}? 2) _____

A) $CH_3COCH_2CH_3$

B) $CH_2{=}CHCOCH_3$

C) $PhCOCH_3$

D) PhCHO

3) Which compound would be expected to show intense IR absorption at 2250 cm^{-1}? 3) _____

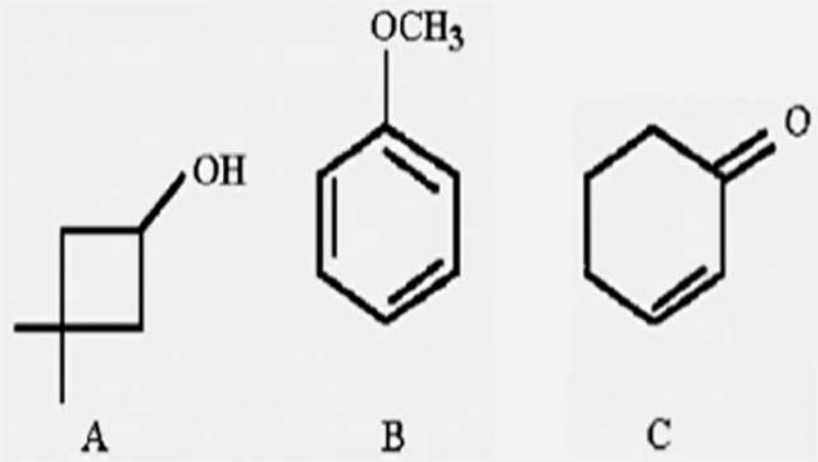
A) $(CH_3)_2CHCN$

B) $CH_3CH_2CH_2CO_2H$

C) $CH_3CH_2CH_2CONH_2$

D) $(CH_3)_2CHCH_2OH$

4) Which compound would be expected to show intense IR absorption at 1680 cm^{-1}? 4) _____



5) In IR spectroscopy, the C—O bond has a _____ frequency than the C—N bond because _____.

A) lower, an O atom has more mass than an N atom
B) higher, an O atom has an even number of neutrons
C) higher, an O atom has more electronegativity than an N atom
D) higher, an O atom has more mass than an N atom
E) lower, an O atom has more electronegativity than an N atom

6) Which of the following does not have a broad absorption with one or more spikes that is centered about 3300 cm^{-1} in the IR?

A) $(CH_2{=}CHCH_2)_2NH$

B) $(CH_3CH_2CH_2)_3N$

C) $CH_3CH_2CH_2NH_2$

D) $(CH_3)_3CNH_2$

E) $(CH_3CH_2CH_2)_2NH$

7) Which of the following compounds would contain characteristic IR stretches at 3300 and 2200 cm^{-1}?

A) $CH_3CH{=}CHCH_2OH$

B) $(CH_3)_2CHCN$

C) $CH_3C{\equiv}CCH_2CH_3$

D) $CH_3CH_2CH_2C{\equiv}CH$

E) CH_3CH_2CHO

14) The IR spectrum of a sample contains absorptions at 3050, 2950, and 1620 cm^{-1}. To what class of organic compound does this sample most likely belong?

A) alkyne B) ester C) alkene D) alcohol E) alkane

15) Which of the following most closely matches the C≡C stretching frequency?

A) 3000 B) 3300 C) 2200 D) 1200 E) 1700

16) A nonlinear molecule with n atoms generally has _____ fundamental vibrational modes.

A) 2n B) 2n - 2 C) 3n - 6 D) 3n - 3 E) 3n

17) Which of the following molecules would be expected to have its C=C stretching frequency at the highest wavenumber: benzene, 1,3-pentadiene, or 1-pentene?

18) Rank the following bonds in order of increasing stretching frequency (cm^{-1}) in IR spectroscopy: C–H, C≡C, C–O, and C=O.

19) Rank the following bonds in order of increasing stretching frequency (cm^{-1}) in IR spectroscopy: C–H, C≡C, C–O, and C=O.

20) Which has a lower characteristic stretching frequency, the C–H or C–D bond? Explain briefly.

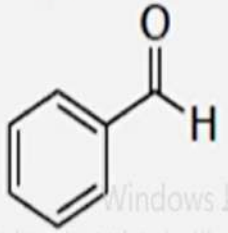
21) Which has a lower characteristic stretching frequency, the C=O bond or the C–O bond? Explain briefly.

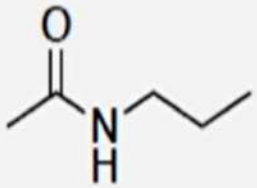
22) The region of the IR spectrum which contains the most complex vibrations ($600\text{-}1400\ cm^{-1}$) is called the _____ region of the spectrum.

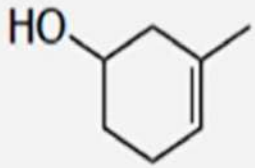
23) Rank the following bonds in order of increasing stretching frequency (cm-1) in IR spectroscopy: O–H, C≡N, C–N, and C=O.

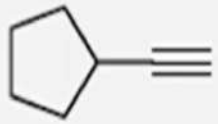
24) In order for a vibration mode to be observable in the IR, the vibration must change the _____ of the molecule.

25) For each compound below, approximate the most important IR absorptions that you would expect to see.

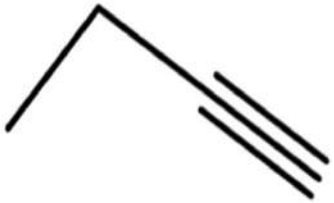




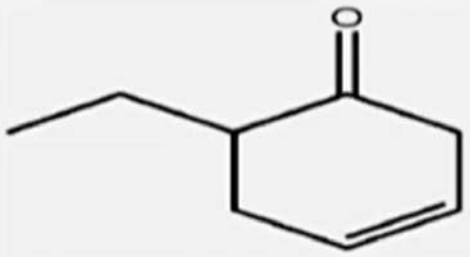


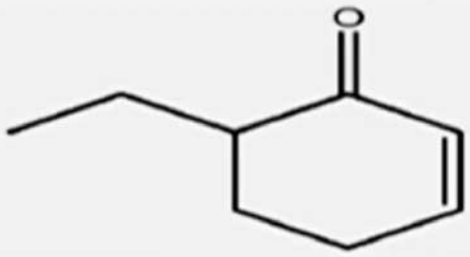


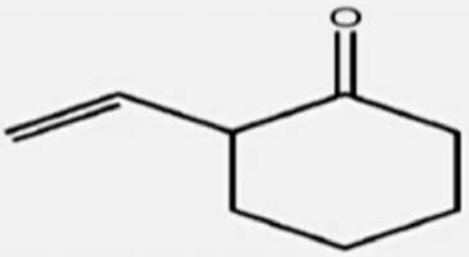
26) How could you use IR spectroscopy to differentiate between the two isomers: 1-butyne and 2-butyne?



27) Which of the following compounds has the lowest carbonyl stretching frequency?







28] In drug synthesis we could use IR spectroscopy to monitor the drug synthesis progress. Explain

Solution:-

Have a look for the following two different examples;