

Tutorial No 1, Semester 2, 2023/24

1. A coconut tree and a tembusu tree which are next to each other are swaying repeatedly from left to right during a strong wind. The coconut tree completes 6 cycles during the same period of time during which the tembusu tree completes 5 cycles. If the tembusu tree completes 8 full cycles in 5 seconds, calculate the frequencies of vibration for each of these two trees. When the wind gets weaker, the frequency of the tembusu tree decreases to 1.2 Hz, and the frequency of the coconut tree decreases by the same proportion. What is the frequency of the coconut tree when the wind gets weaker?
2. A woman in a shopping mall sings a note with a frequency of 1,320 Hz. If a bass singer passing by then sings a note which is 4 octaves below the note from the woman, what is the frequency of the bass singer's note? A flute player nearby then plays a note on his flute which has a frequency of 2,640 Hz. Calculate the number of octaves between the flute's note and the woman's note. A bassoon player standing nearby then plays a note on his bassoon which is 3 octaves below the flute's note. Calculate the number of octaves this note is above the bass singer's note and its frequency. If the woman's note is 880 Hz instead of 1,320 Hz, calculate the frequencies of the bass singer's note, the flute's note and the bas-

soon's note, assuming that these notes maintain the same relationships to each other as before.

3. A jazz band is the first item in a campus concert and you notice that it registers 87 dB on a sound level meter which you as a member of the audience are carrying. The next group to perform is a harmonica quartet whose sound reaching you is 100 times less powerful compared with that from the jazz band. What would the reading on your sound level meter be due to the harmonica quartet? The third group performing is a rock band which registers a reading of 97 dB on your sound level meter. How much more sound power is reaching you from the rock band compared to the harmonica quartet? (Assume that the reading on the sound level meter is due only to the sound of the jazz band, the harmonica quartet and the rock band.)
4. The musical score of a piece for solo voice begins with a time signature of $17/8$. One particular bar in this score begins with two crotchets and ends with three dotted quavers. Calculate the number of semi-quaver notes which could fit exactly into the middle of this bar in order to correspond exactly with the time signature. If the beginning of the bar had three crotchets instead of two crotchets, how many semi-quavers which would fit exactly into the middle of the bar? (If we add a dot to a note or a rest, the duration of the note or rest is increased by 50%.)
5. Starting from any key on a piano keyboard and going up or down to a key which is its immediate neigh-

bour, is always a move by the interval of a semitone. Starting from any key to the next key above or below which has the same letter name (i.e. A, B, C, etc), that interval moved is always by 12 semitones or one octave. If we start from the piano key with the letter name of G just below Middle C, how many semitones are there from this G to the A which is just above Middle C? Express this interval in terms of octaves. Give the letter name of the piano key which is the same number of semitones below the starting G. What is the number of octaves from this lower note to the A just above Middle C?

6. We define the ratio of a musical interval from one musical note to another musical note at a higher pitch as the ratio of the frequency of the higher note to the frequency of the lower note. If we start from a note with a frequency of 80 Hz and move up by an interval with a ratio of $\frac{11}{4}$, what is the frequency of the higher note on which we will arrive? Starting from this second note and going down by an interval with a ratio of $\frac{8}{5}$, what is the frequency of the third note on which we will arrive? Calculate the ratio of the interval between the first note and the third note.

Scientific Inquiry discussion points

1. Science seeks to discover and understand the universe through the methodology of scientific inquiry. Scientists observe the universe and formulate hypotheses to explain what they observe. They test their hypotheses through experiments and further observation. A hypothesis becomes an accepted theory if supported

strongly by experimental or observational evidence. Can you think of examples of scientific inquiry which changed our perception and understanding of the universe?

2. Technology seeks to shape and modify the universe in order to improve the quality of life in human society. Technology can include simple objects like chairs and lamps, and complex objects like computers and integrated circuits. Like science, technology dates back to the earliest days of mankind, and technological tools and artefacts can be found in the earliest archeological sites. What are good examples of technological achievements in early societies and in modern civilisation?